

# Ultraschall

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# DEGUM 2016

## 40. Dreiländertreffen DEGUM, ÖGUM, SGUM 28th Euroson Congress of the EFSUMB

**Date/Venue:** 26.–29. Oktober 2016, Congress Center Leipzig

**DEGUM Kongresspräsident:** Andreas HJ Hagendorff

**EFSUMB Congress President:** Odd Helge Gilja

### Contrast-Enhanced Ultrasound I – Clinical Investigations

#### SL1-1

#### Dynamic Contrast-Enhanced Ultrasound (CEUS) and elastography assess deltoid muscle integrity after reverse shoulder arthroplasty

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**Purpose:** The outcome after reverse shoulder arthroplasty (RSA) depends on the condition of the deltoid muscle, which we assessed with novel ultrasound modalities and electromyography (EMG). Contrast-enhanced ultrasound (CEUS) and acoustic radiation force impulse (ARFI) were applied to compare perfusion and elasticity of the deltoid muscle to the clinical and functional outcome. **Material and methods:** 64 patients (mean age 72.9 years) treated with RSA between 2004 and 2013 were recruited. The deltoid muscle was examined with EMG and ultrasound; functional scores such as Constant (CS) and ASES were assessed. Among other CEUS parameters, Wash-in Perfusion Index (WiPI), Time To Peak (TTP) and Rise Time (RT) were compared between the operated and contralateral shoulders as well as between patients with above- and below-average outcome. The stiffness of the deltoid muscle was analyzed with ARFI. **Results:** After RSA, both the deltoid perfusion (WiPI,  $\Delta = -12 \pm 22\%$ ,  $p = 0.0001$ ) and shoulder function (CS,  $\Delta = -14 \pm 24$ ,  $p < 0.0001$ ) were inferior compared to the contralateral side. This perfusion deficit was associated with a limited range of motion (TTP and anteversion:  $r = -0.290$ ,  $p = 0.022$ ). Deltoid perfusion was higher in patients with above-average outcome (RT,  $\Delta = 33 \pm 13\%$ ,  $p = 0.038$ ). The operated deltoid muscles showed higher stiffness than contralateral (ARFI,  $\Delta = 0.2 \pm 0.9$  m/s,  $p = 0.0545$ ). EMG excluded functionally relevant axillary nerve injuries in the study population. **Conclusion:** CEUS revealed reduced mean perfusion of the deltoid muscle after RSA. Reduced perfusion was associated with limited range of motion and below-average outcome. Functional shoulder impairment after RSA might be predicted by non-invasive CEUS as surrogate parameter for the integrity of the deltoid muscle.

#### SL1-2

#### LI-RADS-CEUS – proposal for a contrast-enhanced ultrasound algorithm for the diagnosis of hepatocellular carcinoma in high-risk populations

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DOI: 10.1055/s-0036-1587712

**Purpose:** To develop a contrast-enhanced ultrasound algorithm (LI-RADS-CEUS = Liver Imaging Reporting and Data System with contrast-enhanced ultrasound) for the diagnosis of hepatocellular carcinoma (HCC) in patients at risk. **Materials and methods:** A contrast-enhanced ultrasound algorithm (LI-RADS-CEUS) was designed analogous to CT- and MRI-based LI-RADS. LI-RADS-CEUS was evaluated retrospectively in 50 patients at risk with confirmed diagnosis of HCC or Non-HCC lesions (test group) with subsequent validation in a prospective cohort of 50 patients at risk for HCC (validation group). Results were compared to histology, CE-CT and CE-MRI as reference standards. **Results:** Tumour diagnosis in the retrospective versus prospective patient cohort ( $n = 50/50$ ) were 46/41 HCCs, 3/3 intrahepatic cholangiocellular carcinomas (ICCs) and 1/6 benign lesions. Diagnostic accuracy of LI-RADS-CEUS for HCC, ICC and Non-HCC-non-ICC-lesions was 89%. For the diagnosis of HCC, diagnostic accuracy was 93.5% (43/46 cases) in the test group and 95.1% (39/41 cases) in the validation group. Sensitivity, specificity, positive (PPV) and negative predictive value (NPV) were 94.3%/66.6%/94.3% and 66.6%, respectively (mean values from both cohorts). Histological findings of HCC were available in 40 versus 23 cases (in total: G1/G2/G3: 15/35/13). Arterial hyperenhancement was seen in 68/87 (78.2%) of HCCs. Arterial hyperenhancement with subsequent portal venous or late phase hypoenhancement was seen in 66% of HCCs. **Conclusion:** LI-RADS-CEUS offers a CEUS algorithm for standardised assessment and reporting of focal liver lesions in patients at risk for HCC. Arterial hyperenhancement in CEUS is the key feature for the diagnosis of HCC in patients at risk, whereas washout is not a necessary prerequisite.

## SL1-3

**Contrast enhanced ultrasound as a first line imaging method in the evaluation of FLL in daily practice. A large monocentric experience.**Moga TV<sup>1</sup>, Ivascu CS<sup>1</sup>, Pienar C<sup>1</sup>, Popescu A<sup>1</sup>, Sirli R<sup>1</sup>, Danila M<sup>1</sup>, Sporea I<sup>1</sup><sup>1</sup>University of Medicine and Pharmacy "Victor Babes", Timisoara, Romania

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**Background:** Contrast enhanced ultrasound (CEUS) has become the first line imaging method in our center, used for the characterization of focal liver lesions (FLL), after it proved to be a cost-efficient method (1). We present you a monocentric experience in the evaluation of focal liver lesions by CEUS in daily practice routine in our center. **Material and methods:** The retrospective study performed between September 2009-December 2015, included 2037 patients, in whom CEUS was performed. We evaluated 2427 FLL "de novo". The evaluation by CEUS was considered conclusive if the FLL had a typical enhancement pattern following contrast bolus as described in the European Guidelines for the use of CEUS, issued by the European Federation of Societies of Ultrasound in Medicine and Biology (EFSUMB) (2). **Results:** From the 2427 FLL examined by CEUS, a positive diagnosis of malignant vs. benign could be established by CEUS in 2138/2427, (88.1%): 49.9% (1068) benign and 50.1% (1070) malignant, the latter with typical wash-out pattern in the late phase. In 289/2427 (11.9%) cases, CEUS was inconclusive, other methods being required (CT, MRI or biopsy) for the final diagnosis. From the total of 2427 lesions evaluated by CEUS, we were able to provide the correct classification in 1931 (79.6%) of cases. From all the FLLs evaluated by CEUS, 442 (22.9%) were hepatocellular carcinomas; 490 (25.4%) were liver metastases; 373 (19.2%) hemangiomas; 257 (13.4%) focal fatty liver alterations; 75 (3.9%) FNH; 1.2% (22) Adenomas, 82 (4.2%) hepatic cyst; 48 (2.5%) liver abscesses; 80 (4.1%) regenerative nodules; 0.5% (10) Cholangiocarcinoma; 0.1% (2) other malignant lesions; 2.5% (48) other benign lesions. **Conclusion:** CEUS demonstrated its efficiency as a good first-line imaging method for the characterization of focal liver lesions detected by ultrasound, with a positive diagnosis in 79.6% cases and differentiation between malignant and benign lesions in 88.1% cases.

## SL1-4

**Diagnostic accuracy and interobserver agreement of contrast-enhanced ultrasound in the evaluation of residual lesions after treatment for malignant lymphoma and testicular cancer**Peil-Grün A<sup>1</sup>, Haasenritter J<sup>2</sup>, Görg C<sup>3</sup><sup>1</sup>Klinik Sonnenblick Lehrkrankenhaus der Universitätsklinik Marburg, Marburg, Germany; <sup>2</sup>Universität Marburg, Marburg, Germany; <sup>3</sup>Universitätsklinik Marburg, Marburg, Germany

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**Purpose:** To calculate the diagnostic accuracy and interobserver agreement of contrast-enhanced ultrasound (CEUS) in the evaluation of residual lesions after treatment for malignant lymphoma and metastatic testicular cancer. **Materials and methods:** Between May 2004 and October 2010 an experienced sonographer performed CEUS in 52 patients with residual lesions after treatment for malignant lymphomas and metastatic testicular cancer. Final judgement on presence or absence of active disease was based on histological findings and/or clinical follow-up. To quantify the diagnostic accuracy of the CEUS we calculated sensitivity, specificity, likelihood ratios and predictive values. A second, equally well experienced sonographer reassessed the results of the CEUS in every patient. To quantify the interobserver agreement we calculated the proportion of agreement and the Kappa statistic. **Results:** Sensitivity was 72.7% (95% CI: 43.4–90.3%), specificity was 87.8% (95% CI: 74.5–94.7%), positive likelihood ratio was 5.96 (95% CI: 2.43–14.63) and negative likelihood ratio was 0.31 (95% CI: 0.12–0.82). The observers agreed in 84.6% (95% CI: 71.4–92.7%) of cases, Kappa statistic was 0.76 (95% CI: 0.60–0.91). **Conclusion:** Our preliminary study indicates that contrast-enhanced ultrasound might be helpful in the evaluation of residual lesions after chemotherapy for malignant lymphoma and metastatic testicular cancer. Based on the results we provide required sample sizes for an adequately powered phase 3 diagnostic accuracy study.

## SL1-5

**Dynamic contrast-enhanced ultrasound (CEUS) after open and minimally invasive locked plating of proximal humerus fractures**Fischer C<sup>1</sup>, Frank M<sup>1</sup>, Hug A<sup>2</sup>, Weber MA<sup>3</sup>, Schmidmaier G<sup>1</sup>, HTRG – Heidelberg Trauma Research Group<sup>1</sup>Orthopädische Universitätsklinik Heidelberg, Zentrum für Orthopädie, Unfallchirurgie und Paraplegiologie, Heidelberg, Germany; <sup>2</sup>Universitätsklinik Heidelberg, Zentrum für Paraplegiologie, Heidelberg, Germany; <sup>3</sup>Universitätsklinik Heidelberg, Diagnostische und interventionelle Radiologie, Heidelberg, Germany

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**Purpose:** Closed reduction and locked plate fixation of proximal humerus fractures with the minimally invasive deltoid-splitting approach intends to minimize soft tissue damage although axillary nerve injury has been reported. The aim of this study was to assess the deltoid muscle perfusion with dynamic contrast-enhanced ultrasound (CEUS) as novel technique and evaluate its relation to the functional and neurologic outcome after open (ORIF) and minimally invasive (MIPO) fracture fixation. **Material and methods:** 50 patients, 30 with deltopectoral ORIF and 20 with deltoid-splitting MIPO approach were examined 6–49 months after surgery. Only patients with a healthy, contralateral shoulder were selected. Shoulder function, satisfaction as well as psychosocial outcome were assessed with established scores (Constant, DASH, Simple Shoulder Test, ASES, SF-12). Electromyography (EMG) of the deltoid muscle was performed to determine axillary nerve damage. Ultrasound of both shoulders included CEUS and Power Doppler after deltoid muscle activation via active abduction for two minutes. **Results:** None of the examinations and scores showed significant differences between ORIF and MIPO patients, the psychosocial outcome was similar. The fracture types were equally distributed in both groups. The normalized Constant Score was  $76.3 \pm 18.6$  in the ORIF and  $81.6 \pm 16.1$  in the MIPO group ( $p = 0.373$ ). Deltoid muscle perfusion in CEUS and Power Doppler revealed no differences between both approaches. EMG excluded functionally relevant axillary nerve injuries. Compared with the contralateral shoulder, Constant- and ASES-Scores ( $p \leq 0.001$  for both ORIF and MIPO) as well as the deltoid CEUS perfusion (ORIF  $p = 0.035$ ; MIPO  $p = 0.030$ ) were significantly worse for both approaches. **Conclusions:** Convincing consensus of functional, ultrasonographic and neurologic examinations demonstrated comparable outcomes after deltopectoral and deltoid-splitting approach. The quantification of the deltoid muscle perfusion with CEUS indicates that the proclaimed benefits of the MIPO approach on soft tissue might not be as great as expected.

## SL1-6

**Liver function assessment using sonazoid, correlation analysis with conventional biochemical marker ICG R15**Cho JH<sup>1</sup>, Gwon HJ<sup>1</sup><sup>1</sup>Dong-A University Hospital, Busan, Korea, Republic of

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**Purpose:** We analyzed the pattern of time-intensity curves (TICs) of the liver parenchyma on contrast-enhanced ultrasonography (CEUS), using Kupffer cell specific contrast agent; Sonazoid. The aim of the present study is to assess the diagnostic accuracy of the parameters of the time-intensity curves (TICs) for assessment of liver function. **Methods and Material:** Between June 2013 and October 2014, total 52 patients (44 men, 8 women) who underwent contrast enhanced ultrasonography and indocyanine green (ICG) tests due to focal liver lesion requiring surgical or ablational treatment were enrolled. We evaluated the hemodynamic-related parameters of TICs such as rise time (s), time to peak (s), peak intensity (dB), time from peak to one half (s), area under curve (dB\*s), mean transit time (s). And compared these parameters with the conventional serologic test, indocyanine green retention rate at 15 minutes (ICG R15). **Results:** There were no significant relationship between rise time (s), time to peak (s), peak intensity (dB), area under curve (dB\*s) and mean transit time (s) with ICG R15. However, correlation between time from peak to one half (s) and ICG R15 was statistically significant. Time from peak to one half was relatively proportional to ICG R15. The cutoff value of 149 seconds was determined for the time from peak to one half for abnormal ICG R15 ( $> 14$ ). And sensitivity and specificity were 85.7% and 92.3% for detecting abnormal ICG R15. **Conclusion:** Time from peak to one half is a useful parameter of TICs using CEUS to predict post-operative liver function.

## Ultrasound of the Head and Neck – Clinical Investigations

## SL2-1

**The complexity of the application TIRADS**Aleksandrov Y<sup>1</sup>, Beliakov I<sup>2</sup>, Sergeeva E<sup>2</sup>, Sokolova E<sup>2</sup>, Yanovskaya E<sup>2</sup><sup>1</sup>Yaroslavl State Medical University (YSMU), Surgery, Yaroslavl, Russian Federation; <sup>2</sup>Yaroslavl State Medical University (YSMU), Yaroslavl, Russian Federation  
DOI: 10.1055/s-0036-1587717

In last years the TIRADS is widely used in evaluating thyroid nodules. Merit of the system is the creation of a standard image assessments and regulation of subsequent decisions, but score 10 US criteria is subjective and depends on the device and the qualification of doctor. The aim of the study was to explore the subjectivity of each of the criteria. For this purpose a double blind study was performed. 145 patients with thyroid gland nodes were examined. Five doctors (independently) examined each patient. Doctors had no information on the results of studies of other professionals. Examination reports were analyzed by qualitative and quantitative indicators, conducted mathematical analysis. Pearson criterion ( $\chi^2$ ) was evaluated the statistical significance of the differences of the frequencies of the criteria. Correlation matrix has been formulated on the basis of the calculation of the coefficient t Kendall on each of the expert and throughout the group. **Results:** The most subjective criteria were the volume of thyroid ( $p=0.00001$ ), the shape nodule ( $p=0.0002$ ), location ( $p=0.06477$ ), vascularization ( $r=0.0753$ ) and borders ( $p=0.07519$ ). More objective were echostucture ( $r=0.69244$ ) and contours of nodules ( $r=0.8791$ ). Subjective were the number of nodules ( $p=0.45535$ ), echodensity ( $r=0.30048$ ), calcifications ( $r=0.45468$ ) and liquid component ( $r=0.6121$ ). The analysis of the number of matches and how widely values (t Kendall) found that less subjective were echostucture, the calcifications, the most subjective criteria were echodensity and borders. **Conclusion:** Analysis of the data from two different methods gave similar results. Number of significant correlations, their direction and strength of ties varies considerably. The experts gave a different assessment in the description of one criterion. The human factor influence on the description of each criteria. This complicates the use of TIRADS.

## SL2-2

**ARFI imaging® in the parotid gland – is it useful in different disease?**Mansour N<sup>1</sup>, Hofauer B<sup>1</sup>, Knopf A<sup>1</sup><sup>1</sup>Klinikum rechts der Isar, Technische Universität München, ENT-Department, Munich, Germany  
DOI: 10.1055/s-0036-1587718

**Purpose:** To evaluate ARFI imaging® in the parotid gland and different parotid gland diseases. **Material and methods:** 143 patients with parotid gland tumours, 50 patients with primary Sjögren's syndrome (pSS), and 78 patients with healthy parotid glands were included. All patients underwent high resolution ultrasound and ARFI imaging® was performed using a 9–14-MHz linear transducer (Acuson S2000, Siemens Healthcare, Erlangen, Germany). **Results:** 64 patients had pleomorphic adenomas (PA) of the parotid gland, 79 patients had Warthin's tumours (WT), 50 patients had pSS, and 78 patients had healthy parotid glands. ARFI values were measurable in 27 patients of the 64 PA (42.2%), in 50 patients of the 79 WT (63.3%), and in all patients with pSS (100%) and healthy parotid tissue (100%). ARFI values in healthy parotid tissue ( $1.92 \pm 0.62$  m/s) were significantly lower than in PA ( $2.4 \pm 0.6$  m/s,  $p < 0.05$ ), WT ( $2.32 \pm 0.69$  m/s,  $p < 0.05$ ), or pSS ( $3.0 \pm 0.97$  m/s,  $p < 0.0001$ ). **Conclusion:** ARFI imaging® is feasible in healthy parotid tissue and the diffuse disease of the parotid tissue like pSS, while it is not regularly reproducible in neoplastic lesions of the parotid gland.

## SL2-3

**Special US pattern of thyroid lesions; “nodule within the nodule”**Fernandez Sanchez J<sup>1</sup><sup>1</sup>Robert-Bosch-Krankenhaus, Radiology and Nuclear Medicine, Stuttgart, Germany  
DOI: 10.1055/s-0036-1587719

**Purpose:** The technical improvement of modern ultrasound (US) equipment allows a better evaluation of the sonographic structure of the thyroid and of the thyroid nodules (TN). The aim of this prospective study is an evaluation and presentation of a new US-pattern of the thyroid lesions denominated “nodule within the nodule”. **Methods:** Thyroid US with

18 MHz transducer in 540 patients. In case of solid TN, the presence of additional circumscribed thyroid lesions within the nodule was studied. The uptake of such TN at thyroid scan with 99 m-Tc-Pertheneate and/or the histology after surgery was evaluated. **Results:** 1920 TN with diverse US pattern were detected. 24 lesions were slightly hypoechoic till iso-echoic nodules (diameter between 15–35 mm) with hypoechoic halo and peripheral vascularization, which showed additional small nodules (diameter between 5–10 mm) within the TN, mainly hypoechoic nodules with microcysts and a peripheral perfusion of diverse degree. These 24 TN showed at the thyroid scan a normal uptake compared to the paranodular tissue or a hypercaptation. **Conclusion:** The special US pattern of thyroid lesions called “nodule within the nodule” is seldom, but it should be known and be taken into consideration in every thyroid US in order to avoid erroneous reports or false US descriptions. The pattern “nodule within the nodule” corresponds to scintigraphic lesions with normal uptake or toxic thyroid adenomas.

## SL2-4

**Concurrent Hashimoto's thyroiditis is associated to less frequency of extrathyroidal extension in papillary thyroid carcinoma**Hu M<sup>1</sup>, Zhu Q<sup>1</sup><sup>1</sup>Beijing Tongren Hospital, Capital Medical University, Department of Diagnostic Ultrasound, Beijing, China  
DOI: 10.1055/s-0036-1587720

**Purpose:** Papillary thyroid carcinoma (PTC) presenting with aggressive evidence such as extrathyroidal extension (ETE) is indicative of immediate surgical management. This study was aimed to investigate the difference of ETE identified between the patients diagnosed with PTC with and without concurrent histopathologically proven Hashimoto's thyroiditis (HT). **Material and Methods:** Totally 199 consecutive patients underwent total thyroidectomy combined with central cervical lymph node dissection between January 2015 and December 2015 were enrolled. All were pathologically confirmed with PTC. Medical record was reviewed for size, multiplicity, lymph node involvement, and ETE for each case. Sonographic features of location, relationship of tumor to the capsule and presence of protrusion that related to local aggressiveness were evaluated. The difference of characteristics between the patients with and without HT were examined. **Results:** Histopathologically confirmed HT was present in 29.1% (58/199) patients. There was a significant difference in gender with a greater proportion of females in PTC coexisting HT (86.2% vs. 64.5%,  $p=0.003$ ). ETE was reported in the patients with HT with a frequency of 5.2% (3/58), whereas 24 (17%) of 141 patients without HT presenting ETE at the time of surgery ( $p=0.038$ ). Otherwise, there was no significant difference in age, size, multiplicity, and lymph node involvement between the patients with and without HT. When compared with those tumors without concurrent HT, PTCs coexisting HT were more frequently located in the isthmus (15.5% vs. 6.4%) and confined within the gland without abutting on the capsule (24.1% vs. 10.6%), though significant difference in the distribution of tumor locations, various degree of contact between tumor and capsule, and presence of tumor protrusion were not found between groups. **Conclusions:** The study indicated that concurrent HT was associated to a decreased risk of ETE in patients with PTC, suggesting a potential protective effect on local tumor progress.

## SL2-5

**Brain imaging in newborn and infant, the method we choose?**Stroescu R<sup>1,2</sup>, Bizerea T<sup>1,2</sup>, Boia M<sup>2,3</sup>, Cerbu S<sup>4</sup>, Marginean O<sup>1,2</sup><sup>1</sup>“Louis Turcanu” Emergency Hospital for Children, Pediatrics, Timisoara, Romania; <sup>2</sup>“V. Babes” University of Medicine and Pharmacy, Timisoara, Romania; <sup>3</sup>“Louis Turcanu” Emergency Hospital for Children, Neonatology, Timisoara, Romania; <sup>4</sup>“Louis Turcanu” Emergency Hospital for Children, Radiology, Timisoara, Romania  
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The availability of increasingly performant methods for investigating the neonate and infant brain led to early diagnosis of cerebral pathologies. **Aims:** Evaluating the diagnostic imaging of cerebral pathology investigations. **Material and methods:** A retrospective study was conducted over a period of two years (2013–2015). 1450 patients were included aged 0 to 18 months, average 3.4 months. All patients were investigated by ultrasonography. Of these, 200 patients (13.8%) performed a CT examination and a smaller number of 75 patients (5.17%) a MRI investigation.



40 (2.75%) of patients were evaluated using all 3 methods. **Results:** Most patients had minor pathology; they were monitored by ultrasound. Patients diagnosed with hydrocephaly were investigated by CT prior to surgery and 15% underwent MRI. 3 patients with clinical suspicion of stroke required CT, 2 patients with vascular malformation were subject to all 3 methods, and one patient with a brain tumor was also examined using all 3 methods. **Discussion:** Additional investigations were not justified for patients diagnosed with hydrocephaly. **Conclusions:** Most cases did not require further investigation; we consider that ultrasound examination is sufficient in case of hydrocephaly. Additional investigations have an important role in trauma, white matter lesions, tumor and vascular pathology.

## SL2-6

### Clinical implication of texture analysis as a prognostic factor of papillary thyroid microcarcinoma

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**Purpose:** We investigated the value of texture analysis as a prognostic factor for pathologic extrathyroidal extension, lymph node metastasis, and high TNM stage. **Methods:** This retrospective study was approved by the Institutional Review Board, and the requirement to obtain informed consent was waived. 363 patients (mean age, 43.8 ± 11.3 years; range, 16–72 years) who underwent staging US and subsequent thyroidectomy for conventional PTMC ≤ 10 mm between May and July 2013 were included. Each PTMC was manually segmented and its histogram parameters (Mean, Standard deviation, Skewness, Kurtosis, and Entropy) were extracted with Matlab software. Multivariate logistic regression analysis was performed to evaluate factors associated with pathologic extrathyroidal extension, lymph node metastasis, and high TNM stage. **Results:** Kurtosis > 6.364 (Odds ratio, 2.496; 95% confidence interval (CI), 1.292–4.821,  $P=0.006$ ) and extrathyroidal extension on US (Odds ratio, 2.501; 95% CI, 1.508–4.147,  $P<0.001$ ) were independently associated with pathologic extrathyroidal extension. Younger age (Odds ratio, 0.963; 95% CI, 0.941–0.985,  $P=0.001$ ) and lymph node metastasis on US (Odds ratio, 7.362; 95% CI, 3.572–15.175,  $P<0.001$ ) were independently associated with pathologic lymph node metastasis. Mean ≤ 102.642 (Odds ratio, 2.271; 95% CI, 1.019–5.062,  $P=0.045$ ) and older age (Odds ratio, 1.144; 95% CI, 1.105–1.184,  $P<0.001$ ) were independently associated with high TNM stage. **Conclusion:** Texture analysis can be used to predict pathologic extrathyroidal extension and high TNM stage in patients with PTMC.

## Pediatric Ultrasound I – Clinical Investigations

## SL3-1

### Pediatric musculoskeletal ultrasound – age- and sex-related normal B-mode findings of the knee

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**Purpose:** Musculoskeletal ultrasound (MSUS) is an important tool for evaluating disease activity, therapeutic progress, and remission status of rheumatic diseases in children. Knowledge of age-related normal findings is essential when interpreting pathological findings such as those seen in juvenile idiopathic arthritis. The most commonly affected joint in

childhood arthritis is the knee. **Material and methods:** To evaluate normal findings of the knee joint, we recorded age-related stages of musculoskeletal development in the knee in 440 healthy children between 1 and 18 years of age using high-resolution B-mode MSUS. We determined approximate age- and sex-related norms for suprapatellar recess size, ossified patella size, and distal femoral intercondylar cartilage thickness. **Results:** In almost all age groups, over 64% of children had visible fluid accumulation in the suprapatellar recess. Significant correlations were found between chronological age and the size of the suprapatellar recess and the length of the ossified patella ( $p<0.05$ ). An age-dependent decrease in intercondylar cartilage thickness of the distal femoral epiphysis was found in children between 10 and 18 years of age. **Conclusion:** High-resolution B-mode MSUS is an excellent tool for assessing joint and skeletal development in children. Our reference data can be used to discriminate better between normal physiological findings and pathological abnormalities.



Fig. 1: Measurement of ossified patella

## SL3-2

### 4-year follow-up of ultrasound-based diagnosis and non-surgical treatment of developmental dysplasia of the hip in mongolia: a prospective cohort study

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**Purpose:** Avascular necrosis of the femoral head and residual dysplasia can occur after non-surgical treatment of developmental dysplasia of the hip (DDH). Both are indications for surgical procedures and cause pain and early osteoarthritis despite interventions. We therefore aimed to determine their prevalence in a prospective cohort study of Mongolian newborns. **Materials and methods:** Hips of all children born within one year in the largest pediatric hospital of Mongolia ( $n=8356$ ) were examined by ultrasound at a median age of one day. If DDH was present, the patient was treated with a Tubinger splint ( $n=107$ ). All treated children could be discharged with healthy type 1 hips after monthly checks by ultrasound. A representative sample of 51/107 children treated was followed up at the age of 3–4 years with conventional radiography. We determined 1) the formation of the femoral head (condensed) and joint space (narrowed) as signs of avascular necrosis; and 2) the acetabular angle ( $\geq 28$  degrees in  $\leq 3$ -year-old participants or  $\geq 25$  degrees in  $> 3$

years) as sign for residual dysplasia. Furthermore, we asked the parents about the use of swaddling. **Results:** No child showed signs of avascular necrosis. One child had a sign of residual dysplasia (acetabular angle 25.8 degrees on the left hip at age 3.5 years). Angles in all other children were below thresholds and highly variable, ranging from 11.1 to 26.2 degrees. They were slightly higher in girls than boys, and on the left compared to the right. Swaddling behavior did not affect the results. **Conclusion:** Ultrasonographic diagnosis of DDH and treatment with Tubinger splint within the first few weeks of life is safe and efficient in preventing surgical interventions.

## SL3-3

### Adaptation of the Graf hip ultrasound system for a newborn DDH screening program in the humanitarian Swiss Mongolian Pediatric Project (SMOPP)

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**Purpose:** In Mongolia, a developing country in Central Asia, SMOPP has introduced a strategy for early detection and treatment of developmental dysplasia of the hip (DDH). A big screening study with 8356 newborns showed a high incidence of DDH (2%) and a remarkable treatment success with a simple and safe reusable abduction device. In the study, we had employed the gold standard in DDH classification of Graf differing 10 types. Yet, for daily use in our program, it proved to be rather complicated and extensive. Furthermore, different types of dysplasia did not lead to different treatment strategies. In order to simplify the instructions of the screeners and their evaluations, SMOPP developed an adaptation of the Graf method. **Method:** We adapted the Graf system for use in a DDH screening program in newborns to 4 different types according to the therapeutic consequences: A – none; B – control; C – conservative; D – surgical. **Results:** The simplification of the Graf method could quickly be implemented and found high acceptance amongst the performing doctors. It helped to compensate the huge turnover of users in governmental hospitals and it will facilitate the implementation of a nationwide screening program. The selected age group (first days of life) allows a narrowing of treatment strategies, so the adaption does not result in an increase of individual risks. All screening doctors are supervised by experts with profound knowledge of the original Graf method. **Conclusion:** The SMOPP adaption of the Graf method is instructed to screeners and shows good acceptance. It will be used in the national newborn DDH screening program in Mongolia.

## SL3-4

### Paediatric musculoskeletal ultrasound – Examination of the joint capsule shape in healthy children and adolescents

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**Purpose:** In rheumatic diseases a convex shape of the joint capsule is valid as a sign of joint effusion. Up to now there are no studies about the capsule shape in a healthy childhood population. **Material and meth-**

**ods:** In an age- and sex-related multicentre study, we examined the formation of the capsules of shoulder, elbow, hip and ankle joints. The evaluation was performed in a longitudinal scan in healthy children and adolescents between 2 and 18 years of age. The shape of the capsule was classified into concave, straight or convex in relation to the bone surface located dorsally of the capsule. **Results:** We evaluated 447 study participants, 245 of them being girls. They were classified into six age groups, which constituted three-year age ranges. For the shoulder and ankle joints, we found a predominantly concave form in all age groups. Regarding the elbow joint, particularly the younger age groups showed both a concave and a straight capsule formation with a concavity increasing with age. In external rotation, the hip joint capsule showed a predominantly concave or straight form, whereas the capsule had a rather convex or straight shape in the neutral position of the joint. **Conclusion:** A convex joint capsule shape can also be found in healthy children and adolescents. It, therefore, cannot be interpreted separately as a sonographic sign for a joint effusion or a synovia inflammation.

## SL3-5

### Standardized joint-ultrasound for individualization of prophylaxis in hemophiliacs: Easy-to-learn-ultrasonography (HEAD-US) of joints and correlation with function and clinics

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**Purpose:** In Haemophilic Arthropathy the extent of synovitis is detected as a sign of the activity, osteochondral defects are quantifiable as a sign of progression by ultrasound. In 2013 an easy-to-use standardized ultrasound protocol (HEAD-US) for examination of early joint changes in Haemophilic Arthropathy was published by C. Martinoli. The results of the first clinical trial to correlate clinics, functional and structural changes in Haemophilic Arthropathy are shown here. **Material and methods:** In 2012–2015 we have included more than 200 young German patients with hemophilia A or B or vWD from different German haemophilia treatment centers in the HaemarthroSonoPilot trial (DRKS00004483, informed consent, ethical approved by the LÄK Baden-Württemberg). Standardized Ultrasound of the elbow, knee and ankle joints was performed and rated with the HEAD-US scale in each patient. Simultaneously an orthopedic clinical examination with clinical scoring and 3D motion analysis of the lower limbs for detecting early function defects (rolling vs. gliding in motion) were performed with an ultrasonic topometer. **Results:** The investigations in the presented pilot study showed correlation of the sonographic diagnostics with the measurement of a clinical orthopedic examination in haemophilic arthropathy depending on age. Through the joint sonography changes were even partially already seen before that stood out in the clinical investigation. **Conclusions:** It may be useful if haemophilia treaters in future apply an easy to learn standardized ultrasonography (HEAD-US) to individualize the therapy under close control and evaluation of joint changes.

## SL3-6

### The use of abdominal ultrasound as a screening method in the neonatal and infant period – is it useful?

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**Introduction:** Over the last few years abdominal ultrasound has become a very useful and accessible method for exploring the pediatric gastrointestinal pathology. **Study objective:** Assessing the need to perform an abdominal ultrasound in the neonate and infant, as a screening procedure, in order to find evidence of malformative or tumoral pathology. **Methods:** Abdominal ultrasounds were performed on 769 patients hos-

pitalized in our clinic during July 2013 – March 2015. The patients were aged between 0 – 1 years, with an average of  $3 \pm 2.5$  months. Of these, 450 patients (58.51%) received a routine abdominal ultrasound without any clinical evidence to justify this investigation. **Results:** The most common pathology was that of the reno-urinary tract: renal malformations – 1 case (cystic renal dysplasia), 1st and 2nd degree hydronephrosis – 75 cases (16.67%), 3rd and 4th degree hydronephrosis – 18 cases (4%); other findings consisted in ovary cysts – 39 patients (8.6%), vascular portal malformations – 5 cases (1.1%), digestive malformations (midgut cyst) – 2 cases (0.04%), tumoral pathology – 10 cases (2.2%), congenital spleen cyst – 1 case. **Discussions:** The relatively high prevalence of abdominal pathology (75 cases, 28%) detected accidentally by performing routine abdominal echography in these patients has not changed the therapeutical approach in 92% of cases. 6 cases were subject to surgical referrals. 2 cases required immediate surgery (neuroblastoma and nephroblastoma), while other 2 cases would undergo surgery at a later stage. **Conclusions:** Abdominal ultrasound during the neonatal period and infancy is important in order to establish a complete diagnosis and subsequent monitoring of these cases.

## Neurological/Nephrology/Musculoskeletal Ultrasound

### SL4-1

#### Comparison of freehand B-mode and power-mode 3D ultrasound for visualisation and grading of internal carotid artery stenosis

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**Purpose:** Currently, colour-coded duplex sonography (2D-CDS) is clinical standard for detection and grading of internal carotid artery stenosis (ICAS). However, unlike angiographic imaging modalities, 2D-CDS assesses ICAS by its haemodynamic effects rather than luminal changes. Aim of this study was to evaluate freehand 3D ultrasound (3DUS) for direct visualisation and quantification of ICAS. **Materials and methods:** Thirty-seven patients with 43 ICAS were examined with 2D-CDS as reference standard and with freehand B-mode respectively power-mode 3DUS (Curefab CS, Curefab Technologies GmbH, Munich, Germany). Stenotic value of 3D reconstructed ICAS was assessed by calculating distal diameter respectively distal cross-sectional area (CSA) reduction percentage and interrater as well as intermethod agreement were calculated. **Results:** Interrater agreement was best for power-mode 3DUS and assessment of stenotic value as distal CSA reduction percentage (intraclass correlation coefficient [ICC] 0.90) followed by power-mode 3DUS and distal diameter reduction (ICC 0.81). Interrater reliability was poor for B-mode 3DUS (ICC, distal CSA reduction 0.36; distal diameter reduction 0.51). In comparison to 2D-CDS intermethod reliability was good and clearly better for power-mode 3DUS (ICC, distal diameter reduction: Ex1 0.85, Ex2 0.78; ICC, distal CSA reduction: Ex1 0.63, Ex2 0.57) than for B-mode 3DUS. For power-mode 3DUS and assessment of stenotic value of ICAS as distal diameter reduction percentage, positive predictive value for differentiation between moderate and high-grade ICAS was 0.81 (Ex1) and 0.76 (Ex2) while negative predictive value was 0.92 (Ex1) and 0.91 (Ex2). **Conclusions:** Non-invasive power-mode 3DUS is superior to B-mode 3DUS for imaging and quantification of ICAS and might ideally complement 2D-CDS as initial vascular diagnostic in stroke patients. Thereby, more invasive and time-consuming imaging modalities like computed tomography angiography might be restricted to those cases of ICAS where a clear discrepancy for stenotic value is found between 2D-CDS and power-mode 3DUS.

### SL4-2

#### Reference values for the cross-sectional area of the vagus nerve in healthy subjects – preliminary results of a high-resolution ultrasound study

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**Purpose:** To assess age-related reference values for the vagus nerve (VN) and to examine interrater reliability. Herewith, we report preliminary results. **Materials and methods:** Both VNs of 26 healthy subjects (18 female, mean age  $31 \pm 7$  years) were examined with high-resolution ultrasound using a 15 MHz ultrasound transducer (Esaote MyLab Five, probe LA435). Cross-sectional area (CSA) of each VN was assessed at 2 points: at level of the distal common carotid artery before beginning of

the bulb (proximal measuring point) and at level of the thyroid gland (distal measuring point). Each subject was examined by 2 sonographers experienced in peripheral nerve ultrasound. **Results:** Median CSA of the VN at the proximal level was significantly larger on the right (examiner 1/examiner 2:  $2.9 \pm 0.7$  mm<sup>2</sup> [mean  $\pm$  SD]/ $2.6 \pm 0.5$  mm<sup>2</sup>) in comparison to the left side ( $2.2 \pm 0.6$  mm<sup>2</sup>/ $2.3 \pm 0.5$  mm<sup>2</sup>; both  $p < 0.001$ ; Wilcoxon signed-rank test). At the distal level, median CSA of the right was also significantly larger ( $2.8 \pm 0.8$  mm<sup>2</sup>/ $2.7 \pm 0.5$  mm<sup>2</sup> versus  $2.0 \pm 0.4$  mm<sup>2</sup>/ $2.2 \pm 0.4$  mm<sup>2</sup>; both  $p < 0.001$ ; Wilcoxon signed-rank test). Interrater agreement (intraclass correlation coefficient) was moderate for the proximal (0.63, 95% confidence interval: 0.43 – 0.77) as well as for the distal (0.69, 95% confidence interval: 0.51 – 0.81) measuring point. **Conclusion:** With restrictions due to the preliminary character of our data, we found a significant difference in CSA between the right and left VN, which further emphasises the need for side-specific reference values. However, because of special anatomical characteristics like the pulsating common carotid artery and the internal jugular vein in direct vicinity, even experienced sonographers of a faculty might consider a training to obtain a good interrater reliability.

### SL4-3

#### Accuracy of high-resolution ultrasound in carpal tunnel syndrome

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**Purpose:** The aim of this study was to evaluate the diagnostic efficiency of high-resolution ultrasound in diagnosis of carpal tunnel syndrome compared to electromyography exam (EMG). **Materials and methods:** 36 wrists of 20 patients with EMG diagnosis of carpal tunnel syndrome were prospectively evaluated using high resolution ultrasound. 14 patients were female and 6 male. Control group consisted of 17 asymptomatic volunteers (34 wrists). Ultrasound exam was performed the same day right after the EMG, by a radiologist experienced in MSK ultrasound. High resolution linear transducer was used. The radiologist was blinded to EMG results. Ultrasound diagnostic criterion for carpal tunnel syndrome was cross section area of median nerve of 10 mm<sup>2</sup> or more measured at proximal carpal tunnel (at the level of pisiform bone). Sensitivity, specificity and accuracy of the method were evaluated. **Results:** Majority of the patients, 80% had bilateral carpal tunnel syndrome. Ultrasound showed true positive finding in 31 of 36 cases of carpal tunnel identified by EMG. Sensitivity was 86.1%. Specificity was also high, 88.2%, 30 of 34 cases were correctly recognized as normal by ultrasound. Positive predictive value was 88.6%, and negative predictive value was 85.7%. Accuracy of the method was high, 87.1%. **Conclusion:** Ultrasound in comparison to EMG shows high sensitivity, specificity and accuracy in diagnosis of carpal tunnel syndrome. Due to its availability, easiness of use and cost of the exam it can be used as a reliable method of choice for quick and accurate evaluation of carpal tunnel syndrome.

### SL4-4

#### Is 2D shear wave elastography (2D-SWE) useful in the assessment of chronic kidney disease? – A 2 center pilot study

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**Purpose:** The results published so far regarding elastography of the kidney (mainly point shear wave speed measurements) are not always consistent. The present study aims to evaluate another elastographic method (2D-SWE, Aixplorer, Supersonic Imagine), performed independently in two centers. **Material and methods:** The study was performed in two Nephrology Clinics from Croatia and Romania on a total of 58 subjects



(33 female, 25 male; mean age  $45.5 \pm 17.4$ ) – 46 with chronic kidney disease (CKD) and 12 healthy volunteers. In all patients kidney shear wave speed (KSWs) values were determined using the 2D-SWE method. We tried to obtain 5 valid measurements in each kidney, with the patient in lateral decubitus, median values were calculated and expressed in meters/second (m/s). **Results:** Valid KSWs values were obtained in 96.5% of the subjects for the left kidney, but in only 77.5% of the subjects for the right kidney, therefore we chose to use the results obtained in the left kidney. We found significantly higher KSWs values in male vs. female subjects (5.3 vs. 3 m/s,  $p=0.01$ ), and in patients compared to normal controls (4.6 vs. 1.7 m/s,  $p=0.005$ ). We found a significant indirect correlation between KSWs and glomerular filtration rate (eGFR) ( $r=-0.31$ ,  $p=0.03$ ), but no correlation was found with measurement depth, age, proteinuria or with histological parameters obtained from renal biopsy (tubulo-interstitial fibrosis, arteriolar hyalinosis). We found a statistically significant difference between the results obtained in the two centers ( $p<0.001$ ). **Conclusion:** KSWs measured using 2D-SWE is difficult to perform due to the inhomogeneity of the renal parenchyma, fact that probably leads to significant differences between results obtained on subjects assessed in two independent centers. KSWs is increasing with the progression of renal disease (decrease in eGFR), but there is no correlation with renal fibrosis, so probably other factors influence kidney stiffness.

#### SL4-5

#### Dynamics of arthrosonographic pattern of gouty arthritis influenced by medication therapy

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**Objective:** To investigate the effect of medication therapy on ultrasound picture of affected joints at gouty arthritis. **Methods:** General clinical examination, ultrasound examination of the affected joints. **Results:** There have been examined 84 patients with gouty arthritis. The monitoring group consisted of 20 healthy volunteers of appropriate age and gender. All patients were divided into two groups. 1 group (40 people) received a daily dose of 400 mg of allopurinol, 2 group (44 people) – allopurinol of 400 mg and atorvastatin of 20 mg for 8 weeks. Before treatment patients of group 1 had been diagnosed with: micro calcification sand dual circuit of cartilage in 95%, joint effusion in 83%, subchondral bone erosions in 82.5%, tophus in 32.5%. After 8 weeks micro calcification sand dual circuit were visualized in 70% ( $p<0.05$ ), effusion in 42.5% ( $p<0.01$ ), erosion in 70%, tophus in 27.5%. Patients of group 2 before treatment had been detected with: micro calcifications and dual circuit of cartilage in 95%, joint effusion in 80%, subchondral bone erosions in 82.5%, tophus in 32.5%. After 8 weeks micro calcifications and dual circuit were visualized in 52.5% ( $p<0.01$ ), effusion in 30% ( $p<0.01$ ), erosion in 52.5% ( $p<0.05$ ), tophus in 15% ( $p<0.05$ ). **Conclusions:** Arthrosonographic changes in patients with gouty arthritis are presented by micro calcifications and dual circuit of cartilage, effusion in the joints, erosions and tophus. Medication therapy by allopurinol improves ultrasound picture in 8 weeks of treatment (frequency of detection of micro calcifications and effusion has been significantly reduced). Additional receiving of atorvastatin allows to reliably reduce the frequency of detection of erosion and tophus. Therefore arthrosonographic is recommended to be used in the dynamic monitoring of the effectiveness of medication treatment of gouty arthritis.

#### SL4-6

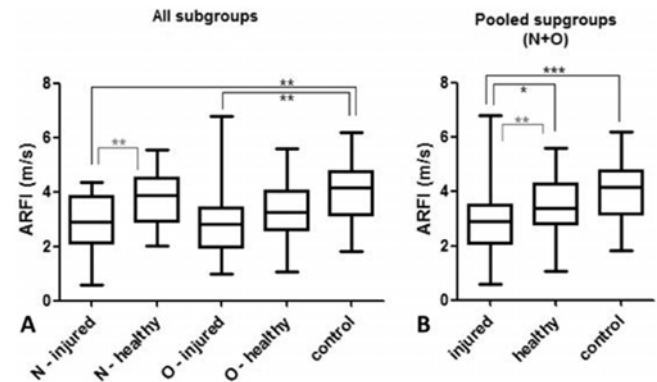
#### Assessment of elasticity by ARFI sonography of ruptured achilles tendons – long-term results

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**Purpose:** Rupture of the Achilles tendon is a common injury. Only a few studies have investigated the biomechanical properties of injured tendons compared to healthy tendons in the long-term results. Our objective was to compare the elasticity of injured tendons vs. non-traumatized tendons by ultrasound elastography in the long-term outcome. Our secondary objective was to investigate differences of operatively vs. non-operatively treated tendons. **Methods:** Acoustic-radiation-force-impulse-elastography (ARFI) was performed on Achilles tendons of patients

who had ruptured their Achilles tendon and received operative (O) or non-operative (N) treatment. We included patients who were injured 2 – 10 two to ten years prior to the examination (exclusion criteria: bi-lateral injury in their history). Both Achilles tendons (injured and healthy) of each patient were scanned in the distal, middle and proximal portion using ARFI sonography (Siemens Acuson 2000, 6 – 9 MHz probe). Statistical analysis was performed by using one-way ANOVA with Bonferroni's post-hoc testing and subgroup analysis by using paired t-test. Furthermore, healthy tendons of the patients were compared to tendons of healthy individuals ( $n=36$ ) without any Achilles tendon rupture in their history (control). **Results:** 56 patients were included in the study [23 (N), 33 (O)]. Mean follow-up-time after injury was  $67 \pm 26$  months [Mean  $\pm$  SD]. No statistical significant differences ( $p<0.05$ ) were found between non-operatively and operatively treated ruptures (Fig. 1). Compared to the control group all injured tendons had significantly lower elasticity in ARFI measurements. No significant differences were found between the healthy tendon of the patients and the control group.



**Fig. 1:** ARFI results of all subgroups (A) and pooled injured subgroups (B) compared using One-way ANOVA with Bonferroni's multiple comparison test (black). Subgroups separately compared using paired t-test (grey). P-values: \* $\leq 0.05$ ; \*\* $\leq 0.005$ ; \*\*\* $\leq 0.0001$

**Conclusion:** Evaluating our patients, we found that previously ruptured tendons still showed deficiencies in elasticity as evaluated by ARFI-sonography after a long period of healing. No significant differences were found between non-operatively and operatively treated tendons. Further investigations need to be performed in order to correlate ultrasound findings with clinical scores, biomechanical, and histological parameters.

#### Safety/Technology/Physics Techniques and Physics of Ultrasound

#### SL5-2

#### Results of a study to check the actual functional status and image performance of ultrasound systems used in ambulances of a hospital (QUINTUS)

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**Purpose:** A pilot study has been performed during Sep.-Nov 2015 in 3 selected ambulances of our hospital to collect data about image quality parameters and about the actual condition of the involved ultrasound systems in general. The results lead support for selecting needed additional technical quality assurance checks regarding image quality deterioration and for assigning check intervals. **Material and methods:** An advanced test protocol has been prepared based on methods published in EFSUMB TQA Guideline 2012 by using different test devices and software for image/data evaluation. The focus has been on testing the status of the installed transducers and monitor quantitatively, while the overall functional status of the system e.g. working of important main console settings, has been done visually. In total 30 different ultrasound units with 89 transducers were involved checking 22 different TQA protocol items. **Results:** 72% of the tested devices were fully operational but around 20% ( $n=17/89$ ) of the transducers and 7% ( $n=2/30$ ) of the monitors were classified as working suboptimal and needed maintenance immediately; the users partly do not register these malperformances in use: e.g. loss of several elements or sensitivity decrease, air inclusions, cracks in cables. The total protocol were worked off in 30 min



per unit sometimes including 3–4 transducers (checking time 5 min each only). **Conclusion:** These results are in accordance with published literature data and show that these kind of tests must be introduced mandatorily to guarantee optimal image quality. In general the testing intervals should depend on the system's operating-hours and carried out for 24/7 machines/transducers optimally monthly for others at least once a year. **Reference:** EFSUMB Technical Quality Assurance Group, *Guideline for Technical Quality Assurance of Ultrasound devices (B-Mode) – Version 1.0*, 2012. *Ultraschall in Med* 2012; 33: 544–549.

## SL5-3

### Reduction of defective transducers by implementing regular technical quality assurance tests

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**Purpose:** Transducers are the most common error source for diagnostic ultrasound devices. Therefore regular technical quality assurance is intrinsic to be able to detect such faults at an early stage. With the implementation of a regular technical quality assurance concept for diagnostic ultrasound devices in the Austrian Mammography Screening Program the amount of defective transducers has been reduced significantly. **Material and methods:** Within two years 198 radiology departments including 237 ultrasound devices and 255 linear transducers were evaluated. Analysis of DICOM images from extensive initial tests, additional tests and monthly consistency checks was performed using in-house software in terms of transducer defects such as weak/dead elements, cyst resolution and penetration depth. **Results:** Initially detected transducer defects revealed a total of 23.5% at screening start. Two years later the amount of defective transducers could be reduced significantly to 13.5%. Additional analysis of initial test data in terms of cyst resolution and penetration depth showed large divergences as a result of suboptimal preset settings. **Conclusion:** It could be shown that technical quality assurance is intrinsic to overcome high numbers of transducer defects. Most of these defects can be detected at a much earlier stage by performing regular quality checks as implemented in the screening program. With such checks a high quality of ultrasound devices and equipment can be ensured, improving quality of diagnoses for physicians as well as patients.

## SL5-4

### A blood mimicking fluid for clot-detection experiments with ultrasound

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**Purpose:** Monitoring of coagulation tendencies is important during many therapies, e.g. during dialysis or heart surgery with extracorporeal blood circulation. The monitoring could be done with ultrasound which can help physicians to make informed decisions on treatments. To ensure safety and to get administrative approval of the ultrasound measurement lots of experiments are necessary. Therefore a fluid that mimics rheological as well as acoustical properties of blood as closely as possible is necessary. **Material & methods:** We want to model the early stages of coagulation and therefore adapted a recipe of a blood mimicking fluid (BMF). The constituents of the BMF are polyamide particles with diameters 5 µm as erythrocyte and 20 µm to 60 µm as small clot mimics. Surfactant is added to suspend the particles. Water, glycerine, and dextran mimic the blood plasma. Their amount was adjusted to represent rheological and acoustical properties of blood as closely as possible. Experiments were performed to examine the fluids properties. Among others, viscosity was measured with a rheometer, speed of sound and the absorption coefficient in pulse-echo-mode, and density with a pycnometer. **Results:** The haematocrit of the BMF is up to 30 Vol% (polyamide particles). Viscosity and density strongly agree with that of blood, speed of sound is somewhat higher (1680 m/s), and the attenuation coefficient is much stronger than that in blood. The latter is due to different impedances of polyamide particles and erythrocytes. **Conclusions:** It is essential to find a blood mimicking fluid that closely reproduces rheological, acoustical and to some extent mechanical blood properties in lar-

ger vessels and during coagulation. Our BMF overcomes difficulties as suspensibility at higher haematocrit concentrations or air bubbles in the solution. Concerning all aspects, this recipe is an adequate mimic for research to be used at higher haematocrit values.

## SL5-5

### Descriptive analysis of errors in internal ultrasound of level DEGUM III for the period 03/2006–03/2013

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**Purpose:** To analyse and describe errors in internal ultrasound and to investigate these with regard to basic factors of influence. **Material and methods:** Diagnostic errors (n = 154) met the inclusion criteria and were analysed retrospectively. Errors were distinguished in the categories major and minor errors (with/without consequences for the patients) as well as preventable and non-preventable errors. Factors of influence like 1. device-related factors, 2. patient-related factors, 3. external factors and 4. observer related factors were differentiated. **Results:** Major errors occurred at n=43 patients (27.9%); minor errors occurred at n=111 patients (72.1%). In n=40 cases (26%) the errors were considered as preventable and in n=114 cases (74%) as non-preventable. The following factors were influential for the error rate: CEUS, Age of patient, ultrasound conditions, organ regions, daytime, incorrect ultrasound-requirements. **Conclusion:** The retrospective analysis of errors provides useful approaches for the prevention of errors. The standardised application of a prospective detection, documentation and analysis of errors in every ultrasound laboratory is demanded.

## New Techniques in Ultrasound

## SL6-2

### Combined optoacoustic and ultrasound tomography for investigation of inflamed finger joints

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Arthritic diseases, including rheumatoid arthritis, psoriatic arthritis and osteoarthritis, have a prevalence between 2 and 3% and lead to joint destruction and deformation resulting in a loss of function. Current diagnostic methods rely on B-scan and Doppler ultrasound, x-ray or MRI, which have the drawbacks of low sensitivity and high user-dependency, involvement of ionizing radiation and high costs, respectively. We propose a new approach based on a combination of ultrasound and optoacoustic tomography for high sensitivity imaging of inflammation induced hypervascularization on finger joints. Optoacoustic signals are generated upon absorption of pulsed light in tissue according to the local absorption coefficient. The optical energy is converted into broadband acoustic waves by means of the optoacoustic effect. Pressure signals can be detected using different kinds of transducers. In our system, a tomographic setup consisting of 4 arc-shapes transducer arrays based on high-bandwidth cMUTs (capacitive micromachined ultrasound transducers), which can independently be moved, allows imaging of all 3 finger joints (full tomographic view of DIP and PIP, top/bottom view of MCP). Signals are generated with a wavelength-tunable pulsed OPO (optical parametrical oscillator) laser system and acquired with the latest version of IBMT's ultrafast ultrasound platform DiPhAS. The system has been evaluated using different phantom structures. The resolution of the combined US/OA imaging system was characterized to be less than 200 µm. Vessel mimicking phantoms embedded in optically scattering media (gel phantoms) were imaged as well. The system has shown to be able to perform combined high-resolution acoustic and optoacoustic imaging in different studies. The platform has furthermore been tested according to different safety standards (acoustic, optical, electrical, EMC). Currently, hardware optimization steps with respect to a further improvement of the sensitivity are performed and a pilot patient study will be initiated soon to demonstrate the clinical potential of the technique.

## SL6-3

### Possibilities of contrast- enhanced ultrasound (CEUS) for evaluation of the success of percutaneous treatments of malignant liver lesions using special perfusion software

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**Aim:** Using new perfusion software for evaluation of the success of percutaneous treatments of malignant liver tumor lesions with CEUS. **Material and methods:** Retrospective analysis of 79 patients (66 male, 13 female; 30–84 years) with 140 malignant liver lesions (size 9 mm–10 cm). The lesions were metastases in 45 cases and HCC lesions in 95 cases. The success of percutaneous interventional treatments (IRE n = 40; RFA n = 33; MWA n = 36; TACE n = 31) was evaluated by CEUS with perfusion imaging using special perfusion software. CEUS was performed after bolus injection of 1–2.4 ml of sulfur hexafluoride microbubbles. Regions of interest (ROI) were manually placed in the centre, and the margins of the lesions as well as in the surrounding tissue. Using perfusion software Time to Peak (TTP), mean Transit Time (mTT), Rise-Time, and wash-in rate were calculated in the ROIs. **Results:** There were significant differences in all cases between the centre compared to the surrounding liver tissue for the main perfusion parameters (Peak, Rise Time, wash-in) ( $p < 0.001$ ). There were also significant perfusion differences for Peak and wash-in when comparing defect and margins ( $p < 0.001$ ), and in Peak, Rise Time, and Wash-in when comparing liver tissue to the defect and the defect in comparison to the margins for completely treated lesions. **Conclusion:** Combination of CEUS with perfusion imaging using special perfusion software enables a very critical analysis of successful treatment by percutaneous interventional procedures of malignant liver lesion. **Clinical relevance Statement:** A combination of CEUS with perfusion imaging is a radiation-free possibility of controlling the success of percutaneous ablation therapies in malignant liver lesion. There are no contra-indication for ultrasound contrast-media so far.

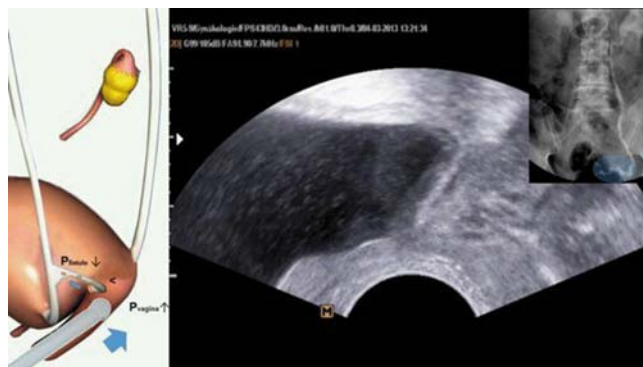


Fig. 1: Pumping Probe Technique

## SL6-5

### Performance of Fetal Intelligent Navigation Echocardiography (FINE, 5DHeart ©) in congenital heart defects – experiences from a retrospective single center study

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**Purpose:** Congenital heart defects (CHD) are among the most common malformations as well as the main cause of malformation related childhood mortality. Although ultrasound is nowadays available almost everywhere, the majority of congenital heart defects are diagnosed postnatally. Fetal intelligent navigation echocardiography (FINE, 5D Heart©) was developed to assist physicians in the extraction of examinations planes in accordance to national and international guidelines from a STIC (spatio-temporal image correlation) volume data set. **Material and methods:** In our retrospective study STIC volumes of patients with a fetus affected by congenital heart disease (n = 35) were examined. After seven predefined anatomical structures were labeled, a sort of “map” of the fetal heart was automatically constructed by the algorithm and nine examination planes in accordance with the guidelines of the German Society for Ultrasound in Medicine (DEGUM), International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) and the American Institute of Ultrasound in Medicine (AIUM) were extracted. The examined heart defects include tetralogy of Fallot, atrioventricular septal defects (AVSD), double outlet right ventricle (DORV), Hypoplastic left heart syndrome and other major structural heart defects. The volume data sets of the affected fetuses were analyzed with the FINE algorithm and the resulting planes have been examined. **Results:** The results whether the heart defect is detectable will be demonstrated. **Conclusions:** Preliminary results confirm and expand previously published data that the algorithm in combination with the standard 2D ultrasound could be a valuable tool to identify CHD and moreover to improve prenatal counseling and multidisciplinary management of the delivery.

## SL6-4

### The “Pumping Probe Technique” and complete sealing stent – a new simple method for the detection and treatment of ureteric fistulae

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**Purpose:** Ureteric fistulae after gynecological surgery are a typical post-operative (PO) complication. In the past, fistula detection was performed by X-Ray or CT. The aim of this study is to show that ultrasound using the novel “Pumping Probe Technique” (PPT) is an alternative method of detecting fistulae. The use of a new intermural complete sealing ureteric stent prevents leakage, covers the tissue and allows the tissue to heal without further measures. The stent will then be removed atraumatically after wound healing is complete. **Methods:** In 19 cases between June 2012 to April 2016 we used the new PPT in both endoluminal sonography and elastography to visualize ureteric fistulae. The technique involves the forward and backward movement of an ultrasound probe to generate pressure in the fistula, thus leading to a movement of the fluid within so that it can be detected. We found 15 ureterico-vaginal fistulae, three ureteric-enteric fistulae and 1 arterio-ureteric fistula using this method. Each patient was then treated with the implantation of a 120 mm, 30Fr self-expanding covered stent (Allium/North Medical (TM)) under radiological control. **Results:** A fistula was detected by elastography in only 12 of the cases, however using ultrasound 17 of 19 were visualized, both imaging modalities were performed with the new PPT. X-Ray and CT were then used to confirm the diagnosis. In 17 of the 19 cases the fistula was successfully closed and the stent could be removed 8 weeks later. **Conclusions:** Endoluminal sonography and elastography using the novel PPT detected approximately 90% of the fistula cases. The subsequent management of ureteric fistulae with stents can be performed gently, safely and quickly. The cure rate was high at 90%. This minimally invasive technique as well as the comfort of the implanted stent leads to high levels of patient satisfaction.

## Elastography and Ultrasound I – Clinical Investigations

## SL7-1

**Results of the DEGUM-multicenter study evaluating strain elastography for differentiation of thyroid nodules**

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**Purpose:** Many patients with thyroid nodules are presently referred to surgery not only for therapeutic but also for diagnostic purposes. Strain elastography (SE) enables the ultrasound-based determination of tissue elasticity. The aim of the present study was to evaluate the value of SE for differentiation of thyroid nodules in a prospective multicenter study. **Material and methods:** The study was registered at clinicaltrials.gov and was approved by the local ethical committees of all participating centers. All patients received an ultrasound (US) of the thyroid gland including Colour Doppler US. In addition all nodules were evaluated by SE (Hitachi Medical Systems) using qualitative image interpretation of colour distribution (SE-ES), strain value and strain ratio. **Results:** Overall, 602 patients with 657 thyroid nodules (567 benign, 90 malignant) from 7 centers were included in the final analysis. Sensitivity, specificity, NPV, PPV, +LR were 21%, 73%, 86%, 11%, 0.8 for colour Doppler US; 69%, 75%, 94%, 30%, 2.9 for SE-ES; 56%, 81%, 92%, 32%, 2.9 for SE-strain value; 58%, 78%, 92%, 30%, 2.6 for SE- strain ratio, respectively. Diagnostic accuracy was 71% for both strain value and strain ratio of nodules. **Conclusions:** SE as an additional ultrasound tool improves the value of ultrasound for the work-up of thyroid nodules. It might reduce diagnostic surgery of thyroid nodules in the future.

## SL7-2

**Rapid and sustained improvements of liver stiffness values in HCV-infected patients treated with direct-acting antiviral drugs**

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**Background:** The use of interferon-free antiviral therapy in patients with chronic HCV infection is associated with high rate of sustained virological response (SVR). The aim of this study was to evaluate changes of liver stiffness (LS) using Acoustic Radiation Force Impulse Imaging (ARFI) elastography and transient elastography (TE) during antiviral treatment and to evaluate its role in relation to SVR. **Patients and methods:** In total 337 chronic HCV-infected patients (mean age 59 years, 42% females) were included in this prospective single center study. Genotype 1 accounted for 75%, 244 patients (72%) had liver cirrhosis at baseline. Patients received direct-acting antiviral drugs (DAADs). 254 patients (75%) reached follow up 24 (FU24) and were considered for statistical analyses. Duration of treatment varied between 8 and 24 weeks. All patients received LS measurement by ARFI during treatment and at FU24 and FU48. TE was performed at baseline and FU24. **Results:** SVR was observed in 219/254 patients (86%). Mean ARFI values decreased significantly from baseline to FU48 ( $p=0.042$ ), with a gradually decrease from baseline to W4 ( $p=0.001$ ), from W4 to W12 ( $p=0.004$ ) and from FU24 to FU48 ( $p=0.031$ ). Median TE showed an overall decrease from baseline to FU24 ( $p<0.001$ ). ARFI values decreased on the LSM scale at W48 from F4 to F3 in 17%, to F2 in 7% and to < F2 26%. Baseline values of ARFI, TE and AST showed higher values in relapsers than in patients with SVR ( $p<0.001$ ,  $p<0.001$ ,  $p<0.029$ , respectively). In the multivariate analysis, ARFI was the only predictor of liver stiffness regression ( $p<0.001$ ). **Conclusion:** LSM by ARFI and TE decreased in almost all HCV-treated patients during the course of treatment, irrespective of HCV response. Base-

line ARFI might be used as predictor of LS regression and HCV response in chronic HCV-infected patients treated with DAADs.

## SL7-3

**Evaluation of 2D-shear wave elastography for characterisation of focal liver lesions running title: 2D-SWE and liver lesions**

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**Purpose:** The aim of this prospective study was to evaluate 2D-shear-wave-elastography (2D-SWE) for characterisation and differentiation of benign and malignant focal liver lesions (FLLs). **Material & methods:** Patients referred to our ultrasound unit for surveillance of chronic liver disease or work-up of incidentally detected FLLs were prospectively included. B-mode ultrasound and 2D-SWE (Aixplorer® France) was performed for one FLL in each patient. Liver histology obtained by biopsy and/or contrast-enhanced imaging was used as reference method. The Mann-Whitney and Kruskal-Wallis test was used to assess the stiffness difference between the groups. **Results:** 140 patients with FLL were included. SWE acquisitions failed in 34 FLLs (24%). Therefore, 106 patients with FLL could be analysed, 42/106 (40%) with benign and 64/106 (60%) with malignant FLLs. 58/106 (55%) FLLs were localized in the right liver lobe. The median stiffness for benign FLLs was 16.4 (2.1 – 71.9) kPa (in detail: 16.55 kPa for 18 focal nodular hyperplasia (FNH), 16.35 kPa for 18 hemangioma, 9.8 kPa for 3 focal fatty sparing (FFS), 8.9 kPa for 1 adenoma, 20 kPa for one regenerative node and 29 kPa for one cholangiofibroma) and for the malignant FLLs 36 (4.1 – 142.9) kPa (in detail: 44.8 kPa for 16 hepatocellular carcinoma (HCC), 70.7 kPa for 7 cholangiocarcinoma (CCC) and 29.5 kPa for the 41 metastasis) ( $p<0.001$ ). Malignant FLLs were significantly stiffer than benign FLLs ( $p<0.0001$ ). CCCs were the stiffest malignant FLLs with significantly higher values as compared to HCCs and metastases ( $p=0.033$  and  $p=0.0079$ ). No significant difference in stiffness could be observed between the different benign FLL entities. No significant difference was observed whether 2D-SWE included the whole FLL, only the periphery or only the hardest area of the FLL. **Conclusions:** 2D-SWE provides further characterising information for interpretation of FLLs and may be useful at least in differentiation of CCCs and HCCs.

## SL7-4

**Reliability and validity of elastography in circumscribed objects: Acoustic-Radiation-Force-Impulse-quantification with fixed Region-of-Interest versus Shear-Wave-Elastography with variable Region-of-Interest – Phantom study**

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**Purpose:** Elastic properties of circumscribed tissue e.g. tendons, lymph nodes, myometrium are in focus of clinical interest. Current elastography systems employ several measurement techniques regarding the application of radiation force, measurement and imaging. The purpose of the study is the comparison of reliability and validity of Acoustic-Radiation-Force-Impulse (ARFI)-quantification versus Shear-Wave-Elastography (SWE) and the assessment of precision of SWE with variable Region-Of-Interest (vROI) in elasticity phantoms. **Material and methods:** The ultrasound (US) elastography phantom Model 049 (CIRS, USA) was used. Targets of varying stiffnesses (8, 14, 45, 80kPa) and diameters (20/10 mm) were examined. Three US-Systems and four probes were applied (Sie-



mensHC/Acuson/S3000 9L4/4C1, PhilipsHC/Epiq7 C51, Toshiba/Aplio/500 PVT375BT). Four different ROIs were used: fixed ROI (fROI), vROI "best fitted" a) rectangular b) round, fully variable ROI. Each measurement was performed twice (day1+8) by four operators. **Results:** 3604 measurements were conducted under standardized conditions. In both methods applied (ARFI-quantification/SWE) elastography showed low intra-observer variability (correlation test-retest reliability (mean) 0.869) and inter-observer variability (Pearsons correlation coefficient (mean) 0.852 – 0.967). Particularly the reliability of the E-modulus range of clinical relevance (8/14 kPa) was verified. The results validity showed nearly independent of operator experience. However, a significant difference between the fROI (ARFI) and vROI (SWE) on circumscribed objects of 10–20 mm diameter in terms of validity was found. Smallest observation error was detected in situations where the ROI is not "best fitted" but placed within the target 3 mm from the border ( $F_r = 15\%$ ). **Conclusions:** Elastography is an established method and widely used, e.g. for the assessment of liver fibrosis. In the estimation of elastic properties of circumscribed tissue, the different measurement techniques performed by commercial elastography systems show a strong susceptibility for observational errors, depending on the ROI and the ARFI-quantification/SWE. A renewed evaluation of the method appears necessary, as the non-standardized conditions provide deviating results likely affected by diameter of the target and artifacts caused by surrounding tissue.

## SL7-5

### Ultrasound based elastographic methods for the prediction of esophageal varices in liver cirrhosis

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**Purpose:** Ultrasound based elastographic methods are non-invasive techniques for the evaluation of liver stiffness (LS) that might be also useful in the assessment of portal hypertension. The aim of this study was to evaluate the performance of 4 ultrasound based elastographic methods for predicting the presence of esophageal varices (EV) in patients known with liver cirrhosis. **Material and method:** The study included 109 consecutive subjects diagnosed with liver cirrhosis (with clinical, biological, ultrasound, endoscopic or histological signs of liver cirrhosis), in whom LS was evaluated in the same session by means of 4 elastographic methods: transient elastography (TE) (M and XL probes), ARFI (VTQ), 2D-SWE and 2D-SWE.GE. Reliable LS measurements were defined as: for TE, VTQ and 2D-SWE.GE the median value of 10 measurements and for 2D-SWE the median value of 3 measurements acquired in a homogenous area. In 60 patients out of 109 all 4 elastographic methods had valid measurements and were included in the final analysis. **Results:** 20/60 patients from the study group had EV while 40/60 had not. The mean LS values for patients without EV were lower as compared to those of patients with EV: TE (21.60 ± 9.24 vs. 29.43 ± 11.23,  $p = 0.005$ ), 2D-SWE (20.24 ± 12.60 vs. 24.38 ± 15.24,  $p = 0.26$ ), ARFI (2.54 ± 0.71 vs. 2.69 ± 0.64,  $p = 0.42$ ), 2D-SWE.GE (12.06 ± 6.52 vs. 12.95 ± 3.49,  $p = 0.49$ ) TE had the best performance for predicting EV. The following cut-off were established for predicting the EV: TE  $^{321.1}$  kPa, Se-94.4%, Sp-57.1%, NPV-48.6%, PPV-96%, AUROC = 0.76,  $p < 0.0001$ ; ARFI (VTQ):  $> 2.01$  m/s, Se-88.9%, Sp-45.6%, NPV-48.6%, PPV-96%, AUROC 0.56,  $p = 0.002$ ; 2D-SWE:  $> 13.7$  kPa, Se-100%, Sp-48.6%, NPV-100%, PPV-37.5%, AUROC = 0.61,  $p = 0.05$ ; 2D-SWE.GE:  $> 13.48$  kPa, Se-77.8%, Sp-64.3%, NPV-87.1%, PPV-48.3%, AUROC = 0.69,  $p = 0.1$ . **Conclusion:** LS values assessed by any ultrasound based elastographic methods are higher in patients with EV as compared to those without EV, but TE seems to be the most predictive for the presence of EV.

## SL7-6

### Ultrasound shear wave elastography and multifrequency magnetic resonance elastography for detection of chronic renal allograft dysfunction

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**Purpose:** Kidney transplant dysfunction is associated with viscoelastic tissue changes. The purpose of this study is to noninvasively assess renal stiffness in kidney transplant recipients using ultrasound shear wave elastography (SWE) and to correlate shear wave velocity (SWV) with renal allograft function and shear modulus values obtained by magnetic resonance elastography (MRE). **Materials and methods:** This prospective study investigated 25 transplant kidneys (functional renal allograft, fct,  $n = 14$ ; renal allograft insufficiency, dys,  $n = 11$ ) in 20 kidney transplant recipients (mean age,  $43 \pm 14$  years). SWE was performed using a high-end ultrasound device (Aplio500, Toshiba) with a 14-MHz broadband linear transducer. In the same group multifrequency MRE (1.5 T scanner, Siemens) was performed with 7 slices at 4 mechanical frequencies from 40 to 70 Hz. Stiffness maps were computed by multifrequency reconstruction of the magnitude shear modulus ( $G^*$ ). SWE and MRE of larger tissue portions including pyramids and renal cortex were compared. SWV was correlated with clinical markers of renal allograft function and MRE. **Results:** Functional allografts had higher SWV than dysfunctional allografts in both cortex and pyramids and showed increased  $G^*$  as well (cortex:  $3.75 \pm 0.82$  m/s vs.  $2.79 \pm 0.73$  m/s,  $P = 0.0002$ ; pyramid:  $2.89 \pm 0.46$  m/s vs.  $2.39 \pm 0.34$  m/s,  $P = 0.044$ ;  $G^*$ :  $7.92 \pm 2.18$  kPa vs.  $6.13 \pm 1.20$  kPa,  $P < 0.0001$ ). Cutoff values of 3.27 m/s for cortex, 2.54 m/s for pyramids and 7.24 kPa for  $G^*$  provided sensitivities of 72.7%/77.8%/90.9% and specificities of 71.4%/78.6%/85.7% for detecting renal allograft dysfunction with AUROC values of 0.831/0.841/0.945 (95% CI, 0.67 – 0.99/0.66 – 1.02/0.86 – 1.03). SWV correlated positively with glomerular filtration rate ( $r = 0.741$ ,  $P = 0.0004$ ) and agreed with MRE-measured shear modulus values ( $r = 0.564$ ,  $P = 0.003$ ). **Conclusion:** SWE is sensitive to renal allograft dysfunction, which is characterized by reduced SWV values. SWE has higher image resolution than MRE, while MRE has slightly better diagnostic accuracy.

## Education and Teaching in Ultrasound

## SL8-2

### A web-based modern ultrasound diagnostic scanner simulation (SimulUS) from high-school students for undergraduate medical e-learning education

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**Purpose:** A unique interactive software has been developed to support E-teaching of students and teachers in medical studies. The functions and settings of a modern ultrasound imaging platform/console (B-/M-Mode, Colour-, Spectral-, Power-Doppler) are simulated to allow users to learn interactively the basic handling and main knobology of an imaging equipment as real as possible. **Material and methods:** The tool is designed as an HTML-based application to use it with common web-browsers being most flexible for its operation on different back-end devices used by students and account for their mobile learning behaviour. On the other hand this design chosen make it possible to access the tool as web-based (server-based) or standalone (downloadable from our lab's website) application. Only one external plugin is needed to run this web-based tool because it was originally layouted and developed with Visual Studio by high school students within a funded summer school program of 4 weeks (FFG Talente 2015, project # 851538). **Results:** Within this simulation the basic functions like selection of transducers, TGC, gain, focal setting, penetration depth etc. have been implemented to explain the essential settings that have to be changed/optimised during a real ultrasound examination. The changes can be seen interactively as live images within the displayed B-Mode image. Additionally the scanner simulates M-Mode as well as Spectral-, Colour- or Power-Doppler features (Fig. 1).

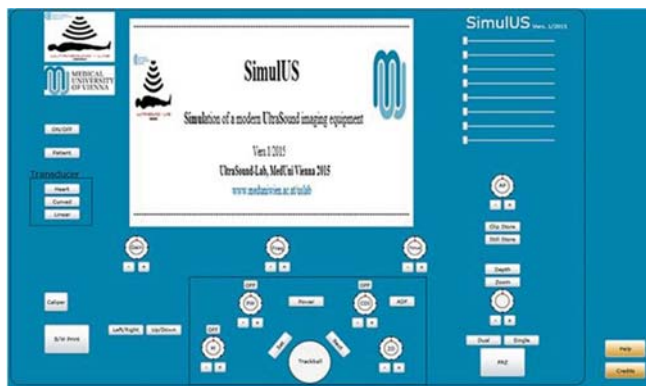


Fig. 1: SimuUS

**Conclusion:** This simulation seems to be an e-learning tool with effective application potential in our medical curriculum or for self-learning at home. It allows reducing temporal and equipment resources in hands-on sessions/skills-labs and fits the personal needs of students.

### SL8-3

#### Teaching ultrasound: do you credit for participation or test knowledge?

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**Background:** The vast majority of ultrasound courses for non-radiologists are giving credit for participation without testing for the actual knowledge and practical skills that were achieved by the participant. We present a structured training concept for ultrasound teaching for internal medicine physicians in Israel, including observed bedside practice and formal knowledge testing. **Intervention and methods:** A basic ultrasound training program for internal medicine physicians, with a total duration of 3–4 months is continuously being offered to hospitals owned by Clalit Health Services (the largest HMO in Israel). The course includes four steps: (1) A 6 hour, bedside course of basic ultrasound skills for fluid identification (pericardium, pleura, peritoneum, and bladder); (2) Four hour personal training on a computerized ultrasound simulator; (3) Bedside practice with a trained sonographer, according to a pre-specified list of skills (3–6 weeks); (4) Final exam (1.5 hours). The final exam tests for 4 skills: (i) Spatial orientation: the participant is required to precisely re-capture ultrasound images/videos using a phantom; (ii) Pattern recognition: the participant is required to explain anatomic and pathologic findings on a given image/video; (iii) Real-time sonography on a simulator, with focused questions (i.e. “is there pericardial effusion?”), and (iv) Operational skills (“knobology”). **Results:** Ninety-three physicians from 28 internal medicine wards in 8 general hospitals of Clalit Health Services across Israel, started the ultrasound training program. Forty-nine doctors (52%) were examined up to date (March 2016). Within the examined participants, 2 physicians (4%) needed additional practice in order to pass the exam. **Conclusion:** Even at basic ultrasound level, such as the point of care ultrasound training for internal medicine physicians presented here, one cannot assume that participation equals knowledge or skills. Knowledge and skills evaluation should become a standard for ultrasound teaching, for both patient safety and clinical quality assurance.

## Gynaecological Ultrasound I – Clinical Investigations

### SL9-1

#### Carotid intima-media-thickness precedes the clinical onset of preeclampsia and persists postpartum: A longitudinal study

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**Purpose:** Carotid intima media thickness (cIMT) is an established marker for endothelial dysfunction and cardiovascular risk. This prospective study aimed to assess differences in cIMT before the onset of preeclampsia and postpartum. **Material and methods:** We longitudinally measured cIMT in 417 pregnant women (31 ± 5 years), in the first (T1: 11.4 ± 1.9 wks), second (T2: 21.5 ± 2.3 wks) and third trimester (T3: 32.5 ± 2.9 wks) and postpartum (21.6 ± 23.6 wks), using high-resolution ultrasound and an automated reading program. Comparisons were made with univariate ANOVA, data are expressed as mean (SD). **Results:** 56 women (32 ± 5 years) who later developed preeclampsia had a higher cIMT [T1: 0.47 ± 0.16/T2: 0.45 ± 0.14/T3: 0.43 ± 0.12 (p < 0.01)] throughout pregnancy compared with 618 women who did not develop preeclampsia (NP) [T1: 0.32 ± 0.09/T2: 0.33 ± 0.10/T3: 0.33 ± 0.09], adjusted for age, body mass index, mean arterial pressure and family history of cardiovascular disease. This difference in cIMT persisted postpartum [PE: 0.55 ± 0.11/NP: 0.36 ± 0.10 (p < 0.01)]. **Conclusion:** This study documents increased carotid arterial remodeling, by measuring intima media thickness, in women who later developed preeclampsia. This difference preceded the clinical signs of preeclampsia and persisted postpartum.

### SL9-2

#### Prediction of preeclampsia by maternal carotid intima-media-thickness, blood pressure, flow-mediated dilatation and uterine artery Doppler

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**Purpose:** To evaluate the performance of a 1st, 2nd and 3rd trimester (T) prediction model for preeclampsia (PMPE) by a combination of carotid intima media thickness (cIMT), flow-mediated dilatation (FMD), retinal arteriolar-venular ratio (AVR), mean arterial pressure (MAP), and uterine artery (UtA) Doppler. **Methods:** We performed the combined screening in 761 pregnant women, of whom 292 were analyzed in the 1st, 475 in the 2nd and 407 in the 3rd trimester. cIMT and FMD were assessed using high-resolution ultrasound and an automated reading program and AVR was calculated using a specific retinal vessel analyser. All women underwent UtA Doppler ultrasonography and pulsatility index (PI) was used. The areas under (AUC) the receiver operating curves (ROC), detection (DR) and false-positive rates (FPR) for the different PMPEs were calculated: 1stT: cIMT, AVR, MAP, 2nd and 3rdT: cIMT, FMD, UtA-PI, MAP and a PMPE for daily use (PMPEdu): cIMT, MAP and UtA-PI. **Results:** The mean maternal age was 31 ± 5 years. 96 women (32 ± 5 years) later developed PE, including 39 early onset, 57 late onset, 10 superimposed early onset and 18 superimposed late onset PE cases. The 3rd T PMPE yielded the best DR for preeclampsia (90.6%, FPR: 20.3%, AUC: 0.92), followed by the 2nd T PMPE (DR: 76.8%, FPR: 20.3%, AUC: 0.85) and 1st T PMPE (DR: 69%, FPR: 17.1%, AUC: 0.84). The DRs of the PMPEdu were slightly different [1st T (DR: 73.7%, FPR: 16.2, AUC: 0.83), 2nd T (DR: 73.2%, FPR: 19.3%, AUC: 0.85), 3rd T (DR: 86.8%, FPR 18.9%, AUC: 0.91)] **Conclusion:** The different combinations of cIMT, FMD, UtA-PI, MAP and AVR were better 1st, 2nd and 3rd trimester predictors of preeclampsia than any individual marker. Since the combination of cIMT, MAP and

UtA-PI provides similar results it could serve as an easy preeclampsia prediction tool for daily use.

## SL9-3

### Sonographic weight estimation in small for gestational age fetuses

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**Purpose:** To determine the accuracy of sonographic weight estimation (WE) for small for gestational age (SGA) fetuses, and to further differentiate the evaluation between fetuses being symmetric and asymmetric SGA. **Material and methods:** The accuracy of WE in SGA fetuses (n=898) was evaluated using 14 sonographic models and was further differentiated between symmetric (n=750) and asymmetric (n=148) SGA fetuses. SGA fetuses were considered to be asymmetric with a head circumference to abdominal circumference ratio above the 95th percentile. The accuracy of the different formulas was compared using means of percentage errors (MPE), medians of absolute percentage errors (MAPE), and proportions of estimates within 10% of actual birth weight. **Results:** Results for the subgroup of asymmetric SGA fetuses differed significantly from the subgroup of symmetric SGA fetuses. MPE values were closer to zero with most of the formulas in the asymmetric SGA group. Apart from the Siemer, Shepard, Merz and Warsow equations, all formulas showed an underestimation of fetal weight in asymmetric SGA fetuses. In contrast, in the symmetric SGA group, all of the formulas commonly used for fetuses in a normal weight range showed a systematic overestimation of fetal weight. Overall the best accuracy was achieved by using the Sabbagha equation (MPE 1.7%; SD 9.0%; MAPE: 6.0). **Conclusions:** An accurate WE in SGA fetuses is feasible using the Sabbagha formula. However, one has to be aware of the significant differences in WE between symmetric and asymmetric SGA fetuses.

## SL9-4

### Update reference charts: Fetal biometry between the 15th and 20th week of gestation

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**Purpose:** Reference charts for biometric parameters are a substantial implement of prenatal ultrasound screening. Inaccurate reference charts lead to fault clinical decisions. In our daily practice we observed an over- and underestimation of biometric parameters. The aim of this study was to derive reference charts between the 15<sup>th</sup> and 20<sup>th</sup> weeks of gestation for biparietal diameter (BPD), occipito-frontal diameter (OFD), head circumference (HC), abdominal circumference (AC), femur length (FL), compare to commonly used curves and evaluating the impact of maternal BMI, ultrasound equipment, fetal gender, and nicotine abuse. **Material & Methods:** In a cross-sectional study of 4,265 low-risk pregnancies, biometric data were obtained between the 15<sup>th</sup> and 20<sup>th</sup> weeks of gestation. The statistical analysis included descriptive data, fitting regression curves for the 5<sup>th</sup>, 50<sup>th</sup>, 95<sup>th</sup> quantile and multivariate quantile regression analyses. **Results:** Reference curves for BPD, OFD, HC, AU, and FL showed a linear increase between the 15<sup>th</sup> and 20<sup>th</sup> week of gestation. New equations and reference charts are presented in this study. In a comparison of influence factors sexes, BMI and ultrasound systems have an impact. **Conclusion:** As a result of the study, we determined current growth curves for BPD, OFD, HC, AC, and FL for both sexes as well as for males and females separately. The updated growth curves for all biometrical parameters differ from the curves used commonly in the last two decades.

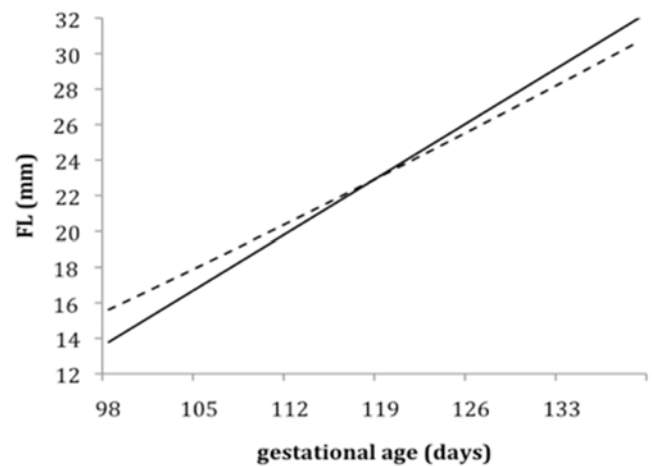


Fig. 1: Comparison of two reference charts for femur length

## SL9-5

### Vascular biopsy of the placenta using VOCAL2 ultrasound software in the prediction of IUGR

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**Purpose:** Firstly, to investigate the potential value of placental vascular biopsy using VOCAL2 software at second and third trimester to define the pregnancies at risk with intrauterine growth restriction (IUGR). Secondly, to prove an effective and novel method to use the software, enabling significant, efficient and easily reproducible results during the scan. **Materials and methods:** Placental vascular image biopsy was taken using VOCAL2 software, prospectively, during the scan, using a practical approach by optimised machine settings (21 cases with IUGR, 233 controls). This enabled the examiner to take the image in 5 seconds. The 3D power Doppler measurements such as placental vascularisation index (VI), flow index (FI) and vascularisation flow index (VFI) were calculated using the machine software. To compare the placental function with the new measurements, the Doppler measurements of the uterine arteries, umbilical artery and middle cerebral artery were performed. The 5. percentile in birth weight was taken as cut-off to define the IUGR. Linear regression analysis was used to estimate the difference of each placental vascular index between IUGR and control pregnancies after adjusting for gestational age. **Results:** Placental VI, FI and VFI were significantly lower in IUGR pregnancies than in controls (p=0.03, p=0.014, p<0.001). Mean uterine artery and umbilical artery PI were higher in IUGR foetuses at the time of the measurements. After adjusting both FI and VFI for gestational age, they remained lower in the IUGR group than in controls (p=0.011 and p<0.001). **Conclusion:** Placental vascular biopsy is easy to perform at second and third trimesters of pregnancy to assess the placental function.

## SL9-6

### MRI-fusion sonography for the evaluation of Trans Vaginal Colposuspension treatment success

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DOI: 10.1055/s-0036-1587756

**Purpose:** Trans Vaginal Colposuspension (TV) is a novel, minimally invasive technique for the treatment of stress urinary incontinence (SUI). To reconstruct the pubourethral or pubovesicular ligaments we use an



MRI visible suturable mini sling (SlimSling) which allows for the preservation of normal anatomy without any mesh material under the urethra. To follow up the success of this procedure we use MRI fusion sonography along with a clinical evaluation of outcomes. By using MRI fusion sonography we are able to see the fixation points and the mesh position angle which is not possible with traditional imaging. The aim of this study is to show that MRI fusion sonography is a superior tool for evaluating the treatment success of TVC. **Method:** Between August 2013 and April 2016 116 patients underwent a TVC procedure. Peri and postoperative complications were recorded. Patients were followed up at six weeks, three and six months and objective and subjective outcomes were evaluated. All patients underwent magnetic resonance imaging (MRI) and then MRI fusion sonography to evaluate the position of the mesh sling following the procedure. **Results:** We found that with ultrasound alone the correct angle of the sling was not able to be measured accurately but with the addition of MRI fusion the outcome of the procedure is easily measurable. Visualization of the 3 mm prolene mesh sling is easier using MRI fusion and a larger field of view is obtained. The paraurethral fixating points of the mesh are seen in only 68% of cases but with MRI fusion nearly 96% are seen. The imaging shows that the traction angle of the sling is the same as the normal anatomy. **Conclusion:** MRI fusion sonography allows for measurable follow up of TVC performance and also proves that it is a good alternative to traditional colposuspension or midurethral slings.

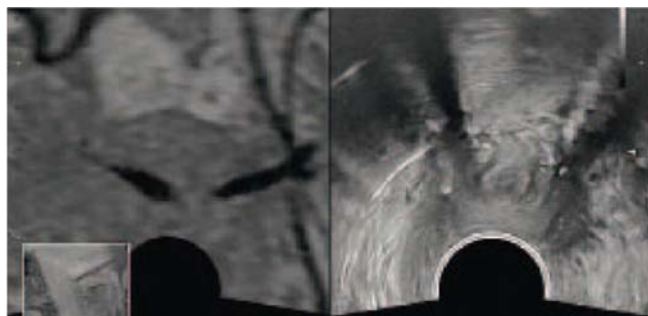


Fig. 1: MRI-US-Fusion\_TVC

## Ultrasound in Emergency

### SL10-2

#### Comparison of Ultrasound-guided interscalene block vs. analgosedation for shoulder reduction in a Swiss University Emergency Department

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DOI: 10.1055/s-0036-1587757

**Purpose:** Patients presenting with traumatic shoulder dislocation in the Emergency Department (ED), often get procedural sedation for shoulder reduction. Recent studies report the possibility of Ultrasound-guided interscalene block (US-IB) in the ED, done by Emergency physicians (EP), to facilitate reduction without analgosedation. The aim of this study was to compare US-IB vs. procedural sedation for shoulder reduction especially considering patient safety and length of stay in the ED. **Material and methods:** We included adult out-patients with traumatic shoulder dislocation, two part fracture-dislocation (greater tuberosity), or dislocated shoulder prosthesis. Exclusion criteria for US-IB were refusal by the patient, associated brachial plexus or axillary nerve palsy, infection at the injection site, or allergies to local anesthetics (LA). Ultrasound-guided single-shot LA was placed beneath the epineural sheath of the three trunks of the brachial plexus. US-IB were performed by two EP and one emergency fellow resident who are trained in the technique. In the US-IB group no further analgesics or sedatives were given. Reduction maneuvers were done by emergency fellow residents. The time of ED-entry and post-reduction radiograph has been taken as start- and endpoint. **Results:** From January 2014 to March 2016 we included 145 out-patients (34 females, 111 males), median age 36.2 years (min. 17.0, max. 94.8). Underlying pathologies: dislocations 126 (86.9%), fracture-dislocations 17 (11.8%), and two dislocated shoulder prosthesis (1.4%). Depending on the availability of the three trained interventionists, US-IB (30) or procedural sedation (115) has been done. The time between ED-entry and post-reduction X-ray was significant shorter in the US-IB-group (mv 94 min) vs. sedation-group (mv 106 min), using the indepen-

dent samples t-test. Complications (intravascular injections, neural lesions, later infections) were not seen in the US-IB-group. **Conclusion:** US-IB for shoulder reduction in the ED is a safe and effective method. Teaching priority for EP's should therefore focus on this technique.

### SL10-3

#### Detection of pneumothoraces in patients with multiple blunt trauma: use and limits of eFAST

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DOI: 10.1055/s-0036-1587758

**Background:** Trauma patients are commonly evaluated in the trauma room by extended focused assessment with sonography for trauma (eFAST). Little is known about the location or size of these missed PTXs in trauma patients with multiple blunt trauma and clinical predictors for successful detection are unclear. **Methods:** This cross-sectional study includes all patients with multiple blunt trauma and PTX who were admitted to the emergency department of a level 1 trauma centre in Bern, Switzerland between June 1, 2012 and September 30, 2014 (n = 109). Demographic data, imaging modalities, medical data on admission and preclinical suspicion of pneumothorax were compared in patient groups with and without PTXs detected in eFAST, compared with CT, using the Mann-Whitney U or Pearson's chi-square tests. Univariate binary logistic regression models were used to identify predictors for detection of PTXs. **Results:** The group of missed PTXs contained significantly fewer ventral PTXs (30 (47.6%) vs. 4 (9.3%), p < 0.001), but more apical and basal PTXs (7 (11.1%) vs. 15 (34.9%), p = 0.003; 11 (17.5%) vs. 18 (41.9%), p = 0.008, respectively). The PTXs missed in the eFAST examination were smaller on both sides (left side: 30.7 ± 17.4 vs. 12.1 ± 13.9 mm; right side: 30.2 ± 10.1 vs. 6.9 ± 10.2 mm, both p < 0.001). In univariate analysis, we found that the preclinical suspicion of PTX was associated with the detection of PTXs in eFAST in all PTXs (p < 0.001, OR 7.002 (2.801; 17.507)) as well as in the subgroup analysis of patients who needed thoracic drainage (p = 0.004, OR 10.487 (2.117; 51.944)). **Conclusion:** Our study demonstrates that missed PTXs are smaller and in more atypical locations than those detected in eFAST. Missed PTXs less often need treatment with thoracic drainage. Preclinical suspicion of PTX is strongly associated with the detection of PTX in eFAST and deserves special attention.

### SL10-4

#### Emergency ultrasound in German emergency departments. Results from a national survey

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DOI: 10.1055/s-0036-1587759

**Purpose:** Evaluation of the current state of ultrasound use in German emergency departments (ED). **Methods:** Online-Survey by SurveyMonkey® for 3 months. Members of DGINA and DEGUM were asked to complete the questionnaire. Responses were collected and anonymized. **Results:** 135 valid answers from different hospitals were received. 85% of the hospitals have 2 or more ultrasound machines in the ED. 1/3 of the examinations are done by residents without supervision from an expert sonographer. Among the most frequent US-examinations are "abdomen", "FAST", "lower-extremity duplex", "echo/FEEL" and "chest-US". The participants claim that basic examinations should be mastered by every doctor. Special ultrasound examinations including gut sonography and contrast enhanced ultrasound are applied in some EDs, but the respective use differs widely. **Conclusion:** To ensure high US quality in the ED, levels of competence and training programs need to be established. Contrast enhanced US is rarely used in EDs even though 50% have the technical possibility. Further research is required which examination types are needed most and how education should focus.

## SL10-5

**Analysis of left atrial auricle morphology and function to detect considerable risk factors regarding the prevention of stroke**Hagendorff A<sup>1</sup>, Farese G<sup>1</sup>, Stöbe S<sup>1</sup>, Jurisch D<sup>1</sup>, Pfeiffer D<sup>1</sup><sup>1</sup>University of Leipzig, Department of Cardiology/Angiology, Leipzig, Germany

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Atrial Fibrillation (AF) is one of the main risk factors for cardio-embolic stroke. The aim of the present study was to define morphological and functional parameters of the left atrium (LA) and the LAA to get a better risk stratification regarding the stroke risk estimation in the low risk group according to the CHA<sub>2</sub>DS<sub>2</sub>-VASc-Score. In 331 patients (pts) transesophageal and transthoracic echocardiography was performed to characterise LA and LAA morphology and function. The following parameters were determined: left ventricular ejection fraction (LVEF), left ventricular end-diastolic pressure (E/e'), biplane LA-volume, LAA morphology (3D-TEE), LAA filling and emptying velocities in the proximal and distal LAA. In pts with SR (n = 242) mean LVEF was 61% ± 10, mean LA volume 57 ml ± 25, mean E/e'-ratio 13 ± 7, proximal mean LAA flow 82 cm/s ± 30, distal mean LAA flow 64 cm/s ± 24. In pts with SR 18pts (7%) showed a reduced LAA flow < 30 cm/s. The LAA morphology could be described by the chicken wing-LAA (37%), the windsock-LAA (56%), the cauliflower-LAA (6%) and the cactus-LAA (1%). A significant statistical correlation of the LAA morphology to the development of neurological events could not be observed in the present cohort. In pts with AF (n = 89; 27% of all pts) mean LVEF was 49% ± 13, mean LA volume was 82 ml ± 32, mean E/e'-ratio 16 ± 8, proximal mean LAA flow 51 cm/s ± 35, distal mean LAA flow 41 cm/s ± 33. In pts with history of neurological event a higher coincidence of reduced LVEF, increased LA volume, increased E/e', and reduced proximal and distal mean LAA flow were observed. In patients with SR and without cardiovascular risk factors, e.g. hypertension and diabetes mellitus, increased LA volumes and reduced LAA flow velocities seem to be major risk factors for the development of cerebral ischemia despite of normal LVEF. Currently, these pts are not considered as risk pts by the CHA<sub>2</sub>DS<sub>2</sub>-VASc-Score.

## Interventional Ultrasound and Miscellaneous

## SL11-1

**Percutaneous ultrasound-guided cyst sclerotherapy in patients with polycystic liver disease**Potthoff A<sup>1</sup>, Sandkühler F<sup>1</sup>, Sandkühler B<sup>1</sup>, Manns MP<sup>1</sup>, Gebel M<sup>1</sup>, Rifai K<sup>1,2</sup><sup>1</sup>Medizinische Hochschule Hannover, Gastroenterologie, Hepatologie & Endokrinologie, Hannover, Germany;<sup>2</sup>Städtisches Klinikum Wolfenbüttel, Klinik für Innere Medizin – Gastroenterologie, Wolfenbüttel, Germany

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**Purpose:** Polycystic liver disease (PCLD) is a genetic disease causing hepatomegaly and local cystic complications. To date, there is no established medical therapy for PCLD. We present our results of percutaneous cyst sclerotherapy in patients with PCLD. **Material and methods:** 301 pat. with PCLD were followed by our centre between 2001–2008 and retrospectively analysed. Mean age was 50 ± 11 years with 19% male. Additional polycystic kidney disease was found in 63%. All pat. received a special questionnaire to report their subjective follow-up. Follow-up was 33 ± 27 months. 31 pat. underwent liver transplantation during this period. A total of 31 pat. died during follow-up. Cyst sclerotherapy was performed in pat. with a minimum cyst size of 8–10 cm or with symptomatic cysts. For sclerotherapy, cyst fluid was aspirated with a 20G needle under ultrasound-guidance. Around 10% of the aspired volume was then administered into the cyst in form of 1% ethoxysclerol. In cysts with a diameter of > 15 cm, cyst drainage was performed to empty them first and perform sclerotherapy via drainage thereafter. In infected or sanguinous cysts, they were rinsed with NaCl 0.9% instead of sclerotherapy. **Results:** A total of 422 cyst therapy sessions of 903 cysts with a mean diameter of 8.1 ± 3.7 cm was performed in 149 pat. (50%). This included 705 sclerotherapies, 33 drainages and 110 cyst rinsing therapies. Indications for cyst therapy were especially symptomatic cysts (67%) and cyst size (48%). The questionnaire of 150 pat. could be analysed, 85 of them underwent cyst therapies leading to a subjective improvement of symptoms in 88% of them. Complications of cyst therapy were noted in 26% of cases, mostly local pain (16%) or inflammatory signs (16%). Bleedings occurred in < 1%. **Conclusion:** Percutaneous ultrasound-guided cyst

sclerotherapy is easy, effective, cheap and with few complications to improve symptoms of patients with PCLD.

## SL11-2

**The study of feasibility of predicting the microwave ablation energy of uterine leiomyomas by three-dimensional power Doppler**Zhang J<sup>1</sup>, Li X<sup>1</sup>, Zhang B<sup>1</sup>, Xu C<sup>1</sup>, Liu H<sup>1</sup>, Xu R<sup>1</sup><sup>1</sup>Chinese PLA General Hospital, Beijing, China

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**Purpose:** To evaluate the feasibility of predicting the microwave ablation (MVA) energy of uterine leiomyomas by three-dimensional power Doppler (3D-PD). **Methods and materials:** 42 uterus leiomyomas in 41 patients who underwent ultrasound-guided Percutaneous Microwave Ablation (PMA) for treatment of uterus leiomyomas were studied from March 2014 to March 2015. Before PMA treatment, the uterus of patients was scanned by 3D-PD ultrasonography. Vascularization flow index (VFI) of 3D-PD of leiomyomas was calculated by virtual organ computer aided analysis (VOCAL) program. The average of three measurement was used for evaluating the richness of blood flow in the leiomyomas and the leiomyomas which mean diameter were more than 5 cm were treated with quantitative ablation energy of 50 W \* 300 s and single antenna with 11 mm tip was used. Immediately after ablation the contrast-enhanced ultrasound (CEUS) was performed. The non-perfused volume (NPV) was measured as the volume of quantitative ablation. Relationship between VFI value of 3D-PD and microwave energy required per unit volume (EPV) was analyzed statistically. **Results:** 42 leiomyomas (41 patients) were analyzed. Average VFI was 1.96 ± 1.63 and average ablation volume was (39.49 ± 22.68) cm<sup>3</sup>. Average EPV was 589.47 ± 399.36 (Jcm<sup>-3</sup>). EPV was positively correlated with VFI value (r = 0.61, p = 0.00). When unit volume of leiomyoma was ablated, the leiomyoma with large VFI values needed higher microwave energy than that with small VFI values. **Conclusions:** The more richness of blood vessel in the leiomyomas the more microwave energy was need for ablation unit volume. The value of VFI of uterus leiomyomas can be used to predict the PMA energy before ablation.

## SL11-3

**Manual versus automatic image fusion of real-time ultrasonography and MR/CT images for radiofrequency ablation of hepatic tumors: A preliminary report of a randomized prospective trial**Choi MH<sup>1</sup>, Choi JJ<sup>1</sup>, Rha SE<sup>1</sup>, Byun JY<sup>1</sup><sup>1</sup>Seoul St. Mary's Hospital, The Catholic University of Korea, Radiology, Seoul, Korea, Republic of

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**Purpose:** To compare the registration error, time required for image fusion and technical success rate of manual and automatic image fusion of ultrasonography (US) and MR/CT images for radiofrequency ablation (RFA) of hepatic tumors. **Materials and methods:** 26 consecutive patients with hepatocellular carcinomas (HCC) or colorectal liver metastases (CRLM) were prospectively enrolled in this study. Patients are randomly assigned to a) manual image fusion group, or b) automatic image fusion group. Two interventional radiologists performed RFA for hepatic tumors with manual or automatic image fusion of real-time US and MR/CT. Time for image registration (s), number of point locks, registration error (cm) and technical success rate were compared between manual group and automatic group. Mann Whitney U-test and Fisher's exact test was performed for statistical analyses and p-values less than 0.05 were considered as statistically significant. **Results:** 15 HCCs and one CRLM were treated using manual image fusion and 13 HCCs and one CRLM were treated using automatic image fusion. Mean sizes of hepatic tumors were 1.67 cm for manual fusion and 1.54 cm for automatic fusion (p = 0.623). Averages of time for image registration, number of point locks and registration error were 156 s, 3.1 and 0.76 mm for manual group, and 201 s, 3.0 and 0.80 mm for automatic group, respectively, and there were no significant difference (p-value = 0.5582, 0.8218 and 0.8058). Technical success rate was 100% (16/16) for manual group and 92.9% (13/14) for automatic group and there was no significant difference between each other. (p = 0.4667). **Conclusion:** Technical performance of manual and automatic image fusion is comparable for RFA of hepatic tumors.

## SL11-4

### Success of an ultrasound guided liver mass biopsy is determined by needle size and liver lesion depth

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**Purpose:** Ultrasound guided puncture is the preferred method for histological sampling of liver lesions. Nevertheless, data evaluating factors influencing the outcome of this procedure are scarce. Therefore we aimed to evaluate predictors of a successful ultrasound guided liver mass puncture. **Material and methods:** Retrospective analysis of all liver mass punctures performed in 2012–2013 in a university hospital was performed. Patient, lesion (depth and size) and technical characteristics of the biopsy as well as final diagnosis and complications were recorded. Successful biopsy was defined by histological accordance of clinical and sonographical preemptive diagnosis. Clinically relevant complications defined by hypovolaemic shock, need for operation or transfusion were recorded. Variables are expressed as proportions, means (SD) or medians (range) as appropriate. Univariate analysis and multivariate logistic regression analysis was performed to evaluate predictors of success. Multivariate analysis included only the variables which were a priori available. **Results:** 195 patients were included, in 154 (79%) cases the lesion was accurately punctured, although a final diagnosis resulting from histological examination of material gained was only made in 144 (74%) cases. 173 patients were biopsied for the first time, 22 patients were repeat biopsies. No patients had clinically relevant complications. Univariate analysis is as shown on the table. In multivariate analysis only distance of the lesion to the liver surface and needle size were independent predictors of successful puncture.

Tab. 1: Univariate Analysis

	Successful biopsy no 51/195 (26%)	Successful biopsy yes 144/195 (74%)	p Value
Repeat biopsy			0.039
No	41/173 (24%)	132/173 (76%)	
yes	10/22 (45%)	12/22 (55%)	
BMI	28.3 (25.7 – 30.5)	25.2 (22.3 – 28.3)	0.002
Age	60 (46 – 71)	65 (55 – 73)	0.031
Sex			0.417
Male	24/102 (24%)	78/102 (76%)	
Female	27/93 (29%)	66/93 (71%)	
Size of lesion	19 (12 – 35)	32 (20 – 50)	<0.001
Depth of lesion from liver surface (mm)	30 (21 – 47)	14 (10 – 24)	0.001
Liver cirrhosis			0.043
yes	16/40 (40%)	24/40 (60%)	
no	35/153 (23%)	118/153 (77%)	
Ascites prior to puncture			0.006
yes	2/30 (7%)	28/30 (93%)	
no	49/163 (30%)	114/163 (70%)	
Needle size			0.010
16G	25/125 (20%)	100/125 (80%)	
18G	26/69 (38%)	43/69 (62%)	
Number of punctures during the procedure	2 (1 – 2)	1 (1 – 2)	0.036
Biopsy length according to sonographer (cm)	1.5 (1.5 – 2)	2.0 (1.5 – 2.5)	0.031
Biopsy length according to pathologist (cm)	1.5 (0.8 – 2.0)	1.8 (1.2 – 2.5)	0.057
Fragmented			0.870
yes	22/88 (25%)	66/88 (75%)	
no	29/107 (27%)	78/107 (73%)	

**Conclusions:** Needle size and the distance of the lesion to the liver surface are independent predictors of a successful liver mass biopsy.

## SL11-5

### Ultrasound guided biopsy for the accurate diagnosis of Leiomyoma in the female lower urinary tract

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**Purpose:** Leiomyomas are benign tumors of smooth muscle origin and are rarely found in the lower urinary tract. To exclude other differential diagnoses such as urothelial cancer, cervical cancer, sarcoma or metastases, histopathological examination is necessary. CT/MRI are insufficient for the exclusion of other diagnoses. The aim of this study is to show that ultrasound guided biopsy is a suitable method for obtaining tissue for histopathology in order to select optimal treatment. **Methods:** Data from 16 patients with leiomyoma of the lower urinary tract, diagnosed with ultrasound guided biopsy and treated between May 2006 and April 2016, was analyzed retrospectively. Analysis included number, size and localization of the leiomyomas, symptoms, voiding function and complications. **Results:** Patients presented with signs and symptoms including: a palpable external genital mass, dysuria, urge urinary incontinence or dyspareunia. Usually physical examination revealed a non-tender mass, 1.5–6 cm in diameter, with a smooth surface located above the urethra or bladderneck. Clinical impression in nine cases included paraurethral masses, seven cases showed intramural or paravesical masses next to the bladderneck. Cystoscopy showed a normal urethra and no communication of the mass with the urethra or bladder tissue. The diagnosis was confirmed after ultrasound guided biopsy in all cases. The masses were sharply dissected and enucleated in nine cases vaginally and in seven cases via bladderoscopy. No postoperative complications were found. Two weeks after the procedure, all patients had a normal voiding function. Terminal histopathological examination showed leiomyomas with fascicles with spindle-shaped cells without mitosis. **Conclusion:** The diagnosis of leiomyomas of the lower urinary tract should be confirmed by transvaginal ultrasound guided biopsy and histopathological study before further therapy. The leiomyomas are always managed operatively and this can be performed easily either vaginally, bladderoscopically or transurethrally. The prognosis is excellent since it has no risk of malignant transformation.

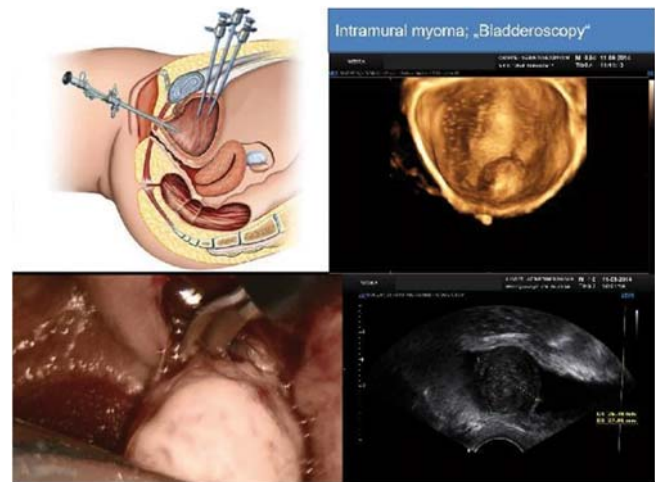


Fig. 1: Intravesical Myoma, Bladderoscopy-Treatment



## SL11-6

**5DHeart approach for (semi-)automized evaluation of the fetal heart – ready for routine use? Prospective Data on ≥460 consecutive cases**Weichert J<sup>1</sup>, Gembicki M<sup>1</sup>, Weichert A<sup>2</sup>, Hartge D<sup>1</sup><sup>1</sup>University Hospital of Schleswig-Holstein, Campus Lübeck, Ob/Gyn, Division of Prenatal Medicine, Lübeck, Germany;<sup>2</sup>Charité Universitätsmedizin, Department of Obstetrics, Berlin, Germany

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**Objective:** To scrutinize the performance and reliability of the 5DHeart™ technology for standardized assessment of the fetal heart throughout pregnancy. **Methods:** In this prospective study we enrolled 485 uncomplicated singleton pregnancies undergoing targeted 1st and 2nd trimester ultrasound examination including STIC volumes of the fetal heart. All volumes were obtained with the fetus in an appropriate position (spine located between 4 and 8 o'clock), absent or minimal fetal breathing/movement and satisfying image quality. All data sets were stored and re-evaluated using the FINE software (Fetal Intelligent Navigation Echocardiography) in order to rule out the visualization rates of nine reconstructed cardiac planes. **Results:** A total of 461 patients were eligible for final analysis. The mean gestational age (GA) was 18.4 weeks (11.3 to 26.0 weeks). One to four STIC volumes were obtained per patient (mean 1.4 exams). In 80% of all volumes > 6 planes were sufficiently visualized, and in 369/461 cases all planes were adequately displayed and labeled or not more than one diagnostic plane failed. Although the rate of non-visualized planes increased with decreasing GA we were able to reconstruct 6 or more planes in 65% of all first trimester volumes (compared to >94% in 2<sup>nd</sup> trimester). With advancing GA the number of properly visualized planes again decreased due to marked acoustic shadowing. Those planes that were difficult to obtain merely comprised the ductal and aortic arch in our cohort (regardless the GA). **Conclusion:** 5DHeart™ technology facilitates reliable assessment of fetal cardiac anatomy even when applied as early as the first trimester, and might therefore aid early diagnosis of CHD even in unexperienced hands. With ongoing pregnancy the visualization rate of all diagnostic planes needed for complete fetal echocardiography improves rapidly (from 14 weeks onwards) and dropped substantially beyond 32 completed weeks.

## Ultrasound of the Gastrointestinal Tract

## SL12-2

**Gastric emptying in Gastroparesis and Functional Dyspepsia measured by Ultrasound**Steinsvik EK<sup>1</sup>, Hausken T<sup>1,2</sup>, Gilja OH<sup>1,2</sup><sup>1</sup>Haukeland University Hospital, Department of Medicine, Bergen, Norway; <sup>2</sup>University of Bergen, Department of Clinical Medicine, Bergen, Norway

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**Purpose:** To assess if patients with Functional Dyspepsia (FD) differ from patients with Gastroparesis (GP) in a cohort referred to the Ultrasound Meal Accommodation test (UMAT), a clinical diagnostic test designed to evaluate gastric accommodation, emptying and visceral hypersensitivity. **Material and methods:** 509 patients referred to the UMAT in a tertiary hospital in Bergen, Norway were included in a study. 160 patients had FD, and 27 had gastroparesis, of which 15 had diabetes type 1 or 2. Measurements of the antral area, fundal area and fundal diameter of the stomach obtained by ultrasound, using a low-calorie meat soup as a contrast agent, were analyzed. A large antral area corresponds to delayed emptying, while small proximal stomach indicates impaired accommodation. Fasting and post-cibal dyspeptic symptoms were reported on a visual analogue scale (VAS). **Results:** Patients diagnosed with GP had a larger antral area compared to patients diagnosed with FD, fasting as well as post-cibally ( $p < 0.007$ ). The differences were significant at fasting state and 20 minutes postcibally when adjusting for diabetes. No significant difference was found in the measurements of the proximal stomach. Although having more marked delayed gastric emptying, diabetic GP patients had lower symptom increase of epigastric pain, nausea and discomfort in a fasting state ( $p \leq 0.01$ ), and also exhibited a lower symptom response of pain, nausea, satiety and fullness after soup intake compared to patients with FD ( $p < 0.035$ ). **Conclusion:** Based on ultrasound, patients with GP have larger antral area both fasting and postcibally compared to FD. Diabetic patients had lower subjective symptom response after a low-calorie meal, indicating intestinal neuropathy.

## SL12-3

**High-intensity focused ultrasound (HIFU) for tumor reduction and symptom relief in advanced pancreatic cancer**Marinova M<sup>1</sup>, Henseler J<sup>1</sup>, Rauch M<sup>1</sup>, Mücke M<sup>2</sup>, Zhang L<sup>3,4</sup>, Schild HH<sup>1</sup>, Strunk HM<sup>1</sup><sup>1</sup>University Hospital Bonn, Radiology, Bonn, Germany;<sup>2</sup>University Hospital Bonn, Palliative Medicine, Bonn, Germany;<sup>3</sup>University Hospital Bonn, Bonn, Germany;<sup>4</sup>Centre for Tumor Therapy, Chongqing, China

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**Purpose:** Evaluation of ultrasound-guided high-intensity focused ultrasound (HIFU) in patients with inoperable pancreatic cancer to reduce tumor volume and tumor-associated pain. **Material and methods:** Fifteen patients with locally advanced inoperable pancreatic cancer and tumor-associated pain symptoms were treated by HIFU (n=6 stage III, n=9 Stage IV UICC). Thirteen patients underwent simultaneous standard chemotherapy. JC HIFU System (Chongqing, China HAIJU Company) was used with an ultrasound device for real-time imaging. Clinical evaluation was performed by imaging (US, CT, MRI) and validated standardized questionnaires (NRS, BPI) before and up to 24 months after HIFU. **Results:** HIFU treatment was performed in all patients in spite of presence of biliary and/or duodenal stents (4/15) and tumor-induced vascular encasement of abdominal vessels (15/15). The mean treatment time was 111 min, sonication time 1103 s and total energy 386,768 J. Post-interventional imaging showed a devascularisation of treated tumor regions with a significant average volume reduction of 63.8% after 3 months. A significant pain relief was achieved in twelve patients following HIFU therapy (n=6 completely, n=6 partially). **Conclusion:** US-guided HIFU can effectively be used for local tumor control and relief of tumor-associated pain in patients with locally advanced inoperable pancreatic cancer.

## SL12-5

**Tablet-sonography is a useful bedside tool during the first week after liver transplantation**van Tilborg M<sup>1</sup>, Hoekstra J<sup>1</sup>, Claessen M<sup>1</sup>, de Kneeg R<sup>1</sup><sup>1</sup>Erasmus MC University Medical Center, Gastroenterology & Hepatology, Rotterdam, Netherlands

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**Introduction:** Detection of vascular complications in the first post-operative week after liver transplantation are very important. In particular an early diagnosis of hepatic artery thrombosis is essential in decision-making to go for early re-intervention or re-liver transplantation. Therefore abdominal sonography is performed several times in the first post-operative week, to look for patency of the hepatic artery, portal vein and liver veins. Hand-held devices might be expected to facilitate bedside abdominal sonography. In this study we compared sonography with regular machines, with tablet-sonography. **Methods:** In the first week after liver transplantation, sonography of the liver vessels was performed at day 0 (immediately after transplantation and arrival at the ICU), day 1 and day 7. Sonography was performed with Hitachi Avius or Hitachi Preirus systems; when the authors were on duty, Philips Visiq system (tablet) was also being used. Good patency was considered when: the Doppler signal of the proper hepatic artery was quantifiable, the maximal velocity in the portal vein was above 15 cm/s, and the qualitative Doppler signal in the liver veins was obvious. **Results:** In the study-period January-February-March 2016, 21 liver transplants were performed in 21 patients. Hepatic artery thrombosis was detected in one patient immediately after transplantation, for which successful thrombectomy was performed. There were 63 sonography moments, whether day 0, day 1 or day 7. During 31 moments the authors were able to perform sonography: at all 31 moments good patency of all liver vessels could be demonstrated, outcomes with tablet-sonography were completely in accordance with 'regular' sonography: 7 moments were at day 0, 13 at day 1, and 11 at day 7. **Conclusion:** First impression of tablet sonography suggests good applicability for the investigation of liver vasculature, which is comparable to regular sonography in the setting of 'first week after liver transplantation'.

## Abdominal Ultrasound – Clinical Investigations

## SL13-1

**Presentation of histologically confirmed mesenteric masses in B-mode imaging and contrast enhanced ultrasound (CEUS): a 10 year retrospective study in 69 patients**Trenker C<sup>1</sup>, Görg C<sup>2</sup>, Neesse A<sup>3</sup><sup>1</sup>Universitätsklinikum Gießen und Marburg, Standort Marburg und Philippsuniversität Marburg, Klinik für Hämatologie, Onkologie und Immunologie, Marburg, Germany; <sup>2</sup>Universitätsklinikum Gießen und Marburg, Standort Marburg, Interdisziplinäres Ultraschallzentrum, Marburg, Germany; <sup>3</sup>Universitätsklinikum Göttingen, Göttingen, Germany

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**Purpose:** Analysis of mesenteric masses in B-mode imaging and contrast enhanced ultrasound (CEUS). **Patients/Methods:** from January 2006 to January 2016, n = 69 patients with mesenteric masses were examined by B-mode imaging, followed by CEUS. The contrast enhancement of the lesions was evaluated in comparison to the enhancement of the parenchymal organs. Histological diagnosis was available for all cases. Malignant diagnoses included lymphoma, GIST, NET, sarcoma and metastases, whereas benign cases consisted of mesenteritis, lymph nodes, adipose tissue, panniculitis and others. **Results:** In B-mode imaging the lesions presented hypoechoic in n = 46 (67%), hyperechoic in n = 14 (20%), and with a complex echo pattern in n = 9 (13%). Histopathology revealed n = 45 (65%) malignant lesions and n = 24 cases (35%) with benign diagnoses. Malignant mesenteric lesions presented with arterial hyperenhancement in n = 10 (22%), isoenhancement in n = 24 (53%), a hypoenhancement in n = 7 (16%), a complex enhancement in n = 3 (7%) and n = 1 (2%) were anechoic. In the parenchymal phase, 40 cases (89%) of mesenteric lesions showed a hypoenhancement. The enhancement pattern was homogeneous in n = 29 (64%). In benign mesenteric masses arterial hyperenhancement was observed in n = 2 (8%), an isoenhancement in n = 9 (38%), a hypoenhancement in n = 10 (42%) and lesions were anechoic in n = 3 (13%) of the cases, followed by a hypoenhancement (n = 21, 88%) in the late phase. The enhancement was homogeneous in n = 16 (67%) benign lesions. **Conclusion:** Mesenteric masses were predominantly (65%) malignant. In B-mode sonography and CEUS, malignant and benign masses show a similar contrast behavior with a predominant parenchymal hypoenhancement. Therefore, histology must be obtained in order to correctly diagnose unclear mesenteric masses.

## SL13-2

**Intrahepatic vessel imaging using novel contrast settings: Low MI Harmonic Imaging and B-Flow CEUS**Weskott HP<sup>1</sup><sup>1</sup>Klinikum Siloah-Oststadt-Heidehaus, Hannover, Germany  
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**Patients and methods:** After bolus injection of 1.4mL SonoVue a sub-costal sweep of the right or left liver lobe was performed with the advent of the first bubbles using a harmonic mode of an AO of 10% (HIREC). By this the intrahepatic arterial tree can be imaged. At an AO of 8% to 10% a sweep during the late arterial or portal venous phase is being performed with a low MI B-Flow (BFC). US device: GE LOGIQ E9 CA1 – 6. 48 liver cirrhosis patients, 20 FNH, 2 hepatocellular adenomas, 10 hemangiomas, 7 with portosystemic shunts (PSS, among one with Osler disease), 5 with portal venous thrombosis (PVT) and 40 patients with malignant liver HIREC and BFC were performed. **Results:** 34/48 pts. with cirrhosis had torturous arteries with major branches being often dilated. Para-biliary veins and collaterals in pts. with PVT and pts. with PSS were best imaged using BFC, as stationary echoes were -due to its subtraction technique- cancelled out. In hyper-vascular lesions like hemangiomas, all FNH and those in the group of malignant lesions the feeding and sometimes intralésional arteries were additionally imaged, and could be imaged using the accumulation and 3-D Mode. We found 4 intrahepatic arterial stenoses. BFC was the most reliable contrast technique to detect and prove PSS. Detection rate of small hyper-vascularized HCC was best and superior to conventional CEUS settings or CT at HIREC. **Conclusions:** HIREC and BFC can be beneficial in addition to conventional CEUS techniques in imaging intrahepatic vessels in diffuse and focal liver diseases.

## SL13-3

**Real-time grey scale contrast-enhanced ultrasonography in diagnosis of gallbladder cancer**Si Q<sup>1</sup>, Zhang W<sup>1</sup>, Qian X<sup>1</sup><sup>1</sup>Nanjing Jingdu Hospital, Nanjing, China

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**Objective:** To explore the clinical value and characteristics of contrast-enhanced ultrasound (CEUS) in diagnosis of gallbladder carcinoma. **Materials and methods:** 384 patients with benign and malignant gallbladder disease were examined by CEUS. The characteristics of CEUS were analyzed and compared with pathological examination. All the fundamental ultrasound examinations were performed by the Siemens Sequoia Acuson512 or Philips iU22, which were matched with contrast pulse sequence (CPS) imaging technique. **Results:** (1) The CEUS patterns of Gallbladder carcinomas showed quick and heterogeneous hyper-enhancement at the early arterial phases. The CEUS shape of the gallbladder carcinomas were irregular. The wall of gallbladder was irregular thickened and interrupted by the mass. The basement of lesions were wide and connected with the gallbladder wall. Almost all the gallbladder carcinomas showed washout from hyper-enhancement to hypo-enhancement quickly after contrast agent administration. The CEUS patterns of Gallbladder benign uplift venereal change lesions showed quick and homogeneous hyper-enhancement at the early arterial phases. The CEUS appearances of Gallbladder benign uplift venereal change lesions were regular. The wall of gallbladder was succession, without intermittent phenomenon. The basement of lesions were narrow or no basal department. Almost the Gallbladder benign uplift venereal change lesions showed washout from hyper-enhancement to hypo-enhancement slowly after contrast agent administration. The biliary mud without enhanced. (2) It was significant different between benign and malignant gallbladder diseases of CEUS characteristics ( $P < 0.05$ ). (3) Compared with pathological examination, the sensitivity, specificity and accuracy of CEUS in gallbladder carcinomas diagnosis was 96.6% (28/29), 99.4% (353/355), 99.2% (381/384) respectively. **Conclusions:** CEUS has an important clinical value in diagnosis of gallbladder carcinoma. **Key words:** Contrast-enhanced ultrasound, Gallbladder carcinoma, Differentiating diagnosis.

## SL13-4

**Evaluation of adipose tissue distribution by ultrasonography and its relationship to metabolic disturbances in obese patients**Buckas B<sup>1</sup>, Brimas G<sup>1</sup>, Kareiva A<sup>2</sup><sup>1</sup>Vilnius University, Department of General Surgery, Vilnius, Lithuania; <sup>2</sup>Vilnius University, Faculty of Chemistry, Vilnius, Lithuania

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**Purpose:** The aim of the study is to find out the relation between ultrasonographic measurements of abdominal adipose tissue and metabolic syndrome in obese patients. **Material and methods:** 52 obese patients (31 women, 21 men) were recruited in prospective study. Mean age 42.6 yrs, mean BMI – 47.7 kg/m<sup>2</sup>. Height (H), weight (W), waist (WC) and hip (HC) circumferences, body mass index (BMI), waist to hip ratio (WHR), systolic (SBP) and diastolic (DBP) blood pressures, and fasting plasma glucose of all participants were recorded. Subcutaneous (SAT) and visceral (VAT) adipose tissue thickness was assessed by ultrasonography. **Results:** VAT thickness was different between men and women (7.85 cm vs. 12.37 cm,  $p < 0.001$ ). In the patients with metabolic syndrome visceral fat thickness was higher compared with metabolically healthy individuals (6.69 cm vs. 10.12 cm,  $p = 0.04$ ). There was very strong correlation between WC and VAT ( $r = 0.93$ ) in the group of patients without metabolic syndrome. In the metabolic syndrome group there was a positive association between W ( $r = 0.39$ ), BMI ( $r = 0.38$ ), WC ( $r = 0.44$ ), HC ( $r = 0.56$ ) and SAT thickness; VAT correlated with W ( $r = 0.66$ ), BMI ( $r = 0.41$ ), WC ( $r = 0.63$ ), WHR ( $r = 0.54$ ), SBP ( $r = 0.33$ ), DBP ( $r = 0.34$ ) and fasting plasma glucose ( $r = 0.64$ ). **Conclusion:** SAT and VAT thickness is related with metabolic diseases in obese patients. The ultrasonography may potentially provide an additional data for the assessment of adipose tissue, especially visceral and their influence on metabolic syndrome.

## SL13-5

**Duplex abdominal examination in portal vein obstruction: how much can we rely on?**

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**Purpose:** Assessment of ultrasound imaging diagnostic particularities related to a group of patients with portal vein obstruction of various etiologies. **Patients and methods:** From January to December 2015, 26 patients, 17 men (65.38%) and 9 women (34.61%) aged of 60.12 ± 11.82 years, hospitalized in an Internal Medicine Clinic, met the criteria for portal vein obstruction. They underwent clinical examination, lab works up, upper and lower digestive endoscopy, abdominal duplex ultrasound (General Electric, Logiq S7, high resolution ultrasound machine, 3.5–5Mhz,convex array probe), thoracic and abdominal CT or MRI exams. **Results:** 23 patients (88.46%) were diagnosed with portal vein thrombosis (PVT) and 3 patients (11.53%) with portal cavernoma. Duplex exam revealed in 14 patients (53.84%) liver cirrhotic pattern and associated hepatocellular carcinoma, in 19 cases (73.07%), secondary ascites and collateral venous circulation, 5 liver metastases (19.23%), 2 pancreatic cancers (7.69). 12 patients (46.15%) had main portal vein obstruction. In 11 cases (42.3%), extensions have been reported to: inferior vena cava (IVC) in 1 case, portal branches (5), or mesenteric veins (5). The obstruction was complete in 19 cases (73.07%), with absence of color and power Doppler signal, no spectral pulsatility and partial in 4 cases (15.38%). 17 cases displayed features of chronic echoic thrombus (65.38%), 6 with recent, hypoechoic aspects (19.23%). 21 cases (80.76%) were first diagnosed or under suspicion by us exams (12 main portal, 5 portal branches, 1 IVC, 3 portal cavernoma). The others 5 (19.23%), were diagnosed by abdominal CT/MRI exams. **Conclusions:** Duplex ultrasound exam could give clues regarding the etiology of PVT, or may provide direct and indirect data of severity, duration and local consequences of PVT. In this series, diagnostic sensitivity of main PVT, right and left branches was about 80%, but significantly lower in cases of extension to mesenteric or splenic veins.

## SL13-6

**Value of ultrasonography in the diagnosis of inguinal hernia – a retrospective study**

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**Purpose:** Diagnostic imaging of inguinal hernia has a high priority. Nevertheless, the ultrasound is not listed in the most recent guidelines of the European Hernia Society as a routine procedure. Aim of the study was to investigate in a retrospective cohort the importance of ultrasound diagnostic of hernias. **Materials & Methods:** Ultrasound findings, patient data and surgical reports of patients with sonographic documentation of inguinal hernia from April 2006 to March 2016 were collected and analysed. **Results:** In the period 2006 – 2016 hernias were diagnosed in 321 patients, 82.6% were male. The average age of patients with a positive result was 56.5 ± 17.9 years. **Conclusions:** Ultrasonography has a high status in the routine diagnosis of inguinal hernia. The high value of sonography with little false-positive results will be presented.

**Contrast-Enhanced Ultrasound II – Clinical Investigations**

## SL14-2

**Is CEUS a tool in a beginner's hand? How much a CAD prototype and a pseudocoloring pattern can help in characterizing the malignancy of FLL?**

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**Background and aim:** CEUS improved the characterization of focal liver lesions (FLLs), but is an operator-dependent method. The goal of this paper was to test a computer assisted diagnosis (CAD) prototype and to

see its benefit in assisting a beginner in evaluation of FLLs. **Material and method:** 97 good quality CEUS videos [34% hepatocellular carcinomas (HCC), 12.3% hypervascular metastases (HiperM), 11.3% hypovascular metastases (HipoM), 24.7% hemangiomas (HMG), 17.5% focal nodular hyperplasia (FNH)] were used to develop a CAD prototype based on an algorithm that tested a binary decision based classifier and a pseudocoloring technique that improved the wash-in/wash-out pattern. Two young MDs (1 year CEUS experience), two experts and the CAD prototype, reevaluated 50 FLLs CEUS videos (diagnosis of benign vs. malignant), in order to evaluate the diagnostic gap beginner vs. expert, first blinded to clinical data. **Results:** I-Beginner misdiagnosed 4/10-FNH, 3/10-HCC, 2/10-HMG, 1/10-HiperM, 1/10-HipoM. After knowing the clinical data 2/10-FNH, 1/10-HCC were misdiagnosed. II-beginner misdiagnosed: 3/10-FNH; 3/10-HCC, 2/10-HMG, 1/10-HiperM. Unblinded: all correctly diagnosed except 1/10-HCC, 1/10-HMG. I-Expert: only 1/10-FNH, 1/10-HCC, 1/10-HMG misdiagnosed. Unblinded, all lesions were correctly diagnosed. II-Expert: 1/10-FNH, 1/10-HCC misdiagnosed. Unblinded, only 1/10-FNH was misdiagnosed. The CAD classifier managed a 75.2% overall correct classification rate. The overall classification rates for the evaluators, before and after clinical data were: I beginner-78%; 94%, II-82%; 96%. I expert-94%; 100%. II-96%; 98%. **Conclusions:** The CAD prototype can assist a beginner operator for a better CEUS diagnostic accuracy. The integration of clinical data in the CAD algorithm may be also beneficial.

## SL14-3

**Quantitative analysis of the uptake from ultrasound contrast agents (CEUS) in hyperechoic splenic lesions**

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**Purpose:** Focal splenic lesions are rare. They are divided in the fundamental ultrasound among others by their echogenicity. Differentiation according to their dignity is often difficult. Histological confirmation is usually not due to the supposedly benign etiology. The purpose of this study was the evaluation of contrast enhanced ultrasound (CEUS) characteristics from hyperechoic splenic lesions using quantitative measurement methods. **Material and methods:** In the retrospective, clinical-sonographic study n=51 hyperechoic splenic lesions (26 female, 25 men) could be included. The contrast enhancement of the lesions was quantitatively analyzed in 7 time slots. The dignity of the lesions was performed in n=14 patients (27.5%) by a histopathologic diagnosis and in n=37 (72.5%) patients by imaging follow-up investigations with measurement of the lesions size. **Results:** Both benign and malignant splenic lesions showed in the CEUS in the average a hypoechoic enhancement. In malignant splenic lesions, however, there was a significantly lower uptake of the contrast agent (p=0.001) compared to benign splenic lesions (figure 1). If the hyperechoic lesions showed an isoechoic or a hyperechoic enhancement pattern in one or more time slots, this was highly significant for a benign lesion (p=0.0004). Additional the male sex, an inhomogeneous echo texture in the fundamental ultrasound and a malignancy of an other region were significantly correlated with a malignant tumor of the spleen. **Conclusion:** Malignant lesions are described in the literature often with a pronounced hypoechoic enhancement compared to benign lesions. The classical division into a hypo- and hyperechoic enhancement does often not help in the differentiation of splenic lesions because both benign and malignant splenic lesions usually show a hypoechoic enhancement. In this case, the quantitative analysis of CEUS can be helpful. The fact, that a iso- or hyperechoic enhancement is highly associated with a benign lesion can be also valuable.



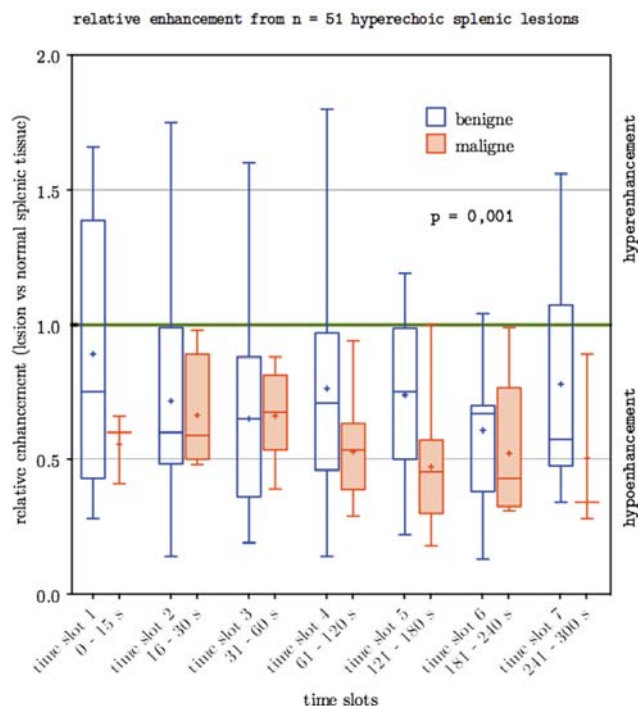


Fig. 1

## SL14-4

## Real-time grey scale contrast-enhanced ultrasonography in diagnosis of gallbladder cancer

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**Purpose:** To explore the clinical value and characteristics of contrast-enhanced ultrasound (CEUS) in diagnosis of gallbladder carcinoma. **Materials and methods:** 384 patients with benign and malignant gallbladder disease were examined by CEUS and the characteristics were compared with pathological examination. All the fundamental ultrasound examinations were performed by the Siemens Sequoia Acuson512 or Philips iU22. The frequency used in the mode of gray-scale US was 7 to 12 MHz, with 4 to 8 MHz in the modes of CEUS, respectively. The contrast agent was SonoVue. The process of CEUS was divided into three phases, arterial phases (after injection to 10 s), portal phases (35 s to 120 s), parenchymal phases (120 s to 360 s). **Results:** (1) The CEUS patterns of gallbladder carcinomas showed quick and heterogeneous hyper-enhancement at the early arterial phases. The CEUS shape of the gallbladder carcinomas were irregular. The wall of gallbladder was irregular thicken and interrupted by the mass. The basement of lesions were wide and connected with the gallbladder wall. Almost all the gallbladder carcinomas showed washout from hyper-enhancement to hypo-enhancement quickly after contrast agent administration. The CEUS patterns of Gallbladder benign uplift venereal change lesions showed quick and homogeneous hyper-enhancement at the early arterial phases. The CEUS appearances of gallbladder benign uplift venereal change lesions were regular. The wall of gallbladder was succession, without intermittent phenomenon. The basement of lesions were narrow or no basal department. Almost the gallbladder benign uplift venereal change lesions showed washout from hyper-enhancement to hypo-enhancement slowly after contrast agent administration. The biliary mud without enhanced. (2) It was significant different between benign and malignant gallbladder diseases of CEUS characteristics ( $P < 0.05$ ). (3) Compared with pathological examination, the sensitivity, specificity and accuracy of CEUS in gallbladder carcinomas diagnosis was 96.6% (28/29), 99.4% (353/355), 99.2% (381/384) respectively. **Conclusions:** CEUS has an important clinical value in diagnosis of gallbladder carcinoma.

## SL14-5

## Characteristics of breast neoplasms on contrast-enhanced ultrasonography and its clinical value

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**Purpose:** To investigate the characteristics of breast neoplasms on contrast-enhanced ultrasonography (CEUS) and its clinical value. **Materials and methods:** 225 female patients with breast masses unable to be diagnosed by conventional ultrasonography were examined with CEUS and compared with the results of pathology examination. Ages range were 12 to 85 years (mean age,  $45.8 \pm 17.6$ ). The process of CEUS was divided into three phases, early (after injection to 1 min), medium-term (1 to 4 min) and late (4 to 6 min). The characteristics of breast neoplasms on CEUS imaging were investigated from 8 aspects, including lesions shapes, boundary of the enhanced lesions, etc.. **Results:** 91 cases were malignant and 134 cases were benign. The 91 malignancies displayed: irregular shapes were 80.2% (73/91), tortuous, massive or penetrating vessels were 86.8% (79/91), heterogeneous distribution of contrast enhancement were 83.5% (76/91), perfusion defect of contrast signals were 89.0% (81/91), local retention of contrast signals were 93.4% (85/91), rapidly entering and exporting from the lesions were 65.9% (60/91). Significant differences of above CEUS characteristics were found between the benign and malignant breast lesions ( $P < 0.05$ ). The two most important features were perfusion defects and local retention of the contrast signals, with the sensitivity and specificity attained to 89.0% and 91.8%, and 93.4% and 92.5%, respectively. Poorly defined boundaries of the 91 malignancies were 64.8% (59/91), and the specificity was 47.8%. The malignant cases had enlarged maximum diameter on CEUS compared to pre-contrast ( $P < 0.05$ ). **Conclusion:** The typical features of breast cancers on CEUS were irregular shapes, tortuous, massive or penetrating vessels, heterogeneous distribution of contrast enhancement, with perfusion defect or local retention of contrast signals, rapidly entering and exporting from the lesions, enlarged maximum diameter of the lesions on CEUS compared to pre-contrast. It is valuable for CEUS in the diagnosis and differential diagnosis of breast neoplasms clinically.

## Prenatal Ultrasound I – Clinical Investigations

## SL15-1

## The importance of isolated muscular ventricular septal defect (VSD) – diagnosed in the second trimester – for pregnancy and delivery

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**Purpose:** The aim was to evaluate the prevalence of isolated muscular ventricular septal defects, the association with chromosomal anomalies, the rate of spontaneous closure and the importance of the delivery procedure. **Material and methods:** From January 2001 – December 2012 we carried out 23,500 fetal echocardiographies in the second trimester. Prevalence of VSDs were analyzed, furthermore the spontaneous closure rate, the rate of chromosomal anomalies. The frequency of caesarian section, natural delivery, forceps- and vacuum extraction delivery, pre-term delivery and perinatal acidosis and other perinatal complications was compared to data from Thuringian-Perinatal-Statistic at the same time. Also we investigated the association between higher maternal age, obesity and isolated muscular VSD. **Results:** 1060 congenital heart defects (CHD) were diagnosed, among 480 VSDs, in some cases with additionally intra- and extracardiac anomalies. After exclusion from these cases with additionally anomalies, we found 236 isolated VSDs, among them 185 were muscular and 51 perimembranous. One chromosomal anomaly was detected – a Klinefelter-syndrom, no case with a trisomy. In approximately 80% the isolated muscular VSD closed spontaneously prenatally or until the end of the first year of life. The pregnant women with a fetus with isolated muscular VSD were older as all pregnant women in our office, but the obesity-rate was similar. The percentage of spontaneous delivery was similar too compared with all births in Thuringia at the same time, the rate of caesarian section was higher. Also no different rates were found concerning preterm-birth and acidosis peripartual. **Conclusion:** The most prenatal prevalent CHD is the VSD. The isolated muscular VSD had a similar risk of chromosomal anomalies like those of normal pregnancies. The prognosis is good concerning delivery, spontaneous closure and healthy life.

## SL15-2

**Thoracoamniotic shunting for fetal hydrothorax – Predictors of intrauterine course and postnatal outcome**

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**Purpose:** To assess predictors for survival and complications among a relatively large cohort of fetuses with hydrothorax treated by thoracoamniotic shunting. **Material and methods:** All cases with a prenatal diagnosis of hydrothorax detected in a 10-year period (2002–2011) in two tertiary referral centers were reviewed retrospectively for intrauterine course and outcome following thoracoamniotic shunting. **Results:** A total of 78 fetuses with hydrothorax treated with thoracoamniotic shunting were included in the study. Mean gestational age at diagnosis was 25.6 weeks (range, 12–34 weeks). In 31 (40%) fetuses additional anomalies were found, 13 of them had trisomy 21. Initial thoracoamniotic shunting was performed at a mean gestational age of 26.5 weeks (range, 16–33 weeks). A mean of 2.53 shunts (range, 1–7) were inserted per fetus. Of the 78 fetuses, 9 (11.5%) died in utero, 69 (88.5%) were born alive and 46 (59%) survived. Prognostic markers significantly associated with non-survival were polyhydramnios, hydrops placentae and mediastinal shift at initial scan, onset of hydrops or lung hypoplasia after first shunt placement, rupture of membranes, a shunt-birth interval <4 weeks and low gestational age at birth. In our cohort, fetuses with trisomy 21 had a significantly better survival than euploid fetuses. They were diagnosed and treated significantly later in pregnancy, the shunt-birth interval was shorter and the number of interventions was lower than in euploid fetuses. **Conclusions:** Although associated with a significant rate of repeated interventions, thoracoamniotic shunting in fetuses with severe hydrothorax might be beneficial and results in an overall survival rate of 59% despite a procedure-related risk of fetal demise of 2/78 (2.5%) cases. Fetuses with hydrothorax and trisomy 21 have a better survival when compared to euploid fetuses.

## SL15-3

**First trimester intervention in twin reversed arterial perfusion (TRAP) sequence – does size matter?**

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**Objective:** To evaluate the outcome of first trimester intervention (12<sup>+0</sup> to 13<sup>+6</sup> weeks of gestation) in pregnancies complicated by TRAP sequence. **Methods:** From 2010 onwards, all patients diagnosed with monochorionic diamniotic TRAP sequence undergoing intrafetal laser ablation (IFL) prior to 14<sup>+0</sup> weeks of gestation at the University of Bonn were retrospectively analysed for intrauterine course and pregnancy outcome. **Results:** In the study period twelve patients were treated by IFL. The mean gestational age at intervention was 13.1±0.5 weeks (range 12<sup>+4</sup>–13<sup>+6</sup>). In all cases one intervention sufficed to disrupt the perfusion of the TRAP twin. No case of abortion, preterm premature rupture of membranes (PPROM) or haemorrhage occurred. In five pregnancies (41.7%) daily follow up scans demonstrated intrauterine death of the pump twin at a mean of 67.2±20.0 hours (range 48–96) after intervention. The remaining 7 pregnancies continued uneventfully with birth of a healthy infant at term. A comparison of survivors and non-survivors identified a significant difference in the median discordance between the crown-rump length (CRL) of the pump twin and the upper pole-rump length (URL) of the TRAP twin (0.56 vs. 0.36; p<0.05). A CRL-URL/CRL ratio >0.48 identified all 7 survivors (p<0.05). All other assessed parameters were not significantly different. **Conclusion:** Although technically feasible, IFL in TRAP sequence performed in the first trimester has a significant fetal loss rate. A large TRAP twins size and a small pump twins size seems to be associated with an unfavourable outcome of IFL.

## SL15-4

**Changes in prenatal care after the introduction of insurance coverage for noninvasive prenatal testing (NIPT) in Switzerland**

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**Purpose:** Prenatal care has been significantly influenced by the introduction of noninvasive prenatal testing (NIPT) for aneuploidies in 2012. In Switzerland starting from July 2015 the national insurance companies cover NIPT as a second line screening for women who are at an intermediate or high risk after first trimester screening (FTS). The aim of this study was to describe the changes in prenatal testing after the integration of NIPT into national health care plans. **Material and methods:** Retrospective analysis including all women with singleton pregnancies who presented for FTS between July 2014 and December 2015 (n=887). After FTS the women were categorized into three risk categories for aneuploidy: low risk (<1:1000), intermediate risk (1:1000–1:100) and high risk (>1:100). We assessed the decision on prenatal testing according to risk category. The year before, and 6 months after the introduction of insurance coverage were evaluated. **Results:** 573 FTS were carried out before the introduction of insurance coverage for NIPT (group 1) and 314 after (group 2). In group 1, 9% had NIPT as compared to 22.9% in group 2. In group 2 52.3% of the high risk patients, 72.4% of women with an intermediate risk and 8.0% of the low risk patients had NIPT. The number of invasive procedures decreased by 5.7%. In group 2 81.8% of the women with a high risk who chose NIPT had a normal ultrasound exam. **Conclusions:** We observed a notable increase of NIPT and a further decrease of invasive procedures after the introduction of insurance coverage for NIPT. The greatest NIPT increase was within the intermediate risk category. Invasive procedures now are mostly chosen in the presence of abnormal ultrasound findings.

## SL15-5

**An optimized approach for early detection of orofacial clefting – recent data on validity of maxillary gap vs. retrorhinal triangle view**

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To elaborate the validity and reproducibility of recent markers of orofacial clefting assessed in early pregnancy. This was a retrospective study reviewing stored 3D volume data sets of first and early second trimester fetuses with suspected or proven genetical and structural abnormalities (n=135; 73 viable vs. 62 non-viable fetuses). Following volume adjustment, visualization and arrangement of craniofacial anatomy were examined in terms of feasibility of reconstruction of the retrorhinal triangle view (RNTV) in the coronal plane, and concomitantly assessment of the maxillary ridge in the corresponding midsagittal view, in order to rule out the presence of orofacial clefts. A total of 121/135 volumes were eligible for final analysis. Mean gestational age was 13+3 weeks for viable and 11+3 for non-viable fetuses (range 8+6 to 17+6 weeks). There was no difference in maternal characteristics in both groups. In 79/121 cases (65%) fetal karyotyping was prompted, showing abnormal chromosomes in 43 cases (38 viable vs. 5 non-viable; p<0.001). Focusing on abnormal maxilla-mandible complex we found irregular RNTV in 38 cases (24/14; p<0.05), out of which 22 were suggestive of orofacial clefting (11/11). In these cases only 12 had an interrupted maxillary echo. In contrast, none of the additional 20 cases (13/7) with maxillary gap had an abnormal RNTV in the coronal plane. A markedly shortened maxilla was noticed in another 8 cases without derangement of RNTV. Of 19 fetuses (13/6) presenting an absent mandibular gap (highly suggestive of micrognathia) six (4/2) also had a maxillary gap. 3D multiplanar assessment of abnormal fetuses allows to assess craniofacial integrity by combining image information obtained from coronal (RNTV) and sagittal (longitudinal maxilla) planes both essential for prenatal work-up for the presence of orofacial clefting. While RNTV seems to be the more reliable marker, adjunctive assessment of the maxilla might be of additional value.

## SL15-6

### Comparison of HD-live 3D and 2D imaging of the fetal face and its social-psychological impact on maternal/paternal-fetal relationship building

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**Purpose:** Medical research has a long tradition in analyzing the value of HD-live/3D-imaging of the fetal face (FF) that provides fundamental information allowing the diagnosis of several fetal diseases. Although ultrasound images are not only used in medical examinations, but become an integral part of the expectant parents' social life, few researchers have focused on their social-psychological dimensions. We therefore conducted a comparative study analyzing the expecting parents' perception, understanding and utilization of HD-live/3D versus 2D-imaging. **Methods:** A randomized longitudinal study of 29 nulliparous pregnant women and 15 of their partners (20–35 years), separated into two groups (G1, G2), was performed at the prenatal-diagnosis center Erfurt, in cooperation with the department of communication science, University of Erfurt. At first-trimester screening (T1), G1-participants received 2D-FF images, while G2-participants received HD-live/3D-FF images. After image-reception, participants underwent standardized and qualitative in-depth interviews at T1 and were questioned again 12–14 days later together with their partner (T2). Interviews were recorded, dimensional analyzed and inductively refined. **Results:** G1 consisted of 15 women and 6 of their partners; G2 of 14 women and 9 partners. Participants of both groups reported FF-imaging to be seen as 'visual evidence', nurturing subjective feelings of security, supporting further integrative social and socio-psychological functions (e.g. 'family function'; reinforcement of mother/father-fetal relationship-building). Especially 3D-images are socially shared, encouraged communication and strengthened social interactions. While G1-participants primarily saw 2D-FF imaging as 'technical' visual representation, similar to radiological imaging, G2-participants reported earlier and closer emotional bonding to the fetus, what especially helped fathers to put themselves in the position of 'being a father.'. **Conclusions:** HD-live 3D imaging rather than 2D imaging contributes to the antenatal emotional maternal/paternal-fetal bonding and the perception of pregnancy as new life situation as well as to the parents' individual realization of their changing social roles, especially among men.

## Breast and Chest Ultrasound – Clinical Investigations

## SL16-1

### Axillary Ultrasound (AUS) Excludes Clinical Lymph Node Disease In Early Breast Cancer

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**Background:** It has been observed, that the caudal Axilla on the border to pectoralis muscle is predictive for the sentinel node and the sonomorphology of lymph nodes has been the subject of multiple publications, usually dealing with malignant Melanoma. In the context of Sentinel lymph node biopsy (SLNB) in breast cancer patients, the following study examines the feasibility of the sonographic differentiation of the Sentinel lymph node (SLN) from neighboring non-SLNs and whether Axillary Ultrasound (AUS) is a useful addition or alternative to current methods of "lymphatic mapping". **Methods:** During a prospective study performed from 1/2003 to 9/2005 including 404 breast cancer patients (Tis-T4), the SLNB was performed using Patent blue+/- 99Tc-Nanocol. In addition to and independent of this method, the axilla was sonographically examined for "reactive" lymph nodes n=180 pt. (Siemens Elegra 7.5 MHz). The "Reactivity" of the nodes was quantified using an index, which allowed the comparison of adjacent nodes. The most "reactive" lymph node in the caudal axilla was identified as the Sentinel node. **Results:** In 180 Patients the SLN was localized using the standard methods as well as (AUS). There was no difference in detection rate for tumor free nodes (SLN-) and using the standard methods. However with metastasized nodes (SLN+) the SUN method provided superior detection (99.1%) and the false-negative-rate could be reduced from 10.7% to 1.3%. This was attributed to the embolization of lymph vessels afferent to the metastasized (SLN+) node causing a bypass of the "lymphatic mapping" and inhibiting detection. **Conclusions:** AUS – Method is comparable to "lymphatic mapping" in tumor free nodes (SLN-). With

metastasized nodes (SLN+) AUS is superior to the standard methods in Sensitivity und Specificity (80%) and the false-negative-rate can be reduced. Systematic Axilla sonography is an effective method for the SLN-Localisation, and offers an excellent method for quality control during SLNB.

## SL16-2

### Ultrasonographic features of male breast disease

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**Purpose:** To describe the ultrasonographic features of male breast disease. **Material and methods:** Between December 2006 and October 2015, ultrasound examinations were performed in 600 male patients who presented with breast enlargement, pain, and/or lump. Of these patients, the ultrasonographic features of 136 histopathologically proven male patients were retrospectively evaluated. Breast Imaging Reporting and Data System (BI-RADS) category assessments were recorded for each ultrasound examination. **Results:** The final diagnoses were: 9 primary breast cancer, 113 gynecomastia, 7 lipoma, 6 chronic mastitis, 1 fibroadenoma. Of 136 cases, 118 lesions (86.8%) were classified as BI-RADS category 2, 5 lesions (3.7%) were classified as BI-RADS category 3, 13 lesions (9.6%) were classified as BI-RADS 4 or BI-RADS 5. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy for detection of malignant breast masses of BI-RADS ultrasound were 100%, 96.9%, 69.2%, 100%, 90.4% respectively. On sonography, eight of 9 cancers were solid and hypoechoic, one was complex mass with mixed solid and cystic components. The shape of the malignant masses was irregular (n=8) or oval (n=1). The margins were well-defined in 1, spiculated in 3, microlobulated in 5 of the malignant masses. Color Doppler flow imaging (CDFI) revealed hypervascularity in 5 masses, moderate vascularity in one mass, mild vascularity in 2 masses. All the malignant masses were corresponded to BI-RADS category 4 or 5. The presence of abnormal axillary lymph nodes was noted in five cases by sonography. The five patients had axillary lymph node involvement by final pathology. The distribution of the sonographic patterns of gynecomastia were 28 nodular (28/113; 24.8%), 30 dendritic (30/113; 26.5%), 55 diffuse glandular (55/113; 48.7%). **Conclusions:** Male breast has a wide spectrum of diseases. Ultrasonography is useful for differentiating male breast cancer from benign diseases.

## SL16-3

### MR-navigated ultrasound with supine breast MRI for suspicious enhancing lesions not identified on second-look ultrasound in breast cancer patients

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**Purpose:** This study evaluated the usefulness of MR-navigated US for evaluation of MRI-detected lesions not visible on second-look US and analyzed differences of the lesion to nipple distance between supine and prone position. **Methods:** Of the 831 consecutive patients who were diagnosed as breast cancer and examined with breast MRI from June 2013 to September 2015, we included 40 lesions in 37 patients who underwent MR-navigated US for MRI-detected lesions which were not visible on second-look US. First MRI was performed in prone position using a 1.5-T imager and second MRI was performed in a supine position for MR-navigated US. **Results:** Of 40 lesions, 31 (78%) were identified with MR-navigated US, whereas 5 (13%) lesions disappeared on supine MRI and 4 (10%) showed no correlation on MR-navigated US. Of 31 lesions with pathologic confirmation, 7 (23%) were malignant, 2 (6%) were high risk lesions and 22 (71%) were benign lesions. Comparing the US findings of benign and malignant lesions, orientation of the lesion showed significant difference (p=0.045), whereas lesion shape, margin and echo pattern were not significantly different between two groups (p=0.088, p=0.094 and p=0.412, respectively). Median difference of lesion to nipple distance on supine and prone MRI was 8 mm (0–34 mm) in horizontal direction and 5 mm (0–39.5 mm) in vertical direction. Thirteen lesions showed more than 1 cm difference in both horizontal and vertical direction. **Conclusion:** MR-navigated US is useful for the evaluation of MRI-detected lesions which were not visible on second-look US in breast cancer patients.



## SL16-4

**The problematic of early diagnosis of breast cancer for young women, the retrospective study**Slobodníková J<sup>1</sup><sup>1</sup>Trenčianska University, Radiology, Trenčín, Slovakia

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**Introduction:** Breast cancer is the most common malignancy of the female population. Recently, however, we meet more often with the occurrence of breast cancer in women between 30 and 40 year. For women this age range is not preventive screening mammography, sonography and only clinical examination-examination by touch. **Material and methods:** In the period from 1.5. 2005 to 31.12. 2015 we performed mammographic and sonographic examinations/more than 56,000 mammograms, while more than 120,000 sonographic examination. Preventive examination completed asymptomatic women without clinical findings. Young women and girls were examined by sonography, next if necessary mammographically too. During the monitored period, we diagnosed 328 new cases of breast cancer. In a retrospective study, we worked with a set of 328 patients. All cases are histologically verified. The age distribution of patients with newly diagnosed cancer we transparently stored in tables and graphs. We focused on women in the age group to 45 year old, we analyzed the different findings, especially with respect to the possibility of diagnosing palpable, clinically and clinically only. **Results:** The patients presented were finally correctly diagnosed, treated with a relatively good prognosis. Their diagnosis, however, could be faster and smaller tumors. However, despite the fact that Slovakia has enacted preventive investigation of the breast young women from the 20 to 40th of clinically and sonographically, encountered in practice, often with cases of breast cancer diagnosed late. **Conclusion:** Case report we highlight the diversity of clinical symptoms and the possibility of imaging diagnostic techniques in the diagnosis of breast disease of young women. We also want to draw attention to some underestimation of clinical symptoms, while revaluation results of sonographic examinations. An important factor is the quality of the ultrasound device and effective consultation and cooperation with other diagnostic departments.

## SL16-5

**Lung ultrasound in the evaluation of interstitial lung diseases**Buda N<sup>1</sup>, Piskunowicz M<sup>2</sup>, Porzezińska M<sup>3</sup>, Kosiak W<sup>4</sup>, Zdrojewski Z<sup>1</sup><sup>1</sup>Medical University of Gdansk, Chair and Clinic of Internal Medicine, Connective Tissue Diseases and Geriatric, Gdansk, Poland;<sup>2</sup>Medical University of Gdansk, Chair of Radiology, Gdansk, Poland;<sup>3</sup>Medical University of Gdansk, Chair and Clinic of Allergy and Pneumology, Gdańsk, Poland;<sup>4</sup>Medical University of Gdansk, Ultrasound & Biopsy Laboratory, Department of Paediatrics, Haematology & Oncology, Gdańsk, Poland

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**Objectives:** Patients with a diagnosed systemic connective tissue disease require regular monitoring from the point of view of interstitial lung disease. The main aim of this work is a description of the criteria for pulmonary fibrosis and the degree of the severity of the fibrosis during the course of interstitial lung disease through the LUS (lung ultrasonography). **Materials and Methods:** 52 patients with diagnosed diffuse interstitial lung disease were qualified for this research, together with 50 volunteers in the control group. The patients in both groups were over 18 years of age and were of both sexes. The results of the TLU of the patients underwent statistical analysis and were compared to High-Resolution Computed Tomography (HRCT) results. **Results:** As a consequence of the statistical analysis, we defined our own criteria for pulmonary fibrosis in TLU: irregularity of the pleura line, tightening of the pleura line, the fragmentary nature of the pleura line, blurring of the pleura line, thickening of the pleura line, artifacts of line B  $\leq 3$  and  $\geq 4$ , artifacts of Am line and subpleural consolidations  $< 5$  mm. As a result of the conducted research, a scale of severity of pulmonary fibrosis in TLU was devised (UFI – Ultrasound Fibrosis Index), enabling a division to be made into mild, moderate and severe cases. **Conclusions:** Transthoracic Lung Ultrasonography (TLU) gives a new outlook on the diagnostic possibilities, non-invasive and devoid of ionising radiation, of pulmonary fibrosis. This research work has allowed to discover two new ultrasound symptoms of pulmonary fibrosis (blurred pleural line and Am lines).

## SL16-6

**Percutaneous ultrasound-guided fine needle aspiration cytology of pulmonary lesions: a single centre experience**Pecorelli A<sup>1</sup>, Nani R<sup>1</sup>, Agazzi R<sup>1</sup>, Sironi S<sup>1</sup><sup>1</sup>Università Milano Bicocca, Ospedale Papa Giovanni XXIII Bergamo, Bergamo, Italy

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**Purpose:** Imaging-guided percutaneous fine needle aspiration biopsy (FNAB) is routinely used for the diagnosis of pulmonary lesions. Computed tomography (CT) is the most common imaging modality used for guidance followed by ultrasound (US). To date there are few data about the use of this technique for the characterization of pulmonary lesions and above all about percutaneous US-guided fine needle aspiration cytology (FNAC). This is considered a reliable method for the diagnosis of malignant lesions despite it has some limitations, such as inadequate sampling and a limited value in the differentiation between benign and well-differentiated malignant lesions. The purpose of this study is to determine the safety and the accuracy of percutaneous ultrasound-guided FNAC of pulmonary lesions. **Materials and methods:** we retrospectively collected 164 percutaneous ultrasound-guided FNAC images, consecutively performed from 2010 to 2015 in our centre, namely 2010 = 21 (7.4%), 2011 = 15 (5.8%), 2012 = 30 (13.0%), 2013 = 24 (12.7%), 2014 = 37 (16.1%), 2015 = 37 (17.2%). Aspirations were performed with 22-G spinal needle. **Results:** Tumour malignant cells were found in 107 cases of FNAC performed with ultrasound guidance (Tab 1)

Tab. 1

	2010	2011	2012	2013	2014	2015	Total
Total	21	15	30	24	37	37	164
Positive	11	8	18	18	25	27	107
Suspect	1	1	3	0	5	2	12
Negative	2	4	0	3	5	3	17
Descriptive	6	1	2	0	1	2	12
Inadequate	1	1	2	3	1	3	11

In detail, in 2015 of 27 positive cases 11 aspirations were diagnostic for non small-cell lung carcinoma (NSCLC), in particular 7 adenocarcinoma and 4 squamous cell, and 1 for small-cell lung carcinoma (SCLC). In none of these cases relevant complications occurred. **Conclusion:** Percutaneous ultrasound-guided FNAC for pulmonary lesions is a safe technique which allows to visualize images in real-time for an accurate device placement. It also provides a specific diagnosis in most of the patients with pulmonary lesions.

**Prenatal Ultrasound II – Clinical Investigations**

## SL17-1

**Outcome of fetuses with bronchopulmonary sequestration after intrafetal vascular laser ablation**Gottschalk I<sup>1</sup>, Mallmann M<sup>1</sup>, Müller A<sup>2</sup>, Geipel A<sup>3</sup>, Gembruch U<sup>3</sup>, Strizek B<sup>3</sup>, Berg C<sup>1</sup><sup>1</sup>Universitätsfrauenklinik Köln, Abteilung für Pränatale Medizin und Gynäkologische Sonografie, Köln, Germany;<sup>2</sup>Universitätsklinik Bonn, Neonatologie, Zentrum für Kinderheilkunde, Bonn, Germany; <sup>3</sup>Universitätsklinik Bonn, Abteilung für Geburtshilfe und Pränatale Medizin, Bonn, Germany

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**Purpose:** To assess the outcome of fetuses with bronchopulmonary sequestration (BPS) with severe pleural effusions after intrafetal vascular laser ablation (VLA). **Methods:** All fetuses with PBS and severe pleural effusions, that were treated with intrafetal VLA in a 5-year period, were reviewed retrospectively for clinical success rate of VLA, reliability of sonographic assessment of regression and prediction of postnatal need for sequestrectomy. **Results:** In the study period, a total of 10 fetuses with BPS and severe pleural effusions were treated with intrafetal laser ablation of the feeding vessel. 9 fetuses had left-sided and 1 fetus had right-sided BPS. All had significant mediastinal shift and polyhydramnios, but normal doppler flow parameters. Median age at time of intrafetal VLA was 31+5 weeks of gestation (24+0 – 33+5 weeks). In 7 fetuses, only one intrafetal VLA was performed, while in 3 fetuses a second intervention was necessary within 72 hours because of recurrent flow in the feeding vessel. Finally, in 9 of 10 fetuses the feeding vessel could be coagulated completely and the pleural effusions dissolved. In one fetus, preterm rupture of membranes with subsequent amniotic infection syndrome and delivery at 30 weeks occurred after unsuccessful VLA and

pleural drainage. Postnatally, 4 fetuses required sequestrectomy because of residual sequestration. Sonographic evaluation of regression (partial or complete) prior to delivery was false in 3 of 10 fetuses. All neonates survived healthy. **Conclusion:** Intrafetal laser ablation of the feeding vessel is an effective and successful treatment of BPS with rare necessity for re-interventions and low risk for preterm rupture of membranes. But intrauterine sonographic assessment of regression and prediction of postnatal need for sequestrectomy is less reliable.

## SL17-2

### Quantified discordant placental echogenicity in twin-twin transfusion syndrome and anemia polycythemia sequence in correlation with peak systolic velocity middle cerebral artery Doppler values

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**Purpose:** Discordant echogenicity and thickness between the donor and recipient placenta has been proposed as an additional sonographic sign of twin-twin transfusion syndrome (TTTS) and twin anemia polycythemia sequence (TAPS). Prenatal criteria of TAPS are increased ( $> 1.5$  MoM) peak systolic velocity in the middle cerebral artery (MCA-PSV) in the donor twin and a decreased ( $< 1.0$  MoM) MCA-PSV in the recipient. The aim of this study was to quantify the placental echogenicity discrepancy in TTTS and TAPS cases correlated with MCA-PSV Doppler findings in both twins. **Material and methods:** We retrospectively evaluated eight patients with TTTS and suspected anemia/polycythemia ( $n = 6$ ) or TAPS-alone ( $n = 2$ ) without or before fetoscopic laser treatment. All cases had difference in echogenicity of the placental part of the donor and recipient twin which were visible on the naked eye and shown on the same digital image. Prenatal placental echogenicity was quantified 40 times using an image processing program and the Doppler values of the MCA-PSV stored at the same examination were correlated to the placental brightness. The sonographic placental thickness was measured 42 times. **Results:** All patients fulfilled the prenatal TAPS criteria. The mean placental echogenicity in the donor twin group was significantly higher than in the recipient group,  $132.9$  (STD  $19.8$ ) versus  $52.7$  (STD  $19.1$ ), respectively ( $p < 0.0001$ ). Furthermore, we found a positive correlation between placental echogenicity and MCA-PSV in the entire group ( $R = 0.79$ ,  $p < 0.0001$ ). Placental region belonging to the donor was significantly thicker compared to the recipient area ( $58 \pm 14$  mm versus  $30 \pm 13$  mm,  $p < 0.0001$ ). **Conclusions:** The significant discrepancy of echogenicity between the placenta of the recipient and the donor correlates with the MCA-PSV, respectively. The prenatal quantification of sonographic placental brightness and thickness may help to investigate the severity of anemia/polycythemia in monochorionic twins.

## SL17-3

### Fetal loss following invasive prenatal testing: a comparison of transabdominal chorionic villus sampling, transcervical chorionic villus sampling and amniocentesis

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**Purpose:** The aim of this study was to compare transabdominal chorionic villus sampling, transcervical chorionic villus sampling and amniocentesis with respect to their total fetal loss rates. **Material and methods:** We retrospectively evaluated procedures of invasive prenatal testing performed during a 14-year period (2001–2014) including 936 amniocentesis procedures and 1051 chorionic villus samplings, of which 405 cases were executed transabdominally and 646 transcervically. Only singleton pregnancies before 24+0 weeks of gestation where the pregnancy outcome was known were included. Fetal loss was defined as an abortion

occurring either before 24+0 weeks of gestation or less than 2 weeks after the procedure. **Results:** The total fetal loss rates were determined to be 1.73% for transabdominal chorionic villus sampling, 2.01% for transcervical chorionic villus sampling and 1.18% for amniocentesis. No statistically noticeable differences between the total fetal loss rates of all three procedures were found ( $p = 0.399$ ). **Conclusions:** Our study has shown that chorionic villus sampling (either transabdominal or transcervical) and amniocentesis are equal methods for invasive prenatal testing with respect to their abortion risk.

## SL17-4

### Outcome in newborns with intervention < 48 hours postpartum in prenatally versus postnatally diagnosed congenital heart disease

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**Purpose:** The aim of this retrospective analysis was to evaluate outcome in neonates requiring intervention within 48 hours postpartum in prenatally and postnatally diagnosed congenital heart disease (CHD). **Material and methods:** We evaluated 142 neonates who presented in our centre between 2005 and 05/2015 with surgery or catheter intervention within 48 hours postpartum and compared 30-day survival and perinatal outcome in patients with prenatally versus postnatally diagnosed CHD. **Results:** In 135 of 142 neonates we had information about prenatal or postnatal diagnosis. 15 were lost for follow up within 30 days postpartum. In the group with prenatal diagnosis of CHD and intervention within 48 h postpartum, the majority had hypoplastic left heart syndrome (HLH) (47.1%), in the group with postnatal diagnosis the majority had transposition of great arteries (d-TGA) (53.8%). 30-day-survival was 78.5% in the group with prenatal diagnosis versus 89.1% in the group with postnatal diagnosis without significant difference. Rate of caesarean section was significantly higher in patients with prenatal diagnosis than postnatal diagnosis (56.7% vs. 33.8%). Patients with postnatal diagnosis needed more often intubation before intervention (32.9% vs. 53.8%), mean umbilical arterial pH was significantly lower (7.29 vs. 7.33) and pre-intervention lactate showed tendency to higher levels than in patients with prenatal diagnosis (34.5 vs. 53.2 mg/dl). There was no difference in length of hospital stay between the prenatally and postnatally diagnosed groups (21.6 vs. 19.5 days). **Conclusion:** 30 days survival showed no difference between the two groups. Prenatal diagnosis seems to influence modus of delivery and pH, lactat levels and need for intubation postpartum. Long time follow up is necessary to evaluate differences in survival and outcomes.

## SL17-5

### Bilateral nasal bone measurements in normal first trimester fetuses and fetuses with trisomy 21 by use of 3D ultrasound

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**Purpose:** Three-dimensional ultrasound with its different display modes allows an accurate demonstration of the ossified bones of the fetal face in the first trimester. In particular, the nasal bones can be evaluated on both sides and measured separately. The aim of this study was to establish the normal range for the left and right nasal bone and to demonstrate the development of the nasal bones in cases with trisomy 21 in the first trimester. **Material and method:** In 200 normal fetuses and 12 fetuses with trisomy 21 the left and right nasal bone was measured in the multiplanar 3D mode after aligning the fetal head into an exact upright posi-

tion to get a true profile. All scans were performed using E8/E10 GE equipment (Zipf, Austria) with a 5–8 MHz 3D abdominal or a 5–9 MHz 3D vaginal transducer. Gestational age was between 10+3 and 14+0 weeks of gestation. **Results:** In the normal fetuses 151 cases had the same nasal bone length on both sides. In 43 cases a difference of up to 5 mm between the left and right nasal bone could be observed and in 3 cases even absence of the nasal bone on one side was found. In the 12 fetuses with trisomy 21, 3 cases showed bilateral hypoplasia of the nasal bones and 9 cases absence of nasal bones on both sides. **Conclusions:** Three-dimensional ultrasound is a useful tool in the evaluation of the nasal bones in the first trimester. Because 23% of the normal cases showed a difference between the left and right nasal bone length, it is important to measure the nasal bone length on both sides consequently.

## SL17-6

### Increased nuchal translucency at a crown rump length <45 mm

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**Aim:** Nuchal translucency (NT) measurement is established for risk evaluation of chromosomal abnormalities between a crown rump length (CRL) of 45 to 84 mm. According to the German regulations the first ultrasound screening takes place between 9th and 11th week of gestation. This results in cases with increased NT and CRL <45 mm, where risk calculation is impossible. In this retrospective study we analysed the outcome of these cases. **Methods:** Between July 2010 and September 2015 we identified 24 pregnancies with a CRL from 35 to 45 mm and a NT above the 95th centile adjusted for a CRL equivalent of 45 mm. Measurement of CRL and NT was performed by four FMF London certified examiners. The outcome was evaluated by data base analysis and direct contact to the patient. **Results:** Median CRL was 43 mm (35.4–44.9 mm) with a median NT of 3.9 mm (2.5–6.6 mm). Median maternal age was 29 years (14–38 years). In 17 of 24 cases (71%) the pregnancy resulted in a delivery of a healthy child. In one of these cases a minor ventricular septal defect was diagnosed postnatally. In 16 of 24 cases (67%) an invasive procedure was performed for fetal karyotyping revealing six fetuses (25%) with chromosomal disorders resulting in the termination of pregnancy. In one case with normal karyotype further sonograms revealed a complex syndrome with hypoplastic cerebellum. In all cases without karyotyping outcome was normal at delivery. The NT in all cases with abnormal karyotype was  $\geq 3.9$  mm. **Discussion:** In cases with NT <3.9 mm and CRL  $\leq 45$  mm it is very likely, that a healthy child will be born. Lacking the possibility of risk calculation non-invasive prenatal testing (NIPT) may be the first choice for these pregnancies.

## Gynaecological Ultrasound II – Clinical Investigations

## SL18-1

### Significance of the size of fetal anterolateral neck cysts in early gestation

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**Purpose:** To recognize the association between the size of fetal anterolateral neck cysts and nuchal translucency, chromosomal aberration and fetal malformations. **Material and methods:** We examined a consecutive collective of 51 fetuses with lateral neck cysts that presented between the 11 and 17 weeks of gestation in the years 2009 to 2016 in our department. The volume of the nuchal cysts was measured. We examined thereafter the statistical association between the cyst volumes, increased nuchal translucency, chromosomal aberrations and fetal anomalies. **Results:** 46 fetuses had bilateral nuchal cysts, while 5 had a unilateral. 26 fetuses had a chromosomal aberration, 9 fetuses had structural malformations without genetic anomaly and 16 fetuses had a normal outcome. All cases with a normal nuchal translucency had a normal outcome (n=11). 5 fetuses with an increased nuchal translucency in early gestation had a normal outcome. All fetuses with a chromosomal abnormality or structural malformations had an increased nuchal translucency (n=35). The cyst volume significantly correlated with the outcome (normal cases 13.6 mm<sup>3</sup>, abnormal cases 136 mm<sup>3</sup>; p<0.001), the nuchal translucency (105.5 mm<sup>3</sup>; p<0.001), chromosomal aberration

(97.6 mm<sup>3</sup>, p<0.001) and fetal malformations (296 mm<sup>3</sup>; p<0.001). A cyst volume of less than 2.4 mm<sup>3</sup> was always associated with a favorable outcome regardless of the diameter of the nuchal translucency. **Conclusion:** In addition to the nuchal translucency in early gestation, in case of their presence, anterolateral nuchal cysts play a significant role in predicting the fetal outcome.

## SL18-2

### Longitudinal analysis of myocardial function and cerebral perfusion in fetuses with left heart defects

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**Purpose:** Fetuses with left heart defects leading to reduced or retrograde perfusion of the aortic arch show decreased resistance in the cerebral arteries and reduced head growth. Aim of this study was to evaluate a linkage of these parameters alterations of fetal myocardial function. **Methods:** Longitudinal examination (20–26, 27–33 and 34–40 weeks of gestation) of fetuses with left heart defects (HLH, HLHC, critical aortic stenosis). Head circumference, umbilical artery and middle cerebral artery pulsatility index and the cerebro-placental ratio (CPR) were measured. Myocardial function was assessed by measuring mitral annular plane systolic excursion (MAPSE) and tricuspid annular plane systolic excursion (TAPSE) in M-Mode and isovolumetric contraction time (ICT), ejection time (ET) and isovolumetric relaxation time (IRT) in pulsed wave tissue Doppler imaging (PW-TDI). E-, A-, E'- and A' wave peak velocity and the systolic downward motion (S') were measured. E'/A' ratios and myocardial performance index (MPI) were calculated. **Results:** 75 fetuses with left heart defects with retrograde or antegrade arch flow were included. Fetuses with retrograde arch flow presented with a significant decrease in head growth between the second and third examination as well as a reduced CPR. Fetuses with antegrade perfusion in the aortic arch did not show these alterations. Parameters reflecting myocardial function did not change over pregnancy and did not differ between fetuses with antegrade or retrograde arch perfusion. **Conclusion:** Fetal myocardial function did not change over pregnancy and was independent of flow direction in the aortic arch in fetuses with left heart defects.

## SL18-3

### Methamphetamine abuse in pregnancy – Prenatal sonographic findings

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**Purpose:** Drug abuse, particularly methamphetamine (METH) is very common in Saxony (Germany). Official reports show an increase since METH is cheap and easy available. It is a strong central nervous system stimulant, that is mainly used as a recreational drug and is associated with a high potential for abuse and dependence. The impact of prenatal METH exposure on pregnancy and development in childhood is unknown. **Material and methods:** At the University Hospital of Dresden pregnancy data and sonographic fetal findings from all METH consuming pregnant women between 2011 and 2015 were retrospectively analyzed. **Results:** The number of METH using pregnant women is continuously rising since 2011 and effects 1% of deliveries since 2013 at the University hospital Dresden. Between 2011 and 2015 105 METH using women were seen during pregnancy, 94 of them delivered in our hospital. Beside METH abuse 79% of women admitted nicotine and 30% Cannabis co-abuse. In 24% of cases pregnancy was detected late or without prenatal care. 32.9% were premature pregnancies, 26.6% small for gestational age (SGA) und 8.5% of cases intrauterine growth retardation. 4 cases were stillbirth. 38% of women received specialized DEGUM II ultrasonic differential screening. Sonographic abnormalities showed a broad spectrum: Ventricular septal defects (VSD), complex heart defects, cleft lip and palate and sporadic kidney abnormalities. Conspicuous was the high rate of microcephaly (6.4%). **Conclusion:** METH use is an increasing problem in



Saxony and problems especially arise because of a higher rate of prematurity or SGA-pregnancies. Specific METH related fetal abnormalities were not detected. Association with a higher rate of microcephaly might be possible. Often women were seen late in pregnancy and ultrasonic differential screening was difficult to assess. More research needs to be done to evaluate the impact of METH abuse on intra- and postnatal development of children.

## SL18-4

### Measurement and evaluation of fetal fat layer in the predication of Macrosomia in pregnancies complicated with gestational Diabetes

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**Objectives:** To explore the addition of fetal fat layer as a soft tissue marker to the biometric values (biparietal diameter, abdomen circumference and femur length) with close monitoring of the blood sugar level of the pregnant women with GDM and BMI changes during the 31, 34 and 37 gestational weeks to improve the detection of macrosomia. **Methods:** We conducted a prospective observational study at the Department of Obstetrics, University Hospitals – Campus Kiel, Germany in collaboration with diabetic clinic staff. The examinations were performed at 31, 34 and 37 week of gestation. The clinical outcomes of pregnancy and birth weight were collected from the obstetric record. All the women enrolled had an early pregnancy ultrasound scan previously to confirm gestational age. Participants underwent a third-trimester scan and an extra measurement fetal fat layer was added. **Results:** In total, 71 women were initially enrolled into the study. The mean age of the study population was 32.26 (SD 5.06) years with 60% primigravidas. In terms of predication of macrosomia, 10 babies with birth weight > 4000 kg, 8 babies had at the 34 weeks of gestation with a fetal fat layer more than or equal to 0.4 cm and at 37 week of gestation it was documented by 7 babies more than 0.5 cm recording the maximum of 0.8 cm by a macrosomic newborn with 4850 gram, which was born by caesarean section. Only two women in the macrosomic group were treated with insulin, and 7 women had a vaginal delivery. The measurement of fetal fat layer with a cutoff 0.5 cm at the 37 weeks of gestation was strongly useful. **Conclusion:** We conclude that the measurement of the fetal fat layer in addition to the standard measurement might be useful for predication of macrosomia and is worthy further evaluation.

## SL18-5

### The use of pentaerythrityltetranitrate (PETN), a nitric oxide donor, to improve utero- and fetal-placental perfusion pregnancies with established pathological flow pattern in the Aa. uterinae beyond 20 weeks of gestation

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**Introduction:** NO-donors like Pentaerythrityltetranitrate (PETN) have been shown before to reduce the resistance index (RI) in the Aa. Uterinae (1), but effects on fetal circulation have not been investigated yet. We performed a randomized, prospective, placebo-controlled, double-blind study to investigate the influence of PETN in pregnancies presenting with persistent high uterine resistance in mid-gestation (2) and analyzed now the effects on uteroplacental and fetoplacental perfusion flow indices. **Methods:** 111 pregnancies presenting with abnormal placental perfusion (bilateral notch or mean RI > 0.7) between the 19<sup>th</sup> to 23<sup>th</sup> w.o.g were included. Further risk factors (high-risk group: history of HELLP/preeclampsia/IUGR/IUFD/placental abruption, type I diabetes mellitus, hypertension, thrombosis/thrombophilia) were identified in 78 study participants. 54 women received PETN 57 received placebo. Doppler velocime-

try measurements of uteroplacental and fetal vessels were monitored biweekly up to delivery. **Results:** Within the first week of prophylaxis, PETN improved uteroplacental perfusion significantly (mean PI 1.26 ± 0.36 vs. 1.49 ± 0.44; p < 0.01). An umbilical ARED flow has to be diagnosed in 21 (18.9%) cases in the course of pregnancy, 13/57 (23%) in the placebo and 8/54 (14%) in the PETN group. Fetal brain sparing occurred in 8/57 (21%) in the placebo vs. 4/54 (7.5%) in the PETN group. Mean gestational age at fetal brain sparing was at 162 ± 12 d in the high risk group and at 203 ± 23 d in the low risk. In the high risk group PETN prophylaxis could postpone fetal brain sparing by 19 days (172 ± 8 d vs. 153 ± 8 d in controls). **Conclusion:** Pregnant women with a high risk for placental insufficiency could have a benefit from a secondary prophylaxis with the NO donor PETN. **References:** [1] Kahler C., Schleußner E., Möller A., Seewald H.-J. Europ J Gynaecol Obstet RB 2004; 115: 10–14 [2] Schleussner E, Lehmann T, Kähler C, Schneider U, Schlembach D, Groten T. J Perinat Med. 2014 Jan 14:1–8

## SL18-6

### Pregnancy outcomes after previable preterm premature rupture of membranes

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**Objective:** A current assessment of the gestational outcomes in pregnancies complicated by previable preterm premature rupture of membranes (previable PPROM) (< 24 weeks of gestation) and neonatal survival after expectant treatment. **Study design:** The perinatal data was collected for the last five years regarding patients with previable PPROM, including the short-term neonatal outcomes. **Results:** 63 patients with 83 fetuses (46 singletons and 37 multiples) were hospitalized. A total of 37.5% (n = 24) patients opted for termination of pregnancy (TOP), 19% (n = 12) suffered a miscarriage, while 42.8% (n = 27) proceeded to a live birth; including 18 singletons and 21 neonates from multiple pregnancies after an average latency period of 39 days (range 2–126 days). Of the live born infants 81.6% survived the perinatal period. The most common neonatal sequelae were infant respiratory distress syndrome, bronchopulmonary dysplasia, and congenital infection. The overall survival, not including elective termination but including miscarriages, was 56.3%.

## Elastography and Ultrasound II – Clinical Investigations

## SL19-1

### Evaluation of liver fibrosis using Transient Elastography in non-alcoholic steatohepatitis (NASH) patients

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**Purpose:** The purpose of this study was to assess by Transient Elastography (TE) the severity and dynamics of liver fibrosis in NASH patients. **Material and methods:** We conducted a prospective study on 890 NASH patients, diagnosed based on: ultrasound examination ("bright liver" with posterior attenuation); biological tests (increased aminotransferases level); no history of alcohol abuse; negative viral hepatitis B or C markers. In each patient ten liver stiffness measurements (LSM) were performed, either with M (3.5 MHz) or XL (2.5 MHz) probe. Reliable measurements were defined as: median value of 10 LSM with a success rate SR ≥ 60% and an interquartile range IQR < 30%. Using the cut-offs proposed by Wong (1), NASH patients were divided into 3 categories: < 7.9 kPa (absence of severe fibrosis); values ranging between 7.9 kPa and 9.6 kPa ("gray zone" in which biopsy is recommended) and > 9.6 kPa (severe fibrosis). **Results:** Out of 890 patients, reliable measurements by either probe were obtained in 76.5%. Older age, female gender and higher BMI were associated with unreliable TE measurements. The analysis of liver fibrosis distribution was performed in 681 NASH patients with reliable LSM. Using the proposed cut-offs, 69.5% of the patients did not have severe fibrosis, 11.5% had F ≥ 2 fibrosis being in the "gray zone" and 19% had severe fibrosis. In 49 patients the dynamics of fibrosis was evaluated. Over a period of at least 2 years, fibrosis progression was observed in 12.2%, 75.6% had stable fibrosis, and 12.2% had an improvement in fibrosis stage. **Conclusions:** Approximately 20% of NASH patients had LSM

compatible with severe fibrosis, therefore LS assessment should be performed systematically in NASH patients. **Reference:** [1] Wong WV et al. Diagnosis of Fibrosis and Cirrhosis Using Liver Stiffness Measurement in Nonalcoholic Fatty Liver Disease Hepatology 2010 Feb; 51 (2): 454–62

## SL19-2

### Spleen Stiffness measured by point Shear Wave Elastography (pSWE) – Comparison between VTTQ/Acoustic Radiation Force Impulse (ARFI) and ElastPQ

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**Purpose:** A comprehensive comparison between Acoustic Radiation Force Impulse (Siemens Acuson S3000) and ElastPQ (Philips EPIQ 7) by means of spleen stiffness (SS) measurement. Standard values of spleen stiffness measured with pSWE until today have been generated solely by means of ARFI. In former studies, measurement of SS is recommended in the lower pole of the spleen. **Material and methods:** In 200 healthy subjects (78 male/122 female, mean BMI  $22.56 \pm 2.57$  kg/m<sup>2</sup>, mean age  $27.93 \pm 8.13$  years, mean fasting time =  $3.74 \pm 1.84$  hours) SS was measured in 3 defined regions of the spleen using VTTQ/ARFI and ElastPQ (lower pole LP, mid region MR, upper pole UP). Shear wave velocities (SWV) were compared between both techniques, furthermore regarding region of measurement, probands gender, BMI, alcohol intake and fasting time. **Results:** Values measured with ElastPQ are significantly lower than measured with VTTQ/ARFI (mean SWV in m/s: ElastPQ: UP  $2.30 \pm 0.87$ , MR  $1.89 \pm 0.38$ , LP  $1.88 \pm 0.40$ ; VTTQ/ARFI: UP  $2.53 \pm 0.58$ , MR  $2.53 \pm 0.44$ , LP  $2.05 \pm 0.54$ ). There is no significant correlation between the values measured with both techniques in the LP ( $p=0.3799$ ) or in the MR ( $p=0.0618$ ). Correlation can be verified in the UP ( $p<0.0001$ ). However, correlation in the UP is not verifiable when BMI is  $>25$  kg/m<sup>2</sup> or age  $>30$ y. **Conclusion:** Standard values for spleen stiffness generated with VTTQ/ARFI do not equally apply to ElastPQ, which should be considered when diagnosing patients with portal hypertension and during their follow-up. Due to the lack of correlation, no valid conversion factor can be calculated.

## SL19-3

### The performance of 2D SWE.GE compared to transient elastography for the evaluation of liver stiffness

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**Aim:** To evaluate the performance of 2D-SWE.GE in noninvasive fibrosis assessment as compared to a validated method-Transient Elastography (TE). **Material and Method:** Our study included 255 consecutive subjects with or without chronic hepatopathies (only compensated liver disease evaluated for decision regarding treatment), in which liver stiffness (LS) was evaluated in the same session by means of 2 elastographic methods: TE (M or XL probes) and 2D-SWE.GE (LOGIQ E9, General Electric Healthcare). Reliable LS measurements were defined as follows: for TE – the median value of 10 measurements with a success rate of  $\geq 60\%$  and an interquartile range  $<30\%$  and for 2D-SWE.GE – the median value of 10 measurements acquired in a homogenous area and an interquartile range (IQR)  $<30\%$ . **Results:** Reliable LS measurements were obtained in 241/255 (94.5%) subjects by 2D-SWE.GE, and in 240/255 (94.1%) by TE ( $p=0.997$ ). The final analysis was performed on 229 subjects with valid measurements by both methods. Based on TE cut-off values (F1 – 6, F2 – 7.2, F3 – 9.6 and F4 – 14.5 kPa), we divided our cohort into 3 groups: F<2: 62/229 (27%); F2-F3: 44/229 (19.3%); F=4: 123/229 (53.7%). We found a strong correlation between the LS values obtained by the 2 methods:  $r=0.833$ ,  $p<0.0001$ . The mean values obtained by 2D-SWE.GE considering TE cut-off values as reference were: F0-F1:  $5.88 \pm 1.39$ ; F2-F3:  $9.86 \pm 2.21$ ; F4:  $13.57 \pm 2.76$  ( $p<0.001$ ). The best cut-off values for 2D-SWE.GE were: F>2 – 6.7 kPa (AUROC=0.975, Sensitivity=96.97%, Specificity=87.1) and for F>4: 10.7 kPa (AUROC=0.911, Sensitivity=81.68%, Specificity=84.37%). **Conclusions:** 2D-SWE.GE and TE (using M and XL

probes) had good feasibility (94.5% and 94.1%), with no statistical differences between them ( $p=0.997$ ). There was a strong correlation between the two methods, with LS values significantly increasing with the severity of fibrosis. The best 2D-SWE.GE cut-off values for predicting F>2 and F>4 was 6.7 kPa, and 10.7 kPa.

## SL19-4

### Shear wave elastography of peripheral muscle stiffness in patients with congestive heart failure – A new diagnostic ultrasound method to detect muscular deficits

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It is well established that patients (pts) with chronic heart failure often suffer from severe peripheral muscular weakness resulting in difficulties performing daily life tasks. Reduced oxygen delivery, lowered lactate turnover and -mitochondrial capacity are thought to be responsible for a diminished contractility of peripheral muscles in heart failure pts. To date, only invasive muscle biopsies are suitable to diagnose this condition. **Purpose:** We sought to investigate whether shear wave elastography (SWE) is useful tool in identifying weaknesses in extension (stretch) and flexion of peripheral muscles. **Material and methods:** 25 subjects were enrolled into the study. 15 pts with chronic congestive heart failure (CHF, age  $66.1 \pm 12.4$ ) and reduced LV-function and 10 control persons (CP, age,  $63.3 \pm 11.5$ ,  $p=n.s.$ ) without heart failure met the inclusion-/exclusion criteria. SWE of the peripheral muscles was performed using a Logiq E9 XDClear ultrasound machine (GE Healthcare) applying a 9L-linear array scanner. Applying a standardized protocol, resting kPa, exercise kPa and difference ( $\Delta$ ) between resting- and exercise kPa of the muscles were measured at a range of 0–300 kPa. Data are expressed as mean  $\pm$  SD and were compared using the unpaired Student's t-test with Bonferroni correction when appropriate. **Results:** Resting kPa of the muscles was not different in CHF and CP subjects, neither in flexors ( $16.7 \pm 2.7$  vs.  $18.7 \pm 3.2$   $p=n.s.$ ) nor in extensors ( $12.6 \pm 3.9$  vs.  $14.4 \pm 3.6$ ,  $p=n.s.$ ). Exercise kPa of the gastrocnemius muscle, however, was markedly reduced in CHF- compared with CP pts ( $58.9 \pm 19.9$  vs.  $88.0 \pm 25.7$ ,  $p<0.001$ ).  $\Delta$  kPa was reduced as well in CHF pts ( $46.3 \pm 23.3$  vs.  $73.7 \pm 16.8$ ,  $p<0.005$ ) when compared with CP. **Conclusion:** Shear wave elastography appears to be an extremely valuable tool to diagnose peripheral muscular deficits during exercise in patients with congestive heart failure.

## SL19-5

### Shear wave elastography: interobserver agreement and influencing factors for liver stiffness measurement

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**Purpose:** To evaluate the interobserver reproducibility of 2-dimensional shear wave elastography (2D-SWE) in measuring liver stiffness and to investigate the clinical and measurement factors related to the reproducibility. **Material and methods:** This study used the cohort of rheumatoid arthritis patients who have been treated with methotrexate and were enrolled under informed consent between August 2011 and August 2012. Two staff radiologists performed SWE by turns at the same day. The measurement was repeated 5 times, and the median value was considered as the liver stiffness. We investigated clinical factors such as age, sex, serum cholesterol, ALT level, BMI, and waist circumference. We also considered the mean standard deviations (SD) of region of interest and mean size of ROI (ROI) as a measurement factor to investigate the relationship with LS. To investigate interobserver agreement of LS and SD between the first and second observations, we calculated concordance correlation coefficient. To explore the interobserver difference, we calculated the absolute difference of liver stiffness between two consequent observations. As well as the clinical factors, SD and ROI were considered as possible influencing factors. Uni- and multivariate linear regression analyses were also performed. **Result:** One hundred and seventy six patients (M:F=40:136; mean age,  $55 \pm 9.3$  years) were subsequently enrolled. Concordance correlation coefficients for LS and SD were 0.76 and 0.62, respectively. Univariate linear regression analysis showed that BMI,



waist circumference, SD, and ROI had significant correlation with interobserver difference of liver stiffness ( $p=0.020$ ,  $p=0.019$ ,  $p<0.001$ , and  $p<0.001$ , respectively). On the other hand, multivariate linear regression analysis revealed that only SD and ROI had significant correlation with interobserver difference of liver stiffness ( $p<0.001$  and  $p=0.021$ , respectively). **Conclusion:** Interobserver agreement of liver stiffness measurement using 2D-SWE was moderate to good. Mean SD and mean size of ROI were significant factors related to interobserver difference.

## SL19-6

### Inter/intra-observer reproducibility of a 2D-Shear Wave Elastography (Logiq E9 system from GE) technique and the impact of ultrasound experience in achieving reliable data

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The aim of this paper was to evaluate the reproducibility of a new SWE technique -2D SWE.GE and the impact of ultrasound experience in acquiring reliable measurements, since no recommendation are available. Liver stiffness measurements were made in 60 healthy subjects by 2D-SWE.GE using Logiq E9. Three examiners, (one with both ultrasonographic and elastographic experience of more than one year – E1; one with only ultrasonographic experience for more than one year – E2; and one without any experience – E3) performed 10 valid measurements for each subject and a median and interquartile range (IQR) were calculated (m/s). The inter-observer reproducibility was assessed by calculating the interclass correlation coefficients (ICCs) for median and IQR. For the intra-observer reproducibility, we calculated, for each examiner, the medians for the first five and the last five measurements, respectively. We then calculated, for each examiner, the ICCs for the two medians. The final study group included 58 subjects: 56.9% women, with a mean age of  $32.69 \pm 13.37$  years and mean BMI  $22.68 \pm 3.96$  Kg/m<sup>2</sup>. 92.7% were healthy volunteers and 8.3% had compensated liver cirrhosis. The ICCs for median values of valid measurements were excellent both between E1 and E2, and E1 and E3 (0.872, 95% CI: 0.784–0.924 vs. 0.842, 95% CI: 0.735–0.907),  $p<0.0001$ . The ICCs for IQR were only fair between E1 and E2 (0.411, 95% CI: 0.033–0.645,  $p=0.018$ ) and between E1 and E3 (0.443, 95% CI: 0.055–0.672,  $p=0.004$ ). The agreement between measurements was excellent for each examiner, however the ICCs were higher for the more elastographic experienced examiner: 0.956, (95% CI: 0.925–0.974) vs. 0.953 (95% CI: 0.920–0.972) vs. 0.984 (95% CI: 0.973–0.991). The good ICCs for the median values show that 2D-SWE.GE is a reproducible method for liver stiffness measurements; however experience plays a role in obtaining reliable results.

### Contrast-Enhanced Ultrasound III

## SL20-1

### Therapeutic response assessment of high-intensity focused ultrasound (HIFU) ablation for pancreatic cancer: Utility of contrast-enhanced ultrasonography (CEUS)

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**Purpose:** To investigate the utility of contrast-enhanced ultrasound (CEUS) in the assessment of the therapeutic response to high-intensity focused ultrasound (HIFU) ablation for pancreatic cancer. **Material and methods:** 28 patients (11 female, 17 male, mean age 66 years, range 47–82) with pancreatic cancer (mean 3.5 cm, range 2.2–6.6 cm; mean  $17.7$  cm<sup>3</sup>, range  $3.2$ – $60.6$  cm<sup>3</sup>) were treated with ultrasound-guided HIFU. All patients underwent CEUS and contrast-enhanced MRI (CEMRI) before and after HIFU. Following HIFU, CEUS and CEMRI were performed after 6 weeks ( $n=17$ ) and 3 ( $n=15$ ), 6 ( $n=7$ ), 9 ( $n=3$ ) and 12 ( $n=3$ ) months. CEUS and CEMRI were compared by two investigators evaluating the presence or absence of residual unablated tumour, size and volume changes compared to pre- and post-HIFU-ablation. The lesions' contrast enhancement characteristics were graded using a four-point scale (0–none, 1–mild, 2–moderate, 3–intense). **Results:** CEUS was impeded early after HIFU due to edema in the acoustic pathway in 6/28 patients. A lack of contrast enhancement in the treated regions in terms of successful ablation was achieved in all patients. A mild ringlike peripheral enhance-

ment around the ablated volume was observed on both CEUS and CEMRI in 7/28 patients up to 6 weeks after HIFU, but vanished in the further follow-up. The sizes and volumes of all tumours decreased in different degrees during follow-up. A tumour recurrence seen as newly emerging nodular enhancement was detected by both methods in 2/28 patients. No significant differences were observed between CEUS and CEMRI when evaluating tumour sizes ( $P=0.415$ ), volumes ( $p=0.181$ ) and contrast enhancement characteristics ( $p=0.146$ ). Correlation analysis showed a good correlation regarding tumour sizes ( $r=0.677$ ,  $p<0.001$ ) and volumes ( $r=0.936$ ,  $p<0.001$ ) measured by CEUS and CEMRI. **Conclusions:** CEUS is useful for early and follow-up evaluation of therapeutic effects after HIFU-ablation for pancreatic cancer, but may be hindered by edema in the acoustic pathway early after HIFU.

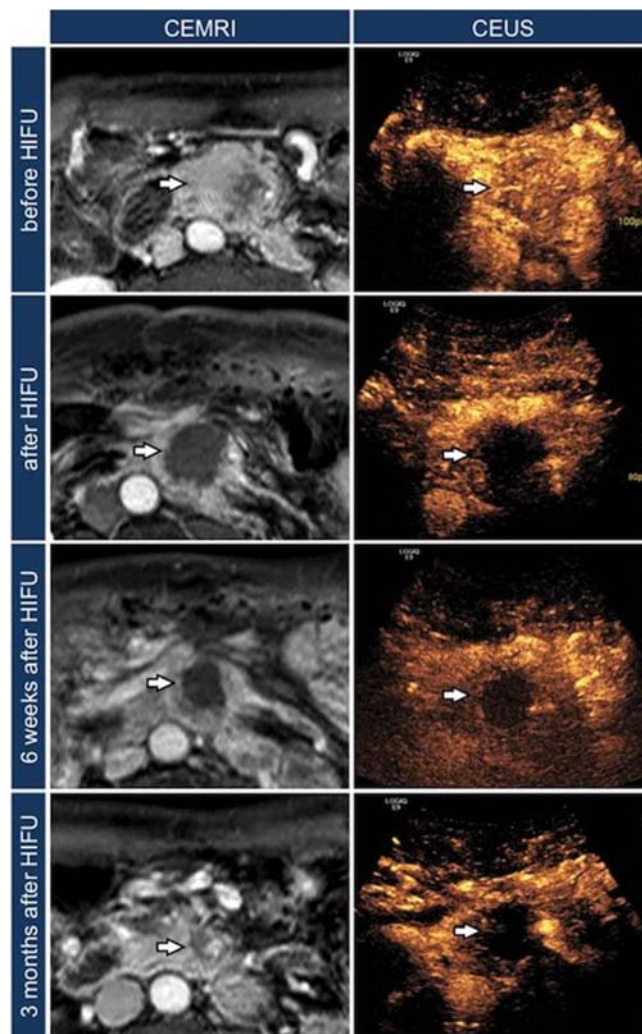


Fig. 1: CEMRI and CEUS after HIFU of pancreatic cancer

## SL20-2

### Diagnostic value of contrast-enhanced transabdominal ultrasound and contrast-enhanced endoscopic ultrasound in pancreatic cystic tumors

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**Purpose:** Pancreatic cystic tumors account for approximately 1–2% of pancreatic tumors. Contrast-enhanced ultrasound has now been used for the differential diagnosis of pancreatic cancer. This research aimed to investigate the diagnostic value of contrast-enhanced transabdominal ultrasound (CEUS) and contrast-enhanced endoscopic ultrasound (CE-EUS) in pancreatic cystic tumors. **Material and methods:** We prospec-



tively reviewed database of patients diagnosed with pancreatic cystic tumors between April 2015 and October 2015 in our institute. The inclusion criteria were as follows: patients who underwent conventional ultrasonography, CEUS, CE-EUS, CT/MRI, endoscopic ultrasound guided-fine needle aspiration and were pathologically diagnosed with pancreatic cystic tumor. One radiologist with more than 20 years' experience in contrast-enhanced ultrasound read all the patients' imaging and made diagnosis. We compared the diagnostic results from CEUS and CE-EUS with that of histopathology and made comparisons between the diagnostic efficacy of CEUS and CE-EUS. **Results:** A total of 55 patients were enrolled in this study. Diagnosis included pancreatic cystadenoma (n=36), pancreatic pseudocyst (n=6), intraductal papillary mucinous neoplasm of pancreas (n=5), solid-pseudopapillary tumor of pancreas (n=3), pancreatic cyst (n=3), and pancreatic cystadenocarcinoma (n=2). The diagnostic accuracy of CE-EUS was significantly higher than that of CEUS (78.2% vs. 85.5%,  $P=0.004$ ). For 36 cases with pancreatic cystadenoma, CEUS and CE-EUS showed comparable diagnostic accuracy of 80.6% and 88.9% ( $P=0.25$ ). **Conclusion:** CE-EUS is more effective in the diagnosis of pancreatic cystic tumor than CEUS.

## SL20-3

### Performance of Contrast Enhanced Ultrasound (CEUS) in the diagnostic of focal liver lesions – monocentric experience

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**Background and aims:** To evaluate the diagnostic performance of contrast enhanced ultrasound (CEUS) in assessing focal liver lesions (FLLs) in a large monocentric experience. **Methods:** The study included 721 patients (57.8% male, mean age  $59.6 \pm 13.1$  years) with 874 FLLs (mean diameter of  $4.5 \pm 3.1$  cm), which were first characterized by CEUS and then were finally evaluated by a 'gold-standard' method (contrast enhanced CT, contrast enhanced MRI or histology). The CEUS diagnosis was based on the FLLs' enhancement pattern following contrast bolus, according to the European Guidelines for the use of CEUS. Using the "gold-standard" methods, we calculated the sensitivity (Se), Specificity (Sp), and accuracy (Ac) of CEUS for the diagnostic of FLLs. **Results:** From 874 FLLs, CEUS was conclusive for the benign vs. malignant nature of the lesions in 776 (88.8%) cases. Using CT, MRI or histology, we established the final diagnostic of the lesions as follows: 246 (28.1%) hepatocellular carcinomas (HCC), 223 (25.5%) liver metastasis, 124 (14.2%) hemangiomas, 30 (3.4%) adenomas, 37 (4.2%) hepatic abscesses, 16 (1.9%) cholangiocarcinomas, 55 (6.3%) focal nodular hyperplasias (FNH), 36 (4.1%) regenerative nodules, 3.3% (29) focal fatty liver alterations (FFLA), 15 (1.8%) liver cysts, 38 (4.3%) other benign lesions, 25 (2.9%) other malignant lesions. For benign liver lesions, CEUS had 78.3% Se, 94.8% Sp, and 87.4% Ac. For the diagnostic of malignant lesions, CEUS had 82.9%Se, 86.4% Sp, and 84.2% Ac. For HCC, CEUS had a 65%Se, 91.4%Sp, and 81.8%Ac. For the diagnostic of liver metastases, CEUS had 74.4%Se, 93.2%Sp, and 86.7%Ac. For liver hemangiomas, CEUS achieved 73.3%Se, 95.6%Sp and 91.1% Ac. For FNH CEUS had 72.7%Se, a 97.3%Sp and a diagnostic Ac of 95%. **Conclusions:** CEUS is a reliable diagnostic, being able to differentiate between malignant and benign lesions in 88.8% cases. The best accuracy was observed for diagnosing hemangiomas and FNHs (91 and 95%, respectively), and the lowest for HCCs (approximately 82%).

## SL20-4

### CEUS and color-coded perfusion analysis in venous malformations before and after sclerotherapy with ethanolgel

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**Purpose:** Therapy monitoring of sclerotherapy with ethanolgel (Sclerogel, ab medica, Duesseldorf, Germany) in patients with venous malformations with CEUS and color-coded perfusions analysis. **Material and methods:** In this prospective study, approved by the local institutional review board, 22 patients with peripheral venous malformations gave their written consent (in case of children their caregivers) and were included (mean age: 25.3 years (6.6–46.5 years), female: n=19). At the beginning of the study and after 1–2 treatment sessions with ethanolgel

ultrasound was executed by an experienced examiner with a high resolution multifrequency linear transducer of an Acuson S 2000 ultrasound machine (Siemens, Erlangen, Germany). Flow in the malformation was detected with CCDS and Power Mode. CEUS and color-coded perfusion analysis were executed after injection of 1–2.4 ml of SonoVue (Bracco, Milan), a cine sequence was stored for 60 s. Quantitative perfusion-analysis was executed, percentage peak enhancement (peak,%), time to peak (TTP, s), area under the curve (AUC, %s), and mean transit time (MTT, s) were measured in the centre of the malformation as well as the surrounding tissue before and after treatment. Statistic analysis was calculated with Wilcoxon signed rank test. **Results:** Comparison of TTP and MTT in the centre of the lesion before and after treatment revealed statistic significant differences (TTP: 32 vs. 26 s,  $p<0.05$ ; MTT: 43 vs. 35 s,  $p<0.05$ ). Comparison of AUC and peak enhancement before and after treatment in the centre of the lesion showed no statistic significant difference (AUC: 984 vs. 668%; peak: 20 vs. 17%). The comparison of all four parameters in the surrounding tissue before and after treatment was not statistically significant. **Conclusion:** In patients with venous malformations TTP and MTT seem to be important parameters for therapy monitoring after sclerotherapy with ethanolgel.

## SL20-5

### Contrast Enhanced Ultrasound (CEUS) in hemangiomas – atypical behavior

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Hemangioma is the most common benign liver tumor with typical behavior in CEUS. Sometimes, washout can be noted in the late phase of CEUS examination, posing problems of differential diagnosis with hypervascular malignant tumors. The **aim** of this paper is assessing the incidence of atypical behavior of hemangiomas in CEUS examination. **Material and methods:** We studied a group of 103 patients (62 women and 41 men, average age  $54.7 \pm 10.3$  years), where CEUS was performed starting from the suspicion in standard ultrasound of liver hemangioma (typical/atypical aspect) between January 2014 – December 2015. We followed the behavior of the lesion in the three phases of CEUS examination (arterial, venous and late phase) and also the presence of central vascular thrombosis. For characterization and diagnosis of hemangiomas we used the EFSUMB criterias (peripheral nodular enhancement progressing in a centripetal direction in the arterial phase, hyperenhancement in the portal and late phase). **Results:** Typical appearance in CEUS was recorded in 90.2% of cases. In 9.8% of cases, the result was inconclusive due to the washout described in the late phase. In all cases with inconclusive result, a second imaging technique was performed (CT/MRI), which confirmed the diagnosis. Central thrombosis, defined as the lack of enhancement of the lesion was found in 15 cases (14.5%). CEUS sensitivity in the diagnosis of hemangioma was 91.1% and specificity of 98.8%. Hemangiomas were more frequent in the female population ( $F/B=1.5/1$ ). **Conclusions:** In 90.2% of cases, the hemangioma has typical loading pattern in CEUS. The presence of late washout may cause difficulties in diagnosis of hemangiomas (in our group in 9.8% of cases). Central thrombosis is common in hemangiomas (14.5% in the studied group). The sensitivity of contrast enhanced ultrasound in diagnosing hepatic hemangioma was 91.1%.

## SL20-6

### Characteristics of breast neoplasms on contrast-enhanced ultrasonography and its clinical value

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**Objective:** To investigate the characteristics of breast neoplasms on contrast-enhanced ultrasonography and its clinical value. **Materials and methods:** 225 female patients with breast masses unable to be diagnosed by conventional ultrasonography were examined with contrast-enhanced ultrasonography (CEUS). 225 cases were investigated. For cases of multiple lesions, performed which was the highest classification level of BI-RADS; for the lesions of the same level, performed the largest lesion. All the fundamental ultrasound examinations were performed by the Siemens Sequoia Acuson512 or Philips iU22, which were matched with contrast pulse sequence (CPS) imaging technique. **Results:** 91 cases were malignant and 134 cases were benign. The 91 malignancies dis-

played: irregular shapes were 80.2% (73/91), tortuous, massive or penetrating vessels were 86.8% (79/91), heterogeneous distribution of contrast enhancement were 83.5% (76/91), perfusion defect of contrast signals were 89.0% (81/91), local retention of contrast signals were 93.4% (85/91), rapidly entering and exporting from the lesions were 65.9% (60/91). Significant differences of above CEUS characteristics were found between the benign and malignant breast lesions ( $P < 0.05$ ). The two most important features were perfusion defects and local retention of the contrast signals, with the sensitivity and specificity attained to 89.0% and 91.8%, and 93.4% and 92.5%, respectively. Poorly defined boundaries of the 91 malignancies were 64.8% (59/91), and the specificity was 47.8%. The malignant cases had enlarged maximum diameter on CEUS compared to pre-contrast ( $P < 0.05$ ). **Conclusion:** The typical features of breast cancers on CEUS were irregular shapes, tortuous, massive or penetrating vessels, heterogeneous distribution of contrast enhancement, with perfusion defect or local retention of contrast signals, rapidly entering and exporting from the lesions, enlarged maximum diameter of the lesions on CEUS compared to pre-contrast. It is valuable for CEUS in the diagnosis and differential diagnosis of breast neoplasms clinically. **Key words:** breast neoplasms/contrast media/ultrasonography

## Abdominal Ultrasound – Clinical Investigations and Case Reports

### PS1-01

#### Systemic and regional hemodynamics in children and adolescents with bone sarcomas of upper and lower limbs

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**The aim:** To study the hemodynamic of upper and lower extremities taking into account of cardiac output and volume of tumors in patients with bone sarcomas. **Patients and methods:** Analysis of data obtained during of the initial ultrasound examination of the 56 patients aged 8–18 years with morphologically proven bone sarcomas of extremities was performed. Were estimated: cardiac output (CO), volume of blood flow in main femoral and subclavian artery (Q ml/min), indices – resistance and pulsation (RI, PI), as well as size of their percentage deviations for the affected limb compared with the contralateral (%Q, %RI, %PI). **Results:** In system “organism-tumor” were noted the change in cardiac output with increasing tumor volume ( $r = 0.42$ ;  $p < 0.05$ ), so-called “systemic effects of the tumor” on the background of the interdependence of volume blood flow in the main artery of the affected and healthy limbs ( $r = 0.67$ ;  $p < 0.05$ ). Herewith a negative correlation between index value of %Q and blood flow to the healthy limb – Q ( $r = -0.39$ ;  $p < 0.05$ ), is confirmation, that one of component of hemodynamic changes there is redistributive blood flow. The volume of malignancies and %RI, %PI ( $r = 0.33 - 0.37$ ;  $p < 0.05$ ) also correlated ( $r = 0.33 - 0.37$ ;  $p < 0.05$ ). That is, there has been a decrease in regional vascular tone in affected limbs. **Conclusion:** Pathological mechanisms of hemodynamic support of affected limb may include systemic increase in CO, regional changes in vascular tone and against this background – the redistribution of certain volumes of blood between from healthy to affected limbs. The values of indicators: %Q, %RI, %PI can serve as additional diagnostic criteria for bone sarcomas of the extremities.

### PS1-02

#### Causes of hydronephrosis in dogs and cats

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**Purpose:** Hydronephrosis represents a comparatively rare disease of the kidneys in dogs and cats. In this study patients of the clinic for small animals with proven hydronephrosis are evaluated and causes of hydronephrosis are compared. **Materials and methods:** The patient data between 2005 and 2015 from the clinic for small animals were evaluated. In this study we included those animals that had at least one kidney being altered in terms of hydronephrosis. The underlying cause had to be confirmed either by a pathological examination or by surgery. Additionally, all those cases were included in which the underlying cause could not be identified during surgery. Those animals, which were diagnosed with hydronephrosis based on ultrasound examination, but which did not undergo any further investigations, were excluded. **Results:** In this study 29 animals from the examination period were finally included,

comprising six cats and 23 dogs. In four animals a bilateral hydronephrosis could be diagnosed, ten animals showed a right-sided hydronephrosis, 15 animals had a left-sided hydronephrosis. In 15 animals neoplasia was responsible for hydronephrosis including seven transitional cell carcinomas. Furthermore we found an ectopic ureter in five animals and a ureteral calculus in four animals. **Conclusions:** There are different causes for hydronephrosis in dogs and cats; in young animals an ectopic ureter should always be considered whereas in older animals a neoplastic disorder is most likely.

### PS1-03

#### Accessory spleen within the pancreatic tail as differential diagnosis to pancreatic tumour

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**Purpose:** Accessory spleens are often incidental findings in abdominal ultrasound. Because of their echogenicity and behavior in contrast enhanced ultrasound they can be misjudged as malignant tumours if found in an atypical location. **Material and methods:** During routine abdominal ultrasound a small round slightly hypoechoic lesion without halo was detected within the pancreatic tail of three persons (size 8–20 mm). EUS and CEUS have been performed as well as contrast enhanced MRI, which showed a hyperenhancing lesion without washout. Two lesions have been punctured, one lesion has been operated (pancreatic tail resection and splenectomy). **Results:** All three lesions were histologically confirmed as being accessory spleens within the pancreatic tail. **Conclusion:** Accessory spleen in the pancreatic tail is an important differential diagnosis to NET tumors of the pancreas. Accessory spleens show a moderate hyperenhancement and washout together with the normal spleen tissue during CEUS. A histological/cytological diagnosis by EUS puncture should be performed before operation is performed.

### PS1-04

#### Effectiveness of contrast enhanced ultrasound examination after radiofrequency ablation liver metastasis

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**Purpose:** Estimate of contrast enhanced ultrasound examination (CUS) after radiofrequency ablation (RFA) liver metastasis. **Material and methods:** 10 patients (7 male and 3 female) after radiofrequency ablation liver metastasis under CUS control using “SonoVue”. Patients age ranged from 46 to 77 years ( $M = 62$ ). 9 patients had colorectal liver metastasis; one has nodular form of hepatocellular carcinoma. Prior RFA for detect and size calculation of liver metastasis standard US (Philips IU-22 Matrix) in B-mode and duplex mode had been done as well as contrast enhanced CT (GE Discovery HD750) or MRI (GE Optima MR450w). Size of metastatic nodes varied from 9×12 mm to 24×34 mm. Tumor angiogenesis had been mapped using CUS in dynamic mode with 2 ml intravenous injecting of “SonoVue” before and after RFA. Scanning protocol and 2D CUS video sequences were identical before and after RFA. We found absence of contrast uptake in tumor nodes in arterial and portal phase after RFA and presume as full tumor ablation after RFA. **Conclusion:** Contrast enhanced ultrasound examination in dynamic mode is a reliable non-ionizing method of liver node radiofrequency ablation effectiveness.

### PS1-05

#### The possibilities of ultrasonography in tumors of the small intestine

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Tumors of the small intestine are rare diseases. Preoperative diagnosis of these tumors is difficult, radiological methods of detection are not always effective. **Purpose:** The work is devoted to the capabilities of ultrasono-

graphy for tumors of the small intestine. **Material and methods:** Behind ten years, tumors of the small intestine was diagnosed in 18 patients during ultrasonography of the abdominal cavity, in 2 patients – during transvaginal ultrasonography: (carcinoid – 7, non-Hodgkin's lymphoma – 7, leiomyoma – 2, cancer – 1, polyp – 1, gastrointestinal stromal tumor (GIST) – 2). **Results:** In all patients, the tumor was diagnosed during the ultrasound examination. Different tumors had different echographic semiotics. Local hypoechoic thickening of the bowel wall was found in cancer and carcinoid. Angular deformation of the intestinal wall in the affected area was typical for carcinoid. In non-Hodgkin's lymphoma, we have seen: 1) large (1.8–8.0 cm) circular hypoechoic wall thickening of the distal ileum; 2) not circular moderate (1.0 cm) thickening with medium or low echogenicity. Two patients with non-Hodgkin's lymphoma had multiple lesions of the small intestine. Leiomyoma and GIST were seen as round or oval knot, located next to the intestinal wall, involved the muscular layer. Two patients had a tumor cavity with a gas. More uneven contours, a large heterogeneity of structure are typically for GIST. The oval, medium echogenicity polyp was located in the lumen of the intestine. Two differential diagnostic characteristics distinguishing tumors of the colon and small intestine were: 1) localization – in the projection of the colon or in the central abdomen, 2) greater mobility for tumors of the small intestine. **Conclusions:** Ultrasonography is an effective method for tumors of the small intestine. The method allows to find the tumor, to determine its organ belong, in some cases – to assume its histological nature.

## PS1-06

### Shear wave elastography of the bowel of patients with Crohn's disease

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**Purpose:** In recent years several papers have been published investigating the use of shear wave elastography of the bowel on operation specimens or on laboratory animals with models simulating Crohn's disease. These studies indicate that shear wave elastography can be used to quantify the degree of fibrosis in the bowel. No clinical trials using transabdominal shear wave elastography have been published. The aim of this study was to examine if shear wave elastography can be used to measure the stiffness of the bowel wall during a clinical ultrasound examination. **Material and methods:** Fifteen patients with Crohn's disease undergoing ileocolonoscopy were invited to participate and scored with the Simple Endoscopic Score of Crohn's disease (SES-CD). Endoscopic remission was considered as SES-CD < 2. Ultrasound was performed using a Logiq E9 ultrasound scanner. The area with the most pronounced bowel wall thickening was considered the most affected and examined with shear wave elastography. Nine single measurements were made in the longitudinal direction of the bowel with a linear ultrasound transducer (9L) with and without pre-compression. The onboard software allowed freehand tracing of the region of interest. The quality criterion for the measurements was a standard deviation less than 30% of the average of the measurements. **Results:** Satisfactory measurements were made in 9/15 patients without precompression and 7/15 patients with precompression. The success rates were 60 and 47%, respectively. SES-CD correlated with the elastography measurements with ( $r = 0.87$ ,  $p = 0.02$ ) and without ( $r = 0.80$ ,  $p = 0.016$ ) precompression, but there was no significant difference between patients with endoscopic activity and patients in remission. **Conclusion:** Elastography measurements of the bowel of patients with Crohn's disease using the shear wave method on the Logiq E9 ultrasound scanner correlate with SES-CD, but the variability is considerable and the method needs optimization before being introduced in clinical routine.

## PS1-07

### Features superb microvascular imaging (SMI) technique in the differential diagnosis of focal liver formations

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**Purpose:** To evaluate the diagnostic accuracy of superb microvascular imaging (SMI) in the differential diagnosis of focal liver lesions tumors in clinical practice. **Materials and methods:** 50 patients with a different focal hepatic lesions were examined by typical B-mode ultrasound and SMI and were included in the trial. All results were compared to histology after biopsy or in some cases to computer tomography (CT) or magnetic resonance imaging (MRI). **Results:** In 3 cases (6%) was focal nodular hyperplasia (FNH) with typical sonographic symptoms (such as central scar and spoke-wheel vessel pattern). The final diagnosis of FNH was verified by lesion biopsy. 10 patients (20%) had hepatocellular carcinoma. These tumors were single and had heterogenic structure, echogenicity was equal to the liver, mean size  $4.2 \text{ cm} \pm 1.1 \text{ cm}$  and pathological chaotic vascularization with high intensity. 17 (34%) were metastatic tumors. Almost all metastases had multiple character and has various echogenicity but most of them were hyperechoic (size varied from 1.5 cm to 5.4 cm). Most they had smooth clear contours, moderate blood flow located in a chaotic manner. In all cases the primary tumor was found on CT. 15 person (30%) had haemangiomas (size from 0.6 cm to 4 cm). In these cases lesions were hyperechoic, with homogenous structure. SMI had shown diffuse bloodstream with low intensity. 6 (12%) hyperechoic focuses (size from 1.5 cm to 6.0 cm) had no blood vessels in colour Doppler and SMI, and were regarded as hotbeds of uneven fatty infiltration, which was confirmed by CT. **Conclusion:** SMI is very useful method of diagnostic and can be the final diagnostic exam without contrast enhanced ultrasound in suspect of FNH and allows to differentiate benign and malignant lesions in liver, and also will reduce the number of biopsies.

## PS1-08

### Sonoporation by microbubbles as gene therapy approach for liver cancer

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**Purpose:** We use an innovative method, known as sonoporation, to induce the expression of silenced gene in liver cancer cells (HepG2), such as (but not restricted to) TRAIL in a specific manner. Aim of the project is the re-activation of silenced apoptotic pathway in liver cancer models, using diagnostic microbubble synovial as plasmidic gene delivery. **Material and methods:** HepG2 ATCC were used to assess all the experiments. Microbubble (Sonovue®) were used at standard condition according to manufacturer's instructions. pEGFP-TRAIL plasmid (Plasmid #10953 addgene) and the respective control were selected and propagated in LB broth in order to obtain the necessary amount. Plasmid were purified with Invitrogen PureLink (thermo-fisher scientific Cod. K210017) kit. Transfection was mediated by Ultrasound device (Sonitron 2000, Artison corporation®) compared with standard protocol for lipofectamine 2000 (Invitrogen). GFP (Green Fluorescent Protein) was acquired via FACS ex-calibur DB analysis. **Results:** HepG2 cells were used to achieve the TRAIL-GFP recombinant protein transfection. Cells were collected and re-suspended in PBS 1X and Cell Cycle Buffer. FACS analysis was performed and results were analysed with Cell-Quest and ModFit software. Among the several condition, cytotoxic parameters were acquired (5 MHz, 100% Duty Cycle, and 3 W/cm<sup>2</sup>, 60 s) with over than 80% cells in Pre-G1 phase; meanwhile lower parameters were not enough for gene delivery (1 MHz, 30% Duty Cycle, and 1 W/cm<sup>2</sup> 60 s). Best parameters were collected between 3 MHz, 100% Duty Cycle, and 1 W/cm<sup>2</sup>, 30 s). Data showed a dose dependent effect in terms of output energy. 30–50% transfection efficacy was acquired and TRAIL re-expression induced apoptotic effect. **Conclusion:** Results showed the possibility to restore the expression of



pro-apoptotic gene TRAIL in a liver cancer model HepG2. The future goal, in our vision, is the translation in animal model of our system, in order to evaluate the in-vivo effect of plasmidic gene therapy in hepatocarcinoma cells.

## Contrast-Enhanced Ultrasound – Clinical Investigations and Case Reports

PS2-01

### Diagnostic assessment of acute respiratory distress syndrome with lung ultrasound – comparison with Computed Tomography – preliminary data

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**Objectives:** Lung ultrasound (LUS) is increasingly used in intensive care medicine to monitor invasive ventilation, however little data exists on the comparison of common lung ultrasound (LUS) findings in Acute Respiratory Distress Syndrome ("b-lines", consolidations) with the imaging gold standard Computed Tomography (CT). Therefore the aim of our study was to examine these findings under controlled conditions at different Positive End Expiratory Pressure (PEEP) levels in healthy and diseased piglets and compare them with dynamic CT scans. **Methods:** After approval of the ethics committee, 8 piglets were studied during pressure controlled mechanical ventilation before and after surfactant depletion injury. Inspiratory, expiratory and dynamic CT scans and ultrasound examinations were performed at defined PEEP levels (0, 5, 15) by one radiologist. (curved transducer 3.5 MHz, in oblique/transverse orientation at approx. 5th/6th intercostal space ventral and dorsal in the anterior axillary line on both sides and additional transhepatic scans on the right side in 6 pigs). Offline evaluation of the CT images and ultrasound images was performed in separate sessions, blinded to the results. **Results:** Transhepatic ultrasound evaluation of lung consolidations as compared with CT showed an excellent correlation. Higher B-line counts were present in the diseased lung (compared with healthy lung), dorsally (compared with ventrally), and at lower PEEP levels (compared with higher PEEP levels). No CT correlate for the B-lines could be identified. **Conclusion:** Transhepatic assessment of consolidations for dynamic modification of respiratory management seems feasible with excellent CT correlation. B lines seemed to be influenced by respiratory parameters and position, however, no CT correlate could be found.

PS2-02

### Sonographic appearance of bronchial carcinoma in atelectasis versus flooded lung

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**Background:** Sonography of central lung tumours is limited, when surrounded by gaseous lung. Only in cases of bronchial- pleural invasion or when atelectatic lung serves as acoustic contact it becomes imageable. Further it has been shown that One Lung Flooding (OLF) is safe and enables sonographically examination of lung in-vivo. For ultrasound guided interventions the tumour demarcation from lung tissue is essential. Therefore the visualization of lung tumours in flooded and atelectatic condition was assessed. **Methods:** Human lung lobes received from surgery after lobectomy was used in 13 cases (10 NSCLC bronchial carcinomas, one CRC lung metastasis, one SCLC and benign Hamartionchondroma). Tumors were sonographically examined first in atelectatic lung than after flooding transpleurally (Micromaxx, Sonosite, USA) and endobronchially. Flooding was performed with isotonic NaCl 0.9% until a hydrostatic pressure of 20 cmH<sub>2</sub>O was achieved. Rate of tumour detection and sonomorphology was assessed. **Results:** Sonographic examination under atelectasis was limited by residual gas in non-collapsed bronchi. Tumors were detectable in 42.6% and could be demarcated from the surrounding lung tissue in 15%. Tumors and atelectatic tissue presented mostly isoechoic. After flooding, 71.4% of lung lobes could be completely

examined. All tumors were visualized by ultrasound after flooding. Tumors were predominantly hypoechoic, polycyclically configured with finger-shaped runners, well-demarcated from surrounding lung. Endobronchial tumor growth and destruction of bronchial wall was observed. Vessels and bronchi differentiated themselves as echoless structures within the parenchyma. **Discussion:** Tumors were detectable centrally in lung and differentiated from the surrounding lung parenchyma after OLF. Infiltration of the tumor into adjoining functional structures was also identifiable. This information is essential for sonographic guided interventions where its use for FUS ablation has been shown. Further studies are required exploring US guidance for therapeutic applications (RF, SEEDS) or diagnostics (Biopsy) under OLF in-vivo, justifying the additional invasivity of OLF.

PS2-03

### The greater omentum mimics chest tumor – case report

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Mild tumours of the chest wall appear rare. The most often mild lesions are lipomas. Differing with malignant lesions and stating the certain recognition require imaging tests and also often the histopathological examination and even the surgical treatment. Here was presented the case of 57-year old man with a tumour in the left pleural cavity, burden with nicotine and a coronary. In the subjective and objective examination were found: the persistent cough and a deterioration in the effort tolerance. In order to verify the lesion's nature (mild or malignant) was performed the classical imaging tests (US and CT) and CEUS. On the basis of the conducted imaging tests and fine needle biopsy were found the features of lipoma. During the intraoperative examination were found the displacement and formation into pathological mass of the left pleural cavity's greater omentum. The prognosis in case of the mild lesion diagnosis in the pleura is very good. However at the stage of diagnosis, mild lesions should be differentiate from more frequent metastatic cancer lesions or diffuse malignant mesothelioma. In diagnostics are useful imaging tests like: US, CEUS, CT or MRI. CEUS is worth noting because this is the test allowing to assess the lesions' nature in the pleural cavity more accurately. Moreover it is deprived of ionizing radiation and it is cost less. In the event of doubt, we should try to establish the histological diagnosis in order to exclude the malignant neoplastic process.

PS2-04

### Elevation of the value of contrast-enhanced ultrasonography (CEUS) in radiology departments in Germany

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**Purpose:** Contrast Enhanced Ultrasound (CEUS) is established methodically for years and is an increasingly important pillar in diagnostic imaging of different organ systems. However, the modality is rarely performed by radiologists, but more often within other disciplines. The present questionnaire study is intended to represent the current value of CEUS in radiology and to stimulate a re-evaluation of the establishment of this method within the discipline. **Materials and methods:** A total of 560 medical directors of radiological departments throughout Germany were contacted and a 3-page questionnaire was presented. On the basis of 37 questions on 5 sets of issues (general structures, CEUS and interdisciplinaryity, CEUS in pediatric radiology, education/training, prospect), the importance of US and especially of CEUS within radiology was requested. **Results:** The response rate was 42.3%. A comprehensive statistical analysis of the issues was performed, including subgroup analyzes.

Overall, it was found that CEUS is indeed practiced in relatively few radiology departments (26.6%), but the significance of the method is perceived by a total of 81.8% by radiologists and is mostly esteemed in the medium to high range of importance. Even more than half of the polled (54.9%) would support to incorporate the method within the radiology specialist training. **Conclusions:** The nationwide questionnaire survey to collect the value of CEUS in radiology revealed a very high response rate. This reflects the perception of the importance of the subject area through the radiological discipline. A large discrepancy between the currently low rate of application of the method within radiology and the still relatively high assessment of the significance of CEUS by many radiologists could be shown. The statistical analyses of the issues offer important professional political aspects of this topic within the radiological discipline.

## PS2-05

### Age-dependency of cardiac morphology and function: results of the LIFE-Adult-Study – analysis of the echocardiographic substudy

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 DOI: 10.1055/s-0036-1587828

In the NORRE study (EHJCVI (2014) 15, 680–690) normal values determined by echocardiography were published in healthy subjects (n = 734) with mean age of 46±13 years (range: 20–78). Left ventricular (LV)-volumes showed good correlations to the participants' (pts') age. LV-volumes were decreased and LV ejection fraction (EF) was increased according to the increase of the pts' age. A significant correlation between age and LV-mass was only found in women. Left atrial (LA)-volumes did not significantly change with age. Parameters of diastolic function showed a strong age-dependency (decrease of E/A-ratio; increase of E'/E'-ratio). In the present LIFE-Adult analysis echocardiographic parameters were compared to the NORRE data. In 773 pts (326 males and 447 females; median age: 51 years), standardised transthoracic echocardiography was performed according to the national and international recommendations. The following parameters were analysed: LV- and LA-volume analyses by M-Mode measurements and 2D-LV planimetry, maximum E- and A-velocity, E/A-ratio and E'/E'-ratio. The cohort was divided in age related subcohorts between 20–40, 41–50 and 51–60 years. Mean LV-diameter was 54±5 mm (males) and 49±4 mm (females). There was no age-dependency in males, but a tendency of LV-diameter increase in females. Mean LA diameter was 39±4 mm in males and 35±4 mm in females. Mean LA-diameter-index was 20±2 mm/m<sup>2</sup> (males) and 20±3 mm/m<sup>2</sup> (females) showing Age-dependency of an increasing LA-diameter in males and females. LV mass-index was 100±20 g/m<sup>2</sup> (males) and 83±19 g/m<sup>2</sup> (females) showing a tendency of increasing LV mass-index with age in males and females. Subsequently, septal and posterior wall thickness slightly increases with age. No differences of LVEF with increase of the pts' age could be observed. E/A-ratio was decreased and E'/E'-ratio was increased with increase of the pts' age. The analysis of the echocardiographic parameters of the LIFE-Adult trial showed differences of the age-dependency in comparison to the NORRE data.

## PS2-06

### Detection of cardiotoxicity in patients with breast cancer treated with chemotherapy

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 DOI: 10.1055/s-0036-1587829

**Purpose:** The aim of the present study was to detect early cardiac changes in patients receiving chemotherapy with respect to the conventional and deformation parameters of 2D echocardiography. **Material and methods:** Thirty patients with breast cancer receiving cardiotoxic chemotherapy (taxane: paclitaxel/docetaxel) underwent 2D echocardiography (General Electric Norway). All patients were examined before and during cardiotoxic chemotherapy at a 6-month follow-up. Systolic function (left ventricular ejection fraction and global longitudinal strain) and

diastolic function (septal E'/E') were analyzed with 2D echocardiography. **Results:** For left ventricular ejection fraction and global longitudinal strain no significant differences were detected 6 month after the start of the chemotherapy. According to our results, myocardial dysfunction induced by cardiotoxic chemotherapy can be detected by early diastolic alterations. The E'/E' was significantly higher after 6 month than before the chemotherapy as a marker of the diastolic dysfunction (E'/E'<sub>start</sub> 9.24±3.4 vs. E'/E'<sub>6 month</sub> 11.32±4.8, P: 0.026, paired sample t-test). **Conclusion:** To detect myocardial dysfunction by global longitudinal strain and left ventricular ejection fraction potentially requires a longer follow-up. E'/E' seems to be the one of the sensitive parameters to detect early myocardial damage during chemotherapy.

## PS2-07

### A new diagnosis tool for the evaluation of liver fibrosis: Parametric Arrival Time imaging (PAT)

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**Introduction:** Liver biopsy is the "gold standard" method for staging liver fibrosis, but it's an invasive procedure and is associated with risk of some complications. There are also noninvasive techniques for assessment of liver fibrosis such as elastography and biological tests, but these techniques can fail or generate false measurements depending on subjects conditions: food intake, ascites, obesity, etc. **The aim** of this study is to determine whether liver fibrosis can be evaluated using the parametric arrival time imaging (PAT) using contrast enhanced ultrasonography (CEUS). **Material and method:** Ultrasonography was performed using the LOGIQ E9 (GE Healthcare, Chalfont St. Giles-UK) system. CEUS using SonoVue as contrast was performed in each subject. Liver scanning during the first 30 s following the injection of contrast agent through the cubital vein were saved as raw data on hard disk. The examination was performed with the patients in left lateral position with the right arm elevated above the head and the patients were instructed to hold their breath for some seconds. Images showing liver parenchyma and the right kidney in a single screen were used for analysis. Following ultrasonography, parametric imaging was performed using the proprietary image analysis software of the ultrasound system. A parametric color scale was used: red-first 5 seconds, yellow 5–10 seconds, green 10–15 seconds, blue 15–20 seconds, purple 20–25 seconds, brown 25–30 seconds. **Results:** A ratio of the arrival parametric time was calculated between the kidney and the liver. Previous studies showed that, the faster the contrast arrives in the liver as compared with the kidney, the higher is the severity of fibrosis. This ratio is compared with liver stiffness assessed by Transient Elastography (performed before the CEUS examination). **Conclusion:** Our preliminary study on 10 patients showed that the method is feasible, but more patients are needed to draw a conclusion.

## PS2-08

### Analysis of coronary sinus, coronary arteries and left ventricular function during carillon device implantation

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Mitral valve annuloplasty via the coronary sinus (CS) is possible by the Carillon device which can create constricting force after insertion into the CS transmitted to the mitral valve and mitral annulus. To strategise this procedure the knowledge about the size and anatomy of the CS in relation to the mitral annulus is crucial. 30 consecutive patients with sinus rhythm were investigated by TEE to test the visualisation of CS and branches of the coronary arteries in the posterior region of the mitral annulus as well as the feasibility of speckle tracking of the left ventricle. An image acquisition protocol for sufficient analysis of these features should be worked out in these patients. The ostium region of the CS, the middle part of the CS in the posterior mitral annulus as well as the distal CS between anterolateral mitral commissure and left atrial appendage can be acquired in ZOOM multidimensional data sets with highest spatial resolution. The completion of this proposed protocol was possible in 80% of the patients' cohort with sinus rhythm and in 6 of 8 Carillon patients. The complete CS visualisation succeeds in 70%, the determination of the coronaries in 50% and the TEE adjustment of the

LV standardised views in 80% of patients' cohort with sinus rhythm. During the intervention the speckle tracking analysis was interfered by artefacts induced by the Carillon device. CS mitral annulus analysis is feasible and helpful prior to the intervention to strategise these procedures in patients with severe mitral valve regurgitation. Thus, the importance of distinct TEE analysis of the CS and LV function is underlined prior and during Carillon interventions.

## PS2-09

### CEUS in gunshot wound of the liver – first experience in military mission

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**Purpose:** Computed tomography (CT) is the gold standard technique in gunshot injuries imaging. In military missions and in case of mass casualties availability of CT scanning and capacity of airborne transporting may be limited. FAST (Focused Assessment with Sonography in Trauma) remains the primary imaging examination in abdominal trauma. Contrast-enhanced ultrasound (CEUS) could close the diagnostic gap between CT scanning and FAST and back-up shortage of diagnostic availabilities. **Material and methods:** We report a case of gunshot wound of the liver during military mission in Afghanistan. FAST and CT scanning were done as first diagnostic imaging. CEUS was performed additionally in the emergency room by CX 50 Philips ultrasound system and SonoVue contrast agent. CEUS was repeated after each following operation and also done intraoperative to estimate the damage of the liver and hematoma. **Results:** The wound tract extension of traumatic gunshot wound could not be estimated on first CEUS examination due to aerodermectasia and gas echo extended along the wound track. Subsequent CEUS after first operations were done revealed that the wound track echo was unenhanced in majority. CEUS effectively detect the wound tract, hematoma, and the liver area injured by the gunshot and could accurately reveal necrotic tissue in the injured area and differentiate it from normal tissue. **Conclusions:** Application of CEUS may provide important imaging for gunshot wound debridement in its follow up and avoid repeated CT scanings. Thus may spare time and transport capacity in military missions. CEUS is an interesting diagnostic tool in blunt and gunshot trauma of the abdomen.

## Education in Ultrasound

## PS3-01

### US B-mode and CEUS (Contrast-Enhances Ultrasound) patterns in n = 62 patient with traumatic and spontaneous non-traumatic (n = 33) and traumatic (n = 29) splenic ruptures: a comparative study between 12/2003 and 2/2010

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**Introduction:** Both US B-mode and CEUS are well established procedures when diagnosing traumatic splenic ruptures (TSR). It is uncertain whether spontaneous splenic ruptures (SSR) and TSR differ concerning clinic, B-Bild and CEUS pattern and prognosis. **Material and methods:** Between 12/2003 and 2/2010 n = 33 SSR and n = 29 TSR were diagnosed in an medical university ultrasound laboratory. All patients were examined with B-Bild and CEUS. Clinical data, US B-mode and CEUS pattern incl. Grading and course were retrospectively analysed and compared. **Results:** There were significant differences concerning clinical data, such as age, underlying disease and splenomegaly. No differences could be shown between Grading of TSR and SSR neither in B-Bild nor in CEUS. As expected, CEUS was significant superior to B-Bild concerning the grading of splenic ruptures and in certain subgroups the choice of therapy was therefore influenced by CEUS. The mortality within 4 weeks was significantly higher in SSR than in TSR. **Conclusion:** There are differences between SSR and TSR especially concerning clinical data (age, course and

prognosis). Regarding the sonographic pattern SSR and TSR show identical lesions. When suspected splenic rupture, CEUS should always be performed.

## PS3-02

### Teaching students two-point compression ultrasound: A randomized, controlled trial

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**Purpose:** Two-point compression ultrasound (2-pc) is an important imaging modality for diagnosing deep vein thrombosis (DVT). Traditional ultrasound training comprises of classroom lectures and hands-on training (HT), both time- and cost-intensive. We wanted to assess whether 2-pc can be learned without instructor. **Material and methods:** N = 47 medical students were randomized into two groups: Group A learning pathway included a new e-learning three days prior to a course, 5 min live demonstration at the venue and self-directed training (SDT) without instructor using a pocket card. Group B only watched a lecture at the venue and, thereafter, participated in a HT guided by an experienced instructor. Both groups took a series of tests: theoretical pre-test (test 1) four to six days prior to the course, a theoretical post-test (test 2) and a practical test (test 3) at the end of the day of the course. The practical test was repeated after four weeks (test 4). Statistical analysis with Mann-Whitney-U-Test. **Results:** 39 of 47 students completed the study protocol. There was no inter-group difference on the pre-test (NS). Group A performed significantly better in test 2 and showed similar retention of practical skills after four weeks (table 1, NS = not significant).

Tab. 1: test results in percent with 5/95 % CI

	Group A	Group B	p
Test 1	60.0 (52.7 – 67.3)	60.8 (54.3 – 67.2)	NS
Test 2	91.5 (87.9 – 95.1)	78.9 (73.7 – 84.2)	p < 0.0001
Test 3	72.6 (65.3 – 80.0)	82.7 (74.7 – 90.7)	p < 0.05
Test 4	75.7 (71.2 – 80.3)	75.1 (70.7 – 79.6)	NS

**Conclusion:** Regarding DVT training, student's practical skills in short term were superior immediately after the course when supported by an experienced trainer. Theoretical basis of DVT can be transferred using e-learning with superior results compared to classroom lectures. However, mid-term retention of practical skills was comparable. Therefore, an e-learning enriched SDT pathway presents an alternative to reduce attendance time for trainees and instructors.

## PS3-03

### A low cost 2D/3D ultrasound training model for the characterization of mesh properties

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**Purpose:** Mesh implants are widely used in Pelvic organ prolapse (POP) repair surgery. Magnetic resonance imaging (MRI) and 2D/3D ultrasound (US) can identify the mesh material used and may provide additional information on mesh type, location, and morphology. This knowledge can help in surgical planning and counseling as well as in complication management. To the best of our knowledge, to date, there is no model for training operators in US mesh identification. The aim of this study is to report on a low cost, home-made US mesh identification training model. **Methods:** An agar gel of 2–5% gives US and MRI representations that are equally artifact-free. Five different polypropylene MRI visible meshes and four PVDF MRI visible meshes were included in this study from two different manufacturers. Copper sulphate was incorporated into the agar gel for better MRI visibility. A house hold plastic container was filled with



a 5 cm layer of 3.5% agar gel upon which the different meshes were placed parallel to one another. These were covered with a 2 cm layer of the 3.5% agar gel. After cooling and consolidation of the agar, MRI and 2D/3D US were performed on the model and the mesh properties were recorded. **Results:** The MRI and 2D/3D US images obtained were able to identify mesh type, mesh location, and morphology (figure). The data obtained was compared with the mesh properties that are defined by the manufacturers. There was complete compatibility between the mesh properties and US images. **Conclusions:** We were able to create a low cost, home-made training model for US mesh identification training.

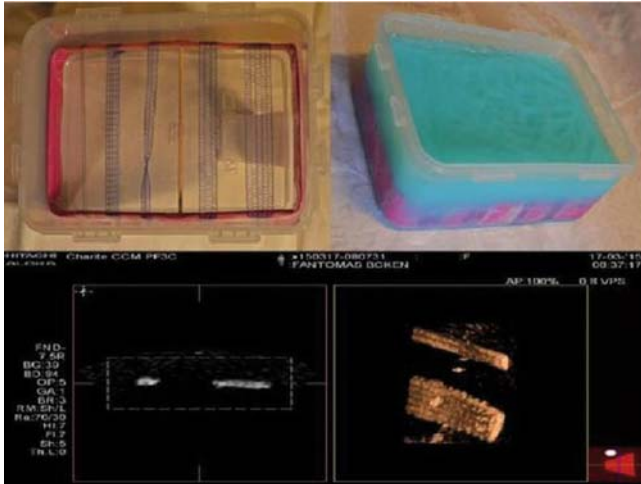


Fig. 1: training model 2d/3d – mesh

### PS3-04

#### Ultrasound education for medical students using e-learning and self-directed hands-on training

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**Purpose:** Ultrasound training is time and cost intense limiting its distribution especially during medical school curriculums. We wanted to assess whether the two-point compression technique (2-pc) used to diagnose deep vein thrombosis (dvt) can be learned without an instructor. **Material and methods:** 30 medical students were recruited for the study. They were given access to a novel e-learning curriculum including podcasts for 6 days. A pre-test was required to enter the self-directed hands-on training (sHT). All students were given pocket cards designed for this study showing the 2-pc with physiologic and pathologic findings. The sHT took place without an instructor being present. At the end of the sHT students were asked to perform a 2-pc, which was filmed (test A) and evaluated later by experienced instructors. The control group (n=24) had a class-room lecture and HT with an instructor. Statistical analysis with Mann-Whitney-U-Test. **Results:** 23 students completed the study protocol of the experimental group, control n=24. The control group performed significantly better in test A (mean 82.7, CI 74.7 – 90.7%) compared to the experimental group (mean 65.7%, CI 59.9 – 72.6; p=0.0009). Regarding preparation, sequence of 2-pc and scan of the inguinal and femoral region there was no difference between both groups. **Conclusion:** Theoretical basis of DVT can be transferred using e-learning. A learning pathway solely consisting of e-learning and self-directed HT achieves acceptable results regarding practical skills but is inferior to HT with an instructor. Regarding the sequence of the exam, preparation of the machine and the patient a self-directed learning pathway showed equivalent results. Interactive e-learning curricula and other media such as pocket cards should be incorporated into ultrasound education.

### PS3-05

#### Enhancing ultrasound peer-to-peer teaching: criteria for a student ultrasound tutor

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**Purpose:** The importance of teaching ultrasound (US) during medical studies is steadily increasing. Nearly all German medical universities provide theoretical and practical classes. Besides different contents, group sizes and the duration, the concepts vary due to the person, who supervises the trainees. It has been shown that students, dedicated and trained in specific skills, could encourage curricular teaching. Especially in skills-labs they are indispensable. Furthermore, the most successful ultrasound projects in Germany are acting on the basis of peer-to-peer-teaching. Nevertheless, standardised procedures are essential to make sure, that these tutors are able to teach their fellows with reliable knowledge and practical skills. **Material and methods:** The working group students in the DEGUM (German Society for Ultrasound in Medicine) has developed a catalogue of criteria which shall be used for the qualification of a student ultrasound teacher. This draft focus on a three-stage-training: (1) theoretical knowledge, (2) profound practical skills in performing an examination and (3) learn how to teach it. Among a complete basic and advanced ultrasound skill training, the tutor should complete a unique didactic training focusing on special needs for peer-to-peer-teaching in ultrasound. Subsequently one has to pass a clinical internship of at least 2–4 weeks, undertaken by an level II-III certified ultrasound trainer of the DEGUM. **Results:** To ensure high-quality education, a standardised training for student tutors is required. From the viewpoint of the working group, this catalogue of certification contains the minimum demand for establishing a quality standard in the field of ultrasound peer-to-peer teaching regarding on profound theoretical, practical and didactic knowledge. **Conclusion:** Taken this catalogue as a manual, it could be an important contribution to enhance the quality of peer-to-peer teaching. This causes in a unified and well-structured education in US, likewise as an element of quality assurance in general.

### PS3-06

#### Ultrasound in acute kidney injury – Showing them how it's done in 4 hours

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**Purpose:** Due to its worldwide increasing prevalence and mortality, acute kidney injury (AKI) has become an immensely important health care challenge. About 10% of AKI cases are caused by postrenal obstruction, with ultrasound (US) being the procedure of choice for diagnosis. Therefore we developed FARIUS (focused on acute renal injury with US), a 4 hours course to educate students and physicians in diagnosing postrenal obstruction via US aiming for an expertise similar to an experienced US examiner. **Material and methods:** FARIUS was developed as a 4hours programme for training in renal US. After positiv voting of the local ethic commission we compared US results of 33 FARIUS-participants (20 students, 13 physicians) with those of 10 experts (2 ICU physicians, 3 urologists, 1 nephrologist and 4 internal specialists). Following, we present the results of two quality parameters, (i) defining length (cm) of the right kidney of a female volunteer, (ii) diagnosing postrenal obstruction by evaluating images from real US examinations. Results and Answers were analyzed for comparability, correctness, specificity, sensitivity, positiv and negativ prediction. Statistical analysis (Wilcoxon, p>0.05) with SPSS™ and Excel 2013™. **Results:** (i) FARIUS: n=33; mean=10.25; SD=0.94; min=7.5; max=12.3; Expert: n=10; mean=10.15; SD=0.46; min=9.7; max=11.3. Statistical analysis did NOT reveal a significant difference between groups (p=0.908). (ii) Evaluation of US images reveal 86.3% (12.9 of 15) correct answers (min=8; max=15; SD=1.9), high sensitivity (98.8%), moderate specificity (80.0%), positive prediction 71.2%, negative prediction 99.2%. **Conclusion:** We could demonstrate that, after completing FARIUS, participants were able to provide renal US examination concerning postrenal obstruction at a similar quality level as experts. Identification of pathological results had a high sensitivity and excellent negative prediction. Thereby treatment of ICU patients with AKI can be more independent from external conditions while offering equal diagnostic quality.

## PS3-07

**A low cost training model for MRI-Ultrasound fusion guided biopsy**

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**Purpose:** Ultrasonography (US)-guided biopsy may be used for the diagnosis of a wide variety of other bladder and pelvic suspicious lesions, however magnetic resonance imaging (MRI)-US fusion combines the superior diagnostic accuracy of MRI for detecting suspicious lesions with the cost effectiveness and familiarity of US biopsy. To the best of our knowledge to date there is no model for training operators in MRI-US fusion guided biopsies. The aim of this study is to report on a model for fusion guided biopsies including an MRI visible phantom that is invisible on US. **Methods:** A regular matrix for image phantoms is made from agarose gel (3% to 5%). Three phantom mediums were created (with Copper sulphate, Ferric hydroxide and medical mineral mud). After cooling and consolidating, these phantom mediums were cut to 0.5 cm cubes. An agar gel of 2–5% gives US and MRI representations that are equally artifact-free. A house hold plastic container was filled with a 2–3 cm layer of agar gel. Some phantom particles were placed on the agar gel and then covered with an additional 2–3 cm layer of agar gel (figure).

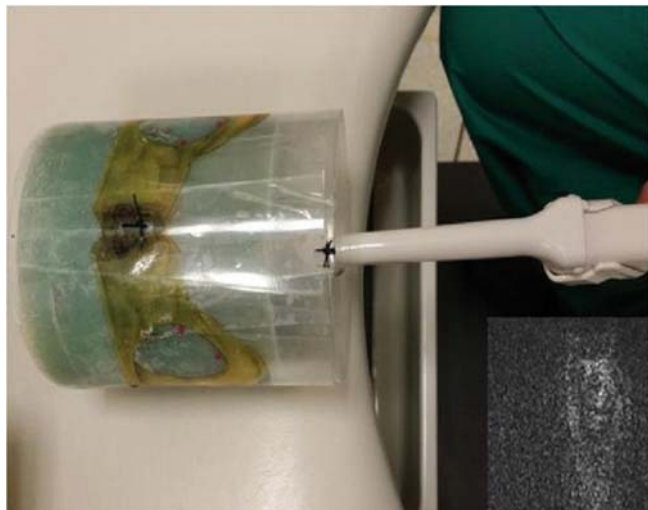


Fig. 1: Training model for MRI-US fusion guided biopsy

**Results:** The MRI-US fusion images were able to identify and localize the phantom particles. While the agar particles including Ferric hydroxide and medical mineral mud were visible by both MRI and US, the Copper sulphate agar particles were visible only by MRI. **Conclusions:** We were able to create a low cost, home-made training model for MRI-US fusion guided biopsy.

## PS3-08

**Ultrasound teaching application for mobile devices**

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**Purpose:** Sonography for medical examination is a widely used technology. However, the proper handling of the ultrasound transducer and the understanding of the resulting data is highly depended on the physician's skills and require a long training, which is not necessarily part of the academic medical career. Thus, students of the university Bonn successfully established an ultrasound academy, the Sono Education Academy (S.E.A), to practice an examination with ultrasound scanners. This program will be enhanced by introducing an application for mobile devices, which gives students the opportunity to learn about ultrasound and test their

theoretical knowledge. **Methods:** The application will be developed for the mobile operating system iOS. Xcode will be used as integrated development environment based on the programming language Swift. A newsfeed of the ongoing events and programs at S.E.A will keep students updated. An interactive multiple choice test will be provided so that a recapitulation of already learnt knowledge is possible at anytime. One further feature will be the import of ultrasound images and videos which were taken in the lesson. Retrospectively, the images and data can be analyzed by examining image parameters such as resolution and using simple statistical methods. The application provides a platform for self-studies and facilitates students to understand the ultrasound technology by interactive lessons. It extends S.E.A courses in terms of a blended learning approach. **Results:** The courses of S.E.A. has been successfully realized and surveys have given a very positive feedback. The resulting data of the courses are exported as video and image data files and can be easily uploaded on the smartphone. An application will simplify this procedure and give access to image processing. **Conclusion:** The future prospect of the S.E.A program and its application is broad and constantly growing. It will serve as an helpful exchange platform for students.

## PS3-09

**Quantitative and qualitative situation analysis of undergraduate ultrasound education in German-speaking-area medical schools**

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**Purpose:** Aim of this study was the evaluation of the current status in undergraduate ultrasound (US) education at medical faculties in the German-speaking area and of the extent to which medical students can acquire basic skills in US. The collected data will be utilized to establish a framework for a longitudinal US curriculum in the German-speaking area. **Material and methods:** A questionnaire was sent to all Skills Labs of the "DACH region" (Germany, Austria and Switzerland) via the Skills Lab Forum platform in December 2015. **Results:** 26 of 44 questionnaires have been returned until April 12, 2016. The final results will be presented at the 28<sup>th</sup> EUROSON Congress in Leipzig. Based on the "National Ultrasound Curriculum for Medical Students", possible integration of a longitudinal US education into pre-existing curricula will be presented using the example of the Leipzig medical faculty curriculum. **Conclusion:** So far there is consensus among respondents that undergraduate US education is important. At most faculties there is no longitudinal integration and students mostly rely on elective classes to get hands-on training time. Peer-teaching is valued to overcome thin resources as long as student qualification through supervision and clerkships is guaranteed.

## PS3-10

**Ultrasound of gout in routine rheumatologic practice**

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In gout ultrasound imaging has become a relevant part of rheumatology practice for precise evaluation intra-articular and periarticular structures. In routine rheumatology practice muscular-skeletal ultrasound is demanded tool to assess common features of gout: joint inflammation, enthesopathies and "double-contour". **Objectives:** To assess ultrasound imaging utility in gout patients in routine rheumatologic practice. **Methods:** Database of patients admitted to tertiary rheumatology department in 2015. **Results:** Inpatient database of rheumatology department include 1021 patients (2015). Diagnosis of gout was established in 18 patient. Ultrasound investigation was done in 9 patients out of them. Feet ultrasound was done in 4 patients, ankles – in 5, knees – in 2, elbows – in 2, shoulders – in 2, wrists – in 2, hands – in 1 patients. We observed synovitis in 11 (61.1%) joints, in 72.7% it was symmetrical, in 22.2% it was heterogeneous with hyperechogenic inclusions. The double-contour phenomena was observed in 16 (88.8%) joints. Periarticular tissue involvement was also assessed: enthesopathies were found in 16 joints, tenosynovitis – in 17 joints, tendinitis – in 9 joints. **Conclusion:** Ultrasound investigation is useful tool to assessment common features in gout: sy-

novitis, enthesopathies, “double-contour” phenomena. **References:** [1] E. Naredo. One year in review: ultrasound in arthritis/E. Naredo A. Iagnocco//Clinical Experimental Rheumatology.-2016.- №34/- P.1 – 10 [2] A. Delle Sedie. Ultrasound imaging for the rheumatologist X. Ultrasound imaging in crystal-related arthropathies//Clinical Experimental Rheumatology.-2007.- №25/- P.513 – 517.

## PS3-11

### Imaging remission by musculoskeletal ultrasound leads to a better functional outcome – results of the us 7-score implementation study in early rheumatoid arthritis

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**Background:** Novel treatment options together with a treat-to-target strategy present new challenges to imaging procedures in terms of therapy monitoring. **Objectives:** To evaluate the functional outcome measured by Health Assessment Questionnaire (HAQ) as the primary outcome in patients with early rheumatoid arthritis (RA) who were treated by standard clinical care (clinical cohort) in comparison to patients in whom treatment decisions were additionally based on musculoskeletal ultrasound (US) using the US7 score (US-cohort) in a nationwide investigator initiated study in Germany. **Methods:** Functional (HAQ), clinical (DAS28, patient's Visual Analogue Scale [VAS] for disease activity) and laboratory parameters (ESR, CRP) were analyzed at seven different time points for a total of 18 months and compared between the two study cohorts. Treatment decision was made according to local standard of care (SOC) with a treatment goal of DAS28 <3.2. In the US-cohort, imaging remission criteria were defined as Gray-scale US <2 and Power Doppler-US = 0 per joint level. In a subgroup analysis, US patients were analyzed separately regarding imaging remission status and the parameters outlined above. **Results:** Data of 313 patients (US-cohort [n = 166], clinical cohort [n = 147]) demonstrated a reduction of HAQ, DAS28, VAS and laboratory activity (ESR, CRP) to low disease activity status 18 months after the beginning/change of antirheumatic therapy according to SOC. The results of functional and clinical outcome in both cohorts did not show significant differences. However, subgroup analysis of the US-cohort with imaging remission resulted in a significantly lower HAQ, DAS28 and VAS compared to patients not fulfilling these US remission criteria. **Conclusions:** Treatment strategies by a treat to target approach in early RA patients reduced disease activity and improved functional outcome of HAQ irrespective of imaging guidance. However, patients with imaging remission by US exhibited a significantly better functional outcome and lower disease activity status.

## PS3-12

### The routine use of contrast enhanced ultrasound in the imaging work-up of focal liver lesions: A proposed algorithm

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**Background:** Grey scale ultrasound study of the liver is frequently performed for routine health screening or surveillance of high-risk patients. Our institution performs an average of 15000 ultrasound liver examinations a year. Focal liver lesions (FLL) are detected in about 10 – 15% of these patients, requiring further work up. Contrast enhanced ultrasound (CEUS) is now a widely accepted imaging technique for characterization of liver lesions. However, they are considered less established when compared to CT or MRI imaging. While various guidelines on its use in liver imaging have been published, some recommendations are not universally accepted or disputed by local and regional practices. We seek to establish a practical algorithm in which CEUS can be included as both a first line investigation or problem solving tool. **Methods:** We reviewed

major guidelines available for surveillance of liver lesions and use of contrast-enhanced ultrasound. Appropriateness and cost effectiveness are major considerations when designing the algorithm. The proposed algorithm was discussed and endorsed by the institution's hepatobiliary multi-disciplinary team. **Results:** The proposed algorithm is based on two major considerations, patient's risk factors and size of detected FLL. Lesions smaller than 10 mm are generally observed rather than characterized. For low risk patients in which a benign aetiology is strongly expected, CEUS may be used as a first line investigation as there are strong evidences to suggest that CEUS is sensitive and has high predictive value for malignant lesions. For high-risk patients, CEUS is more commonly deployed as a problem-solving tool, when CT/MR evaluation is indeterminate or contraindicated. **Conclusion:** CEUS has been successfully integrated into our practice. It is deemed a reliable tool, particularly in the hands of experience operators. We hope our experience will help others introduce CEUS into their routine practice.

## PS3-13

### Complete abdominal scans or goal-directed scans for abdominal emergencies?

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**Purpose:** To determine, whether in case of abdominal emergencies, goal-directed sonography is as effective as a complete abdominal scan or if important pathologies will be missed by a focused strategy. **Material and methods:** Retrospective analysis of consecutive emergency exams that were ordered by the medical ER in our medical sonography unit in the course of one year. All patients got an ultrasound of the complete abdomen. We compared the findings of the complete abdomen study with the findings of a hypothetical focused sonography. The scope of the focused sonography depended on the presenting problem. 17 groups of clinical problems were created, each with its own regions that a focused sonography would cover (e.g. right upper quadrant pain, acute kidney failure, jaundice). Ultrasound findings were classified as relevant or irrelevant. A finding was considered relevant, if it triggered diagnostic or therapeutic consequences. **Results:** 629 patients, 47% male and 53% female, average age 59 years (+/- 20, 18 – 97) had emergency sonographies. Focused sonography detected relevant pathologies in 63% (396/629) of patients. In 17% of patients (106/629) complete abdominal ultrasound led to additional clinically meaningful findings. This translates into a number needed to scan (NNS) for relevant pathologies of only 6. The issues relevant to the exam could be answered by 57% (361/629) of focused sonographies, whereas complete abdominal scans solved the problem in 63% (396/629) for a NNS of 17. The rate of problem-solving-scans depended on the indication (with jaundice having the highest (90%) and left-upper-quadrant pain having the lowest (45%) rate) and increased with age (37% for the second decade up to 85% for the 10th decade). **Conclusion:** Complete abdominal ultrasound scans are superior to focused sonography for (medical) abdominal emergencies. In one of 6 patients a relevant pathology will be missed, if a goal-directed strategy is followed.

### Elastography and Ultrasound I – Clinical Investigations and Case Reports

## PS4-01

### Intraoperative US of liver tumors using acoustic radiation force impulse (ARFI, shear wave) elastography and contrast enhanced ultrasound (io-CEUS) for optimization of surgical resection

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**Purpose:** Intraoperative US characterization of liver tumor morphology and surrounding tissue before surgical resection using ARFI and CEUS. **Material and methods:** Intraoperative US during elective liver tumor surgery performed by one experienced radiologist using multifrequency linear probes (6 – 9 MHz). Localisation and characterization by B-mode, ARFI and io-CEUS. ARFI values for characterization of tissue stiffness collected placing 5 ROIs in the tumor's center and 5 ROIs in the surrounding tissue. Tumor characterization by io-CEUS after bolus injections of



max. 5 ml sulphur hexafluorid microbubbles. Wash-in/-wash – out kinetics analyzed in arterial, portal venous and late venous phase (~5 min). Findings correlated to histopathology after tumor resection. **Results:** Retrospective analysis of DICOM-US data (08/2015 – 03/2016) of 24 patients w/30 liver lesions ranging from 0.5 – 5.25 cm in size. Histology showed 27 malignant and 3 benign lesions. Signs of malignancy were found in all 27 malignant tumors displaying late wash out up to 5 min in I<sub>o</sub>-CEUS. All 3 benign lesions displayed benign findings in I<sub>o</sub>-CEUS without late wash out. ARFI values ranged from 0.85 to 6.99 m/s (mean 3.3 m/s, SD ± 1.84) in tumors' center. ARFI values in surrounding liver tissue ranged from 1.02 to 3.58 m/s (mean 2.33 m/s, SD ± 0.56). According to histopathology after surgical resection ARFI could correctly detect fibrosis, cirrhosis (> 1.8 m/s) or steatosis in patients' liver in 22/30 cases. Assuming a cut off value of 2.5 m/s for malignancy ARFI could correctly characterize 17 of 27 malignant lesions. Sensitivity was 63%, specificity 100%. Findings of I<sub>o</sub>-CEUS and ARFI lead to immediate changes in surgical approach in 20/30 cases, including 3 cases w/non-resectability and 11 cases w/intraoperative ablation (RFA etc.) **Conclusion:** Intraoperative US diagnostics and consequently liver tumor surgery can definitely be optimized by modern US performed by an experienced examiner.

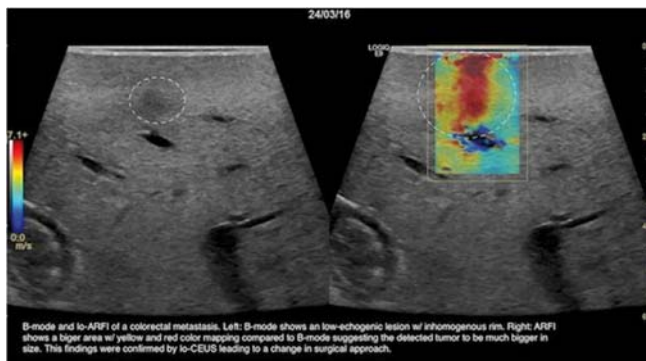


Fig. 1: ARFI of a metastasis

#### PS4-02

### Point shear wave elastography is comparable to transient elastography for the assessment of liver fibrosis in patients with chronic hepatitis B or C infection

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**Background:** Non-invasive evaluation of liver fibrosis is important in determining prognosis in patients with chronic hepatitis B (HBV) and C (HCV) virus infection. Transient elastography (TE) (FibroScan; Echosens, Paris, France) is a well-established method for assessment of liver stiffness (LS). Point shear wave elastography (pSWE) (ElastPQ, Philips) is a new technique that measures the speed of a shear wave to determine LS. This method could result in more accurate assessment of liver fibrosis due to real time imaging. Our aim was to determine if pSWE is comparable to TE in the assessment of LS. **Methods:** A retrospective international multicentre study was conducted. Patients with chronic HBV and HCV infection for whom a paired TE and pSWE LS measurement was available, were enrolled. Successful TE was defined as 10 successful measurements with an interquartile range (IQR) of ≤ 30% of the median. At least 10 successful ElastPQ measurements were needed. A Bland-Altman assessment for agreement was used. In addition we used linear correlation and regression analysis. **Results:** For 265 patients both a successful TE and pSWE were available. The majority was female (54%), mean age was 52.9 (19–79) and had chronic HCV infection (67%). The overall median LS with TE and pSWE was 10.7 kPa (range: 2.7–75) and 7.5 kPa (0.72–44.1). Mean difference between TE and pSWE was 1.28 kPa. TE failed in 17 patients (6.4%) and pSWE failed in 3 patients (1.1%). There was a strong linear correlation (spearman's rho: 0.85,  $p < 0.001$ ) between TE and pSWE. The Bland-Altman analysis (figure 1) showed a mean bias of 0.25 kPa with the limits of agreement -0.55 to 1.07. Regression analysis did not show a significant difference between the two methods

( $p = 0.191$ ). **Conclusions:** There is good agreement between TE and pSWE in the assessment of LS among patients with chronic HBV and HCV.

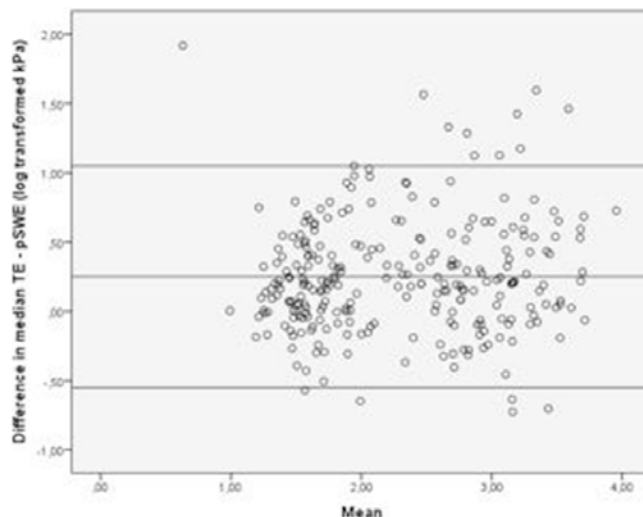


Fig. 1: Bland and Altman plot

#### PS4-03

### False negative results of real time strain elastography in thyroid nodular disease

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Strain elastography is a diagnostic method that adds quality in the evaluation of benign versus malignant thyroid nodules. Meta-analysis are suggesting overall sensitivity of 0.85 with a pooled specificity of 0.80. The present study is a retrospective analysis of the main causes of false positive and false negative results in thyroid nodular disease. **Material and method:** 433 thyroid nodules, that were operated, were evaluated by conventional ultrasound and real time elastography (RTE), with linear multifrequency probe, Hitachi Preirus Machine, Hitachi Inc., Japan: qualitative (Rago criteria) and semiquantitative evaluation (strain ration threshold of our center of 4.28) were performed. The pathologist was blinded to the ultrasound result. Retrospective analysis of the elastography evaluation was made. The mean nodule volume was 2.14 ml (range 0.78 ml to 10.45 ml). **Results:** 134/433 cases were malignant, 251/434 being benign. The sensitivity of RTE was 82.02%, specificity of 83.94%, accuracy of 83.37%. We observed 48 benign cases with false positive RTE results: 23/48 were Hurthle cell proliferations, without vascular involvement, 8/19 being classified as proliferating lesions with uncertain evolution potential, 5/48 follicular proliferation and 8/48 mixomatous thyrotoxicosis and 12/48 autoimmune thyroid disease with high fibrotic content. There were also 24 false negative results: 19/24 cases were papillary micro carcinoma and 5/24 were follicular carcinoma. There is to mention that 10/19 papillary micro carcinoma were observed in nodules with diameter larger than 3/5 cm. **Conclusion:** Potential evolutive Hurthle cell proliferation and papillary micro carcinoma are the most common cases of false results in RTE.

#### PS4-04

### Point shear wave elastography in congenital metabolic liver diseases

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**Purpose:** To evaluate hepatic and splenic shear wave velocity (SWV) values in patients with congenital metabolic liver diseases. **Materials & Methods:** Eighty-four patients with different types of congenital metabolic liver diseases (Group 1) and 29 age, gender, body mass index-

matched control patients with other metabolic disorders and normal liver functions (Group 2) were enrolled in this study. Hepatic and splenic SWV values were obtained by two sonologists with high interobserver agreement, using standard point shear wave elastography (pSWE) technique. The sonographic examinations were performed without being informed with clinical diagnoses. **Results:** Group 1 consisted of 21 patients with sphingolipidosis, 30 patients with mucopolysaccharidosis, 10 patients with glycogenosis and 23 patients suffering intoxication type in-born metabolic diseases. Hepatic and/or splenic enlargement was significantly more common among the patients of Group 1. The SWV values obtained in the livers of the patients in Group 1 had a significantly higher median value (1.36 m/s; IQR=1.23–1.56) than the ones obtained in Group 2 (1.26 m/s, IQR=1.16–1.37). Median splenic SWV values of Group 1 and Group 2 were 2.74 m/s (IQR=2.52–3.02) and 2.65 m/s (IQR=2.46–2.72), respectively. The difference among them was not significant. Similarly, the ratios of splenic/hepatic SWV values were 1.94 m/s (IQR=1.68–2.22) and 2.01 m/s (IQR=1.83–2.26), respectively, and did not differ significantly. Further analysis of pSWE parameters among the patient subgroups and control group did not yield any significant difference. **Conclusion:** We concluded that congenital metabolic liver diseases result in higher hepatic SWV values compared to other diseases of metabolism, suggesting increased liver stiffness due to disease processes.

## PS4-05

### The assessment of the kidney using a new elastographic method – 2D-shear wave elastography GE (2D-SWE.GE)

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**Purpose:** Different types of point shear wave elastography (Siemens-Virtual touch quantification, Phillips- Elastography point quantification) have been previously used to assess the kidneys. In the present study we aim to use for the first time a new method: 2D-SWE.GE (LogiqE9, GE Healthcare, Chalfont St Giles-UK), in order to analyze how many measurements are needed and what factors influence kidney shear wave speed (KSWs) in normal subjects. **Material and methods:** Our study included 49 subjects (mean age 45.3±16.6 years; 30 female, 19 male) without known kidney pathology or renal history, with normal renal ultrasonography. Using a Logiq E9- GE ultrasound system we aimed for ten valid KSWs measurements, which were performed in the mid-portion of the parenchyma in each kidney with the subjects in left or right lateral decubitus; median values were calculated and expressed in meters/second (m/s). **Results:** We obtained 5 valid results in all studied subjects, but 10 valid results in just 32 subjects for the right kidney (RK) and 29 subjects for the left kidney (LK). In the cases were 10 measurements were performed, the median value of 10 measurements or of the first 5 KSWs measurements was similar (RK: p=0.39; LK: p=0.62). Further on we used the median value of 5 measurements and we obtained no statistically significant difference between KSWs for the two kidneys (RK 1.78 ±0.38 m/s, LK 1.72±0.36 m/s, p=0.33). We found an indirect correlation with age (RK: r=-0.42, p=0.002; LK: r=-0.21, p=0.15) and with body mass index (BMI) (RK: r=-0.56, p=0.0001; LK: r=-0.34, p=0.01), but no correlation with gender. **Conclusion:** In order to measure KSWs, using this new method (2D-SWE.GE), it is enough to perform 5 valid measurements. KSWs value is decreasing with the increase in BMI and in age (consistent with published results using other types of elastography).

## PS4-06

### Acoustic Radiation Force Impulse imaging of the kidney – a pilot study

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**Purpose:** To establish Acoustic Radiation Force Impulse (ARFI) imaging on the human kidneys using the Philips ultrasound system iU 22. The first goal of this study was to define the measuring location with the least variation of ARFI results. The further aim is to establish ARFI Imaging as a non-invasive surrogate marker to evaluate kidney parenchymal stiffness and kidney function. **Material and methods:** 20 healthy volunteers (age

range 21–32 years) underwent ultrasound elastography on their kidneys with ARFI. We used the Philips iU 22 ultrasound system with a C5–1 MHz curved array probe. On both the right and left kidney the upper pole, the lower pole, and the parenchyma around the hilus were examined in two sections – longitudinal and axial. 10 measurements were performed in each region and their median was built. **Results:** Intraclass-correlation is a statistical method to show the most agreement between the ten measurement in one region also the measurements of all 20 volunteers in this region. For this study, the best agreement was observed performing the ARFI Imaging in the parenchyma around the hilus of the kidney in a longitudinal section. The mean ARFI values in this Position were 1.61 m/s (±0.40 m/s) for the right, and 1.61 MS (±0.44 m/s) for the left kidney. **Conclusion:** Kidney parenchyma of the hilus region showed the least variation in ARFI values. So, this position will be used for sampling elastography data in the next step of our study. Healthy adults have values around 1.61 m/s. We expect to have a change in ARFI values in children with solitary kidneys compared to healthy children.

## PS4-07

### Two-Dimensional Us Elastography for focal lesions in liver phantoms: influencing factors for stiffness measurement of small lesions

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**Purpose:** To determine accuracy and influencing factors of stiffness value of focal lesions in the phantoms using 2-D USE. **Materials and methods:** Using two customized phantoms with different elasticity (4 ± 1 kilopascal [kPa], mimicking normal liver; 15 ± 2 kPa, mimicking liver cirrhosis [LC]) which have 9 spherical hypoechoic inclusions with same elasticity (23 ± 3 kPa), different size (20 mm, 15 mm and 10 mm in a row) and different depth (3 cm, 5 cm and 7 cm). Mean stiffness and standard deviation (SD) in ROI were acquired, and the shape of inclusion was also assessed with a qualitative 5-graded scoring system about target visualization on color map. As possible influencing factors, the type of background phantom, depth of inclusions, size of inclusions, and observers were considered. We compared by Kruskal-Wallis test, and performed multiple regression tests to detect significant influencing factors about 2-D USE. **Results:** Measured mean stiffness value was significantly higher in LC phantom (10.50 kPa in normal, 13.81 kPa in LC; p=0.013), inclusions in 7 cm of depth (10.94 kPa in 3 cm, 11.20 kPa in 5 cm and 15.59 kPa in 7 cm; p=0.001). In multiple regression analysis in mean stiffness, there was significant difference of mean stiffness in type of phantom, depth and size of inclusions. Mean SD in ROI was also significantly larger in 7 cm of depth (0.86 kPa in 3 cm, 1.23 kPa in 5 cm and 3.94 kPa in 7 cm; p=0.001). In multiple regression analysis for SD in ROI, there were significant differences in type of phantom and depth of inclusions. Morphologic score was significantly different only in aspect of the size of inclusion bodies (p<0.001). Background stiffness was not different according to depth or observers (p=0.491 and 0.522, respectively). **Conclusion:** 2-D USE for focal lesion evaluation could be influenced by different background stiffness, deep position of the lesion, and small size of lesion.

## PS4-08

### Point Shear Wave Ultrasound Elastography to quantify liver stiffness with Esaote MyLab Twice compared to 2D-Shear Wave Elastography with Supersonic Imaging

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**Purpose:** Several manufacturers have implemented their ultrasound (US) equipments with shear wave elastography (SWE) very recently, so that there is still a lack of data about clinical performances of many of them in evaluating liver stiffness (LS). Since the introduction of first SWE device, the number of biopsies has dramatically dropped, hence new techniques can be hardly validated versus histology. Possibly already validated systems should be considered as reference standards. The aim of this study is to investigate the correlation between point SWE (pSWE) on MyLab Twice (Esaote, Genova, Italy) and two-dimensional SWE (2DSWE) on Aixplorer (SuperSonic Imagine, Aix-en-Provence, France) as reference. **Materials and methods:** Consecutive healthy and liver disease patients (regardless of etiology) accessing the US lab were considered.

Exclusion criteria were focal liver lesions, age < 18, BMI > 35, severe extra-hepatic comorbidities. LS was sampled intercostally from at least one intercostal space with both equipments. 110 LS measurements were obtained with both techniques from the same intercostal space and tested with Pearson correlation, Lin's correlation concordance coefficient (CCC) and Bland-Altman analysis (B&A) which investigates systematic deviation of the study test versus the reference at different thresholds. **Results:** Pearson coefficient resulted 0.77 (95% CI 0.68 – 0.84;  $p < 0.0001$ ). CCC similarly was 0.75 (CI 0.66 – 0.82), with precision of 0.77 and accuracy of 0.97. B&A plot shows a mean of only -0.7 (CI -2.0 – 0.6) KPa with limits of agreement at -14.0 and 12.7 KPa, confirming absence of statistical difference ( $p = 0.3016$ ). **Conclusion:** pSWE shows results well correlating with the reference. Overall degree of concordance resulted remarkable, with good accuracy and precision in assessing LS, even though B&A plot and LOESS line (66% smoothing span) enlight the incostancy of the relationship in the higher range of LS (> 20 KPa) which does not affect staging of disease as such patients are anyhow classified as in cirrhotic stage.

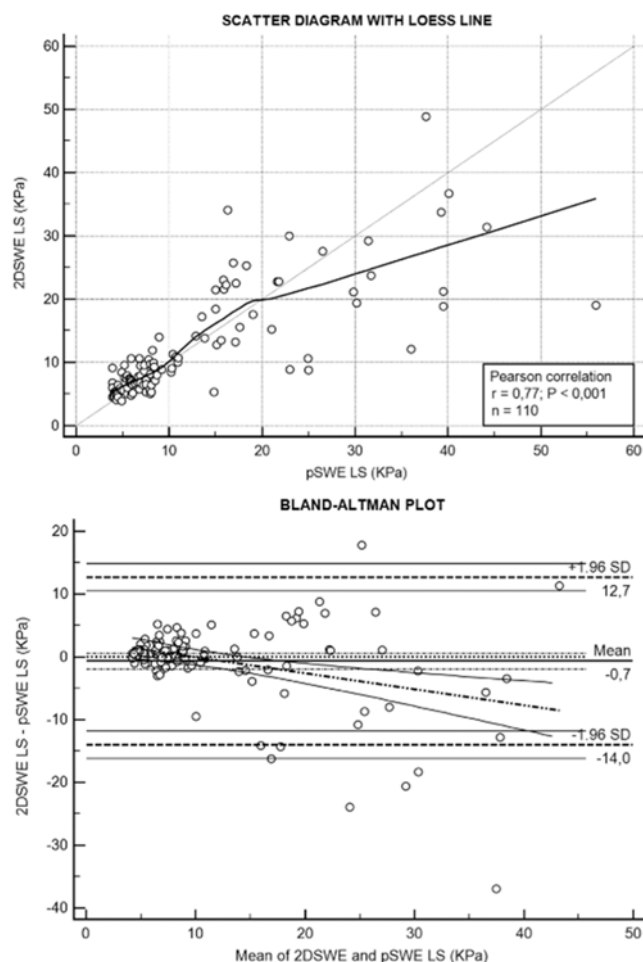


Fig. 1: Results of the study

#### PS4-09

##### Liver stiffness measured with the new technique of Shear Wave Elastography in patients with primary sclerosing cholangitis – A prospective comparison with transient elastography

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**Purpose:** Elastography is a well-established non-invasive method to evaluate fibrosis and cirrhosis in chronic liver disease. The aim of this study was to evaluate the new technique of Shear Wave Elastography (SWE) in a homogenous cohort of patients with primary sclerosing cholangitis (PSC). **Methods:** In total 49 patients with PSC were included in this study. Clinical characteristics, B-mode ultrasound, Transient Elastography (TE – Echosens, FibroScan) and Shear Wave Elastography (GE, Logiq E9) of the right and left liver lobe and spleen were obtained in patients with primary sclerosing cholangitis (PSC). Patients were previously diagnosed with PSC mainly by magnetic resonance cholangiopancreatography (MRCP), laboratory findings and/or liver biopsy. **Results:** The relationship between both liver stiffness techniques SWE and TE was well described using an exponential correlation ( $R^2 = 0.65$ ) (Picture). The values of liver stiffness measured by SWE did not increase exponentially as the values measured with TE did (Maximum TE 70 kPa vs. SWE 22 kPa). The stiffness of the right and left liver lobe measured by SWE were moderately correlated ( $R^2 = 0.50$ ). This could be explained either by unclear regions at interest resulting in difficult measurements or by differing stiffness of both sites. The stiffness of the right liver lobe measured by SWE did not correlate with the stiffness of the spleen. **Conclusion:** In a homogenous cohort of patients with primary sclerosing cholangitis stiffness of the right liver lobe measured by Shear Wave Elastography correlated well with the technique of transient elastography. The reasons for moderate correlation of liver stiffness in the right and left liver lobe need to be further studied including histological fibrosis staging. Further studies with greater numbers of patients are required.

graphy (TE – Echosens, FibroScan) and Shear Wave Elastography (GE, Logiq E9) of the right and left liver lobe and spleen were obtained in patients with primary sclerosing cholangitis (PSC). Patients were previously diagnosed with PSC mainly by magnetic resonance cholangiopancreatography (MRCP), laboratory findings and/or liver biopsy. **Results:** The relationship between both liver stiffness techniques SWE and TE was well described using an exponential correlation ( $R^2 = 0.65$ ) (Picture). The values of liver stiffness measured by SWE did not increase exponentially as the values measured with TE did (Maximum TE 70 kPa vs. SWE 22 kPa). The stiffness of the right and left liver lobe measured by SWE were moderately correlated ( $R^2 = 0.50$ ). This could be explained either by unclear regions at interest resulting in difficult measurements or by differing stiffness of both sites. The stiffness of the right liver lobe measured by SWE did not correlate with the stiffness of the spleen. **Conclusion:** In a homogenous cohort of patients with primary sclerosing cholangitis stiffness of the right liver lobe measured by Shear Wave Elastography correlated well with the technique of transient elastography. The reasons for moderate correlation of liver stiffness in the right and left liver lobe need to be further studied including histological fibrosis staging. Further studies with greater numbers of patients are required.

#### PS4-10

##### ElastP a novel elastographic method for the evaluation of liver fibrosis in patients with B and C chronic hepatopathies

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**Purpose:** The purpose of this study was to evaluate the diagnostic performance of a point shear wave elastography using ARFI technique – ElastPQ, in patients with B and C chronic hepatopathies, using Transient Elastography (TE) as the reference method, since it is a validated method for liver fibrosis assessment (EASL Guidelines). **Materials and methods:** The study included 228 consecutive subjects with chronic hepatopathies (26% HBV, 74% HCV) from whom 51% had liver cirrhosis. Liver stiffness (LS) was evaluated in the same session by means of 2 elastographic methods: TE (Fibroscan, Echosens) and ElastPQ (Philips, Affinity) techniques. Reliable LS measurements (LSM) were defined as follows: for TE – the median value of 10 LSM with a success rate  $\geq 60\%$  and an interquartile range < 30%. For ElastPQ – the median value of 10 LSM in the liver parenchyma, at least 1 cm below the capsule, avoiding large vessels. For TE M and XL probes were used. For differentiating between stages of liver fibrosis we used the following cut-off values for TE – mild fibrosis (F1) – 6.1 kPa, moderate fibrosis (F2) – 7.2 kPa, severe fibrosis (F3) – 9.6 kPa and for liver cirrhosis (F4) – 14.5 kPa (1). **Results:** Reliable LSM were obtained in 90.7% (207/228) by means of TE and in 98.7% (225/228) with ElastPQ. In the final analysis 206 patients were included. The areas under the receiver operating characteristic curve for ElastPQ were: 0.90 for patients with mild fibrosis (F1), 0.95 for moderate fibrosis (F2), 0.96 for severe fibrosis (F3) and 0.94 for cirrhosis. The best cut-off values for discriminating mild, moderate, severe fibrosis and cirrhosis were 6.4, 7.2, 8.5 and 9.9 kPa. **Conclusions:** ElastPQ is a feasible method for the evaluation of LS with good diagnostic accuracy for all stages of fibrosis. **References:** [1] Tsochatzis et al. Elastography for the diagnosis of severity of fibrosis in chronic liver disease: a meta-analysis of diagnostic accuracy. J Hepatol. 2011 Apr; 54 (4): 650 – 9.

#### PS4-11

##### Comparative study between two 2D-Shear Waves Elastography techniques for the assessment of liver stiffness: 2D-SWE.SSI vs. 2D-SWE.GE

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**Aim:** The aim of this study was to compare the feasibility of two 2D-Shear Waves Elastography (2D-SWE) methods for the assessment of Liver Stiffness (LS) and also to compare the methods with a validated one – Transient Elastography (TE). **Material and method:** Our study included 130 consecutive patients with chronic hepatopathies (HCV-90%, HBV-6%, other-4%), in which LS was evaluated in the same session by means of two 2D-SWE techniques: 2D-SWE.GE (LOGIQ E9, GE Healthcare) and 2D-SWE.SSI (Aixplorer® ultrasound system, SuperSonic Imagine) and also by



an elastographic reference method: Transient Elastography (TE) – FibroScan, EchoSens (M and XL probes). Reliable LS measurements were defined as follows: for 2D-SWE.GE: the median value of 10 measurements acquired in a homogenous area and an interquartile range (IQR) < 30%, for 2D-SWE.SSI: the median value of 3 measurements acquired in a homogenous area and for TE: the median value of 10 measurements with a success rate of  $\geq 60\%$  and an interquartile range < 30%. Spearman's rank correlation coefficient ( $r$ ) was used to assess the correlation of LS measurements by means of 2D-SWE.GE, 2D-SWE.SSI and TE. **Results:** Valid measurements were obtained in 94.6% (123/130) for 2D-SWE.GE, 90.7% (118/130) for 2D-SWE.SSI and 89.2% (116/130) for TE ( $p > 0.05$ ). The values ranged from 4.17 to 20.48 kPa for 2D-SWE.GE and from 3.4 to 82.4 kPa for 2D-SWE.SSI. The mean LS values by 2D-SWE.SSI were significantly higher than for 2D-SWE.GE:  $19 \pm 12.3$  kPa vs.  $12.1 \pm 3.7$  kPa ( $p < 0.0001$ ). There was a significant correlation between 2D-SWE.GE and 2D-SWE.SSI LS values ( $r = 0.712$ ,  $p < 0.0001$ ). The correlation between 2D-SWE.GE and TE was  $r = 0.746$ ,  $p < 0.0001$ , and between 2D-SWE.SSI and TE was  $r = 0.604$ ,  $p < 0.0001$ , with no significant differences between them ( $p = 0.0565$ ). **Conclusion:** Both 2D-SWE techniques have a good feasibility for the noninvasive liver fibrosis assessment and both have a strong correlation with TE. LS values obtained by 2D-SWE.GE are significantly lower than those obtained by 2D-SWE.SSI.

## PS4-12

### Prospective comparison of noninvasive techniques for the assessment of liver stiffness in a cohort of compensated HCV liver cirrhosis

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**Background:** Liver biopsy is the "gold standard" for diagnosing liver fibrosis, but it also can be diagnosed by means of noninvasive techniques, either biological tests or elastographic techniques. **Aim:** The aim of this study was to compare the performance of five ultrasound elastographic techniques and FibroTest in diagnosing compensated HCV liver cirrhosis. **Material and Method:** We performed a prospective study, including 54 consecutive patients diagnosed with HCV liver cirrhosis. All patients were evaluated by five elastographic techniques-Transient Elastography [(TE)-FibroScan, EchoSens], Virtual Touch Quantification[(VTQ)-Acuson S2000, Siemens] and ElastPQ-Affinity, Philips), 2D Shear Waves Elastography[Aixplorer, Supersonic Imagine (SSI)] and the LOGIC E9[GE Healthcare, Chalfont St. Giles-UK (2D-SWE GE)]-in the same session, while FibroTest was performed within a month. **Results:** Our cohort included 54 subjects (34 women and 20 men), mean age of  $59.9 \pm 7.9$ . Reliable LSM by means of VTQ, ElastPQ, 2D-SWE.GE were obtained in 54/54 subjects, by means of TE in 51/54 subjects (94.4%) and by means of SSI in 49/54 subjects (90.7%), so the final analysis included 46/54 subjects (85.2%). TE elastography had 95.6% accuracy, VTQ – 89.1%, ElastPQ – 82.6%, 2D-SWE.GE – 78.2%, SSI – 86.9%, and FibroTest – 82.6% for the diagnosis of liver cirrhosis. There were no significant statistical differences between FibroTest vs. TE ( $p = 0.25$ ), FibroTest vs. VTQ ( $p = 0.55$ ), FibroTest vs. ElastPQ ( $p = 0.95$ ), FibroTest vs. SSI ( $p = 0.77$ ), FibroTest vs. 2D-SWE.GE ( $p = 0.78$ ) respectively. Neither between TE vs. VTQ, ElastPQ, SSI; VTQ vs. ElastPQ, VTQ, SSI, 2D-SWE.GE; ElastPQ vs. SSI, 2D-SWE.GE; SSI vs. 2D-SWE.GE, all  $p$ -values were  $> 0.05$ . Significant statistical differences were found only between TE and 2D-SWE.GE (95.6% vs. 78.2%,  $p = 0.03$ ). **Conclusion:** In this preliminary study, all ultrasound based elastographic methods had good performance for the diagnosis of compensated liver cirrhosis and this seem to be similar with FibroTest.

## PS4-13

### Optimal number of valid measurements for the assessment of liver stiffness using 2D-SWE.GE

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**Background and aim:** According to the manufacturer's recommendations, in order to obtain reliable liver stiffness values, 10 valid measurements need to be performed. The aim of this study was to evaluate whether 5 liver stiffness measurements are as useful as 10. **Material and method:** 109 consecutive subjects with or without chronic hepatopathies were included in the study, in whom liver stiffness (LS) was

evaluated by 2D- Shear Waves Elastography implemented on the LOGIQ E9 system (GE Healthcare, Chalfont St Giles – UK). 10 valid measurements were performed in each case, and the mean, median, standard deviation (SD), and interquartile range (IQR) were calculated. We compared the first 5 measurement group with the 10 measurement group. We used the following 2D-SWE.GE cut-off values:  $F < 2$ : 8.3 KPa;  $F = 4$ : 12 KPa. **Results:** The structure of the cohort study was the following: Group I ( $F < 2$ : 43/109 (39.5%), Group II ( $F2-F3$ : 27/109 (25%); Group III ( $F = 4$ : 39/109 (35.5%). We found no significant statistical differences between the LS measurements in the three groups, neither for median ( $p = 0.86$ ), mean ( $p = 0.72$ ), IQR ( $p = 0.59$ ) or SD ( $p = 0.41$ ). There was also no significant differences between the LS measurements in the 3 groups of fibrosis  $F < 2$ – $F2F3$ – $F = 4$  (all  $p > 0.05$ ). **Conclusion:** 5 valid measurements may be enough to quantify the liver stiffness by 2D-SWE.GE without significant loss of accuracy even in patients with advanced liver disease.

## PS4-14

### Which elastographic method is more feasible in assessing spleen stiffness in patients with HCV compensated liver cirrhosis?

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The **aim** of this study was to compare the feasibility of four ultrasound based elastographic methods used for assessing spleen stiffness. **Material and methods:** The study included 42 subjects diagnosed with HCV compensated liver cirrhosis in whom spleen stiffness (SS) was evaluated in the same session by means of 4 elastographic methods: Point shear wave elastography techniques: Virtual Touch Tissue Quantification (VTQ)-Acuson S2000, Siemens and ElastPQ technique-Affinity, Philips; 2D Shear Waves Elastography-Aixplorer, Supersonic Imagine (2D SWE) and the LogiqE9, General Electric (2D-SWE GE). Reliable SS measurements were defined as follows: for ElastPQ, VTQ and 2D-SWE.GE- the median value of 10 SS measurements with a success rate  $\geq 60\%$  and an interquartile range < 30% and for 2D-SWE the mean value of 3 measurements acquired in a homogenous area. SS was expressed in kPa for 2D-SWE, ElastPQ and m/s for VTQ and 2D-SWE GE. **Results:** Reliable SS measurements were obtained in: 85.7% with 2D-SWE GE, 85.7% with VTQ, 47.61% with 2D-SWE and 30.95% with ElastPQ. 2D-SWE GE and VTQ had similar rates of reliable SS measurements. The mean value for 2D-SWE GE was  $2.46 \pm 0.74$  m/s and for VTQ was  $3.14 \pm 0.58$  m/s. **Conclusions:** 2D-SWE GE and VTQ were the most feasible shear-waves elastographic methods in assessing spleen stiffness in patients with HCV compensated liver cirrhosis.

## PS4-15

### Assessment by real-time shear wave elastography (SWE) in diffuse thyroid pathology: utility of this new technique

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Real-time shear wave ultrasound elastography (SWE) is a new technique, recently introduced in the evaluation of thyroid pathology. **Purpose:** To evaluate and compare the values of the elasticity index (EI) measured by SWE in healthy subjects and in cases with diffuse thyroid pathology, in order to establish if this investigation could be useful, as a diagnostic tool, in these thyroid diseases. **Patients and methods:** We studied 136 subjects ( $F/M = 113/23$ ), 49 with chronic autoimmune thyroiditis (CAT), 35 with Graves' disease (GD) diagnosed by specific tests and 52 healthy volunteers. For all subjects, 3 elastography determinations were performed for each thyroid lobe and a mean value was calculated and expressed in kilopascals (kPa). The measurements were performed with an Aixplorer system (Supersonic Image Inc. France), using a linear high-resolution transducer 15 – 4 MHz. **Results:** Three valid SWE measurements were obtained in both thyroid lobes in all the subjects. The mean EI (kPa) was similar in the right and left thyroid lobe in patients with CAT, GD and in normal subjects:  $27.06 \pm 11.31$  vs.  $25.05 \pm 10.82$ ,  $p = 0.37$ ,

23.55 ± 10.3 vs. 22.84 ± 11.34,  $p=0.78$  and 19.6 ± 6.55 vs. 19.48 ± 6.84,  $p=0.93$ , respectively. Because the mean SWE values obtained in the right and in the left lobe were similar in subjects from both groups we decided to use the EI from the right lobe for comparison. The mean EI assessed by SWE in patients with CAT and GD was significantly higher than in normal subjects: 27.06 ± 11.31 kPa vs 19.6 ± 6.55 kPa,  $p<0.0001$  and 23.55 ± 10.3 vs 19.6 ± 6.55 kPa,  $p=0.03$ , respectively. The mean EI in patients with CAT and GD did not differ significantly ( $p=0.15$ ). **Conclusion:** SWE seems to be an useful method to differentiate between subjects with normal thyroid and those with autoimmune thyroid diseases, but cannot help in distinguishing between CAT and GD.

## PS4-16

### The influence of food intake on liver stiffness measurements obtained by two 2D-SWE methods

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**Purpose:** The aim of the study was to assess the influence of food intake on liver stiffness values obtained by two 2D-SWE techniques 2D-SWE and 2D-SWE.GE. **Material and methods:** 2 groups of healthy volunteers in whom liver stiffness measurements were performed first in fasting condition, followed by measurements made at 30 minutes, 1 h, 2 h after food intake, were included in this study. All subjects received the same standard solid meal. **Group 1** included 50 subjects (39 female, 11 male) in whom the liver stiffness was assessed by 2D Shear Waves Elastography-[Aixplorer, Supersonic Imaging (SSI)], valid measurements being defined as the median value of 3 measurements acquired in a homogenous area. **Group 2** included 33 subjects (20 female, 13 male) in whom the liver stiffness was assessed by 2D-SWE.GE-(LOGIC E9, General Electric), valid measurements being defined as the median value of 10 measurements. For both groups the mean values of liver stiffness on fasting, at 30 minutes, 1 h, 2 h after food intake were calculated and compared. **Results:** The liver stiffness values did not increase after food intake neither for 2D-SWE, nor for 2D-SWE.GE: 2D-SWE – fasting vs. 30 minutes (5.73 ± 1.18, 5.64 ± 1.07,  $p=0.69$ ), fasting vs. 1 h (5.73 ± 1.18, 5.56 ± 0.96,  $p=0.43$ ), fasting vs. 2 h (5.73 ± 1.18, 5.61 ± 0.95,  $p=0.57$ ); 2D-SWE.GE – fasting vs. 30 minutes (5.24 ± 0.23, 5.47 ± 0.16,  $p=0.42$ ), fasting vs. 1 h (5.24 ± 0.23, 5.2 ± 0.23,  $p=0.90$ ), fasting vs. 2 h (5.24 ± 0.23, 5.20 ± 0.24,  $p=0.91$ ). **Conclusion:** Our preliminary results show the food intake did not significantly increased the LS values obtained by 2D share wave elastography techniques.

## PS4-17

### Comparison of four elastographic methods for the assessment of liver stiffness in compensated HCV liver cirrhosis

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**Aim:** To compare the performance of four ultrasound elastographic techniques and FibroMax in diagnosing compensated HCV liver cirrhosis. **Material and method:** The study included 81 consecutive patients previously diagnosed with HCV liver cirrhosis by means of clinical, biological, ultrasound findings, liver biopsy or laparoscopy. All patients were evaluated by four elastographic techniques in the same session: Transient Elastography (TE), Virtual touch Quantification (VTQ), 2D Shear Waves Elastography from Supersonic Imagine (2D-SWE.SSI) and from General Electrics (2D-SWE.GE), while FibroMAX was performed within a month. Reliable LS measurements were defined as follows: For TE, VTQ, 2D-SWE.GE – the median value of 10 LS and for 2D-SWE.SSI the median value of 3 LS measurements acquired in an homogenous area. The following published cut-offs were used to diagnose liver cirrhosis: TE-12 kPa; VTQ-1.81 m/s; 2D-SWE.SSI-13.5 kPa; 2D-SWE.GE-11.9 kPa. **Results:** Reliable LS measurements were obtained in 76/81 (93.8%) for TE, 81/81 (100%) for VTQ, 71/81 (87.6%) for 2D-SWE.SSI and 79/81 (97.5%) for 2D-SWE.GE. The accuracy of the methods for diagnosing liver cirrhosis were the following: TE- 94.7%, VTQ- 85.1%, 2D-SWE.SSI- 80.2%, 2D-SWE.GE- 71.6%. No statistical differences were found between FibroTest and VTQ ( $p=0.51$ ), FibroTest and 2D-SWE.SSI ( $p=0.86$ ), FibroTest and 2D-SWE.GE ( $p=0.29$ ), VTQ and

2D-SWE.SSI ( $p=0.55$ ), VTQ and 2D-SWE.GE ( $p=0.059$ ), 2D-SWE.SSI and 2D-SWE.GE ( $p=0.3$ ). Statistical differences were found between TE and 2D-SWE.SSI ( $p=0.01$ ), TE and 2D-SWE.GE ( $p=0.003$ ), TE and FibroTest ( $p=0.01$ ). **Conclusion:** All ultrasound based elastographic methods had good performance for the diagnosis of compensated liver cirrhosis.

## PS4-18

### Elast PQ a novel elastographic method for the evaluation of liver stiffness in patients with B and C chronic hepatopathies

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**The purpose** of this study was to evaluate the diagnostic performance of a point shear wave elastography using ARFI technique- ElastPQ, in patients with B and C chronic hepatopathies, using Transient Elastography (TE) as the reference method, since it is a validated method for liver fibrosis assessment. **Materials and methods:** The study included 228 consecutive subjects with chronic hepatopathies (26% HBV, 74% HCV) from whom 51% had liver cirrhosis. Liver stiffness (LS) was evaluated in the same session by means of 2 elastographic methods: TE (Fibroscan, Echosens) and ElastPQ (Philips, Affinity). Reliable LS measurements (LSM) were defined as follows: for TE – the median value of 10 LSM with a success rate ≥ 60% and an interquartile range < 30%. For ElastPQ- the median value of 10 LSM in the liver parenchyma, at least 1 cm below the capsule, avoiding large vessels. For differentiating between stages of liver fibrosis we used the following cut-off values for TE – mild fibrosis (F1)-6.1 kPa, moderate fibrosis (F2)- 7.2 kPa, severe fibrosis (F3)-9.6 kPa and for liver cirrhosis (F4) -14.5kPa (1). **Results:** Reliable LSM were obtained in 90.7% (207/228) by means of TE and in 98.7% (225/228) with ElastPQ. In the final analysis 205 patients were included. The areas under the receiver operating characteristic curve for ElastPQ were: 0.90 for patients with mild fibrosis (F1), 0.95 for moderate fibrosis (F2), 0.96 for severe fibrosis (F3) and 0.94 for cirrhosis. The best cut-off values for discriminating mild, moderate, severe fibrosis and cirrhosis were 6.4, 7.2, 8.5 and 9.9 kPa. **Conclusions:** ElastPQ is a method that seems to be good for the diagnosis of all stages of liver fibrosis with good diagnostic accuracy. **Reference:** [1] Tsochatzis et al. Elastography for the diagnosis of severity of fibrosis in chronic liver disease: a meta-analysis of diagnostic accuracy. J Hepatol. 2011 Apr; 54 (4): 650 – 9.

## Gynaecological Ultrasound I – Clinical Investigations and Case Reports

## PS5-01

### Ultrasound imaging of breast implants: A pictorial essay demonstrating normal morphology and implant related complications

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 DOI: 10.1055/s-0036-1587864

**Objective:** Ultrasound imaging is widely used for screening of breast implants. It is an inexpensive and reasonably reliable tool in the hands of good ultrasound operators. As breast implants are not infrequently encountered in clinical practice, the sonographers and radiologists should be familiar with and competent in recognizing normal morphology and implant related complications. We aim to demonstrate these features in our educational poster. **Materials and methods:** A selection of breast implant ultrasound images seen in our institution are organized and curated for this purpose. The common types of implants, site of implantation, normal morphological features and variances are discussed. Important and common types of implant related complications as well as pitfalls are also reviewed. When available, counterpart mammograms or MRI images will be shown for correlation and comparison. **Results:** Commonly encountered complications in our practice include capsular retraction, intra-capsular rupture and extra-capsular rupture. Conversely, normal morphological appearances are also commonly observed and should not be mistaken for pathological changes. These appearances include radial folds, reverberation artifacts, peri-implant seroma, implant valve capsular calcifications and other appearances. **Conclusion:** Ultrasound can reliably identify the appearances of normal and abnormal breast implants. Knowledge and recognition of these features

will enable the accurate assessment of implant integrity and consequential delivery of appropriate patient care.

## PS5-02

### Maternal serum copeptin, MR-proANP and procalcitonin levels at 11–13 weeks gestation in the prediction of preeclampsia

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**Purpose:** We investigated the potential value of maternal serum copeptin, midregional proatrial natriuretic peptide (MR-proANP) and Procalcitonin (PCT) levels at 11–13 weeks' gestation in the prediction of preeclampsia (PE) in a case-control study. **Materials and methods:** Maternal serum concentration of copeptin, MR-proANP and PCT were measured at 11–13 weeks' gestation in cases of PE (n=35) and controls (n=100). The PE group was divided into early-onset PE (EO-PE) and late-onset PE (LO-PE). From the regression model, the value in each case and control was expressed as a multiple of the expected median (MoM). The Mann-Whitney test was used to determine the significance of differences in the median MoM in each outcome group from that in the controls. **Results:** In the PE group, compared to controls, maternal serum concentrations of copeptin, MR-proANP and PCT were not significantly different. **Conclusion:** The maternal serum copeptin, MR-proANP and PCT levels are higher in EO-PE and LO-PE patients, but the difference is not significant. Thus, their levels in first trimester are not proven to be effective markers to screen for PE.

## PS5-03

### Impact of maternal serum levels of Visfatin, AFP, PAPP-A, sFlt-1 and PlGF at 11–13 weeks gestation on small for gestational age births

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**Purpose:** Investigating potential value of maternal serum Visfatin, sFlt-1, PlGF, AFP, PAPP-A levels at first trimester for prediction of small for gestational age (SGA) at birth. **Materials and methods:** Measurements were performed in 20 SGA and 65 control cases. Logistic regression analysis adjusted for age and weeks of pregnancy at data collection was performed to estimate odds ratios (OR), 95% confidence intervals (95% CI) and p-values separately for each potential predictor. A multiple regression model was used to assess the impact of all promising predictors adjusted for each other. Receiver operating characteristic (ROC) analysis was used to indicate the ability to discriminate between SGA cases and controls. **Results:** There was an association of serum PlGF levels (OR 0.53 per interquartile range [IQR] increase in PlGF; 95% CI 0.24–1.16), sFlt-1/PlGF ratio (OR 1.42 per IQR increase in sFlt-1/PlGF; 95% CI 1.03–1.96), serum Visfatin levels (OR 0.31 per IQR increase in Visfatin; 95% CI 0.10–0.95) and smoking (OR 4.24; 95% CI 1.10–16.37) with SGA at birth. **Conclusions:** Associations between SGA and lower PlGF, Visfatin levels as well as increased sFlt-1/PlGF ratio and smoking status were detected which may contribute to predict SGA.

## PS5-04

### Carotid artery stiffness precedes the clinical onset of preeclampsia and persists postpartum: A longitudinal study

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**Purpose:** Arterial stiffness is associated with an increased risk of cardiovascular events and preeclampsia is linked with profound changes in the maternal cardiovascular system. The aim of this prospective study was to characterize differences in several arterial elasticity parameters throughout pregnancy and postpartum in relation to preeclampsia development. **Material and methods:** We longitudinally assessed pulse wave velocity (PWV),  $\beta$ -stiffness index ( $\beta$ SI), incremental elastic modulus (IEM), diameter (dD) and pressure difference (dP), compliance coefficient (CC), diameter distensibility (DD) and compliance (DC), cross-sectional distensibility (CSD) and compliance (CSC) of the carotid artery in 406 pregnant women (31 ± 5 years), in the first (T1: 11.4 ± 1.9 wks), second (T2: 21.5 ± 2.3 wks) and third trimester (T3: 32.5 ± 2.9 wks) and postpartum (21.6 ± 23.6 wks), using high-resolution ultrasound and an automated reading program. Comparisons were made with univariate ANOVA, data are expressed as mean (95%CI). **Results:** 54 women (32 ± 5 years) who later developed preeclampsia had higher PWV: 7.9 (7.1–8.7),  $\beta$ SI: 1.8 (1.4–2.1) and IEM: 1242.1 (984.9–1499.3) throughout pregnancy compared with 352 women who did not develop preeclampsia [PWV: 6.7 (6.5–7.1),  $\beta$ SI: 1.3 (1.2–1.4) and IEM: 814.5 (730.6–898.4)], adjusted for age, body mass index, mean arterial pressure and family history of cardiovascular disease. These differences persisted postpartum. There were no differences in dD, dP, CC, DD, DC, CSD and CSC between the two groups. **Conclusion:** Increased maternal arterial stiffness, as assessed by pulse wave velocity,  $\beta$ -stiffness index and incremental elastic modulus, pre-dates the development of preeclampsia and persisted postpartum.

## PS5-05

### Rare case of malignant yolk sac tumor and contralateral teratoma in pregnancy

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A 32-year-old nulligravida was referred to our outpatient clinic in her 24th week of pregnancy with suspicion of placenta praevia. In our scan we could locate the placenta in the fundal area, but in the right adnexal region we detected a 17 × 9 cm inhomogeneous mass with cystic and non-cystic areas. The tumor presented with increased doppler perfusion but without papillary structures. No ascites was found. The contralateral ovary could be visualized. CA 12–5 was 78 U/ml, CEA normal, AFP and  $\beta$ -HCG highly elevated. Adnexectomy of the right ovary via a longitudinal laparotomy was performed and the histologic evaluation of the tumor revealed a malignant yolk sac tumor of the ovary. After 4 weeks and in her 28th week of pregnancy we started chemotherapy with bleomycin, etoposide and cisplatin and applied 3 cycles in total. Regular scans of the fetus were performed, growth, doppler of the umbilical artery and amniotic fluid were normal. With 40 weeks she delivered vaginally a 3000 g male baby. In the follow-up scan 6 weeks after delivery we detected a 5 cm inhomogeneous mass together with normal ovarian tissue in the area of the left ovary without ascites, highly suspicious for a teratoma.  $\beta$ -HCG and AFP were still normal, so we decided to excise only the tumor and preserve the main part of the ovary. Histologic analysis confirmed the diagnosis of a benign teratoma. Malignant tumors of the ovary in pregnancy are rare. Most of the tumors represent germ cell tumors. The treatment of the tumors in pregnancy follows same protocols as in nonpregnant women but long-term effects on the fetus are not clear. This is a rare case of a malignant yolk sac tumor and contralateral teratoma.



## PS5-06

**Automated versus manual disinfection of transvaginal ultrasound probes – a clinical study**Willems S<sup>1</sup>, Schmitz R<sup>2</sup>, Hammer K<sup>2</sup>, Braun J<sup>2</sup>, Oelmeier de Murcia K<sup>2</sup>, Möllers M<sup>2</sup><sup>1</sup>University Hospital Muenster, Hygiene, Münster, Germany;<sup>2</sup>University Hospital Muenster, Gynecology/Obstetrics, Münster, Germany

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**Objectives:** Disinfection of transvaginal ultrasound (TVUS) probes is currently under discussion in Europe. As there is a potential risk of nosocomial infection, an appropriate disinfection method has to be used. Automated methods are relatively new in Europe and scientific background is scarce, so in this study we compared an automated method to our standard method. **Methods:** For this purpose, we designed a prospective randomised controlled clinical study. Currently, we are collecting samples from TVUS probes in our outpatient department. In one group disinfection is done with Antigermin<sup>®</sup> (high level disinfection using UVC radiation) and in the other manually with Mikrozid sensitive<sup>®</sup> wipes. Samples are taken before and after disinfection and are then analysed for microbial growth. **Results:** We are still evaluating our samples and will present our final results. Data will be evaluated separately for the probe handle and body. **Conclusion:** There is no doubt that disinfection of TVUS probes has to be adequate. Automated methods are easy to handle, meet the criteria of national hygiene recommendations but are expensive. Scientific background and guidelines of the leading ultrasound societies are needed to implement the most effective method as a standard.

## PS5-07

**Reference values for carotid intima-media thickness and flow-mediated dilatation in normal pregnancies from 8 to 41 weeks gestation and from 8 to 14 weeks postpartum**Brückmann A<sup>1</sup>, Seeliger C<sup>2</sup>, Lehmann T<sup>3</sup>, Schlembach D<sup>4</sup>, Schleußner E<sup>2</sup><sup>1</sup>GesaTal Medical Center, Department of Prenatal Diagnosis and Preventive Medicine, Erfurt, Germany; <sup>2</sup>University Hospital Jena, Friedrich-Schiller-University, Department of Obstetrics, Jena, Germany; <sup>3</sup>University Hospital Jena, Friedrich-Schiller-University, Institute of Medical Statistics, Jena, Germany; <sup>4</sup>Vivantes Hospital, Department of Obstetrics, Berlin-Neukölln, Germany

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**Purpose:** To determine carotid intima-media thickness (cIMT) and flow-mediated dilatation (FMD) and to describe the characteristic of both endothelial markers, throughout pregnancy and postpartum. **Material and methods:** A cross-sectional analysis of 566 low-risk singleton pregnancies, including 987 visits, was performed from 8 to 41 weeks' gestation and from 8 to 14 weeks postpartum, using high-resolution ultrasound and an automated reading program. **Results:** When segregated for gestational age, the mean  $\pm$  SD cIMT was  $0.32 \pm 0.09$  in the first (1T), second (2T) and third trimester (3T) and  $0.35 \pm 0.09$  at postpartum period (PP). The means for FMD were as follows: [1T:  $7.6 \pm 6.2$ ; 2T:  $8.5 \pm 6.6$ ; 3T:  $7.7 \pm 5.7$ ; PP:  $6.5 \pm 4.9$ ]. No significant changes from the midline in cIMT and FMD were observed with increasing gestational/postpartum weeks. **Conclusion:** Normal reference ranges for cIMT and FMD were established. This may serve as a basis for further studies and patients with abnormal endothelial function.

## PS5-08

**Abnormal posterior brain and molar tooth sign in a fetus with Joubert syndrome at 11 – 13 weeks – new gene mutation discovered: Case report**Brückmann A<sup>1</sup>, Brückmann D<sup>1</sup>, Hering A<sup>2</sup>, Lachmann R<sup>3</sup><sup>1</sup>GesaTal Medical Center, Department of Prenatal Diagnosis and Preventive Medicine, Erfurt, Germany; <sup>2</sup>Center for Human Genetics, Erfurt, Germany; <sup>3</sup>University Hospital Carl Gustav Carus, Department of Obstetrics and Gynecology, Dresden, Germany

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**Purpose:** Joubert syndrome (JS), a rare autosomal recessive disorder, is characterized by the molar tooth sign on an axial magnetic-resonance-imaging (MRI). This abnormality results from a complex brainstem malformation and co-occurs with agenesis/hypoplasia of the cerebellar vermis, that leads to an abnormal enlargement of the fourth ventricle (4V).

The adverse outcome of JS is characterized by episodes of hyperpnea, abnormal ocular movement, hypotonia, ataxia and developmental delay. Variable features, including cystic kidneys have led to a broader classification, such as JS and related disorders. **Results:** We describe abnormal sonographic findings of 4V, brainstem and kidneys in one fetus with JS. A 26-year-old nulliparous woman was referred for evaluation after a nuchal translucency of 3.5 mm had been measured (11+4wks). The midsagittal view displayed: enlarged 4V/cisterna magna, increased BS/OB, decreased BS/BSOB-ratio and horizontalization of the brainstem. A high risk for cystic posterior fossa malformations, particularly Dandy-Walker continuum, was suspected. The molar tooth shaped cerebellar peduncles on an axial view in the first trimester were noted in the sonographic imaging review. The kidneys appeared normal at this stage. Chorionic villus sampling was performed and revealed a normal male karyotype. Sonographic evaluation (15+4wks) showed marked vermian hypoplasia, deep interpeduncular fossa, brainstem dysplasia, echogenic kidneys. Confirmed by fetal-MRI (16+4wks). After termination of pregnancy (17+6wks), further fetal-DNA analysis revealed two mutations in the IN-PP5E-gene, which carry a high probability in causing JS in this family and of which one mutation has not been previously described. This allows early prenatal genetic diagnosis in their future pregnancies. **Conclusion:** As exact prenatal genetic testing may not always be compelling in Joubert syndrome, the ability to identify the molar tooth sign in prenatal ultrasound before 17 weeks provides a valuable adjunct to differentiate between posterior fossa abnormalities, particularly Dandy-Walker malformation, Blake's pouch cyst, isolated vermian hypoplasia, encephalocele and to select appropriate genetic analysis.

## PS5-09

**Maternal Acetylcholine-Receptor Autoantibodies causing recurrent fetal Arthrogryposis**Verlohren S<sup>1</sup>, Ott CE<sup>2</sup>, Meisel A<sup>3</sup>, Dame C<sup>4</sup>, Henrich W<sup>1</sup><sup>1</sup>Charité – Universitätsmedizin Berlin, Department of Obstetrics, Berlin, Germany; <sup>2</sup>Charité – Universitätsmedizin Berlin, Medical Genetics and Human Genetics, Berlin, Germany; <sup>3</sup>Charité – Universitätsmedizin Berlin, Neurology, Berlin, Germany; <sup>4</sup>Charité – Universitätsmedizin Berlin, Neonatology, Berlin, Germany

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**Background:** The foetal Arthrogryposis multiplex congenita is defined as the occurrence of malposition of two joints in at least two body regions. This descriptive definition comprises a multitude of genetic and non-genetic causes. The detection of the underlying aetiology is reported to be approximately 5%. A rare non-genetic cause of foetal Arthrogryposis is a maternal myasthenia gravis or maternal autoantibodies against the Acetylcholine-Receptor (AChR-AA). By passing the placenta, they cause foetal akinesia deformation sequence. **Case report:** A healthy 28-year-old primigravida presents in 13 weeks of gestation for first trimester screening. A cystic hygroma is detected and chorionic villous sampling is performed yielding a normal fetal karyotype. In the 16 weeks scan, a fixed extension in the knee joints, a fixed flexion in the elbow joint is detected. In 21 weeks the patient is referred with hydrops fetalis and massive skin oedema. The liver function tests were abnormal and pregnancy was terminated due to impending mirror syndrome. Six months later the patient presents with a new pregnancy. The first trimester- as well as 16 weeks scan were uneventful. In the 22 weeks scan, the fetus exhibited extended legs, talipes on both sides, fixed flexion in the elbow joints, retrognathia and polyhydramnios. The karyotype was normal. A genetic counselling was performed and maternal AChR-AA were determined, which were elevated 40x above normal. Due to progressive fetal akinesia including thorax deformation, pregnancy was terminated. **Conclusion:** Maternal AChR-AA constitute a rare cause of fetal Arthrogryposis, also in the absence of symptoms of myasthenia gravis in the pregnant mother. By passing the placenta, they cause foetal akinesia deformation sequence. Differential diagnostic workup, especially in recurrent cases, should include their evaluation. Knowledge about their presence allows for diagnostic intervention such as plasmapheresis before the subsequent pregnancy.

## PS5-10

**3D Ultrasound measurements of the Bilateral nasal bone in the first trimester fetuses and fetuses with trisomy 21**Pashaj S<sup>1</sup>, Merz E<sup>2</sup><sup>1</sup>Maternity Hospital "Koco Gliozheni" Hospital, Ultrasound Department, Tirana, Albania; <sup>2</sup>Centre for Ultrasound and Prenatal Medicine, Frankfurt am Main, Germany  
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**Purpose:** Three-dimensional ultrasound with its different display modes allows an accurate demonstration of the ossified bones of the fetal face in the first trimester. In particular, the nasal bones can be evaluated on both sides and measured separately. The aim of this study was to establish the normal range for the left and right nasal bone and to demonstrate the development of the nasal bones in cases with trisomy 21 in the first trimester. **Material and method:** In 200 normal fetuses and 12 fetuses with trisomy 21 the left and right nasal bone was measured in the multi-planar 3D mode after aligning the fetal head into an exact upright position to get a true profile. All scans were performed using E8/E10 GE equipment (Zipf, Austria) with a 5–8 MHz 3D abdominal or a 5–9 MHz 3D vaginal transducer. Gestational age was between 10+3 and 14+0 weeks of gestation. **Results:** In the normal fetuses 151 cases had the same nasal bone length on both sides. In 43 cases a difference of up to 5 mm between the left and right nasal bone could be observed and in 3 cases even absence of the nasal bone on one side was found. In the 12 fetuses with trisomy 21, 3 cases showed bilateral hypoplasia of the nasal bones and 9 cases absence of nasal bones on both sides. **Conclusions:** Three-dimensional ultrasound is a useful tool in the evaluation of the nasal bones in the first trimester. Because 23% of the normal cases showed a difference between the left and right nasal bone length, it is important to measure the nasal bone length on both sides consequently.

## PS5-11

**Cloacal dysgenesis sequence and myelomeningocele in maternal obesity and gestational diabetes**Lauten A<sup>1</sup>, Fröber R<sup>2</sup>, Schleußner E<sup>1</sup>, Groten T<sup>1</sup><sup>1</sup>Universitätsfrauenklinik, Obstetrics, Jena, Germany; <sup>2</sup>Universitätsklinikum, Institut für Anatomie I, Jena, Germany  
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**Purpose:** The risk of prenatal caudal regression syndrome in worse managed gestational diabetes mellitus is fourhundredfold and in women with BMI > 40 threefold higher in comparison to normal collective. This constellation is often found in pregnant women with a deficiency of folic acid. We describe a case of fetal malformation in obesity and gestational diabetes. **Method:** Case report. **Result:** The 25 years old woman (BMI 43) ist seen in the first pregnancy because of an insulindependent gestational diabetes mellitus. The perinatal outcome was without pathological findings. After this pregnancy she gained weight for 20 kg. A postnatal observation did not occur. In the second pregnancy (BMI 48) she already received insulin since the 8th week of gestation. During the second trimester an anhydramnion occured. Furthermore we found an intraabdominal cystic mass. We suspected a cloacal dysgenesis, which was confirmed after pathologic examination after induced abortion. After one year she was seen with the third pregnancy für insulin therapy during 12 th week of gestation. During the second screening we found a fetal myelomeningocele and an arnold chairi malformation. Periconceptional the HbA1c was quite normal (< 6%). We suspect the reason for this malformation in deficiency of folic acid in obesity. **Conclusion:** The close meshed interdisciplinary care in women with obesity and gestational diabetes mellitus should be carried out experienced. Especially in preparation of following pregnancies such women have to lose weight after child birth und should obtain 5 mg folic acid per day preconceptional.

## PS5-12

**Growing renal mass: mesoblastic nephroma in pregnancy**Dany N<sup>1</sup>, Frankenschmidt A<sup>2</sup>, Stenzel M<sup>3</sup>, Pohl M<sup>4</sup>, Kurz P<sup>5</sup>, Prömpeler H<sup>1</sup><sup>1</sup>Unifrauenklinik Freiburg, Freiburg, Germany; <sup>2</sup>Uniklinik Freiburg, Kinderurologie, Freiburg, Germany; <sup>3</sup>Uniklinik Freiburg, Radiologie, Freiburg, Germany; <sup>4</sup>Uniklinik Freiburg, Klinik für allgemeine Kinder- und Jugendmedizin, Freiburg, Germany; <sup>5</sup>Uniklinik Freiburg, Pathologie Freiburg, Freiburg, Germany  
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**Case report:** A 41-year-old GIII/PI presented for the first time at 30+3 weeks of pregnancy with a newly diagnosed fetal abdominal mass, which hadn't been visible 6 weeks before. At present, sonography reveals a 66 × 56 × 66 mm left renal mass with abundant vascularisation and a macrosomic male fetus. The right kidney is normal in size and shape. The consulted pediatric nephrologist suspects a wilms tumor or a mesoblastic nephroma. Fetal MRT shows a solid mass, 160 ml in volume, the radiologists suspect a mesoblastic nephroma. Because of the maternal pain and respiratory distress of the severe polyhydramnios amnioreduction is performed weekly. During the following three weeks the tumor grows from 160 ml to almost 400 ml. The case is presented to the pediatric oncology board; together, it is decided to allow the pregnancy to go to term despite the fast growth of the tumor. At 34+3 weeks of pregnancy, a spontaneous rupture of membranes occurs 3 days after the last amnioreduction. A cesarean section is performed at the mothers request without complication. The newborn is cyanotic without spontaneous breathing, APGAR 3/5/5, pH 7.31, BE -2.3. Intubation is necessary because of the respiratory failure caused by the big abdominal mass. On the 3<sup>rd</sup> day of life, left radical transperitoneal nephrectomy and staging lymphadenectomy is performed. The operation proves to be difficult to carry out because of the extensive blood vascularisation of the tumor, with great loss of blood. The exchange of 1.5 times the total blood volume is necessary, the newborn receives catecholamine therapy for 2 days. Histology shows a mesoblastic nephroma with tumorfree staging lymph nodes, SIOP Stade II. The newborn is discharged from hospital on day 22 of his life. Follow-up examinations have been uneventful until now.

## PS5-13

**Fatal neonatal hemochromatosis as a rare cause of intrauterine growth restriction**Schneider U<sup>1</sup>, Muth P<sup>2</sup>, Wieland T<sup>3</sup>, Voigt C<sup>1</sup>, Doerfel C<sup>3</sup>, Gajda M<sup>4</sup>, Mentzel HJ<sup>5</sup>, Proquitt H<sup>3</sup><sup>1</sup>Klinik für Frauenheilkunde und Geburtshilfe, Universitätsklinikum Jena, Arbeitsbereich Pränatale Diagnostik und Fetale Physiologie, Jena, Germany; <sup>2</sup>Klinik für Frauenheilkunde und Geburtshilfe, Universitätsklinikum Jena, Abteilung Geburtshilfe, Jena, Germany; <sup>3</sup>Klinik für Kinder und Jugendmedizin, Universitätsklinikum Jena, Sektion Neonatologie, Jena, Germany; <sup>4</sup>Institut für Pathologie, Universitätsklinikum Jena, Jena, Germany; <sup>5</sup>Klinik für Kinder und Jugendmedizin, Universitätsklinikum Jena, Sektion Kinderradiologie, Jena, Germany  
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Neonatal hemochromatosis (NHC) is characterized by severe liver disease in the newborn accompanied by extrahepatic siderosis. This Gestational Alloimmune Liver Disease (GALD) is resulting from the placental transfer of maternal IgG antibodies against fetal hepatocytes. Diagnosis is often only made post mortem for the severe and unexpected occurrence [1]. A 27 y east-african patient (GIII/PII, 2 healthy children born at term in 2003/SVD and 2012/CS for cephalopelvic disproportion) was admitted for anhydramnios and symmetric IUGR (EFW 1020 g/< 3<sup>rd</sup> perc.) at 31+0 wksGA. PROM could be excluded biochemically; sonographic assessment revealed an increased cardiothoracic ratio and peak systolic velocity in the MCA, changing over time, with otherwise normal sonoanatomy and fetomaternal Doppler findings. The patient has been known for severe anemia since 15 wksGA and presented with an unexplained increase in maternal CRP serum level. Under the suspicion of occult PROM steroids were given accompanied by antibiotic coverage and delivery was performed at 32+0 wksGA. A preterm, asymmetrically dysmature, severely anemic boy was delivered in intact membranes (1190 g, 39 cm). Cardiopulmonary adaptation was impaired (APGAR 1/8/8, pHUA 7.33). The infant presented with peripheral edema, reduced muscular tone and deranged hematologic and plasmatic coagulation parameters. Over the next days the clinical situation deteriorated despite neonatal intensive care from primary liver leading into fatal multi-organ failure after 7 days.

Laboratory tests revealed massive iron overload (ferritin 5300 µg/l; transferrin 0.6 g/l, transferrin saturation 100%). The suspected diagnosis of NHC was eventually confirmed on post-mortem liver biopsy. The risk of recurrence is up to 90%. Therefore, identification of GALD is of utmost importance since these patients benefit from therapy with immunoglobulins at narrow intervals during a consecutive pregnancy and from preterm delivery [1,2]. [1] Feldman AG, Whithington PF. J Clin Exp Hepatol, 2013;3:313–20. [2] Lopriore E et al. Prenat Diagn, 2013;33:1221–5.

## PS5-14

### Prenatal MRI: Is it still useful in the clinical management of fetal central nervous system malformations diagnosed by ultrasound?

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**Purpose:** To evaluate the role of magnetic resonance imaging in the diagnosis of central nervous system abnormalities and to report its additional and differential value being used as a second line diagnostic procedure. **Material and methods:** This was a retrospective study based on 54 women in singleton pregnancies with recognized or suspected fetal central nervous system anomalies based on ultrasound evaluation. All patients underwent a following magnetic resonance imaging in order to confirm or exclude ultrasound diagnosis or to incorporate additional findings. **Results:** Fetal ultrasound was performed at mean gestational age of 21 weeks (range 12–33) and fetal magnetic resonance imaging at 27 weeks (range 21–35). In 51.9 percent of the cases the diagnosis from ultrasound and MRI were the same. In 37 percent of the patients the diagnoses were also concordant, but magnetic resonance imaging brought additional information. In 88.9 percent of the cases diagnostic results have been confirmed by MRI. Lack of concordance between both techniques was found in 11.1 percent of the cases. Patient's BMI, ultrasound conditions like oligo or anhydramnios or the use of 3 dimensional ultrasound did not show statistically significant results in this particular study. **Conclusion:** MRI plays a significant role as an addition to ultrasound in diagnosing fetal central nervous system anomalies. Our data supports the hypothesis that ultrasound alone is highly predictable, but magnetic resonance imaging can bring additional information or clarify a suspected finding. This sometimes can lead to a change in treatment approach and appropriate counseling. Taking this into consideration we can state that both the ultrasound and MRI should still be used as complementary techniques in prenatal diagnosis of central nervous system anomalies.

## Interesting Case Reports of all Disciplines

## PS6-01

### Two cases of fetuses with urointestinal fistula

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**Introduction:** Congenital urointestinal fistula is a rare abnormality. In a period of 8 years two male fetuses were referred to our centre because of dilated bowels with intraluminal echogenic foci combined with oligohydramnios. Suggested prenatal diagnosis, management and outcome diverged. **Case 1:** In 2007 a 37-year-old second gravida was referred for ultrasound at 24 weeks of gestation. We found bowel dilatation with intraluminal fluid and enterolithiasis. Amniotic fluid was decreased. Fetal sphincter ani could be detected. We performed amniocentesis showing normal results. Further investigations showed increasing bowel dilatation and decreasing amniotic fluid. The suggested diagnosis was colon stenosis. At 34 weeks of gestation cesarian section was performed due to therapy resistant preterm labor. The birth weight was 2700 g. The newborn presented with respiratory problems and oliguria of unknown cause. On day three laparotomy was performed and a colostoma constructed because of high anal atresia. Furthermore intraoperative inspec-

tion showed rectovesicular fistula. In the postoperative course the boy was depressed and died the next day by sudden asystolia following surfactant application. **Case 2:** In 2015 a 26-year-old first gravida was referred for ultrasound at 31 weeks of gestation. There were similar findings like in case 1 this time suggesting urointestinal fistula. In a prenatal interdisciplinary conference with pediatric surgeons an explorative laparotomy right after birth was planned. At 39 weeks of gestation the boy was delivered by cesarian section. The birth weight was 2930 g. Suprlevator anal atresia and rectovesicular fistula were confirmed. Postoperative course had no complications. 6 weeks after surgery the child is developing with no peculiarity. **Discussion:** Because direct imaging by ultrasound is not possible, prenatal diagnosis of urointestinal fistula is difficult. Dilated fetal colon with echogenic foci caused by enterolithiasis combined with oligohydramnios serve as sufficient diagnostic signals. Early postnatal operation seems to be mandatory for positive outcome.

## PS6-02

### Bedside ultrasound in the emergency department and abdominal pain

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**Purpose:** Abdominal pain is a common symptom in emergency room (ER), covering 10% of the assists. The delay in diagnosis and treatment adversely affects the patient's prognosis. Transabdominal ultrasonography is most commonly used to obtain images of hepatobiliary, urogenital, and pelvic structures. However, improvements in ultrasound technology and increasing familiarity with ultrasonographic findings in a variety of gastrointestinal disorders, as Crohn's disease (CD), are broadening its applications, and it is an aspect to be considered by emergency physicians (EP) in patients with recurrent abdominal pain. We present a case of CD, diagnosed at ER, through the use of ultrasound scanning by EP. **Material and methods:** A patient with abdominal pain, with a final diagnosis of an CD. **Results:** 36 year old male, was admitted to the ER for the third time by abdominal pain. Emergency analytical were unremarkable, as in the preceding cases. Because of the pain the emergency physician underwent an ultrasound scan observing area terminal ileum same transmural thickening with luminal narrowing and decreased peristalsis, involvement of the mesenteric lymph nodes and multiple underlying fat, suspecting CD. We entered the patient performing CT abdomen and ileo-colonoscopy confirmed the diagnosis. **Conclusion:** Bedside ultrasound of the patient by the EP could be an useful tool in cases with abdominal pain whose clinical data and laboratory are unclear. Suspicion of CD, the sensitivity of ultrasound is nearly 90%, especially if ileal location, as in the case presented; being the specific data and the transmural segment thickening, and the presence of fistulae or abscesses. Stenosis exists ultrasound specificity is greater than 95%. Due to its great advantages such as low cost, accessibility, not irradiated and non-invasive ultrasound should be considered in the diagnosis and monitoring of all CD, therefore EP must be trained to diagnose sonographically acute complications of this disease.

## PS6-03

### Undergraduate teaching in ultrasound to medical students

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**Purpose:** Assessing and training ultrasound to undergraduate students of 3rd year medical assigned to Valme Hospital, University of Sevilla. **Materials and methods:** Descriptive study developed in February, March and April of 2012 by 48 medical students from 3rd year who studied the subject of Medical Pathology. They were divided into groups of 8, and each group was taught a Theoretical and practical 4-hour workshop, the contents was the protocol Focused Assessment With Sonography in Trauma (FAST) for detecting abdominal free-flowing liquid. The workshop was led by two emergency physicians with extensive training and experience in clinical ultrasound. After the theoretical explanation of each block, students practiced the basic plans using their peers as models for over 3 hours. Upon completion, students had to complete a questionnaire and they were asked, using a Linkert 5-point scale (very good = 5, ... very bad = 1), to evaluate the agreement or disagreement about their experience with the workshop. Their knowledge did not evaluate ultrasound. **Results:** 100% of students (50) evaluated the workshop as very



good and teachers, and 98% (49) assessed equally the teaching methodology. The students were excited about the practical part of the workshop, 98% of them (49) agreed that the usefulness and clinical applicability of ultrasound and its inclusion in medical training programs at undergraduate level would be essential. 100% of students suggested implementing more workshops as performed and in turn, that the workshop had been conducted had more hours and more educational content.

**Conclusions:** The vast majority of students were very satisfied with the workshop and, according to them, it should include training in clinical ultrasound in the formal curriculum of the Faculty of Medicine of Seville, since they believe will help them in their future practice as doctors, regardless of the specialty they will choose in the future.

## PS6-04

### Usefulness of bedside ultrasound by emergency physicians in a patient with acute hepatitis

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**Purpose:** Case study of gallbladder ascariasis complicated with acute hepatitis, diagnosed at ED, through the use of US scanning by EP. **Material and method:** A patient with jaundice, with a final diagnosis of Ascariasis infestation assessing US, performed by EP. **Results:** 16-year-old male suffering malaise and jaundice for two days, without fever. He was hemodynamically stable, with extended jaundice. Abdomen was soft, depressible, painless and non-palpable masses or organ enlargement, no signs of peritoneal irritation. The analytical tests showed AST 1488, LDH 552 and bilirubin of 9.1, along with coagulopathy with INR of 1.88. The emergency physician made an abdominal ultrasound scan, which showed an echogenic tubular image without posterior acoustic shadowing, mobile, several centimeters long and about 6 mm in diameter, compatible with Helminth infestation. The patient was admitted to the Infectious Diseases Unit. Within 24 hours of admission there was a rapid and progressive deterioration of the liver and renal function and overall severe liver failure, requiring an urgent liver transplant. **Conclusions:** *Ascaris lumbricoides* is the largest and most predominant of the human helminths. Infection occurs by ingestion of the embryonated eggs. The released larvae from the eggs in the intestine go into a pulmonary migration phase. The larvae attain sexual maturity within three months after reaching the small intestine. It is proven that ultrasound can diagnose this worm infestation hepatobiliary in up to 84% of cases, it may however, fail in cases where the parasite has died or the visualisation is hindered by the presence of stones. Ascariasis of the gallbladder is a very rare occurrence and its relationship with acute hepatitis has not been well studied, therein lies the importance of this case, along with the news of the diagnosis of a case of this type, for the use of ultrasound by the emergency physician.

## PS6-05

### Gastrointestinal stromal tumor of the appendix, extremely rare, mostly benign

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A 92-year-old female is admitted with acute right-sided lower abdominal pain. On admission the patient is in good general condition. The abdomen is soft, with tenderness in the right lower abdomen, peristalsis is downright. In the abdominal ultrasonography we find a 2.5 cm long and 14 mm wide cockade with preserved wall stratification in the right lower abdomen. Immediate laparoscopy is initiated. It reveals a necrotic, fibrin-appearing appendix with ischemia of the distal cecum. Laparoscopic appendectomy with ileocecal resection is performed. Wound healing is primarily, the patient can be discharged after 5 days. Histological examination shows a gangrenous appendicitis with ischemic colitis. There is a 5 mm large gastrointestinal stromal tumor with 4 mitoses per 21 HPF. Immunohistochemistry shows a strong positivity for CD34 and DOG1 and focal positivity for S100. 1A4, Desmin and Calponin are negative. Risk group is 0 by Miettinen and Lasota.



Fig. 1: Cockade of cecum

Gastrointestinal stromal tumors are common mesenchymal tumors of the digestive tract. They have a characteristic morphology, are usually positive for CD117 (c-kit), CD34 and S100. The tumor is caused by a mutation in the KIT or PDGFRA. The tumors predominantly appear in stomach (60%) and small intestine (30%), rarely in rectum. Gastrointestinal stromal of the appendix are extremely rare, 0.1% of the cases described. 9 cases have been reported in the world literature to date, one malignant, the others benign. The age of the patients described so far are between 56 to 78 years with a mean age of 67 years. Our patient is the oldest patient previously described.

## PS6-06

### Hyperechoic mesenteric lymphnodes, weight loss and abdominal pain

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A 40 years old male was admitted for weight loss of 5 kilograms and abdominal pain. Diarrhea was denied. He had no further history of diseases. He reported a cigarette consumption of about 25 pack years. At physical examination we found slight tenderness of the abdomen, no other pathological findings. His general practitioner had already arranged a CT-scan of the thorax, which showed enlarged mediastinal and retroperitoneal lymphnodes without tumor growth in thorax and abdomen. The patient was sent for ultrasound guided puncture of the abdominal lymphnodes to our ultrasound laboratory. We found the lymphnodes being hyperechoic and settled the puncture because of the typical aspect. We sent the patient for upper gastrointestinal endoscopy, which revealed duodenal lymphangiectasia. Histological analysis of mucosal specimens showed Whipple's disease. The patient got antibiotics and recovered fully.



Fig. 1: Hyperechoic lymph node in whipple's disease

**Conclusion:** Hyperechoic lymph nodes are seen at disturbed lymph drainage. One explanation is a high amount of fatty acids in the lymph. Hyperechoic lymph nodes are found in celiac disease, Crohn's disease, AIDS, T-cell lymphoma, and carcinoma of the small intestine as well, they are not pathognomonic for Whipple's disease. Duodenal biopsy before ultrasound guided puncture is less invasive, was highly effective as diagnostic tool to clear up the differential diagnosis. It was helpful to avoid the invasive puncture.

## PS6-07

### Asymptomatic patient with an ectopic pregnancy @ 11 weeks

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**Purpose:** Ectopic pregnancy occurs in around 1–3% of all pregnancies and is still the most common cause of first trimester maternal death accounting for 73% of early pregnancy mortality. The incidence of ectopic pregnancy has increased markedly over the last three decades. Cases may be mislead by asymptomatic patients and the absent of common clinical findings. **Material and methods:** Case report, literature review. **Results:** A 28-year-old woman was referred with a tubal ectopic pregnancy @ 11 weeks of gestation detected at her first visit for antenatal care. On admission vital signs were stable and no abdominal guarding or rebound tenderness was present. She had no history of a previous ectopic pregnancy. Transvaginal ultrasound scan revealed a vital right-sided tubal ectopic pregnancy with a CRL of 45 mm (Fig. 1) and an empty uterus with a thickened endometrium (Fig. 2). Laparoscopic intervention confirmed ultrasound findings (Fig. 3). Despite the large fetus the fallopian tube was not ruptured. The removal of the fetal body (Fig. 4) was followed by salpingectomy.

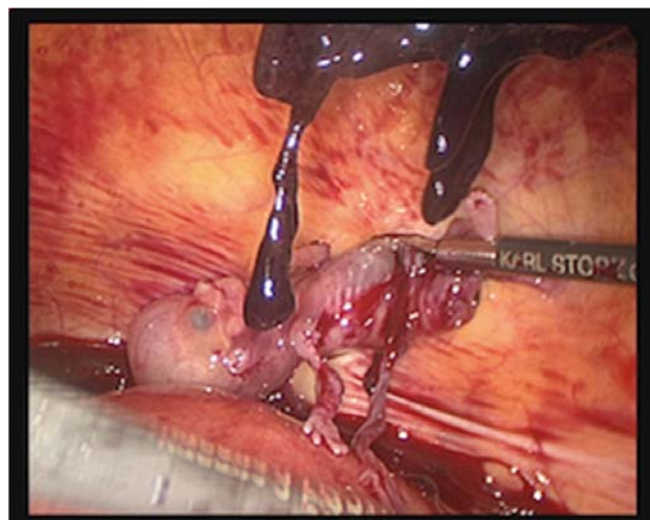


Fig. 1

**Conclusions:** Three findings can be drawn from this case:

1. Patient with an advanced tubal ectopic pregnancy can present asymptomatic and common clinical findings can be absent leading to misdiagnosis.
2. Advanced tubal ectopic pregnancy can be managed laparoscopically.
3. The mucosal layer of the fallopian tubes is capable to provide an environment for implantation and supply for fetal growth up to 11. Weeks of gestation.

## PS6-08

### Fetal intrauterine volvulus in cystic fibrosis

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**Purpose:** Up to 15% of fetuses with cystic fibrosis develop meconium ileus and 50% of these are associated with perforation, volvulus and atresia. Intrauterine volvulus is a life threatening condition and rarely diagnosed prenatally. We present a case of intrauterine volvulus associated with cystic fibrosis in a mother with a previously affected child.

**Case:** The 26-year-old, gravida 2, para 1 was referred at 35+3 gestational weeks for the planning of delivery. In the first pregnancy she had caesarean section at term for fetal meconium ileus and ileal atresia, with the diagnosis of cystic fibrosis. In the current pregnancy the patient had normal first and second trimester ultrasound scans. Amniocentesis was not performed due to the presence of a retroplacental hematoma. Ultrasound examination revealed polyhydramnion, dilated and aperistaltic bowel loops and ascites. In one section the bowel loops corresponded to the so-called “whirlpool sign”. By suspicion of a volvulus with meconium peritonitis, an urgent caesarean section was performed. A girl, 2490 g (APGAR 9/9/9, umbilical artery pH: 7.30) was delivered. She had a massively distended abdomen with livid discoloration. Laparotomy revealed a partial, 720° volvulus and a long-standing perforation in the right upper abdomen. The bowel was filled with meconium pellets. Fifteen cm of necrotic distal ileum were resected and a “double-barrel” ileostomy was performed. A reanastomosis was performed on the 4th postnatal day. The newborn suffered from an exocrine pancreas insufficiency and was diagnosed with cystic fibrosis. The baby was discharged on the 37th postnatal day. **Conclusion:** Cystic fibrosis induced meconium ileus can be associated with intrauterine fetal volvulus. Bowel obstruction may not be apparent at the time of anomaly scanning. The obstetric history led to a targeted ultrasound examination at presentation with a high index of suspicion of intrauterine volvulus necessitating delivery. Such timely intervention prevents fatal fetal outcomes.

## PS6-09

### Point of care echocardiography in the emergency room

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**Purpose:** Apical hypertrophic cardiomyopathy (AHM) is a variant of hypertrophic cardiomyopathy, involving nearly exclusively apex. It is very common among Asian patients, predominantly in Japanese, which is considered relatively benign condition. However, severe clinical manifestations, including sudden cardiac death, severe arrhythmias and apical infarction have been described in case reports. The electrocardiographic changes (giant negative T waves) and associated symptoms (chest pain, palpitations, dyspnea...) often present as acute coronary syndromes. AHM diagnosis is based on the demonstration of myocardial hypertrophy in the apical region of the left ventricle, usually by echocardiography with classical image “ace of spades”, although in many cases the use of contrast necessary. We present a case of young patient admitted at ER with palpitations. **Material & Methods:** The most frequent morbid events in Eriksson et al study of AHM were atrial fibrillation (AF), probably related to left atrial enlargement and impaired LV relaxation. It is prudent to also closely examine the heart on bedside emergency echocardiography looking for the presence of left atrial enlargement. **Results:** 37 year old male, with no significant medical history, was admitted to the ER by palpitations. The electrocardiogram showed AF with deep, negative T-waves in leads V3-V6. Bedside emergency echocardiography (BEE) initially performed to look for left atrial enlargement, revealed apical hypertrophy, with apical cavity obliteration during systole. These findings were confirmed by contrast ecocardiography. The patient was diagnosed with AHM (Yamaguchi's syndrome) and started on beta-blocker therapy. **Conclusion:** In this case, BEE helped to identify an AHM. It was the findings on emergency ultrasound, performed and interpreted by EPs, that helped to identify the correct diagnosis and prompted the appropriate consultations to cardiologist, with a final diagnostic of AHM.

## Ultrasound of the Head and Neck and Vascular Ultrasound – Clinical Investigations and Case Reports

PS7-01

### The study of normal parathyroid echogenicity

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**Background:** Some of the normal parathyroid can be shown on an ultrasound image. To our knowledge, however, either high or low echoic level of the normal parathyroid has been described without the confirmation of an experiment. Therefore, the echogenicity of the normal parathyroid was studied using intraoperative ultrasound. **Materials and methods:** Between October 2015 and January 2016, the parathyroid was examined in thyroidectomy procedures of 16 contiguous patients with thyroidal disease using an intraoperative array 8–18 MHz probe sheathed with a sterilized covering. There were 12 female and 4 male patients with an age range of 29–74 years old (mean, 47 ± 15). After one thyroid lobe or whole thyroid gland was removed, the parathyroid was found out by the surgeon. Then the parathyroid was scanned directly and through frontally-padded muscle of the neck, respectively. **Results:** The pathology results were thyroid papillary carcinoma (n = 11), thyroid medullary carcinoma (n = 2), thyroid adenoma (n = 1), retrosternal nodular goiter (n = 1), and thyroid nodular goiter (n = 1). Totally, twenty-five parathyroids were scanned in operation, including 8 right superior, 6 right inferior, 6 left superior, and 5 left inferior glands. All the parathyroids were visualized as hyperechoic structures, being homogeneous in texture (n = 22, 88%) and oval (n = 20, 80%), round (n = 3, 12%), or strip-like (n = 2, 8%) in shape. The length, width, and thickness averaged 6.8 ± 2.9 mm (range, 4–18 mm), 4.3 ± 1.6 mm (range, 3–10 mm), and 3.5 ± 1.3 mm (range, 1–7 mm). **Conclusion:** The normal parathyroid was confirmed to have a hyperechoic echogenicity, with most of them being homogenous and round-shaped, and measuring an average size of 6.8 × 4.3 × 3.5 mm through intraoperative ultrasound.

PS7-02

### Sonography of the hypoglossal nerve in the neck: visualization and first clinical experience

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**Purpose:** The hypoglossal nerve provides the motor innervation for the tongue. A lesion of the nerve can lead to dysphagia, dysarthria, and finally to atrophy of the tongue. Established imaging protocols with MRI and CT solely include the assessment of the supposed path of the nerve and do not allow the direct visualization of the nerve. The aim of this study is to determine the feasibility of the direct sonographic visualization of the nerve and to evaluate it in a clinical setting. **Material & methods:** First, the nerve was marked with ink in 24 neck sides of 12 fresh human cadavers. Subsequently the nerve was exposed for confirmation. Second, the nerve was morphometrically assessed in healthy volunteers. Third, 2 resident physicians with little and intermediate experience in ultrasound scanned volunteers. Fourth, patients with motor symptoms of the hypoglossal nerve were examined. **Results:** The hypoglossal nerve was identified correctly in all cadaver specimens and all volunteers. We found a cross sectional area of around 1.9–2.1 mm<sup>2</sup>. The resident physicians could locate the hypoglossal nerve correctly in 19/22 cases. Finally we could depict pathological alterations of the nerve in clinical cases. **Conclusion:** A direct visualization of the hypoglossal nerve in the neck is reliably and reproducibly feasible.

PS7-03

### Ultrasonography of tertiary hyperparathyroidism: a pictorial review

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**Purpose:** This didactic exhibit aims to

1. Review the efficacy of ultrasound in detecting parathyroid hyperplasia in tertiary hyperparathyroidism and post parathyroidectomy with autotransplantation
2. Recognize the abnormal sonographic appearances of parathyroid glands
3. Recognize the normal and usual ectopic locations of parathyroid glands.

**Materials and methods:** Ultrasound parathyroid scans in patients with tertiary hyperparathyroidism were retrospectively reviewed from the Picture Archiving System (PACS). A few ultrasound parathyroid scans in patients who had parathyroidectomy followed by autotransplantation were also reviewed. The sonographic appearances and locations of parathyroid glands were evaluated. Where available, correlation with laboratory results, other imaging modalities and histopathology will be presented. **Results:** Tertiary hyperparathyroidism is seen in patients with long-term secondary hyperparathyroidism with resultant hyperplasia of multiple parathyroid glands, usually seen in patient with chronic renal failure. The hypertrophied parathyroid glands could be easily identified with ultrasound scan in the expected anatomical locations posterior to the thyroid gland. They appear hypoechoic and oval or rounded in shape on ultrasound with the larger ones being multilobulated. Cystic component and calcification may be noted in the glands. Colour Doppler shows a characteristic extrathyroidal-feeding vessel and arc vascularity around the periphery of the glands. **Conclusion:** Ultrasound is a widely available cost effective first line imaging modality in detecting and locating the abnormal parathyroid glands in patients with tertiary hyperparathyroidism as well as in cases with recurrent hyperparathyroidism following parathyroidectomy. Recognition of abnormal sonographic features and normal as well as usual ectopic locations of the parathyroid glands helps in more thorough search of all abnormal parathyroid glands to achieve early diagnosis and necessary treatment.

PS7-04

### Does Shear Wave Elastography (SWE) parameters improve the differentiation the character of the thyroid lesions

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The aims of study were to determine whether shear wave elastography (SWE) can improve the B-mode differentiation of thyroid lesions, determine the most accurate SWE parameter for differentiation, and assess the influence of microcalcifications (MCs) and chronic autoimmune thyroiditis (CAT) on SWE values. We examined 119 patients with 169 thyroid nodules who prospectively underwent B-mode US and SWE using the same US machine. The following parameters were assessed using SWE: mean elasticity within the entire lesion (SWE-whole) and the mean (SWE-mean) and maximum elasticities (SWE-max) for a 2-mm region of interest (ROI) in the stiffest portion of the lesion, excluding MCs. The discriminant powers of a GEE model including B-mode only and both B-mode and SWE parameters were assessed and compared using the area under the ROC curve (AUC), in association with pathological verifications. In total, 50 and 119 malignant and benign lesions were detected. Multivariate logistic regression analysis for B-mode parameters revealed that MCs [odds ratio (OR), 4.3, hypoechogenicity (OR, 3.13, and irregular margins (OR, 10.82) were associated with a higher OR for malignancy, while that for SWE parameters revealed that SWE-max was an independent parameter for the same (OR, 2.95). The AUC for the B-mode model was 0.85, while that for the model combining B-mode and SWE parameters was 0.87. There was no significant difference in the mean SWE values between patients with and without CAT. The results of the present study suggest that SWE is a valuable tool for the characterization of thyroid nodules, with SWE-max being a significant parameter to differentiate



benign and malignant lesions, independent of conventional B-mode parameters. The combination of SWE parameters and conventional B-mode parameters does not significantly improve the diagnosis of malignant thyroid nodules. The presence of MCs can influence the SWE-whole value, while the presence of CAT may not.

PS7-05

### Static and dynamic sonography of facial muscles in healthy subjects – Intra-observer and inter-observer reliability in dependence of time interval between measurements

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**Purpose:** Are static and dynamic ultrasound measurements of facial muscles reliable when measuring with two week intervals? The intra- and inter-observer reliability has shown good results in facial muscle area measurements, but high variability in longitudinal and cross-diameter when measuring twice within  $\leq 48$  hours (Sauer, 2014). Short timeframes seem to improve the intraclass correlation coefficient (ICC), because the observer has the chance to remember the position of the probe and the ultrasound scan plane (Satioglu et al. 2005). In clinical practise, patients are typically followed over larger time intervals. That is why this study was designed with measurement intervals of 14 days. **Material and methods:** Using an eZono4000, eZono, Germany, with linear probe (L3–12), bilateral scans of seven facial muscles and two masticatory muscles were performed in 10 volunteers (5 women; age: 21 to 27 years). Following a standardized examination protocol (Sauer, 2014), two different examiners (A.H. and T.S.) performed all scans and muscle segmentations at two time points with 14 days interval. The results of the intra-observer reliability were compared to the results recently obtained for a 2-day interval (Sauer, 2014). **Results:** The ICCs of the intra-observer reliability were lower than in recent studies (areas: ICC/median 0.815–0.986/0.909; diameters: 0.162–0.988/0.678 with 2-weeks-interval; areas: 0.826–0.996/0.990; diameters: 0.221–0.991/0.860 with a 2-day-interval). The ICCs of the inter-observer reliability were 0.476–0.968/0.866 for area and 0–0.931/0.633 for diameter with 2-weeks-interval vs. areas: 0.495–0.977/0.907; diameters: 0–0.933/0.660 with a 2-day-interval. **Conclusion:** A longer timeframe in the intra- and inter-observer reliability creates lower ICCs ( $p=0.002$ ). Nevertheless they still showed a good reproducibility over time (especially for area measurements). As a result the standardized protocol can be applied to monitor changes in facial muscles over time even when performed by different examiners.

PS7-06

### Static and dynamic sonography of facial muscles in healthy subjects – Impact of the process of manual muscle segmentation on inter-observer-reliability

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**Purpose:** Identifying the impact of manual segmentation on the reliability of static and dynamic ultrasound measurements of facial muscles. The inter-observer-reliability (for scanning and manual segmenting by two independent observers) in recent studies has shown good results in area measurements (intra class coefficient (ICC)/median: 0.960–0.997/0.98), but high variability in longitudinal and cross-diameter (0–0.954/0.83 Sauer, 2014). The aim of this study was to figure out the impact of the muscle-segmentation on the ICC in contrast to the impact of the ultrasound scans. **Material and methods:** Bilateral scans of seven facial muscles and two masticatory muscles were performed on 10 volunteers (5 women; age: 21 to 27 years) using an eZono4000, eZono, Germany, with linear probe (L3–12). The scans were based on a standardized examination protocol (Sauer, 2014) and were made by two different examiners (T.S. and A.H.) at two separate time points. Both sets of ultrasound pictures were manually segmented by both examiners. **Results:** There was a high inter-observer-reliability (scanning and segmenting by two different examiners) in area measurements (0.49–0.98/0.91) and high variability in diameter measurements (0–0.91/0.66). The inter-rater-reliability (segmenting of the same scans by two different examiners) showed similar results with nearly the same ICCs (areas: 0.814–0.98/0.92; diameters: 0.12–0.95/0.75). **Conclusion:** The similar ICCs of inter-observer-reliability and inter-rater-reliability prove that most

variability is due to the process of manual segmentation, not to the ultrasound scanning. Reversely, this means that the existing ultrasound protocol is already a good instruction to achieve reproducible images of facial muscles. To improve the reproducibility of the segmentation, especially of the longitudinal and cross-diameter measurements, based on the presented results, a new instruction focused on segmentation was developed. Using this segmentation-instruction is believed to further improve the reliability of quantitative ultrasound of facial muscles in future studies.

PS7-07

### Sonoelastographic modalities in the evaluation of salivary gland disease

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**Purpose:** The evolution of sonoelastographic modalities facilitated new diagnostic options in the evaluation of pathologies in numerous regions of the human body. While sonoelastographic modalities could be implemented in the clinical routine of various specialties, its benefit in the clarification of salivary gland pathologies, despite good accessibility, is still part of ongoing investigation. **Material and methods:** Sonoelastographic modalities (real-time elastography, virtual touch imaging, shear wave velocity=SWV) have been evaluated in the diagnosis both of tumorous lesions of the salivary glands and in general salivary gland disorders (chronic inflammation, irradiation, Sjögren's syndrome). Reproducibility of SWV was evaluated with inter- and intrarater reliability. A review of the available literature including various publication from our study group is presented. **Results:** SWV proved to be beneficial in the diagnosis of Sjögren's syndrome, mainly early presentations of this disease. There is first evidence, that SWV might be suitable for the monitoring of local-therapeutic measures, e.g. in Sjögren's syndrome but also irradiated salivary glands. Sonoelastographic modalities are not able to provide reliable information in respect of the entity and dignity of salivary gland tumors and should therefore not be applied as single imaging modality. Our study group developed indications for the application of sonoelastography within the setting of a multimodal sonographic pathway. The reproducibility of SWV in the submandibular gland proved to be limited, in the parotid gland SWV should be performed by experienced examiners. **Conclusion:** Sonoelastographic modalities for the evaluation of tumors of the salivary glands should only be applied within the framework of multimodal sonographic pathways. There is increasing evidence that SWV is beneficial in the evaluation of general salivary gland diseases, mainly in patients with Sjögren's syndrome.

PS7-08

### Doppler based algorithm for detection of blood flow restriction in vertebral artery

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**Purpose:** Arterial diameter and flow velocity are manipulated variables of flow volume and local blood pressure drop. The total pressure drop in right vertebral artery (VA) equals left. Based on here we propose an algorithm for detection of flow restriction in VA by standard extracranial vascular sonography of V2. **Material and method:** The blood pressure drop in VA in the quasi-stable laminar enddiastolic flow phase results from the sum of pressure drops  $dP$ , thus in sample volume of vascular sonography of V2. After Hagen-Poiseuille is valid  $dP = k \cdot v / d^2$ , whereby  $v$  represents maximum enddiastolic flow velocity,  $d$  diameter of VA measured in the color mode and  $k$  a factor. Dividing  $dP$  of right and left VA results in a ratio, which describes, around how enddiastolic pressure drop in sample volume of both VAs differs. This blood pressure drop ratio will be set in relation to the diameter ratio of VAs. The measured values by vascular sonography of V2 in 303 patients were arranged on the basis of CT- or MR-angiography and sonographic findings as moderate or severe flow restriction or normal. **Results:**

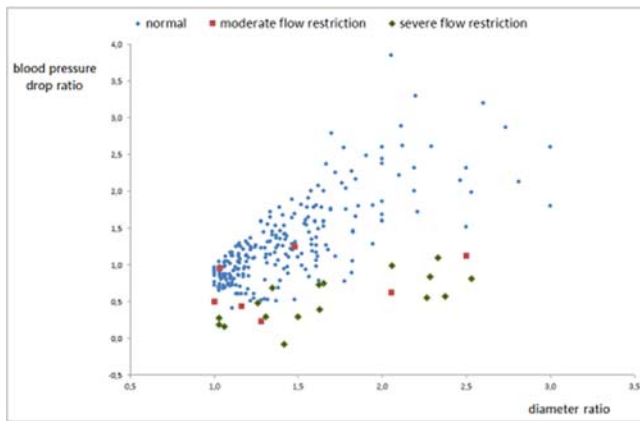


Fig. 1: Blood pressure drop ratio as a function of diameter ratio of VAs

Values of severe pathology show all over smaller blood pressure drop in the sample volume (pressure drop ratio is smaller in same diameter ratio) in comparison to normal. This deviation fails smaller for moderate pathology, but increases for both pathological groups with larger diameter ratio. **Conclusions:** The proposed algorithm illustrates reduction of pressure drop in V2 due to flow restriction in another location of VA and is recommended as screening parameter in standard extracranial vascular sonography. Particularly a reactively narrowed VA in pathological case can be distinguished from hypoplasia.

## PS7-09

### The influence of the hematocrit level in dogs and cats on the presentability and accuracy of the blood flow visualization

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**Purpose:** It is to be assumed, that beside the parameters like angulation, velocity and vessel size the appearance of the ultrasound image is also influenced by the number of reflectors. If this hypothesis is true, the diagnostic evaluation might be influenced in anemic patients. **Materials and methods:** The presentability and accuracy of the blood flow detection was analyzed on different flow phantoms also comparing CDI, PDI and B-Flow<sup>®</sup>. The influence of the hematocrit level on the presentability and accuracy of the blood flow visualization was examined under standardized conditions. The flow phantoms consists of a plastic box, containing a tissue mimicking agent made of gelatin, starch and water and a silicone blood vessel imitation with a diameter of either 1 mm, 2 mm or 5 mm. Porcine blood was pumped through the vessel imitations at three different hematocrit levels (10%, 30% and 60%) and four different velocities (0.4 m/s, 0.8 m/s, 1.2 m/s and 1.4 m/s). The visualization was performed with a fixed M12L matrix linear transducer and a Logiq 9 (General Electric). In order to evaluate the presentability of the vessels, a score system was created. The scores and the measured data were transferred into SPSS for Windows 11.5 and tested for normal distribution by Kolmogorov-Smirnov-test. Subsequently, the scores were checked for significance by Chi<sup>2</sup>-test and the acquired data were evaluated by Kruskal-Wallis-test or t-test, respectively. **Results:** Hematocrit had no significant influence on presentability and accuracy of all methods. **Conclusions:** Anemic or hypovolemic patients need no other settings than normovolemic patients to investigate the bloodflow.

## PS7-10

### Aorto-caval fistula mimicking severe liver disease – Problems and possibilities of EVAR in a ruptured aortic aneurysm -

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DOI: 10.1055/s-0036-1587896

**Purpose:** To show primary and secondary symptoms and diagnostic problems of a high flow aorto-caval fistula. **Material and methods:** A 60 year old male was admitted to hospital due to severe pulmonary hypertension (PH), cardiomegaly and liver cirrhosis with ascites. Cardiac output was elevated up to 12 l/min. CT and Color coded duplex sonography (CCDS) without and with contrast (CEUS) are compared with angiography. LFTs and elastography (Shear wave technique) were controlled over more than 6 months. **Results:** CT showed an infra-renal aneurysm of 8 × 9 cm with early filling by contrast misinterpreted as a sign of tricuspid insufficiency. CEUS showed a high flow aorta caval fistula proved by angiography. An aortic stent was implemented (Aorfix, Lombard Medical). First control measurements showed a reperfusion by A. mes. inferior and lumbar arteries. After three re-interventions with occlusion of feeding vessels and a coated stent in the IVC only a small leakage persisted with shrinking size of the aneurysm during follow-up. Ascites disappears immediately after fistula occlusion. Liver stiffness reduces after 3 month from more than 3 m/s to 1.5 m/s. **Conclusions:**

1. High volume fistula and severe right heart failure can mimic severe liver cirrhosis. Especially high pressure in the liver can cause false positive fibrosis measurements with Fibroscan<sup>®</sup> and ARFI technique.
2. EVAR in cases of persistent fistula showed a high rate of reperfusion. In this case 3 interventions were necessary and helpful for reducing the HZMV slowly.
3. In cases with severe hypertension a systematic search for fistula should be done.

## Interventional/Neurological and Pediatric Ultrasound – Clinical Investigations and Case Reports

## PS8-01

### Two cases of an acute arterial embolic occlusion following ultrasound guided thrombin injection of iatrogenic femoral artery pseudoaneurysm

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DOI: 10.1055/s-0036-1587897

**Purpose:** Here, were present 2 cases of iatrogenic femoral pseudoaneurysm following transfemoral aortic valve implantation (TAVI). Shortly after therapeutic thrombin injection postinterventional embolic occlusion of the femoral artery developed. **Material and methods:** A 86-year-old- and a 83-year-old male patient were admitted to our hospital because of severe aortic stenosis. TAVI (Edwards Sapien XT bioprosthesis, 26 mm) was carried out using a large femoral bore-catheter (18 french). Postinterventional B-mode-imaging and color duplex revealed a 3 × 2 cm p.a. near the outlet of the right V. femoralis, and one 2 × 1 cm on the left side in the second case. The neck was < 1 cm in both cases. Ultrasound-guided thrombin injection (Berioplast<sup>®</sup> P Combi-Set 1 ml) was executed. **Results:** Immediately after successful thrombin obliteration, a sufficient perfusion of the femoral artery was observed on duplex sonography. However, few hours later both patients developed a sudden onset of lower leg pain with sensor motor deficits. Acute embolic occlusion of the femoral artery confirmed by computertomographic angiography and duplex sonography. Emergency thrombectomy of the affected arteries was performed in both cases with successful reperfusion. Histopathology showed fresh thrombus material. **Conclusion:** Acute arterial embolic occlusion is a rare but serious complication of ultrasound guided

thrombin injection of p.a. TAVI is increasingly used in interventional cardiology and requires the use of large bore catheters (18 french). Our two reported cases are aimed to raise awareness of the increased risk of 1) development of p.a. in these patients, and 2) an increased risk for postinterventional embolic occlusions following therapeutic thrombin injections. Moreover, a short p.a. neck (<1 cm) can be considered as additional risk for embolic complications.

## PS8-02

## Microwave ablation – a 7-years review

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**Purpose:** We evaluated the effects of microwave ablation to malignancies. **Materials and methods:** A 7-years review of conducted microwave ablation at Department of Gastroenterology, Waldklinikum Gera, Germany. We evaluated microwave ablation in terms of success rate and complications. The results after microwave ablation (local recurrence or devitalized necrosis) were checked with contrast-enhanced ultrasound (CEUS) in specified intervals. **Results:** 59 microwave ablations of liver malignancies in 45 patients with curative intention were enrolled (5-times ablation in 2 patients, 3-times ablation in 1 patient, 2-times ablation in 3 patients because of local recurrences of the liver malignancies; 2-times ablation in 2 patients because of several liver malignancies). The histological examination of the previously conducted percutaneous liver biopsy showed 9 different entities (20 x HCC, 19 x CRC, 7 x breast cancer, 6 x cholangiocellular carcinoma, 3 x gastric carcinoma, once each RCC, ovarian cancer, ductal adenocarcinoma, urothelial carcinoma). One microwave ablation was accomplished at the kidney. The primary success rate (devitalized necrosis in CEUS) was 63%. The definitive success rate after several ablations was 80%. Major complications occurred in 5% (one skin necrosis, 2 hepatic abscesses) and the rate of minor complications was 7% (2 bleedings, one liver hematoma, one abdominal wall hematoma). **Conclusion:** Microwave ablation with the intention of a curative treatment is a effective and save alternative for patients with malignancies of various entities up to a size of 5 cm, especially when there is an increased risk in surgical resection. The success rate is high with a low rate of complications. The follow-up examination with CEUS is safe and radiation-free and does not interfere with renal or thyroid function.

## PS8-03

## Complication rates of ultrasound-guided liver biopsies in dogs and cats

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DOI: 10.1055/s-0036-1587899

**Purpose:** The interpretation of ultrasound detectable liver changes is very difficult. The diagnosis can be made after examination of a liver specimen which could be taken by ultrasound guidance. There are some known complications associated with ultrasound-guided biopsies. The most common complication after sampling is bleeding which could lead to death. The aim of the study is to prove the correlation of observable ascites and changes in coagulation parameters. **Materials and methods:** Retrospective study. The database of the Department of Small Animals of the Veterinary faculty of the University Leipzig was searched for patients with ultrasound-guided liver biopsies. Included patients must have the findings of the ultrasound examination and at least the coagulation parameter thromboplastin time (TPT) or the combination activated partial thromboplastin time (aPTT) and prothrombin time (PT). **Results:** The data of 104 patients met the inclusion criteria. There were 90 dogs (37 male, 12 male neutered, 21 female, 20 female neutered) and 14 cats (3 male, 5 male neutered, 3 female, 3 female neutered). After the ultrasound-guided biopsy there were 20 of the 90 dogs with free abdominal fluid of whom ten patients showed an altered coagulation. One dog with coagulation changes and ascites past puncture died. In the cat group nine patients were present with free abdominal fluid after sample taking. Three of them showed alteration of coagulation parameters. There was one cat that died from a cardiopulmonary arrest. Both patients with complications had a mean hematocrit. **Conclusions:** There is no obvious correlation between blood changes and complication rates after an ultrasound-guided liver biopsy.

## PS8-04

## Importance of preoperative ultrasound diagnosis of peripheral nerve tumors

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DOI: 10.1055/s-0036-1587900

**Purpose:** A significant proportion of soft tissue tumors are peripheral nerve tumors. So far, it is difficult to make a diagnosis preoperatively. In recent years Neurosonography becomes increasingly important. The aim of the study is to work out morphological characteristics of peripheral nerve tumors in B-mode sonography, Superb Microvascular Imaging (SMI) and contrast enhanced ultrasound (CEUS) and to compare the results with histopathological findings. **Material and methods:** Within a prospective observational study a total of 11 cases with peripheral nerve tumors (54.5% women) were examined by B-mode, SMI, and CEUS. **Results:** Postoperative histopathology yielded 8 schwannomas (72.7%), 2 neurofibromas (18.2%) and one (9.1%) malignant peripheral nerve sheath tumor (NST). In B-mode, all examined tumors showed hypoechoic patterns. Often the incoming and outgoing nerve of a schwannoma can be depicted. Using conventional Doppler method moderate vascularization could be detected in 7 of 10 benign nerve sheath tumors (70%). However, no vascularization was detectable in the malignant peripheral NST. SMI showed vascularization in 10 of 11 nerve sheath tumors, a differentiation between benign and malignant tumor was not possible. By use of CEUS the nerve sheath tumor and the neurofibromas showed a slightly faster contrast-enhancement than the schwannomas. Altogether within 8 tumors vascularization could be detected. In the malignant peripheral NST a cystic area was detected by means of CEUS. 4 of 8 schwannomas showed a chaotic, early arterial, iris-like contrast uptake; 3 schwannomas revealed no contrast uptake. **Conclusion:** Peripheral nerve tumors can be depicted well by means of ultrasound and appear predominantly hypoechoic in B-mode. The highly sensitive Doppler method seems to be suitable for the characterization of peripheral nerve sheath tumors. CEUS exhibits to be very heterogeneous in those tumors. Studies with larger numbers of cases are needed to further evaluate the value of those sonographic methods in this context.

## PS8-05

## Longitudinal gliding of the median nerve in the carpal tunnel: anatomical study and evaluation of mobilization exercises

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DOI: 10.1055/s-0036-1587901

**Purpose:** Nerve gliding exercises are a promising new conservative therapeutic approach to carpal tunnel syndrome. These exercises should improve the gliding of the median nerve, thus reduce mechanical stress on the nerve. Unfortunately they lack strong evidence for efficacy. The aim of this study is to evaluate median nerve gliding excursions during these gliding exercises in the carpal tunnel. **Material & Methods:** In 2 stages a total of 18 arm from 18 fresh, non-embalmed, whole-body cadavers with a mean age of 82.3 years were examined. Under ultrasound guidance pieces of steel wire were implanted at 3 sites (within the carpal tunnel, proximal to the carpal tunnel, and between the heads of the pronator teres muscle). These pieces of wire were inserted longitudinally inside the median nerve using a spinal needle. Slightly larger pieces were placed into the periosteum of the adjacent bone. During the exercises gliding of the nerve markers were visualized with ultrasound. The extent of gliding was measured. After conventional exercises we also evaluated a new set of exercises. **Results:** During conventional exercises we found gliding of the median nerve of around 6–12 mm at the forearm measurement sites, but close to no gliding in the carpal tunnel. During the novel exercises, which include the adduction and abduction of the fingers, we could evoke a substantial nerve gliding in the carpal tunnel of around 13.8 mm. **Conclusion:** Conventional nerve gliding exercises lead to nearly no gliding of the median nerve in the carpal tunnel and significant gliding in the forearm. Our new exercises led to substantial gliding in the carpal tunnel to the same extent as in the forearm.



## PS8-06

**Acute peroneal nerve injury after lateral ligamentous reconstruction**Schwarzkopf P<sup>1</sup>, Boeckler D<sup>2</sup>, Goldammer A<sup>3</sup>, Trantakis C<sup>3</sup>, Pracht K<sup>1</sup><sup>1</sup>Sana Klinikum Borna, Department for Anaesthesia, Intensive Care Medicine, Pain Therapy and Palliative Medicine, Borna, Germany; <sup>2</sup>Sana Klinikum Borna, Department for Neurology, Borna, Germany; <sup>3</sup>Sana Klinikum Borna, Department for Head and Spinal Microsurgery, Borna, Germany

DOI: 10.1055/s-0036-1587902

A 24 year old woman with a history of anterior cruciate and lateral ligament rupture of the right knee was referred to our hospital because of acute peroneal nerve injury with foot drop and toe lifter palsy on the right side after reconstruction surgery of both ligaments in an external hospital. Our neurosurgeon referred her to our neurosonographical consultation. Electromyography (EMG) and neurosonography of common peroneal nerve (CPN) were performed. A complete foot lifter paralysis and an incomplete deficiency of sensory components of superficial peroneal nerve were seen. EMG of the anterior tibial muscle suggested complete denervation. It showed massive pathological spontaneous and no volitional activity. During neurosonography of the CPN a hypoechogenic structure was seen perforating and compressing CPN at the site of fibular head (picture 1 – B: yellow arrow pointing at CPN, C: black arrow pointing at perforating structure) We strongly recommended an operative exploration of the CPN at the fibular head. During surgery which was done both by a neurosurgeon (AG) and an orthopedic surgeon it became obvious that the tendon graft of the lateral ligament perforated the CPN at the fibular head (picture 1 – A: black arrow pointing at perforating structure, yellow loops around CPN, tweezers holding CPN). The loosened tendon graft was cut and pulled under the CPN and reinserted again. The continuity of the CPN was macroscopically and electromyographically preserved – so no transplantation had to be done. Three months after the operation the foot lifting power reached muscle strength grade (M) 4. Paresis of the toe lifter remained low, M 1–2, so physiotherapy was still needed.

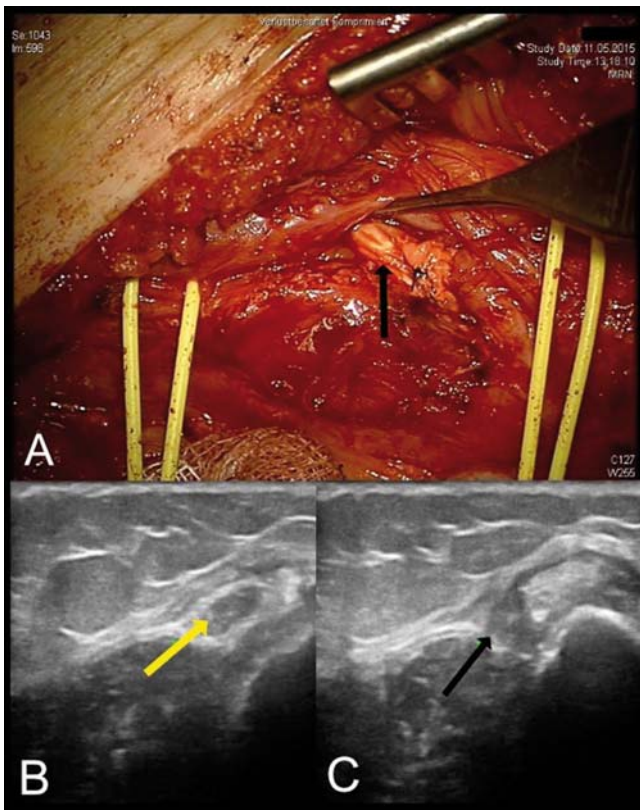


Fig. 1

## PS8-07

**Ultrasound elastography – A pilot study to examine muscle stiffness**Wenz H<sup>1</sup>, Dieckmann A<sup>2</sup>, Simon A<sup>1</sup>, Brandl U<sup>2</sup>, Renz DM<sup>1</sup>, Mentzel HJ<sup>1</sup><sup>1</sup>University Hospital Jena, Section of Pediatric Radiology, Department of Radiology, Jena, Germany; <sup>2</sup>University Hospital Jena, Pediatric Neurology, Jena, Germany

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**Purpose:** As an innovative, noninvasive technique ultrasound elastography allows to assess the elasticity of tissue. The aim of this study was to evaluate strain elastography as a reliable method in different groups of muscles; determination of muscle elasticity in young adults at rest and after exercise and to compare the results with data of children. Subsequently, the elasticity of muscles in children with cerebral palsy will be examined before and after the treatment with botulinum toxin A. **Material and methods:** Elastography of the M. biceps brachii, quadriceps femoris, and gastrocnemius lateralis was obtained at rest and after standardized exercises in 11 female and 11 male healthy young adults (Ages 20–30 years) by using the iU 22 ultrasound device (Philips) with a linear transducer (L 12–5 MHz). Anamnestic data were collected by using standardized questionnaires. **Results:** By analysing a five-point colour scale post exercise muscle elasticity increased significantly only in the M. biceps brachii ( $p < 0.05$ ). The deformation ratio of fatty and muscle tissue showed a significant difference in the M. biceps brachii and the M. quadriceps femoris ( $p < 0.05$ ) after standardized exercises. There were no significant gender-, age- and BMI-related differences in postexercise muscle elasticity. **Conclusion:** In this pilot study strain elastography was able to show differences in muscle elasticity between rest and after activity. In a next step children with cerebral palsy will be evaluate before and after the injection of botulinum toxin A. It is to be expected that the elasticity in the muscles will increase after the injection.

## PS8-08

**Sonographic diagnostics of ventricular cysts in children with recurrent neurological symptoms**Lemmer A<sup>1</sup><sup>1</sup>Helios Klinikum, Klinik für Kinder und Jugendmedizin, Erfurt, Germany

DOI: 10.1055/s-0036-1587904

**Purpose:** To assess the diagnostic value of cranial ultrasound examination in children with neurological symptoms as vertigo and clouding of consciousness. **Method:** Over a time period of 10 years 420 patients were sent to our sonography unit with symptoms of vertigo or clouding of consciousness. All included patients were younger than 18 years and received sonography of the CNS. If possible, sonography was performed transfontanelar, in older patients transcranial. **Results:** Intraventricular cystic lesions with visible potent obstruction of CSF circulation was found in 6 of 420 patients. Most findings – associated with neurological symptoms – were cysts of the choroid plexus within the third ventricle. The age of the patients ranged from 3 months to 12 years. **Conclusion:** A sonography screening of the CNS is useful in neurological incident sucklings and children. In a part of these patients it is possible to identify cystic lesions of the CNS causing recurrent obstruction of CSF circulation followed by an increasing intracranial pressure.

**Prenatal Ultrasound – Clinical Investigations and Case Reports**

## PS9-01

**OEIS complex – associated malformations in 12 new cases**Mallmann MR<sup>1</sup>, Reutter H<sup>2,3</sup>, Müller AM<sup>4</sup>, Geipel A<sup>1</sup>, Berg C<sup>1</sup>, Gembruch U<sup>1</sup><sup>1</sup>University of Bonn, Department of Obstetrics and Prenatal Medicine, Bonn, Germany; <sup>2</sup>University of Bonn, Department of Neonatology and Pediatric Intensive Care, Bonn, Germany; <sup>3</sup>University of Bonn, Institute of Human Genetics, Bonn, Germany; <sup>4</sup>University of Bonn, Center of Pediatric Pathology and Pathology, MVZ Venusberg, Bonn, Germany

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**Purpose:** The OEIS (omphalocele, exstrophy, imperforate anus, and spinal defects) complex is a rare variant of the bladder exstrophy epispadias complex with in most cases unknown etiology. Due to the rarity of the disease no large series that describe the prenatal spectrum of disease or additional malformations exist. **Material and methods:** In this study we present the prenatal findings in a series of 12 cases from 2004 to

2013. **Results:** All fetuses showed exstrophy of the bladder, 9/12 an omphalocele, 9/12 anal atresia, 10/12 showed neural tube defects, 4/12 vertebral defects, 5/12 lower extremity defects including clubfoot and 4/12 a single uterine artery. Additional malformations included hydrocephalus, hypertelorism, aplasia of the gall bladder, heart defects and kidney malformations. 11/11 fetuses showed a normal karyotype. **Conclusions:** These findings illustrate the spectrum of disease in prenatal diagnosis.

## PS9-02

### Impact of endocardial fibroelastosis of the left ventricle on right ventricular function in fetuses with hypoplastic left heart syndrome

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DOI: 10.1055/s-0036-1587906

**Purpose:** Postnatal outcome of fetuses with hypoplastic left heart syndrome (HLHS) is determined by right ventricular function (RVF). Our study examines, whether there are differences in RVF of HLHS fetuses with endocardial fibroelastosis of the left ventricle (LV EFE) without LV EFE and controls during gestation. **Material and methods:** A prospective study was conducted with 10 gestational age matched fetuses in each of the three groups. M-mode was used to assess displacement of the tricuspid annulus (TAPSE), the ejection fraction (EF) and the shortening fraction (SF). PW-Doppler and PW-TDI derived velocities were assessed. Among others the early wave to early diastolic annular relaxation velocity (E/E') ratio, the early diastolic annular relaxation velocity to late diastolic annular relaxation velocity (E'/A') ratio and the myocardial performance index (MPI') were calculated. Conventional fetal Doppler parameters, the umbilical and middle cerebral artery pulsatility index (UA-PI, MCA-PI) and the CPR (cerebroplacental ratio) were obtained to test for possible correlations to cardiac function indices. **Results:** HLHS fetuses with LV EFE revealed significantly lower peak S' velocities, lower peak A' velocities and higher values for EF and SF compared to those without LV EFE (p < 0.05). Furthermore they showed significantly higher values for peak E wave velocity, E/E' and both EF and SF compared to healthy controls. In HLHS w/o LV EFE but not in HLHS LV EFE fetuses, TAPSE increased significantly during gestation. In HLHS fetuses with LV EFE peak A' velocity was significantly negative correlated with UA-PI. HLHS fetuses w/o LV EFE showed significant positive correlations of TAPSE with CPR. **Conclusions:** Significant differences in RVF of HLHS fetuses with LV EFE, without LV EFE and healthy controls are present during gestation. These results might lend support to the notion of negative ventricular-ventricular interaction in case of HLHS with LV EFE possibly influencing surgical outcomes.

## PS9-03

### Combined tracheal and esophageal atresia with fatal outcome

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**Purpose:** Congenital tracheal atresia is a rare anomaly (1:50.000). The defect consists of partial or complete absence of the trachea below the larynx. The lower airway often is connected to the gastrointestinal tract via a distal tracheo- or bronchoesophageal fistula. **Material and meth-**

**ods:** This is a case report of an extremely rare combination of tracheal and esophageal atresia with fatal outcome. **Results:** A 32 years old woman (gravidity 2/parity 0) presented with suspected esophageal atresia in 32+0 weeks of gestation. Secondary diagnoses were gestational diabetes and hypertension. Ultrasound examination revealed polyhydramnios, absent stomach and amniotic sac prolapse. There were no further sonographic abnormalities. Antenatal corticosteroids were given and amniocentesis because of labour was necessary twice (32+2 and 33+4 gestational weeks). Preterm premature rupture of the membranes and labour occurred with 36+5 weeks of gestation. Emergency caesarean section for abnormal fetal blood analysis was conducted, and the newborn was resuscitated because of no audible cry and fetal bradycardia. Despite multiple attempts intubation and ventilation failed. So, resuscitation was stopped after 60 minutes. The autopsy revealed non-ventilated lungs and a combined tracheal and esophageal atresia. A tracheoesophageal fistula below the atresia was found. Therefore, CHAOS did not develop prenatally. There were no further malformations. **Conclusions:** Combined tracheal and esophageal atresia can be very difficult to detect prenatally which results in high risk for fatal outcome.

## PS9-04

### Influence of the frame rate (DICOM vs. acoustic frame rate) on strain analysis assessed by two-dimensional (2D) speckle tracking in fetal echocardiography

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**Purpose:** Frame rates (FR) used for strain analysis assessed by speckle tracking in fetal echocardiography show a huge variation. Due to higher heart rates compared to adults, much higher FR are requested in fetuses. The aim of this study was to investigate the influence of the FR on strain analysis in two-dimensional (2D) speckle tracking. **Material and methods:** A prospective cross-sectional study was performed. Based on an apical or basal four-chamber view of the fetal heart, cine loops were acquired on a Toshiba Aplio 500 system. Each loop was digitally stored twice: firstly as a DICOM (digital imaging and communications in medicine) file with a FR of 30 frames per second (fps), secondly with the original FR (acoustic FR = AFR). For each loop, fetal global longitudinal peak strain values of both, left (LV) and right ventricle (RV), were assessed by 2D Wall Motion tracking. Strain analysis was performed offline by two investigators. Interobserver variability was analysed. **Results:** A total of n = 11 healthy fetuses with an echocardiogram performed between 19 and 34 weeks of gestation were included. The AFR was 126 ± 16 fps. Relating to global longitudinal peak strain values of both ventricles, there was no significant difference between DICOM FR and AFR (LV: -18.22% (DICOM FR) vs. -17.77% (AFR), RV: -16.30% (DICOM FR) vs. -15.28% (AFR); p > 0.05). The interobserver variability showed a strong agreement with an Intraclass Correlation Coefficient (ICC) of > 0.8. **Conclusions:** The influence of the FR on global longitudinal peak strain values in 2D speckle tracking seems to be less important than expected. For strain analysis in fetal echocardiography FR of > 100 fps seem to be non-essential.

## PS9-05

### Diagnostic imaging in Linnaeus's two-toed sloth (*Choloepus didactylus*) – pregnancy diagnosis and fetometry

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**Purpose:** The knowledge of the reproductive physiology and biology of the two-toed sloth is fragmentary at best. So the data of the gestation period in the literature vary from 150 to 322 days. This study is intended to demonstrate the pregnancy diagnosis and the fetometry in the two-toed sloth with ultrasonography. **Material and methods:** The ultrasound investigations to visualize the genital system in this species can be performed transcutaneous or transrectal. Only the transcutaneous examinations can be performed without immobilization, if the animals are in



medical training. The transcutaneous pregnancy examination is executed with a transducer frequency from 6 to 10 MHz. In total 23 pregnancies (n = 10 animals) were sure diagnosed. The ultrasound investigations were also used to detect the fetal development (n = 8 animals). **Results:** The first indication of an existing pregnancy is the visualization of the gestational sac at the end of the first month of pregnancy. With the beginning of the second month of the gestation period, the embryo is detectable. In the same gestation month the cardiac activity can also be recognized. The crown-rump length of the fetus is only measurable in the third month. For the following months the fetal development is represented on the biparietal diameter (BPD) and the abdominal diameter (AD). **Conclusion:** The total gestation period in a two-toed sloth lasts 330 to 350 days. In a range from 294 to 316 days, the fetal development could be visualized with ultrasound (n = 7 animals). A shorter fetal development of 265 days was registered in one female.

## PS9-06

### 3D ultrasound evaluation of the fetal ear – comparison of an xMatrix probe with a conventional mechanical probe

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DOI: 10.1055/s-0036-1587910

**Purpose:** New 3D technologies like xMatrix probes promises superiority to conventional mechanical probes and may allow a more detailed and timesaving prenatal diagnosis. In a comparison study we evaluate the fetal ears. The aims of our study were to compare the following aspects of both techniques: (1) the ultrasound detail resolution, (2) the raw data acquisition time (AT) and (3) the influence of covariates. **Materials and methods:** 3D raw data volumes of the fetal ear were collected with the V6 – 2 (V6) and with the xMatrix (X6) probe and were stored after offline customization to a single picture. Two observers scored these images independently. Furthermore, the 3D raw data acquisition time (AT) was recorded. Concordance between observers, maternal age, body mass index (BMI), weeks of gestation and location of the placenta were evaluated. **Results:** Data volumes of 103 patients were analyzed. The X6 detected anatomic structures like the scapha (p = 0.0146), fossa triangularis (p = 0.0075) and cymba conchae (p = 0.0025) more often. Mean AT of the X6 was shorter compared to V6 (p < 0.0001). A placenta location in the scanning field increased AT only for the V6 (p < 0.01). Concordance between observers was higher for the X6 in most cases. Detailed structures were less visible at the end of pregnancy for both devices. **Conclusion:** The comparison study demonstrated clear advantages of the new xMatrix technology concerning an advanced and fast examination of detailed structures like the fetal ear. Further assessments of the fetal ears with recent 3D technology generate important additional information in prenatal diagnosis.

b)

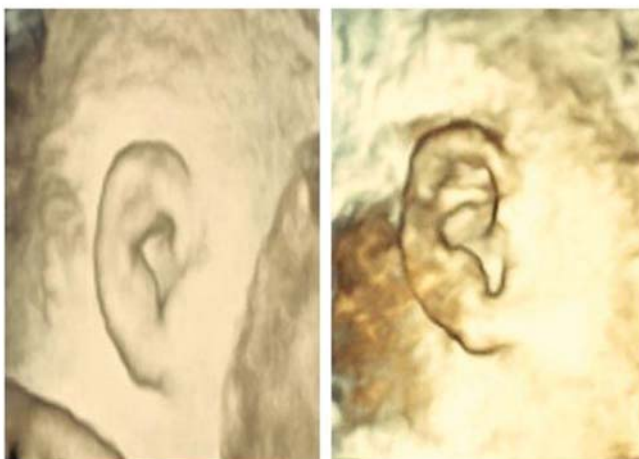


Fig. 1: 3D images of fetal ears: left V6, right X6

## PS9-07

### 5DCNS+ approach for (semi-)automized evaluation of fetal cranial structures – a step toward to improve detection of CNS anomalies?

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**Objective:** To scrutinize the performance and reliability of the 5DCNS+™ algorithm for standardized assessment of the fetal cranial structures in 2<sup>nd</sup> and 3<sup>rd</sup> trimester fetuses. **Methods:** In this prospective study we enrolled 440 uncomplicated singleton pregnancies undergoing targeted second and third trimester ultrasound examination at a tertiary referral center. All volume data sets were obtained with the fetus' head in an appropriate position (transverse plane, horizontal falx cerebri), absent or minimal fetal breathing/movement and satisfying image quality. After application of the 5DCNS+ software all images were scored and biometric measurements were compared with those obtained by standard 2D ultrasound assessment. **Results:** A total of 421 patients were eligible for final analysis. The mean gestational age (GA) was 18.4 weeks (ranging from 15.0 to 36.1 weeks). One to 3 separate volumes were obtained per patient (mean 1.1 exams). In >80% of all volumes ≥8 diagnostic planes were sufficiently visualized. The rate of inappropriately visualized planes (≤6) increased with advancing GA and was highest beyond 32 completed gestational weeks (complete exam including all 9 planes in 21% vs. 75.3% in 2<sup>nd</sup> trimester, p < 0.0001). There were no statistically significant differences between measurements derived from 5DCNS algorithm and those obtained from standard 2D approach. **Conclusion:** 5DCNS+™ technology facilitates reliable assessment of fetal CNS anatomy and might therefore aid early diagnosis of cranial anomalies particularly in early and advanced second trimester.

## PS9-08

### Prenatal second trimester ultrasound diagnosis of cloacal extrophy

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**Purpose:** Bladder extrophy is rare and affects 1:30.000 – 50.000 live births, more often boys than girls. Prenatal diagnosis shows normal amniotic fluid with no visible bladder, but normal kidneys. Cloacal extrophy occurs in 1: 200 000 – 250 000 live births. Affecting the pelvic embryogenesis it results in the persistence of a common cloaca receiving ureters, ileum and a rudimentary hindgut in association with a wide range of urogenital tract anomalies, spinal dysraphism and imperforate anus. **Case:** A 27-year old II Gravida II Para presented for second trimester screening. Until then, the pregnancy had been uneventful. The parents were not related. The first child is healthy, family history was unremarkable. Ultrasound detected an infra-umbilical anterior abdominal wall defect with the non-visualization of the fetal bladder, agenesis of the left kidney and a right single umbilical artery. The column spine appeared altered with a hypoplastic os sacrum. A "wavy cord-like segment of soft tissue protruding from the anterior abdominal wall" was detected strongly resembling the trunk of an elephant. After interdisciplinary counselling the parents decided to terminate the pregnancy. An autopsy of the abdominal wall defect was permitted confirming the prenatal ultrasound diagnosis showing an abdominal wall defect with no bladder and imperforate anus. There was no appendix, an ureteral opening into the abdominal wall and left sided kidney agenesis with a right single umbilical artery. There was no macroscopic discrimination between the terminal ileum and the Colon. The Raphe testis was partially existent and an intestinal loop opened out into this. An X-ray was not performed. **Conclusion:** This case shows the feasibility of the prenatal diagnosis for midline abdominal and pelvic defects during the second trimester and confirms the elephant trunk-like image as an ultrasound criteria for the diagnosis of CE, allowing adequate prenatal counselling.





Fig. 1: Elephant Trunk

## PS9-09

**Fetal vanishing gastrochisis and neonatal short bowel syndrome**Kreiselmaier P<sup>1</sup>, Krapp M<sup>1</sup><sup>1</sup>Amedes-experts Hamburg, Prenatal Medicine, Hamburg, Germany

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**Purpose:** We report a rare case of vanishing gastrochisis. With an incidence of 1:4000 Gastrochisis and Omphalocele are the most common congenital abdominal wall defects. Gastrochisis is defined by a paraumbilical defect of the abdominal wall with protrusion of mainly intestine fetal organs. **Material and methods:** A 27 year old gravida I was referred at 13+5 week of gestation (WOG) with suspected gastrochisis. Detailed sonography confirmed this finding and revealed no further abnormalities. The patient denied first trimester risk calculation, NIPT and an invasive procedure. During the next examination in 21+4 WOG gastrochisis was diminished. The abdominal wall defect was small and intraabdominal bowel was dilated. At 28+4 WOG the gastrochisis has vanished. The intradominal bowel was dilated. Additionally, a dilated stomach was visualized at 33+4 WOG. Primary cesarean section was performed at 37+4 WOG because of breech presentation. **Result:** A healthy newborn was delivered weighing 2940 g, APGAR 9/10/10 and umbilical artery pH 7.37. There was no abdominal wall defect, umbilical cord insertion was normal. Sonography revealed dilated small intestine and stomach with non-propulsive peristalsis. Explorative laparotomy revealed severe dilated small intestine commencing from the duodenojejunal flexure ending blindly after 30 cm. Cecum and appendix were missing. Colon ascends and transversum were atretic. An end to side anastomosis connected the rest of the small intestine with colon descendens. Because of the short bowel syndrome parenteral alimentation was necessary for six weeks. **Conclusion:** Vanishing gastrochisis with dilated intraabdominal bowel is a rare variation of gastrochisis. Antenatal counselling should address this as an severe complication with a worse outcome.

## PS9-10

**Response of severe IUGR human fetuses with brain sparing to amino acids supplementation via subcutaneously implanted port system with and without hyperbaric oxygenation**Tchirikov M<sup>1</sup>, Bapaeva G<sup>2</sup>, Entezami M<sup>3</sup><sup>1</sup>Martin-Luther-Universität Halle-Wittenberg, Clinic of Obstetrics and Prenatal Medicine, Center of Fetal Surgery, Halle, Germany; <sup>2</sup>Nazarbayev University, Obstetrics and Gynecology, Astana, Kazakhstan; <sup>3</sup>Center of Prenatal Diagnosis and Human Genetics, Berlin, Germany

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**Objective:** This study aims to treat severe placental insufficiency with amino acid and glucose intraumbilical supplementation via a port system and hyperbaric oxygenation (HBO). **Study design:** A prospective clinical study of 6 IUGR very preterm human fetuses with cerebroplacental ratio < 1 with long-term intraumbilical amino acid and glucose supplementation, using subcutaneously implanted port system (10% of fetoplacental blood volume/day, n = 6) and HBO (1.4 Bar, n = 1). **Results:** Fetal nutrition significantly reduced the pulsatility index in the umbilical artery after

first week from  $2.44 \pm 1.35$  to  $1.47 \pm 0.53$  and after two weeks in the non-placental uterine artery ( $1.7 \pm 0.56$  vs.  $0.97 \pm 0.47$ ) but did not affect Doppler profile of cerebral arteries and ductus venosus. The mean weight gain remained under the third percentile. However, the fetuses between 22 and 28 week of gestation did not have any sufficient benefit from infused commercial amino acids. The brain sparing to delivery interval could be prolonged to 24 [14; 33] days (median; range). The port system was successfully used in one case for fetal blood transfusion. The method was successfully improved by hyperbaric oxygenation without any adverse effects to the mother and her baby. **Conclusion:** The subcutaneously implanted perinatal port system can be used for a long-term intraumbilical administration of nutrients, blood and other medicine in humans. The intravascular treatment of growth restriction with fetal nutrition and HBO could prolong pregnancies with severe placental insufficiency and brain sparing for many weeks. The intraumbilical infusion seems to improve the placental blood perfusion. The commercial amino acid nutrition formulas cannot be safely recommended for the prenatal supplementation of extreme preterm IUGR fetuses because of lack of some amino acids combined with extreme deviations to this in similar fetuses under physiologic conditions.

## PS9-11

**Twin to twin transfusion syndrome – comparison between 1 mm and 2 mm optic laser coagulation**Bergner M<sup>1</sup>, Tchirikov M<sup>1</sup><sup>1</sup>Universitätsklinikum Halle, Geburtshilfe, Halle, Germany

DOI: 10.1055/s-0036-1587915

**Introduction:** Twin to twin Transfusion syndrome is one of the most severe complications in monochorionic twin pregnancies and can cause severe impairment of fetal and neonatal outcome. In severe TTTS the fetoscopic laser coagulation is the Treatment of choice. Fetoscopic laser coagulation is associated with a morbidity and mortality due to iatrogenic rupture of membranes as well as iatrogenic placenta insufficiency. An Adaptation of the fetoscopic Tools to reduce the lesions of the amniotic Membrane can decrease the risk of PROM and increase the overall survival. **Methods:** This is a retrospective Analysis of 176 cases of monochorionic twin pregnancies complicated by TTTS which underwent a fetoscopic laser coagulation in University clinic of Mainz and the University clinic of Halle. A Fetoscope with a 2 mm Optic was used in 84 cases, the new 1 mm Fiber Optic was used in 92 cases. **Results:** Long-time survival was higher in the 1 mm Group than in the control Group (90% vs. 80%). The survival of at least one twin was higher in 1 mm Group than in control Group (98% vs. 86%). The rate of intrauterine death (IUD) of both twins was lower in the pregnancies treated with 1 mm fiber optic than in the control Group (13% vs. 1%), IUD of one twin was more common in the 1 mm Group than in the 2 mm control. (18% vs. 13%). **Discussion:** By reducing the Diameter of the fetoscopic Tools, we are able to reduce the risks of complications in Treatment of TTTS complicated pregnancies and we were able to increase the Overall neonatal survival.

## PS9-12

**Different outcomes in two cases of Dural Sinus Malformation**Schneider U<sup>1</sup>, Fiedler A<sup>1</sup>, Lesser A<sup>2</sup>, Kasprian G<sup>3</sup>, Intek J<sup>4</sup>, Proquitte H<sup>4</sup>, Fröber R<sup>5</sup>, Romeike B<sup>6</sup>, Mentzel HJ<sup>7</sup><sup>1</sup>Klinik für Frauenheilkunde und Geburtshilfe, Universitätsklinikum Jena, Arbeitsbereich Pränatale Diagnostik und Fetale Physiologie, Jena, Germany; <sup>2</sup>St. Georg Klinikum Eisenach, Klinik für Frauenheilkunde und Geburtshilfe, Eisenach, Germany; <sup>3</sup>Medical University of Vienna, Department of Imaging and Image-Guided Therapy, Wien, Austria; <sup>4</sup>Klinik für Kinder und Jugendmedizin, Universitätsklinikum Jena, Sektion Neonatologie, Jena, Germany; <sup>5</sup>Institut für Anatomie I, Universitätsklinikum Jena, Jena, Germany; <sup>6</sup>Institut für Pathologie, Universitätsklinikum Jena, Sektion Neuropathologie, Jena, Germany; <sup>7</sup>Klinik für Kinder und Jugendmedizin, Universitätsklinikum Jena, Sektion Kinderradiologie, Jena, Germany

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Fetal Dural Sinus Malformation (DSM) is a rare condition with massive dilation of dural sinuses due to an arteriovenous shunt. It most frequently involves the confluence sinuum above the cerebellum in the posterior fossa [1,2]. Clinical courses range from intrauterine demise (IUD) to live birth with normal neurological outcome depending on associated factors like sufficient collateral venous drainage, absence of addi-

tional structural abnormalities, brain insult, infarction, ventricular hemorrhage and cardiac failure. We report on two consecutive cases of DSM. In case 1 the diagnosis was made on post mortem pathologic examination after IUD at 21 wksGA. Sonographically the abnormality was misclassified as a brain tumor. In case 2 a mass was spotted during routine scan at 26 wksGA and assessed by Level 2 ultrasound accompanied by fetal MRI and telemedical expert consultation. The posterior fossa mass with a size of  $4.5 \times 4.9 \times 6.5$  cm and signs of an intraluminal thrombus was associated with mild ventriculomegaly and downwards-shift of the cerebellum. Both the size of the lesion and secondary features decreased with ongoing pregnancy. Delivery was performed 37+1 wksGA by planned caesarian section. (APGAR 9/10/10). Neonatal intensive care was required for respiratory complications due to borderline preterm delivery. Postnatal cMRI confirmed the diagnosis of thrombosis in the sagittal posterior sinus decreasing in size in comparison to prenatal findings accompanied by hypoplastic transverse and sigmoid sinuses. Thrombosis of a DSM may lead to secondary intraventricular hemorrhage and hemorrhagic cerebral necrosis which had been the cause of IUD in case 1, where the Sinus confluens showed partial thrombosis. On the contrary, in the absence of severe complications DSM may lead to favorable perinatal outcome not even requiring neurosurgical or minimal-invasive radiologic intervention [3]. [1] Asai H, et al. J Neuroimaging 2014; 24: 603 – 606. [2] Barbosa M, Interventional Neuroradiology 2003;9:407 – 424. [3] Jagadeesan et al., J Neurosurg Pediatr 2015;16:74.

## PS9-13

### Prenatal diagnosis of gastroschisis. A Lagos prenatal diagnosis experience

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**Objectives:** Gastroschisis is a congenital malformation characterised by the herniation of intestinal contents through a full thickness paraumbilical abdominal wall defect. The diagnosis can be made as early as first trimester and fast often in the second trimester by fetal ultrasound, to retrospectively analyze cases of gastroschisis diagnosed in the centre in years. 1992 to 2015, the prenatal diagnosis is important because of rapid and appropriate treatment both during and after pregnancy. **Setting:** Prenatal Diagnosis And Therapy Centre of a tertiary hospital in Lagos/Nigeria. **Material and methods:** We analysed 29 cases of fetal gastroschisis diagnosed in Prenatal Diagnosis and Therapy Centre, College of Medicine, University Of Lagos, Lagos/Nigeria between 1992 and 2015. **Results:** The age group less than 30 years were more involved in 11 and in 19 cases there were no complications observed during pregnancy. **Conclusion:** Early diagnosis is necessary as it allows monitoring for potential complication of gastroschisis and for prompt decision of elective preterm delivery at referral centre with the possibility of preparing neonatal and pediatric surgical team. **Keywords:** prenatal diagnosis, gastroschisis, congenital malformation

## PS9-14

### Study on augmented reality 4-D ultrasound in prenatal medicine

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**Purpose:** The aim of the preclinical test was to evaluate an augmented reality (AR) based 4-D ultrasound system regarding its acceptance by pregnant women in prenatal medicine. **Material and methods:** The used hardware consists of a clinical ultrasound device ( Esaote MyLab70 XVG; 4-D curved array transducer) and a tablet PC (Toshiba AT300SE) with an integrated camera device. The ultrasound device collects ultrasound volumes continuously using the 4-D transducer and renders them on a standard monitor screen. Furthermore the ultrasound device acts as an image server that holds the render results available for the tablet PC (client). The tablet PC collects these results via WLAN. The integrated camera enables to track an optical marker fixed to the transducer. Finally the tablet PC displays the rendered (virtual) ultrasound volumes as a 2-D texture under the (real) ultrasound transducer. Nine women in different states of pregnancy (12<sup>th</sup>-37<sup>th</sup> week) were scanned transcutaneously in supine position with the ultrasound device. During this examination they were able to watch the ultrasound volumes on a standard monitor screen. Afterwards they used the tablet PC and watched the rendered

ultrasound volumes directly “inside” their abdomen (see figure 1). Finally they rated their acceptance of both visualization techniques on a scale 1 (poor) to 10 (very good).



Fig. 1: AR ultrasound

**Results:** On average the women granted eight points on acceptance of the conventional visualization and ten points on the AR system. They were willing to pay (on average) 80 Euros with a spread from 40 to 150 Euros. **Conclusions:** The preclinical test shows that the AR based 4-D ultrasound system can be used in prenatal medicine. All participants were willing to pay for such an individual health service. However the visualization needs to be upgraded to 3-D textures instead of 2-D textures to improve the optical impression.

### Elastography and Ultrasound II – Clinical Investigations and Case Reports

## P1-09

### 58-year old patient with atypical peritoneal manifestation of diffuse amyloid deposition: presentation of systemic Amyloid Light-chain (AL) amyloidosis in B-mode imaging and contrast-enhanced ultrasound (CEUS)

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**Purpose:** Here, we present a case of with atypical peritoneal manifestation of diffuse amyloid deposition in B-mode-imaging and contrast-enhanced ultrasound (CEUS). **Material and methods:** A 58-year-old patient in poor general condition presented for tumor search with an increased waist circumference, dysphagia, dyspnea and weight loss. B-mode ultrasound presented interenteric throughout the mesentery and retroperitoneum an echogenic material surrounding the intestines, which impressed soft upon compression and was thus primarily interpreted as echogenic ascites. Additionally pleural effusions on both sides, as well as pericardial effusion were observed. In contrast-enhanced ultrasound (CEUS) the interenteric material presented with a homogeneous enhancement. **Result:** For tumor staging a sonographically guided biopsy of inter-enteric material was performed. After positive Congo red staining, histological examination of the material showed the findings of systemic Amyloid Light-chain (AL) amyloidosis. The bone marrow biopsy revealed the diagnosis of a multiple myeloma type IgG kappa. **Conclusion:** This case describes the diagnosis of multiple myeloma with cardiac,

gastral, pulmonary and renal involvement of AL amyloidosis, as well as an atypical peritoneal, interenteric and retroperitoneal tumor manifestation of the disease. This peritoneal involvement of AL amyloidosis can be diagnosed using CEUS to establish hyperechoic solid lesions.

## P1-10

### FNH in men – an important differential diagnoses in metastatic diseases

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**Purpose:** Liver FNH (focal nodular hyperplasia) are much rarer in males than in females. In case of a malignant disease they can be misjudged as a liver metastasis, especially if not previously documented. **Material and methods:** During routine abdominal ultrasound we detected hypoechoic liver lesions of 14–18 mm in three men: one 47 year old with a large renal cell carcinoma, one 56 year old with a bronchial neoplasm and one 71 year old patient who was diagnosed with 4 malignant melanomas in the abdominal region one year later. Colour Doppler ultrasound, CEUS and abdominal MRI were performed in all three patients. **Results:** Colour Doppler Ultrasound and CEUS showed the typical characteristics of a FNH. Abdominal MRI confirmed the diagnoses in two cases, the third one was suspected to be a melanoma metastasis by the radiologist. A later performed surgical excision proved the lesion to be a FNH as well. **Conclusion:** The occurrence of FNH in men is much lower than in women. In a large study population of the Berlin-Charité of 292 patients with FNH only 8% were male. The influence of estrogens in growth of these lesions seems highly probable. We found three men between 47 and 71 years during routine ultrasound, who had an accompanying malignant disease. A correlation of FNH with malignant diseases is not described in the literature. Knowing the liver lesion being a FNH may have critical impact on therapeutic decisions.

## P1-11

### Ultrasound aspects in acute pancreatitis

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Acute pancreatitis is a pathology with an unpredictable evolution that can lead to serious complications with extremely fast dynamics. The aim of this paper is to evaluate the role of abdominal ultrasound in the diagnosis and monitoring of acute pancreatitis, but also in highlighting some ultrasound changes suggestive for moderate or severe forms of acute pancreatitis. **Material and method:** We performed a retrospective study in which were enrolled 343 patients with acute pancreatitis (56.2% men and 43.8% women), mean age  $56.7 \pm 17.9$ , admitted between January 2014 – December 2015. We followed: the etiology of acute pancreatitis and the role of ultrasound in the diagnosis of biliary pancreatitis, ultrasound changes over the evolution of the disease: ascites, hyperechoic omental bursa, peripancreatic fluid, areas of pancreatic necrosis and also the clinical condition of the patient. **Results:** 58% of cases presented biliary etiology – suggestive ultrasound changes: gallstones, obstructive jaundice, followed by ethanolic etiology (15.8%) and acute pancreatitis due to hypertriglyceridemia (6.4%). Other causes (~20%) were post-ERCP acute pancreatitis, non-A non-B, pancreas divisum etc. Trans-abdominal ultrasound detected changes in 94 patients (27.5%): ascites, hyperechoic omental bursa, peripancreatic fluid, areas of pancreatic necrosis. In all other cases (72.5%), pancreas had normal ultrasound appearance or could not be evaluated by ultrasound. Of the 94 cases with ultrasound changes, 12 (12.7%) progressed to severe forms of acute pancreatitis with development of organ failure. **Conclusions:** In our study, the most common etiology of acute pancreatitis was biliary followed by alcohol consumption. Ultrasonographic changes in acute pancreatitis (ascites, hyperechoic omental bursa, peripancreatic fluid, areas of pancreatic necrosis) were present in 27.5% of cases. Evaluation of the pancreas in acute pancreatitis can be difficult (in 41% of cases, the pancreas was not visible in ultrasound) due to associated conditions (meteorism, poor visualization of the pancreas, abdominal pain).

## P1-12

### Ultrasonographic accuracy in detecting intestinal foreign body's in dogs and cats

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**Purpose:** Vomiting after the suspected intake of foreign body's or foreign material is a common reason for veterinary consultation. The foreign material can lead to intestinal obstruction and is an indication for immediate surgical removal. For diagnosing an ileus abdominal radiographs are taken routinely. The purpose of the study was to define ultrasonographic accuracy in detecting these intestinal obstructions due to a foreign body. **Materials and methods:** Dogs and cats underwent ultrasonographic examination of the entire abdominal cavity by two experienced radiologists when an ileus was suspected. The examiners had no further information about the history or clinical status of the patients. After the ultrasound the two examiners had to take the decision if the patients should be treated conservatively or with surgery. The animals without surgery received a clinical follow up, ultrasound and subsequent owner communication. **Results:** 81 patients, 24 cats and 52 dogs (16 intact males, 26 neutered males, 18 intact females and 21 neutered females) were included in the study. Radiologist number one examined 25 animals and radiologist number two 56. 8 patients were excluded from the study because of unsure follow up results. 73 animals were finally included. 21 of them were cats and 47 dogs 18 of these animals were diagnosed with obstructive ileus and sent to surgery. In 17 of these 18 the ileus was confirmed and in one only enteritis was found. Of the remaining 56, four underwent surgery for other reasons and no ileus was identified. For the rest of the patients the ileus was excluded due to clinical follow up, ultrasound and subsequent owner communication. **Conclusions:** Ultrasound is a valuable and safe method for detecting obstructive intestinal foreign bodies. In both dogs and cats no ileus was missed. In only one patient the misdiagnose ileus was made.

## P1-13

### Evolving cystic lesions

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**Purpose:** This didactic exhibits aims to:

- Showcase different cases of cystic lesions that turn out to be malignant.
- Highlight the importance of utilising different functions/knobs in ultrasound to classify pathologies.

Highlight the importance of close monitoring and proper documentation of 'benign-looking' lesions. **Materials and methods:** Despite the availability of CT and MRI, ultrasound being non-ionising and relatively cheap, is an important tool in primary screening and surveillance. There is a broad spectrum of sonographic appearances of lesions, regardless of benignity or malignancy. Therefore, the operators' skills in detecting various lesions by optimising the different functions/knobs available on the ultrasound machine help to sieve out the possible entities for the differential diagnosis. This competency in ultrasound will allow for timely management and treatment. Several ultrasound cases with notable discrepancy are reviewed retrospectively, with the intentions to identify the areas to be improved. The grey scale appearances and presence of vascularity were evaluated, and correlated with available CT, MRI and operation reports. **Results:** This pictorial review demonstrates the possible optimisation of sonographers' techniques in image acquisition when detecting lesions. Possible strategies for improvement are demonstrated to increase diagnostic value in ultrasound imaging. **Conclusions:** The ability to optimise the different functions/knobs available on an ultrasound machine serves as an advantage in identifying various lesions and eventually classifying them further allowing for timely management and treatment.

## P1-14

### Sonographic examination of the multicentric lymphoma in dogs

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**Purpose:** The diagnosis and staging of multicentric lymphoma include sonographic examination of the abdomen. Routinely the spleen, liver and



abdominal lymph nodes are assessed. The aim of the present study was to evaluate whether the diagnosis “multicentric lymphoma” could be confirmed most likely on the basis of specific sonographic changes. **Materials and methods:** Retrospective analysis of data from 76 patients with multicentric lymphoma for which ultrasonographic images were available. Inclusion criteria were cytological or histological diagnosis of the multicentric lymphoma. Exclusion criterion was administration of cytostatic agents prior to diagnosis. **Results:** In all dogs with multicentric lymphoma the abdominal lymph nodes were massively rounded and enlarged. The nodal parenchyma of 73% of the 76 patients presented as hypoechoic. A moth-eaten pattern of the splenic parenchyma was diagnosed in 62 dogs. Only two patients displayed a physiological spleen. In 23 dogs the gallbladder was altered within the meaning of cholecystitis. The sonography revealed in 26 dogs hepatic parenchymatous changes. **Conclusions:** Sonographic changes of the spleen and abdominal lymph nodes are often diagnosed in dogs with multicentric lymphoma. Splenic moth-eaten pattern and enlarged, rounded and hypoechoic abdominal lymph nodes are combined an indicative parameter of malignancy. In contrast an abnormal appearance of the liver is no evidence that lymphoma is existing.

### Contrast-Enhanced Ultrasound – Clinical Investigations and Case Reports

P2-10

#### Value of contrast enhanced ultrasound in evaluation of small hepatomas: a case series review

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**Purpose:** Contrast enhanced ultrasound (CEUS) is currently well recognised as an imaging modality for evaluation of hepatic lesions. There are various published guidelines which have recognised its use as a definitive diagnostic tool for hepatocellular carcinoma (HCC) in high risk patients. However, this opinion may not be universally accepted. While we do not routinely use CEUS as a first line modality in high risk patients, we had observed and recognised its value as a problem solving tool; particularly for small sonographically detected lesions which measures less than 20 mm. **Methodology:** We reviewed 7 CEUS liver cases which were performed in our institution. These were patients who had hepatitis B or C cirrhosis. All subjects had a single ultrasound detected liver lesion which measured less than 20 mm on its longest axis. Initial contrast enhanced CT and/or MRI evaluation were inconclusive or not definitely conclusive of a hepatoma. These cases were referred for further evaluation with CEUS. **Results:** Six of the cases demonstrated arterial hyper enhancement and porto-venous washout on CEUS, which was specific for the diagnosis of HCC. The last case did not demonstrate arterial hyper-enhancement but showed definite late phase washout and was labelled as a suspected “hypovascular” hepatoma. Two cases, including the “hypovascular” lesion were resected and had histology evidence of HCC. Four cases which were treated by radio frequency ablation were de-novo lesions not seen in previous surveillance studies. The last case refused treatment, had disease progression and eventually developed multi-focal HCC. **Conclusion:** CEUS has demonstrated value in the diagnose of small HCCs. It serves as a troubleshooting tool, particularly when initial CT or MRI evaluation of small ultrasound detected lesions are non-confirmatory or inconclusive. High temporal resolution of real-time ultrasound imaging and use of blood pool contrast agents are key contributory factors.

P2-11

#### (Interesting case) multiple abscesses of liver and spleen by rheumatoid arthritis man taking Methotrexat

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A 52-year-old patient with a fever for a day. Patient has known, pvd, rheumatoid arthritis since 8 years and taking MTX (Methotrexat). Sonographic examination show multiple echo poor liver lesions. In the SonVue – Sonography show the lesions peripheral Enhancement. The CT also multiple liver/spleen lesions with peripheral enhancement. Improvement of symptoms after pause of MTX and administration of antibiotic. **Result:** Sepsis with detection of *Fusobacterium necrophorum* in blood

culture with multiple abscesses in the liver and spleen. cause of odontogen.

P2-12

#### Strain analysis in patients with Barlow's disease

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The aim of the present study was to detect characteristic patterns of longitudinal strain curves in patients with Barlow's disease. Standardised transthoracic echocardiography was performed in patients with Barlow's disease (group I; n=20) and in patients with mitral regurgitation due to Carpentier's classification type I (group II; n=20). Strain analysis by 2D speckle tracking was performed in all patients of both cohorts to obtain regional strain curve patterns and for determination of longitudinal strain values. The strain curves were compared to each other with respect to the segment which corresponds to the affected scallop of the mitral valve. The severity of mitral regurgitation was estimated by proximal isovelocity surface area, vena contracta and left ventricular systolic function. In 18 of 20 patients (90%) with Barlow's disease the segmental strain curve of the affected scallop shows a characteristic positive peak ( $3.92 \pm 1.79$ ) at the beginning of the systole (Fig.1). However, reduced strain values in these segments were not necessarily determined. The most affected scallop was the P2-scallop. Thus, the characteristic positive peak could be seen most often in the posterior segment of the left ventricle (Fig. 1). In group II a minor positive peak was only present in 2 of 20 patients (10%). In contrast to patients with Barlow's disease ( $-21.39 \pm 4.12$ ) global peak systolic strain was reduced in these patients ( $-13.48 \pm 6.15$ ). In patients with Barlow's disease the positive peak at the beginning of the systole can be defined as a characteristic echocardiographic sign. This has to be distinguished from positive peaks due to hypokinesia or dyskinesia. Artifact tracking in the far field in the region of the mitral valve annulus can also produce similar strain curves. Thus, accurate tracking of the myocardium using standardized views is the prerequisite for a correct analysis.

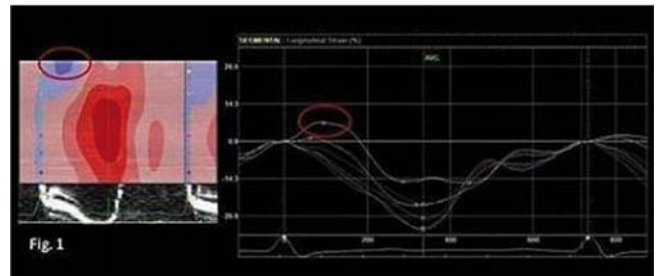


Fig. 1: Typical longitudinal strain pattern

P2-13

#### Contrast enhanced ultrasound of the spleen in pediatric patients

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**Purpose:** Retrospective analysis of the diagnostic accuracy and safety of contrast enhanced ultrasound (CEUS) in children. **Material and methods:** Retrospective analysis of the diagnostic findings of CEUS in 9 pediatric patients. After written informed consent all patients underwent CEUS with a high-end ultrasound machine using sulfur hexafluoride microbubbles (Sonovue<sup>®</sup>) and a multi-frequency probe (1–5 MHz, 6–9 MHz). **Results:** 9 patients (median age 12.4 years, min. 5.1 years, max. 16.2 years; male n=4) underwent CEUS for the following reasons: demonstration of the perfusion of the spleen after partial embolization (n=3) and after trauma (n=1) and characterization of focal lesions (n=5): one lesion was considered to malignant (histopathologic diagnosis hodgkin lymphoma), the remaining 4 were characterized as benign ((hem)angioma n=3, cyst n=1). No complications or side effects were observed. **Conclusions:** We could demonstrate that CEUS is safe and accurate for the examination of the spleen in pediatric patients.

## P2-14

### Correlation of the E/E'-ratio to NT-BNP: echocardiographic subanalysis of the LIFE-Adult-Study

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The E/E'-ratio is used as a surrogate parameter for the estimation of the left ventricular enddiastolic pressure. It is assumed that chronic systolic and diastolic heart failure is associated with E/E'-values of more than 15 or at least with intermediate values between 9–5. The aim of the present retrospective analysis of the epidemiological echocardiographic cohort of the LIFE-Adult study (Leipzig Research Centre for Civilization Diseases) was to evaluate the correlation of NT-BNP (N-terminales propeptid BNP) values to the E/E'-ratio by the assessment of left ventricular diastolic function in this cohort. In 773 participants (pts) standardised transthoracic echocardiography was performed and in 748 pts NT-BNP was analysed. The E/E'-ratio was determined according to the international recommendations by measuring the maximum velocity of the early diastolic inflow by pulsed wave Doppler echocardiography and the basal septal maximum myocardial velocity by tissue Doppler echocardiography at early diastole. NT-BNP was determined using commercially available diagnostic tests. Pathological NT-BNP levels were assumed in the range >222pg/ml. Normal E/E'-ratios as well as normal NT-BNP levels were observed in 91% of all participants. In 1.4% of the pts elevated NT-BNP levels were found in the presence of normal E/E'-ratio. In contrast in 1.1% of the pts elevated E/E'-ratios were found in the presence of normal NT-BNP levels. Most of the pts with heart failure detected by NT-BNP values >222pg/ml also showed intermediate E/E'-ratios between 9 and 15 (42pts). In only 0.8% of the pts (5 pts) significantly elevated E/E'-ratios >15 and pathological NT-BNP levels could be observed (see fig). Only 4 pts with elevated NT-BNP values showed left ventricular systolic dysfunction. E/E'-ratio has to be verified to be suitable for the detection of heart failure patients. The present data show that E/E'-ratio of >15 is not well correlated to increased NT-BNP levels.

## P2-15

### Analysis of echocardiographic parameters for the evaluation of Aortic Regurgitation

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In the present study different approaches for the evaluation of aortic regurgitation (AR) in patients with chronic AR and in patient after TAVI were analysed. 55 patients with chronic AR and 15 patients with AR after TAVI were analysed by the conventional approach, semi-quantitative parameters and global left ventricular (LV) peak systolic strain (PSS). The conventional approach was performed by the assessment of the regurgitant fraction (RF), the regurgitant volume (RV), the effective and total stroke volume (SV). In TAVI patients AR was additionally analysed by the proportion of the valvular defect to the aortic valve ring. Total SV determinations by Doppler echocardiography and biplane planimetry showed good correlations. The assessment of the effective SV using the pulmonary valve (PV) diameter and the VTI<sub>PV</sub> or the mitral valve (MV) diameter and the VTI<sub>MV</sub> showed less good correlations. Higher or preserved global LV PSS values were observed in chronic AR patients. However, in extremely dilated left ventricles global PSS values seemed to be reduced. The Pressure-Half-Time (PHT) could be determined in 80%, the proximal isovelocity surface area (PISA) in 21% and the vena contracta (VC) in 56% of patients with chronic AR. The PHT could be determined in 40%, the PISA in 0% and the VC in 40% of patients with AR after TAVI. The conventional analysis of AR in patients with chronic AR and in patients with AR after TAVI is feasible and suitable. Semi-quantitative parameters were less suitable and will often lead to overestimation in patients with chronic AR and to underestimation of AR in patients after TAVI. Global LV PSS can be used as a descriptive parameter for the assessment of LV eccentric hypertrophy but cannot be used to characterise various stages of chronic AR. AR in patients after TAVI can be well analysed by the conventional approach.

## P2-16

### Echocardiographic analysis of left and right ventricular function in patients after mitral valve reconstruction

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The aim of the present study was to analyse left (LV) and right ventricular (RV) function in patients after mitral valve reconstruction (MVR). Transthoracic echocardiography was performed in 31 patients with severe mitral valve regurgitation (MR) before and after MVR. Furthermore, patients were divided into several subgroups: firstly, asymptomatic (n=7) and symptomatic (n=24), secondly, isolated MVR (n=18) and MVR with tricuspid valve reconstruction (TVR) (n=7) or aortic valve implantation (AVI) (n=6) and thirdly, paroxysmal atrial fibrillation (AF) (n=23) and chronic AF (n=8). LV dimensions and volumes were reduced after MVR. LV ejection fraction (EF) did not change after MVR. However, LV global longitudinal peak systolic strain (PSS) was reduced after MVR. In contrast to LV global longitudinal PSS values data of the free RV wall did not show reduced RV PSS values after MVR. However, TAPSE was significantly reduced after MVR. Parameters of diastolic function did not improve and systolic pulmonary pressure (sPAP) and pulmonary vascular resistance (PVR) were reduced after MVR. LV function after MVR was mostly improved in patients with asymptomatic MR, with SR or paroxysmal AF and after isolated MVR than in symptomatic patients with MR, with chronic AF and MVR with TVR or AVI. Despite of improvement of LV function the reduction of TAPSE indicates impairment of longitudinal RV deformation. However, RV strain analysis after MVR indicates unchanged RV contractility. Thus, RV function should be analysed more accurately by 3D volume changes and radial deformation analysis. In addition, a moderate MR quantified by Vena contracta-method was observed in 6 patients after MVR (20%).

## Education in Ultrasound

## P3-14

### Introduction of basic dermatologic ultrasound in undergraduate medical education

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**Purpose:** Teaching ultrasound procedures to undergraduates has recently been proposed to improve the quality of medical education. We address the impact of applying standardized ultrasound teaching to our undergraduates. **Material and methods:** Medical students received an additional theoretical and practical seminar involving hands-on ultrasound screening during their mandatory practical training week in dermatology. The students' theoretical knowledge was tested before and after the course. After the course, the students were asked to answer a course evaluation questionnaire. **Results:** The multiple-choice question scores after the course showed statistically significant improvement (53.4 vs. 87.4%; P<0.001). The questionnaire revealed that students were satisfied with the course, felt that it increased their ultrasound knowledge, and indicated that they wanted moreonographic hands-on training in both dermatology and other medical fields. **Conclusion:** Using practical, hands-on medical teaching is an emerging method for undergraduate education that should be further evaluated, standardized, and developed.

## P3-15

**Pitfall at diagnosis: lymphnode tuberculosis as cause of fatigue syndrome and abdominal complaints**Thomsen T<sup>1</sup><sup>1</sup>Westküstenklinikum Brunsbüttel und Heide gGmbH, Innere Abteilung, Brunsbüttel, Germany

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We report the case of a 23 years old refugee from Ethiopia. He was admitted to our hospital because of fatigue syndrome, weight loss and abdominal pain. No coughing was reported by the patient. Clinical examination, laboratory tests, abdominal sonography and gastroscopy revealed acute gastritis. Quantiferon test was positive. The patient was discharged with recommendation for further treatment. Several weeks later the patient was readmitted because of progressive weight loss and fatigue syndrome. Now we performed extensive diagnostics with CT scan and found mediastinal lymph node enlargement. Bronchoscopy with aspiration of bronchial secretion showed multiple bacteria, but no mycobacteria. We performed a transesophageal fine needle aspiration. Cytological examination of the fine needle aspirate revealed bacterial overgrowth with multiple grampositive and gramnegative bacteria in the microbial tests plus mycobacteria. But PCR showed mycobacteria other than tuberculosis. We started antimicrobial treatment against the proven microbiologic agents and transferred the patient to a specialised lung clinic for further diagnostics and treatment. Bronchoscopy was repeated there and mycobacterium tuberculosis without resistance against tuberculostatic agents was secured. Tuberculostatic treatment was initiated. Two months after the transesophageal fine needle aspiration we got the result of the cultural testing of our specimen. It showed mycobacterium tuberculosis as well. **Conclusion:** 85% of patients with tuberculosis show pulmonary affection as first manifestation. 50% of extrapulmonary manifestation are found in lymph nodes. 20% of the affected lymph nodes are situated in the mediastinum. Diagnosis of tuberculosis in this case was challenging because of the presence of several non tuberculosis mycobacteria in the PCR of our fine needle aspirate. Culture secured tuberculosis. It remains remains gold standard, but it takes two months time.

## P3-16

**Ultrasound in the undergraduate medical curriculum: Designing the learning material**Altersberger M<sup>1</sup>, Pavelka P<sup>2</sup>, Sachs A<sup>3</sup>, Anner P<sup>4</sup>, Wagner-Menghin M<sup>2</sup>, Prosch H<sup>3</sup><sup>1</sup>Medical University of Vienna, Radiology, DEMAU, Vienna, Austria; <sup>2</sup>Medical University of Vienna, DEMAU, Vienna, Austria; <sup>3</sup>Medical University of Vienna, Radiology, Vienna, Austria; <sup>4</sup>Medical University of Vienna, Center for Brain Research, Vienna, Austria

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**Purpose:** During the last decades, ultrasound has been established as an effective diagnostic tool. Medical students learning ultrasound already as undergraduates clearly benefit in terms of understanding of anatomy and pathology. Thus systematic training on how to perform clearly defined ultrasound standard views is important early in the undergraduate medical curriculum. However, as organizing practical ultrasound training is resource intensive, suitable learning material for preparation and review can alleviate shortage of practical training possibilities. For demonstrating practical skills videos have been shown to be effective, provided they show relevant aspects. The study describes our process of developing instructional ultrasound videos. **Material and methods:** Learning materials were designed in an interactive process: (1) define learning goals (2) outline steps to be taken, written documentation (3) outline script for video recording (4) video editing (5) review with ultrasound experts and students (6) revise video editing. The videos consist of various compositions such as a video of the transducer next to the resulting ultrasound video (split screen). Students' perception of the material is being surveyed asking about their preferences of learning material and instructional setting together with how the videos helped them to prepare for the upcoming practical ultrasound assessment. **Results:** 11 concise ultrasound videos were created and implemented in curricular training at our university, which include instructions on a defined examination process, image optimization and 9 standardized ultrasound views. Although our recording system allows us to minimize the need for extensive post video editing by being able to choose the composition of video and audio signals on the fly during the recording process, multiple takes were needed as well as audio and video post processing. By means of an online

questionnaire students' perception of video material is currently being evaluated.

## P3-17

**Introduction of augmented reality in ultrasound training – The set up for the UppStudy (Ultrasound aPP Study)**Lato K<sup>1</sup>, Degregorio N<sup>1</sup>, Lato C<sup>1</sup>, Schochter F<sup>1</sup>, Simon U<sup>2</sup>, Niemeyer F<sup>2</sup>, Thoma M<sup>2</sup>, Eisenberg J<sup>2</sup>, Schramm A<sup>1</sup>, Schwentner L<sup>1</sup>, Friebe-Hoffmann U<sup>1</sup>, Janni W<sup>1</sup>, Ebner F<sup>1</sup><sup>1</sup>Universitätsfrauenklinik, Ulm, Germany; <sup>2</sup>Ulmer Zentrum für Wissenschaftliches Rechnen (UZR), Ulm, Germany

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**Purpose:** Virtual and augmented reality are upcoming new technical features used in the entertainment industry. Here the first theoretic preparations towards implementing an augmented reality based ultrasound training are presented. 3D objects in a wavefront file format should be visualized like on an ultrasound screen. Implementing the physical laws of reflection, intensity and absorption (Law et al 2011). **Material & methods:** We developed a raytracing/-casting-based rendering method in order to approximate ultrasound propagation in piecewise homogeneous media. In contrast to existing methods, which are based on volume data (like CT images), our scene geometries consist only of surfaces delimiting the volumes inside which the actual ultrasound propagation takes place. This enables interactive volume rendering within the resource constraints of modern smart phones, but also implies that material properties can only be associated with those boundary surfaces. To determine which material properties apply at each position the ray is sampled, we keep track of the currently active volume using a stack of volume IDs, which we accordingly modify on entering/exiting a volume through its surface. After determining the reflected energy at each point along the ray, we also add noise and blur in a post-processing step. Our surface-based rendering method thus requires only a compact 3D scene description, which however must contain only closed, non-overlapping surfaces, similar to our simplified test scene, consisting of a larger sphere (the "body"), enclosing a smaller box, which in turn contains a much denser small sphere. **Results:** The results enabled a sonographer to imagine the original 3D objects without a problem (graphic 1). Further optimizing of the algorithm is needed to enable a smooth calculation of more complicated objects like internal organs. **Conclusion:** Augmented/virtual reality simulation may open up more training possibilities for students to learn the motorical skills faster and more efficiently and also enable students to train on various pathological findings.



Fig. 1: demonstration of the US screen of the 3D model

## P3-18

**Christian Doppler and the Doppler-Effect with a focus on the use in Ultrasound Diagnostic**Steffgen L<sup>1</sup><sup>1</sup>Trainings-Zentrum Ultraschall-Diagnostik, Mainleus, Germany

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Research on Christian Doppler unveiled new aspects of his life. The Doppler-Effect is used in many physical fields, even several Nobel Prizes are associated with the Doppler Effect. Following the path of his observa-



tions, from the primary formulas he developed, to the use in Ultrasound Diagnostic. Translating this interesting vita into a modern presentation with distinctive examples.

P3-19

### Facing the Ultrasound education: Establishment of an unified and well-structured curriculum

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**Purpose:** The role of medical ultrasound (US) is steadily increasing. Ultrasound is an inexpensive and readily available diagnostic method. Therefore ultrasound becomes even in medical schools more and more important in theoretical as well as in practical teaching. Following this development many medical schools offer now a basic training in ultrasound. The concepts varies both in time, scope, content and availability of capabilities. **Material and Methods:** The working group students in the DEGUM (German Society for Ultrasound in Medicine) has developed a catalogue of learning objectives, which is to represent the content minimum requirement and shall aid for a uniform and high-quality ultrasound training program. The basic principle for the development of this catalogue was the evaluation of various US-training concepts of medical universities in Germany, performed in 2014. Furthermore, the already existing concepts and topics for US-courses, established by DEGUM and the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) has been considered. **Results:** From the viewpoint of the working group, this catalogue of learning objectives, separated into theoretical and practical skills, contains the minimum requirements for learning abdominal ultrasound in medical studies and can be valuable for medical schools to establish an ultrasound training for students. **Conclusion:** The catalogue could make an important contribution to a unified and well-structured education in US, likewise as an element of quality assurance. Beyond, it could be the prospective basis for new course concepts.

P3-20

### Implementation of a novel iPhone and Android application for educational and training purposes in prenatal and pelvic ultrasound

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**Purpose:** Downloadable applications (apps) are becoming widespread across medical specialties. Recently, the advancement of smartphone technology has provided us with an excellent opportunity for the development of new apps, that may benefit education in obstetrics and gynecology (OB/GYN) globally. The aim of this study was to assess the usefulness of a novel ultrasound app, operating on Android and iPhone mobile platforms, among OB/GYN residents, participating in DEGUM courses. **Material and methods:** The app (You-Scan) was developed by Geektank Labs, using DICOM-stored ultrasound (US) sweeps, acquired during prenatal and pelvic US, to build an image data bank (US-scan) per case. A finger swipe across the screen allows to go back and forth through the US-scan. Multi-touch gestures allow to zoom in and out or to drag the US-scan. Color Doppler imaging or labeling is available within the US-scan, when enabled. After usage of this app in two separate US courses, an anonymous paper pencil survey was distributed to all 47 participating residents. **Results:** The ownership and usage of a smartphone was 100%. 16 (34.0%) residents think the app is very useful, 23 (48.9%) think it is useful. 15 (31.9%) see the app as a textbook replacement, 13 (27.7%) report willing to pay an even higher price and 11 (23.4%) downloaded the app after the course (iPhone: 7, Android: 4). **Conclusion:** OB/GYN residents participating in DEGUM courses find the novel ultrasound app a useful aide and endorse its implementation to support their education.

## Elastography and Ultrasound I – Clinical Investigations and Case Reports

P4-19

### Effectiveness of sonoelastography in differential diagnosis of benign and malignant solid breast lesions

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**Aim:** In the current study, we aimed to evaluate effectiveness of ultrasonographic elastography in differential diagnosis of breast lesions which were detected by B-mode ultrasonography, in terms of being malignant and benign.

P4-20

### Effectiveness of sonoelastography in differential diagnosis of benign and malignant solid thyroid nodules

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We aimed to evaluate effectiveness of ultrasonographic elastography in differential diagnosis of thyroid nodules.

P4-21

### Point shear wave elastography by acoustic radiation force impulse (ARFI) of rare chronic liver disease such as autoimmune hepatitis (AIH) and overlap-syndrome

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**Purpose:** Acoustic radiation force impulse (ARFI) elastography is a non-invasively method for evaluating liver fibrosis. Performance data on rare autoimmune liver diseases like autoimmune hepatitis (AIH) and overlap-syndrome are sparse. Therefore, ARFI shear wave velocities of the liver were ascertained and correlated with histological degree of fibrosis. **Material and methods:** In a retrospective analysis, a total of 28 patients (21 female, 7 male, mean age 49 years, range: 19 – 74 years) with AIH (n = 19) and overlap-syndrome (n = 9) have been evaluated by use of ARFI elastography and histological degree of fibrosis by Ishak. A minimum of 7 measurements of the right hepatic lobe were obtained. The ARFI shear wave velocities are expressed as meters per second (m/s) and were calculated as the mean ± standard deviation (range). **Results:** The mean ARFI values of all AIH patients showed 2.11 ± 1.01 m/s (range: 0.92 – 3.98 m/s) and correlated with the histological classification of fibrosis (r = 0.507, p < 0.05). The patients with an overlap-syndrome had an ARFI mean of 2.12 ± 0.74 m/s (range: 1.06 – 2.96 m/s), well correlating with the Ishak score (r = 0.813, p < 0.01). The mean ARFI values of all patients correlated well with the Ishak fibrosis score (r = 0.611, p < 0.01). These shear wave velocities of all patients correlated also with patient age (r = 0.365, p < 0.05) and negatively with platelet count (r = -0.449, p < 0.01). The diagnosis of relevant fibrosis (Ishak ≥ 2) had a cutoff-value of 1.58 m/s with a sensitivity of 82.4% and a specificity of 81.8%. **Conclusion:** Autoimmune liver diseases like AIH and overlap-syndrome revealed increased ARFI shear wave velocities values of the liver. Hepatic ARFI elastography correlated well with the degree of fibrosis and represents a helpful diagnostic adjuvant.

## P4-22

### Ultrasound evaluation of coexistent thyroid and parathyroid lesions in end stage renal disease cases

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**Preliminary:** the incidence of thyroid disease in cases operated for hyperparathyroidism is 2.5 – 17.6%. The current study is evaluating the series of secondary and tertiary hyperparathyroidism with thyroid and parathyroid lesions. **Material:** From series of 44 operated cases with renal secondary and tertiary hyperparathyroidism, with 10/44 associated thyroid nodules. **Method:** 2 B ultrasound, Power Doppler, and real time elastography with qualitative (Rago criteria) and computer assisted quantitative measurement of tissue elasticity with high accuracy linear probe, Hitachi Preirus Device, Hitachi Inc., Japan. Histopathology evaluation was performed in all cases. FNAB was performed in cases with associated thyroid nodules. **Results:** Pathology evaluation confirmed the association of thyroid carcinoma (papillary carcinoma) and parathyroid nodular hyperplasia in 4 cases. The other 6/10 cases were classified as benign thyroid pathology: 2 follicular adenoma, 2 autoimmune thyroiditis and 1 Hurtle cell adenoma. The thyroid cancer cases consist of 3 women (aged 57 and 61), and two men (40 and 42 years). Preoperative imaging showed proper localization of the hyperthrophic/hyperplastic parathyroid glands but also proper description on the thyroid nodular disease. Ueno score 3 and 4 was observed in all four cases of thyroid cancer. The qualitative suspicion was confirmed by an increased strain ratio in suspicious thyroid nodules, compared with unsuspicious thyroid and parathyroid nodules. FNAB was impossible in 1 case (para-carotidian nodular position). Cytological results: 2 Bethesda 4, 1 unclear diagnostic. Total thyroidectomy was proposed in all the 4 cases. From the 6 benign cases, 5 were clear on elastography, but 1 cases was classified of highly suspicious on elastography. **Conclusion:** Elastography brings important data in respect to different types of nodular aspects described by conventional ultrasound. It may be used in differentiation of difficult cases with nodular intra and extra-thyroidal masses, where FNAB can not be easily used.

## P4-23

### Quality control of elastography measurements – influencing factors and pitfalls

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**Purpose:** To evaluate the correctness of shear wave measurements of different vendors and scanheads. **Material and methods:** For comparing different US machines and scan heads we used the 2nd generation elastography phantom of CIRS (039) with 4 different stiffness values from 3.5 kPa (1), 10 kPa (2), 25 kPa (3) and 45 kPa (4) simulating the range from normal liver to severe fibrosis. 3 US machines with up to three scan heads (4 MHz, 6 MHz and 9 MHz) were compared (Siemens S2000 and S3000 with 4C1, 6C1, and 9L4 scan head, Toshiba Applio 500 with 6C1 scan head). In every phantom 5 measurements are done in 2, 4, 6 and 8 cm depth. Additionally the pressure of the scan head was modified. **Results:** The best correlation was seen at 2 cm with the 4C1 scan head of the S2000 (3.63 kPa, 9.61 kPa, 22.69 kPa, 42.19 kPa) and with the Applio 500 in single shot technique (3.2 kPa, 9.7 kPa, 20.4 kPa, 41.2 kPa). With the 9L4 comparable results are only achievable in phantom 1 and 2 with significant underestimation of the stiffer phantoms. All machines and scan heads showed an increasing underestimation of the kPa values with depth.

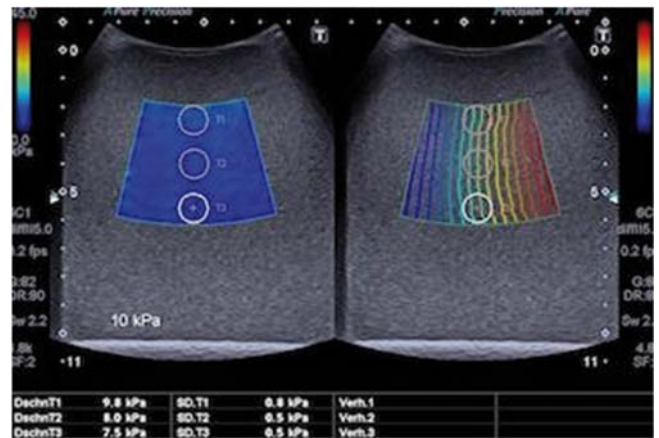


Fig. 1: Depth dependence

Only the 4C1 scan head was able to measure correct values up to 8 cm depth, The 6C1 scanheads of Siemens and Toshiba are limited to 6 cm. Realistic measurements with the Applio 500 are only possible with the One Shot technique. **Conclusion:** Besides influence factors as compression there was a systematic underestimation in greater depth possibly due to loss of energy of the push pulse, that induces the shear wave. Realistic measurements were possible up to 6 cm.

## P4-24

### Non-invasive assessment of liver fibrosis by means of Transient Elastography and Fibrotest in patients with HCV compensated liver cirrhosis

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**Purpose:** The severity of liver disease should be assessed prior to therapy. The purpose of the study was to evaluate the accuracy of FibroTest and Transient Elastography (TE) for predicting HCV liver cirrhosis (LC), in naïve or treatment-experienced patients, with compensated liver disease. **Material and methods:** The study included 104 consecutive patients previously diagnosed with compensated HCV LC based on clinical, biologic, ultrasonographic, morphologic, laparoscopic or endoscopic (esophageal varices) criteria, who were considered for interferon free treatment (Viekirax/Exviera). Liver fibrosis was assessed during a two week period by means of TE (using M or XL probe) and by FibroTest. For TE reliable measurements were defined as median value of 10 liver stiffness measurements, with a SR ≥ 60% and an IQR < 30%. For diagnosing cirrhosis by means of TE we used a cut-off value 12.5 kPa [1] and for FibroTest a value of 0.75. **Results:** Out of 104 patients, reliable measurements by TE were obtained in 93.3%, so that the final analysis included 98 patients (having valid TE and FibroTest). According to FibroTest cut-off, 74.5% (73/98) patients were correctly classified, while according to TE cut-off – 91.8% (90/98) patients (p=0.002). Out of the 98 cirrhotics, 4.1% were misclassified by TE as having significant fibrosis (F2) and 4.1% with severe fibrosis (F3). When we evaluated the performance of FibroTest, 9.2% of patients with LC were misclassified as having F2, 13.3% as having F3 and 3% as having F3/F4. 16% (4/25) patients misclassified by FibroTest had grade I esophageal varices. **Conclusions:** The accuracy of FibroTest for predicting HCV liver cirrhosis in naïve or treatment-experienced patients, with compensated liver disease was significantly lower than of TE (74.5 vs. 91.8%; p=0.002). **Reference:** [1] Castera L, et al. Prospective comparison of transient elastography, FibroMax, APRI, and liver biopsy for the assessment of fibrosis in chronic hepatitis C. Gastroenterology 2005; 128: 343 – 350.

## P4-25

### The prevalence of liver steatosis, streatohepatitis and inflammation activity in a cohort of compensated HCV liver cirrhosis patients, according to FibroMax

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**Background:** The diagnosis of liver cirrhosis is based on clinical evidence of liver disease, laboratory abnormalities, liver stiffness assessed by non-invasive techniques such as elastography based techniques and biological tests. **Aim:** The aim of this study was to evaluate the prevalence of liver steatosis, fibrosis, streatohepatitis and inflammation activity as assessed by FibroMax in a cohort of compensated HCV liver cirrhosis. **Material and methods:** We performed a prospective study, including 109 patients diagnosed with HCV liver cirrhosis by means of elastography techniques, by clinical, biologic or endoscopic criteria. Using FibroMax test, fibrosis was staged as F0, F1, F2, F3, F4, steatosis as S0, S1, S2, S3, nonalcoholic steatohepatitis as N0, N1, N2, alcoholic steatohepatitis as H0, H1, H2, H3 and inflammatory activity as A0, A1, A2, A3. **Results:** Even if all patients had liver cirrhosis, false negative results of mild fibrosis ( $F < 2$ ) were present in 4/109 cases (3.6%), and of significant fibrosis ( $F > 2$ ) in 20/109 cases (18.4%), while cirrhosis (F4) was correctly diagnosed in 85/109 (78%). Without steatosis we found 14/109 (12.9%) cases, with mild steatosis ( $S < 2$ ) 29/109 cases (26.7%), moderate steatosis ( $S = 2$ ) was observed in 32/109 (29.3%) and severe steatosis (S3) in 34/109 cases (31.1%). Minimal alcoholic steatohepatitis (H1) was found in 6/109 cases (5.5%), moderate (H2) in 1.8% and 101/109 had no alcoholic steatohepatitis (H0). The distribution of nonalcoholic steatohepatitis was: N0: 47/109 (43.11%), N1: 12/109 (11.09%), N2: 50/109 (45.8%). Regarding activity: A0-A1 was found in 10% of cases, A2 in 31/109 cases (28.4%), A3 in 66/109 (55%), A4 in 6.6% of cases. **Conclusion:** An important proportion of HCV cirrhotic patients also had associated liver injury besides fibrosis: severe steatosis, steatohepatitis and inflammation activity. Thus, FibroMax is useful to assess these modifications outside fibrosis evaluation.

## P4-26

### Non-invasive liver fibrosis assessment in children: Two Dimensional Shear Wave Elastography and point Shear Wave Elastography

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**Aim:** To compare the feasibility and performance of two elastographic methods involving ultrasound shear waves in children: two dimensional shear wave elastography (2D-SWE) and point shear wave elastography (point SWE). **Material & methods:** We conducted a prospective study in children. Elastographic measurements of liver stiffness were performed using point SWE – Virtual Touch Tissue Quantification (VTQ) (Acuson S2000 Siemens) and 2D-SWE (Logiq E9, GE Healthcare, Chalfont St Giles- UK). Reliable measurements were defined as a median value of 10 liver stiffness measurements with a success rate  $\geq 60\%$  and an interquartile range interval  $< 30\%$ . Our study population consisted of 30 children (mean age  $11.4 \pm 3.9$ , 23.3% girls, mean BMI  $22.53 \pm 7.3 \text{ kg/m}^2$ ) divided into 3 groups: obese ( $n = 13$ ), children with hepatopathies (cystic fibrosis associated liver disease, chronic autoimmune hepatitis,  $n = 4$ ) and a group of normal weight children without liver disease ( $n = 13$ ). **Results:** We obtained a high percentage of reliable measurements when using both VTQ and 2D-SWE GE (90%). We found no significant differences between VTQ and 2D-SWE GE ( $1.3 \pm 0.51 \text{ m/s}$  vs.  $1.17 \pm 0.18 \text{ m/s}$ ,  $p = 0.8$ ) in our study population. No significant differences were found between VTQ and 2D-SWE GE across study groups, as well: obese ( $1.36 \pm 0.67 \text{ m/s}$  vs.  $1.19 \pm 0.16$ ,  $p = 0.8$ ), children with hepatopathies ( $1.5 \pm 0.02 \text{ m/s}$  vs.  $1.3 \pm 0.11 \text{ m/s}$ ,  $p = 0.1$ ) and normal weight children without liver disease ( $1.11 \pm 0.15 \text{ m/s}$  vs.  $1.11 \pm 0.19 \text{ m/s}$ ,  $p = 0.7$ ). **Conclusion:** Both VTQ and 2D-SWE GE performed excellent in obtaining reliable measurements of liver fibrosis in children. Similar values were obtained when using either VTQ or 2D-SWE GE, even in obese and children with hepatopathies.

## P4-27

### Quantification of tissue elasticity using three shear wave elastography platforms on liver fibrosis phantoms

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**Purpose:** To assess the reproducibility of quantitative shear-wave elastography measurements, on four tissue-mimicking liver fibrosis phantoms with known Young's modulus. **Materials and methods:** We used three different shear wave elastography platforms: GE Logiq E9 SWE, Philips iu22 XM ARFI and Samsung RS80A. Both linear (frequency: 9 MHz) and curvilinear (frequency: 7 – 1 MHz) probes were applied. The objects were four separate tissue mimicking liver fibrosis phantoms with different Young's modulus within the range of biological soft tissue (2.7kPa, 11.5kPa, 24.8kPa, 46.3kPa). Two investigators performed all measurements in parallel. Each investigator made 10 separate measurements of each phantom. The results were evaluated for inter- and intraobserver variability, coefficient of variation, ICC and Bland-Altman using the median value for each platform. Statistical analysis was performed with SPSS. **Results:** All three elastography platforms showed excellent intraobserver agreement (ICC: 0.987 – 1.000) and interobserver agreement (ICC: 0.981 – 1.000). All four liver fibrosis phantoms could be differentiated by quantitative elastography, by all platforms ( $p < 0.001$ ). In the Bland-Altman analysis the differences in measurements were larger for the phantoms with higher Young's modulus. All platforms had a coefficient of variation in the range 0.00 – 0.21 for all four phantoms, equivalent to low variance and high reproducibility (Table 1). Median (min-max) elasticity measurements performed with three elastography platforms on liver fibrosis phantoms.

Tab. 1

Elastography system	Probe shape	Observer	Phantom 1 2.7 kPa $\pm 5\%$	Phantom 2 11.5 kPa $\pm 5\%$	Phantom 3 24.8 kPa $\pm 5\%$	Phantom 4 46.3 kPa $\pm 5\%$
Philips iu22 XM ARFI	curvilinear	A	1.93kPa (1.76 – 2.23)	8.29 kPa (7.35 – 9.66)	20.46 kPa (18.2 – 34.88)	47.09 kPa (38.29 – 50.75)
		B	1.89 kPa (1.8 – 2.01)	7.73 kPa (7.23 – 7.92)	19.68kPa (18.88 – 23.9)	44.74 kPa (36.73 – 46.85)
		A + B	1.9 kPa (1.76 – 2.23)	7.82kPa (7.23 – 9.66)	20.19 kPa (18.2 – 34.88)	45.5 kPa (36.73 – 50.75)
	curvilinear	A	2.1 kPa (2 – 2.3)	7.6 kPa (7.2 – 8.9)	18.40 kPa (17 – 20)	43.85kPa (40.9 – 45.8)
		B	2.1 kPa (2 – 2.2)	7.65 kPa (7 – 8.1)	18.15kPa (17.6 – 20.7)	43.65 kPa (40.9 – 47.8)
		A – B	2.1 kPa (2 – 2.3)	7.6 kPa (7 – 8.9)	18.30 kPa (17 – 20.7)	43.7 kPa (40.9 – 47.8)
Samsung RS80A SWE	curvilinear	A	1.9kPa (1.85 – 2.98)	7.02kPa (6.98 – 7.09)	17.06kPa (16.9 – 17.16)	35.93 kPa (35.52 – 36.47)
		B	1.97 kPa (1.93 – 2.05)	6.88 kPa (6.79 – 6.91)	17.05kPa (16.83 – 17.27)	36.47 kPa (36.3 – 36.82)
		A+B	1.89 kPa (1.85 – 2.98)	6.94 kPa (6.79 – 7.09)	17.06kPa (16.83 – 17 – 27)	36.37 kPa (35.52 – 36.82)
	curvilinear	A	1.86 kPa (1.83 – 1.94)	7.24 kPa (7.15 – 7.28)	18.92 kPa (18.25 – 19.52)	39.44 kPa (38.5 – 40.44)
		B	1.92 kPa (1.85 – 1.94)	7.21kPa (7.15 – 7.23)	18.47 kPa (17.96 – 18.97)	38.67kPa (37.84 – 39.54)
		A+B	1.95 kPa (1.83 – 1.94)	7.23 kPa (7.15 – 7.28)	18.75 kPa (17.96 – 19.52)	38.9 kPa (37.84 – 40.44)
GE E9 Logiq SWT	linear	A	1.9kPa (1.85 – 2.98)	7.02kPa (6.98 – 7.09)	17.06kPa (16.9 – 17.16)	35.93 kPa (35.52 – 36.47)
		B	1.97 kPa (1.93 – 2.05)	6.88 kPa (6.79 – 6.91)	17.05kPa (16.83 – 17.27)	36.47 kPa (36.3 – 36.82)
		A+B	1.89 kPa (1.85 – 2.98)	6.94 kPa (6.79 – 7.09)	17.06kPa (16.83 – 17 – 27)	36.37 kPa (35.52 – 36.82)
	curvilinear	A	1.86 kPa (1.83 – 1.94)	7.24 kPa (7.15 – 7.28)	18.92 kPa (18.25 – 19.52)	39.44 kPa (38.5 – 40.44)
		B	1.92 kPa (1.85 – 1.94)	7.21kPa (7.15 – 7.23)	18.47 kPa (17.96 – 18.97)	38.67kPa (37.84 – 39.54)
		A+B	1.95 kPa (1.83 – 1.94)	7.23 kPa (7.15 – 7.28)	18.75 kPa (17.96 – 19.52)	38.9 kPa (37.84 – 40.44)

**Conclusion:** All systems used in this study obtained high reproducibility in quantitative measurements in a liver fibrosis phantom and excellent interclass correlations.

## Gynaecological Ultrasound I – Clinical Investigations and Case Reports

## P5-15

### Fetal ascites caused by intraabdominal bleeding and secondary fetal anaemia treated by intrauterine blood transfusion (IUT) in the gestational age of 28 weeks

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**Purpose:** Fetal ascites refers to the accumulation of free fluid in the fetal abdomen. After the recognition of ascites in antenatal ultrasound, it is essential to establish whether this is an isolated fetal ascites or associated with hydrops. **Methods:** A 30-year-old woman (G II P 0, 27 + 4. SSW) was admitted for generalised pruritus and sonographically diagnosed



isolated fetal ascites. **Results:** The mother was blood group A and Rh positive. The prae-natal organ screening was without pathological findings. Further we diagnosed an intrahepatic cholestasis of pregnancy (ICP) with a enormously level of bile acids (160 µmol/l). Antenatal TORCH, HIV, Treponema and Hepatitis screening were all normal. Fetal MRI detected no other organic abnormalities. The isolated intraabdominal ascites can be caused by blood or meconium. Intermittently the peak systolic velocity of the MCA was pathological. In the further course the fetus presents a suspect fetal heart rate. In a gestational age of 29 weeks, under the suspicion of intraabdominal bleeding we admitted the patient to the UKH for intrauterin blood transfusion (IUT). The concentration of foetal haemoglobin was determined in umbilical cord blood before (9 g/dl) and after (15.8 g/dl) the IUT. 105 ml of red blood cell concentrate were transfused. In the gestational age of 37 weeks our patient was born by secondary lower segment Cesarean section due to fetal distress (APGAR 8 – 8 – 9, pHUA 7.29, 2750 g, 45 cm). Under suspicion of ileus one day after birth the explorative laparotomy was performed. Intraoperativ the newborn developed a pulmonary hypertension, the operation had to interrupted. In a second look laparotomy an atresia of jejunum with perforation and meconium peritonitis were detected. **Conclusion:** Fetal ascites can result from many different aetiologies, including gastrointestinal and genitourinary anomalies. Chromosomal abnormalities and viral aetiologies must also be considered.

P5-16

### A case of antenatal-suspected thanatophoric dysplasia type 1 turning out as rather osteogenesis imperfecta type 2

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**Case:** A 26 year old patient 2 gravida, 0 para was referred to our prenatal diagnosis unit at 22 weeks' gestation because of a previous scan showing strong suspicion of thanatophoric dysplasia type 1. The parents were nonrelated. Family history was unremarkable. **Material and methods:** Abdominal sonography was performed using GE Voluson E8 RSA. Chromosome analysis from a sample of amniotic fluid was performed by optical microscopy. Amniotic fluid cells were subjected to a mutation analysis regarding the FGFR3-gene. A postpartum fetogramm was performed. **Results:** Fetal ultrasound scan showed skeletal abnormalities with short limbs and ribs, a hypoechogenic cloverleaf skull, a narrow chest encasing hypoplastic lungs, gyration anomalies and rocker-bottom feet typical for thanatophoric dysplasia. The amniotic fluid index, umbilical artery doppler and fetal echocardiography were normal. After excessive interdisciplinary counselling, the patient opted for a fetocide. The stillborn girl of 205 g macroscopically exhibited the predicted features. Interestingly, a postpartum fetogramm hinted to osteogenesis imperfecta type 2 as the underlying pathology, displaying fractures of the upper extremities as well as multiple consolidated rib fractures and a retardation in the development of the frontal bone and the base of the skull as signs of bone fragility. Flattened vertebral bodies as typical for thanatophoric dysplasia were lacking. The postpartum cytogenetic report yielded unremarkable findings regarding the fetal karyotype. A molecular genetic analysis of the amniotic fluid cell culture regarding a mutation of the FGFR3-gene pathognomonic for thanatophoric dysplasia turned out to be inconspicuous. **Conclusion:** The feasibility of prenatal ultrasound for the diagnosis of lethal skeletal dysplasias is confirmed. Nevertheless differentiation might be difficult between thanatophoric dysplasia and osteogenesis imperfecta type II. The fetogramm proved to be helpful. For further confirmation an analysis of COL1A1/COL1A2-genes mutations, typical for osteogenesis imperfecta, might be considered.

P5-17

### Noninvasive management of isolated bilateral fetal hydrothorax

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**Purpose:** The incidence of fetal hydrothorax is estimated to be 1 in 15 000 pregnancies. In the absence of hydrops fetal medicine specialists

consider invasive prenatal treatment not indicated. The evidence is limited, as it consists exclusively of case-reports. **Material and methods:** Case report, literature review. **Results:** Pregnant refugee from Syria was referred because of pleural effusion @ 33 weeks. Ultrasound scan revealed a female fetuses with isolated hydrothorax, polyhydramnios and the absence of hydrops (Fig. 1).



Fig. 1: bilateral fetal hydrothorax

Additional congenital, structural and chromosomal anomalies were ruled out. Besides this the patient was diagnosed with gestational diabetes. According to the NICE Guideline, 2006 no invasive prenatal treatment was carried out. Under close surveillance ultrasound spontaneous resolution of pleural effusion was observed within 2 weeks. (Fig. 2).



Fig. 2: spontaneous resolution of pleural effusion

Data from literature review is given comparing survival with and without pleuroamniotic shunting. **Conclusion:** In this present case noninvasive management of isolated fetal hydrothorax seems to have been justified.

P5-18

### Conjoined twins @15+4 weeks

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**Purpose:** Conjoined twins is a rare phenomenon, the occurrence is estimated to range from 1 in 50,000 births to 1 in 200,000 births. Approximately 40% are stillborn, the overall survival rate is about 20%. The condition is more frequently found among females, with a ratio of 3:1. The most famous pair of conjoined twins was Chang and Eng Bunker (1811 – 1874), Thai brothers born in Siam. As a crowd puller in a circus they were billed as the famous Siamese Twins for many years. Hence the term "Siamese twins" came to be used as a synonym for conjoined twins.

**Material and methods:** Case report and literature review. **Results:** A 30-year-old gravida 3, para 2 presented for her first antenatal visit at 15+4 weeks of gestation. Ultrasound showed a non-viable monochorial mono-amniotic twin pregnancy with the signs of a hydrops fetalis. Further a polyhydramnion was present. The fetuses were not distinguished from one another at the thoracic-abdominal level. Ultrasound imaging was limited due to advanced state of fetale maceration. (Fig1 – 3). Autopsy findings after induced abortion: the two fetal bodies fused at the lower chest, only sharing the liver with a conjoined umbilical cord, no further organ system was involved (Fig4).



Fig. 1

**Conclusion:** Although the advanced state of fetal maceration limited ultrasound its results were still consistent with autopsy.

## P5-19

### Asymptomatic rupture of the uterine scar – diagnosis during routine ultrasound check

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**Purpose:** Asymptomatic ruptures of uterine scars after previous Caesarian Section (CS) are of utmost clinical importance even more so if a vaginal birth after CS (VBAC) is planned. Ultrasound is commonly used in pregnancy and widely available. The routine measurement of the lower uterine segment (LUS) could help detecting patients who should by no means attempt a VBAC as our case suggests. **Case:** A 38-year-old G4P3 was referred to our unit at 35 weeks and 2 days due to fetal renal pyelectasis seen in the second trimester ultrasound. In all previous pregnancies the children were delivered by CS using a longitudinal incision in India.

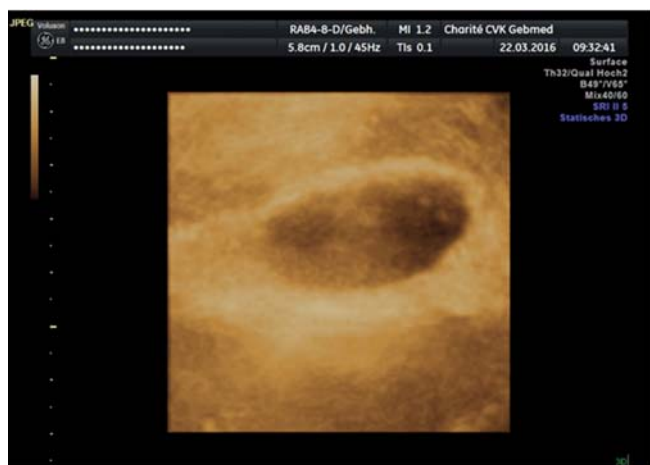


Fig. 1: 3D scan: complete rupture of the uterine scar

The ultrasound showed a viable appropriately grown fetus in cephalic presentation showing a discrete bilateral pyelectasis. Our routine check of the uterine scar however, revealed an asymptomatic rupture of the anterior uterine wall with bulging of the amniotic membrane. The patient was admitted for observation. Four days later she developed local pain close to the uterine scar associated with contractions of the uterus. The CS was performed and a healthy male baby was born weighing 2650 g. The uterine scar showed a complete rupture with bulging amniotic membranes according to the sonographic findings measuring approximately 6×3 cm. The patient recovered normally. Mother and baby could be discharged 5 days after CS. **Conclusion:** Routine ultrasound which should include the measurement of the LUS after CS is able to provide reliable data which are important in risk management after CS.

## P5-20

### Repetitive circumvallate placenta as a cause for early preterm rupture of membranes?

#### Presentation of a rare case

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**Purpose:** Circumvallate placenta is a rare abnormality of placental development, which can cause severe perinatal complications. Prenatal diagnosis is difficult and includes sonographic and clinical features. Here we present a case of suspected repetitive circumvallate placenta. **Materials and methods:** A 32-year-old patient IVG IP with a history of one spontaneous delivery and two cases of rupture of membranes in 18 weeks of gestation and consecutive loss of pregnancy presented at our department at 11 weeks of gestational age. Sonography revealed a massive retro-amnial hematoma surrounding the amniotic sac with an otherwise un-suspicious fetus. In further course of pregnancy the hematoma disappeared slowly, mostly by vaginal bleeding. At 31 weeks of pregnancy PPROM and consecutive vaginal bleeding led to suspicion of placental abruption and cesarian section. Placental examination after birth revealed the diagnosis of circumvallate placenta. **Results:** Reevaluation of the previous cases of loss of pregnancy in second trimester revealed similar sonographic findings of extensive hematoma in first trimester with consecutive loss of pregnancy due to rupture of membranes at 18 and 20 weeks of pregnancy. However reevaluation of the sonographic images of the most recent pregnancy did not show definite signs of the latter diagnosed circumvallate placenta. Parameters for hemostaseology were within normal limits. **Discussion:** Though circumvallate placenta is a rare condition and prenatal diagnosis is demanding, anamnestic and clinical findings like early preterm rupture of membranes and first trimester vaginal bleeding must be suspicious for this diagnosis. So far only very few cases of repetitive circumvallate placenta have been described and further studies are necessary to elucidate the etiology of this suspected repetitive abnormal placenta development.



Fig. 1: Hematoma in first trimester

P5-21

**Idiopathic polyhydramnios and fetal gender**Birdir C<sup>1</sup>, Banica R<sup>2</sup>, Kimmig R<sup>1</sup><sup>1</sup>University of Duisburg-Essen, Department of Obstetrics and Gynaecology, Essen, Germany; <sup>2</sup>Bucharest University of Medicine and Pharmacy, Bucur Maternity, Saint John Clinical Emergency Hospital, Bucharest, Germany  
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**Purpose:** To determine the relationship between idiopathic polyhydramnios and fetal gender in the absence of fetal or maternal abnormalities. **Materials and methods:** This was a retrospective population-based register study. 295 women with singleton pregnancies complicated by idiopathic polyhydramnios (amniotic fluid index (AFI) higher than 24 cm) who were delivered at our institution from January 2002 till December 2012 were included. Only pregnancies with an uncomplicated outcome were accepted in this study. The incidence of the male to female fetuses was compared with the one in the general population. **Results:** Among pregnancies complicated by idiopathic polyhydramnios, the following gender distribution was found: 72.9% male and 37.1% female. The distribution in the general population was 51.5% female and 48.5% male. The mean AFI was significantly increased in male fetuses ( $p < 0.001$ ). The increased AFI did not correlate with gestation age, fetal head circumference or estimated fetal weight. **Conclusions:** Idiopathic polyhydramnios is more frequent in male normal fetuses than in female ones.

P5-22

**Outcome of fetuses with gastroschisis after modification of prenatal management strategies**Bauseler A<sup>1</sup>, Falkenberg M<sup>1</sup>, Funke K<sup>2</sup>, Möllers M<sup>1</sup>, Hammer K<sup>1</sup>, Steinhard J<sup>3</sup>, Müller V<sup>2</sup>, Klockenbusch W<sup>1</sup>, Schmitz R<sup>1</sup><sup>1</sup>University Hospital Muenster, Gynaecology and Obstetrics, Münster, Germany; <sup>2</sup>University Hospital Muenster, Paediatric Surgery, Münster, Germany; <sup>3</sup>Zentrum für Pränatalmedizin und Humangenetik, Münster, Germany  
DOI: 10.1055/s-0036-1587955

**Purpose:** Several studies have been performed to evaluate prenatal predictors to improve the outcome of fetuses with gastroschisis. There are no standards in prenatal care since there are different guidelines. In our study we evaluated the outcome of fetuses with gastroschisis after modification of prenatal management strategies at the Department of Obstetrics and Gynecology of the University Hospital Münster. **Methods:** In this explorative retrospective study of 39 fetuses with gastroschisis, we compared the clinical outcome between two management groups. In the first group (group 1,  $n = 14$ ) prenatal indication for delivery was confirmed by a subjective evaluation of the small bowel diameter and the wall thickness without established cut-off values for these parameters. In the second group (group 2,  $n = 25$ ) certain limits for the small bowel diameter (25 mm) and the wall thickness (2.5 mm) were used for fetal surveillance. **Results:** No noticeable differences between the two groups regarding birth weight, weight centile, arterial pH, small bowel diameter, wall thickness, adverse bowel condition and re-operations could be observed. Regarding group 2, delivery was earlier ( $p = 0.011$ ), and a lower rate of prenatal complications was observed ( $p = 0.016$ ). **Conclusion:** To avoid adverse prenatal complications we recommend the close observation of fetuses with gastroschisis by sonographic monitoring of the small bowel diameter and the wall thickness.

P5-23

**First trimester screening for Preeclampsia (PE) using FMF-London-Algorithm with placenta associated plasma protein-a (PAPP-A) and placental growth factor (PlGF)**Birdir C<sup>1</sup>, Eneke A<sup>1</sup>, Iannaccone A<sup>1</sup>, Fryze J<sup>1</sup>, Gellhaus A<sup>1</sup>, Köninger A<sup>1</sup>, Kimmig R<sup>1</sup><sup>1</sup>University of Duisburg-Essen, Department of Obstetrics and Gynaecology, Essen, Germany  
DOI: 10.1055/s-0036-1587956

**Purpose:** To investigate the pregnancy outcomes of the high risk population after screening and off-label use of acetylsalicylic acid (ASA) 100 mg/day. **Materials and methods:** 343 patients were screened between August 2013 and August 2015 using the FMF-London-Software combining the maternal history with multiple of the median (MoM) – Results of PlGF, PAPP-A, mean arterial pressure and pulsatility index of uterine arteries. **Results:** 40 patients (12%) were screened positive for early-onset PE with a cut-off of 1:150. 26 patients (84%) accepted a prophylactic

off-label therapy with ASA 100 mg/day. Among these patients, 5 patients (19%) developed late-onset PE, 1 patient (4%) early-onset PE, 3 patients (12%) with intrauterine fetal growth retardation (IUGR) before 34 weeks and 2 patients (8%) with IUGR after 3 weeks. **Conclusion:** The results of the multicenter ASPRE-Study need to be awaited to correlate our local results.

**Interesting Case Reports of all Disciplines**

P6-10

**Bedside Ultrasound in emergency department to a patient with recurrent abdominal pain**Oviedo García AA<sup>1</sup>, Algaba Montes M<sup>1</sup>, Patricio Bordonas M<sup>1</sup><sup>1</sup>Hospital de Valme, UGC Urgencias, Sevilla, Spain  
DOI: 10.1055/s-0036-1587957

**Purpose:** Gallbladder cancer (GC), is the most common biliary tract malignancy, representing 3% of malignant tumors, and has a high mortality, mainly related regional spread. Early detection remains difficult, and is often casual. We present a case of GC, diagnosed at emergency department, through the use of ultrasound scanning used by emergency physicians. **Material and methods:** A patient with abdominal pain, with a final diagnosis of a GC. **Results:** 81 year old woman, was admitted to the emergency room after several consultations at its health center by right upper quadrant pain of several weeks duration, accompanied by fatigue, weight loss and a feeling of abdominal distention. On examination he had preserved the vital signs and had only found tenderness in the right upper quadrant, without signs of peritoneal irritation. Analytical emergency were unremarkable. Given the persistence of pain the emergency physician made an ultrasound scanning observing a large mass occupying the gallbladder bed, hypoechoic lesions in liver parenchyma, and perihepatic free fluid. **Conclusion:** Most are adenocarcinomas (95–98%). The histological type with better survival is papillary adenocarcinoma. Produce liver metastases from expansion angiolymphatic own areas of direct hepatic infiltration. The presenting symptoms are non-specific and difficult to differentiate from other more prevalent diseases such as biliary colic or chronic cholecystitis. The most common symptom is pain in right upper quadrant dull and aching. When symptoms such as jaundice or other constitutional symptoms usually appear advanced. Ultrasonography is the method of initial diagnosis image, and when it is diagnosed in early stages is usually discovered incidentally by ultrasound for another reason, which can observe a large mass occupying the gallbladder bed with wall thickening. Furthermore, ultrasound is very sensitive for detecting dilatation of intra/extrahepatic bile duct and the presence of hepatic metastatic lesions or direct infiltration of the parenchyma.

P6-11

**Bedside ultrasound in a Jaundice patient by emergency physicians**Algaba Montes M<sup>1</sup>, Oviedo García AA<sup>1</sup>, Patricio Bordonas M<sup>1</sup><sup>1</sup>Hospital de Valme, UGC Urgencias, Sevilla, Spain  
DOI: 10.1055/s-0036-1587958

**Purpose:** Abdominal ultrasound has proven to be a useful, safe, versatile, with appropriate experience, help earlier diagnosis and comprehensive management of patients seen in the emergency department. We present a case of jaundice by biliary stent obstruction in patient with pancreatic neoplasia, through a bedside ultrasound by Emergency Physicians. **Material and methods:** We report the case of a patient of 64 years with pancreatic neoplasia bearer of 8 French plastic stent by ERCP for biliary drainage for 6 days as palliative treatment, admitted in Emergency Room by jaundice and abdominal pain in epigastrium. **Results:** On arrival had malaise, was hypotensive, febrile, tachycardic and jaundice universal. The analyzes highlighted a bilirubin of 9.52 at the expense of direct fraction (8.60 mg/dl), and 22.500 leukocytes with neutrophilia. She underwent a bedside abdominal ultrasound where we found a central hyperechoic endoprosthetic image with acoustic shadowing, compatible with biliary lithiasis. The patient was derived for urgent endoscopic retrograde cholangiopancreatography, sphincterotomy, removal of prosthesis, washing and placement 10 French prostheses, allowing a favorable evolution of the patient discharged within 72 hours without complications. **Conclusion:** The use of stents as temporary drainage of the bile duct as palliative treatment for pancreatic head tumors is an effective, useful, safe and effective, it also represents a decrease in short-term mortality in these patients, and survival increased disease-free. The use of ultrasound in



emergency allows us greater agility and speed in the diagnosis of prosthetic obstructions, allowing a more integrated management of the same. As shown in the case that concerns us a bedside ultrasound by Emergency Physicians favored a quick and agile diagnosis of biliary sepsis patient suffering, allowing prompt treatment and an early solution to the problem.

P6-12

### Axillary vein cannulation for central venous access in critical care

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**Purpose:** The central veins that are usually cannulated are the jugular, subclavian and femoral. As we know ultrasound guidance can reduce complication rates and increase the success of cannulation. We present a case of ultrasound-guided axillary vein placement catheter by Emergency Physicians. This approach is not widely used among emergency physicians because of its safety features for the patient. **Material and methods:** A patient addicted to parenteral drugs, was admitted to the ER in septic shock condition. **Results:** 52 year old woman addicted to parenteral drugs, stage C3 HIV with 2 weeks duration fever. On arrival had malaise, hypotensive, febrile, tachycardic... it was not possible to catheterize a peripheral vein we performed a central line cannulation: ultrasound-guided infraclavicular axillary vein. Less arterio-venous overlap and a greater distance between artery and vein and from vein to rib cage should provide an increased margin of safety for central venous cannulation. We will describe step by step, accompanied by images, the steps necessary to achieve infraclavicular axillary vein cannulation. **Conclusion:** The ultrasound-guided axillary approach offers a number of potential advantages over others central line cannulation. The anatomy favours ultrasound guidance and less complications. Manual compression of the axillary artery or surgical access is possible if arterial damage is caused. The puncture site is further away from potential sources of infection in patients with tracheostomy, central chest wall burns or sternotomy wounds. Once mastered, this is a safe, useful, and reliable technique for central venous access, so the axillary vein is an alternative for central venous cannulation, as can be seen in the case presented, an effective alternative to US-guided IJV and SCV cannulation.

P6-13

### Septic shock patient and ultrasound in the emergency room

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**Purpose:** Pyonephrosis (PN) is an uncommon disease that is associated with suppurative destruction of the renal parenchyma in adults. Obstruction and upper urinary tract infection play a role in its etiology. Fever, shivering, and flank pain are frequent clinical symptoms. Septic shock and death can occur if the disorder is not treated with urgent surgery. In this context percutaneous open nephrostomy or retrograde ureteral catheter insertion is appropriate, so it is a very serious disease and emergency physicians (EP) have a very important role in early diagnosis to start antibiotic treatment and early referral to surgery. **Material and methods:** A patient with fever, right flank pain and septic condition, with a final diagnosis of a calculus PN, through the use of US scanning used by EP. **Results:** 56 year old male, was admitted to the emergency room by right flank pain and fever. On arrival had malaise, hypotensive, febrile, tachycardic... in septic shock condition. Bedside emergency abdominal US was performed by EP, demonstrating right moderate to severe pelvocaliectasis due to a distal right ureteral stone. The patient was started on empirical antibiotics and a retrograde ureteral internal stents was placed by urologist. **Conclusion:** Identifying PN with early obstructive uropathy is clinically important in the emergency department because obstructive urolithiasis is an independent risk factor for inpatient death; so PN is a life-threatening condition. Emergent bedside ultrasound can do that EP may dramatically increase their ability to identify those patients that need further investigation, consultation and ultimately increase patient safety in emergency department. In the case presented thanks to the implementation of emergency US by the EP came to a prompt diagnosis of the cause of septic shock, with a quickly drainage of the infection site, which it allowed rapid patient recovery.

P6-14

### Bedside echocardiography by emergency physicians in acute myocardial infarction

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**Purpose:** Echocardiography is a non invasive diagnostic technique that uses ultrasound waves to create images of the heart. It is comprised in training programs in ultrasound medical emergency of prestigious international scientific societies, such as WINFOCUS (World Interactive Network Focused on Critical Ultrasound), and the American College of Emergency Physicians (ACEP). The current scientific evidence supports the use of echocardiography by emergency physicians for its speed, agility and safety for the patient. **Material and method:** Case study of the diagnosis of an interventricular communication as mechanical complication of anterior septal myocardial infarction, using echocardiography performed by Emergency Physician. We used a Sonosite M-Turbo, P21 probe of between 1 and 5 MHz, and echocardiography software. **Results:** 85 year old female, obese, hypertense and diabetic, with poor quality of life, attended at emergency room for oppressive chest pain with several days of evolution, presenting sickness, sweating, tachycardia and severe hypotension (70/30). Showing an ECG with ST segment elevation with Q wave formation in the precordial leads (V1-V6). The EP performed a bedside echocardiography, observing a discontinuity at the level of apical interventricular septum with left-right shunt and dyskinesia at medium-apical septum and anterior akinesia, fully compatible with the anterior myocardial evolved, with break septal... a postinfarct interventricular communication. Given this findings and her quality of life, the patient was sent to have an urgent catheterization, starting with sedation and analgesia. She finally died after 24 hours of arrival at the hospital. **Conclusions:** Incorporating emergency echocardiography lowers the overall service time, since the emergency physician can be more effective, efficient and dynamic when handling "time-dependent" emergencies, providing greater clinical patient safety. Unfortunately, in this case the patient could not benefit from curative treatment, but avoided echocardiography to undergo unnecessary interventionism, which would not have prevented the fatal outcome.

P6-15

### Emergency physicians and clinical abdominal ultrasound in emergency room

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**Purpose:** Abdominal pain is one of the symptoms which most often brings patients to the Emergency Room, being nearly 10% of cases. The delay in diagnosis and negative treatment influences the prognosis. Abdominal ultrasound is a fast, portable, repeatable, cheap and non-invasive method, that can provide abundant information to the emergency physicians. **Materials & Methods:** Case study of the diagnosis of a splenic infarction using an ultrasound scan performed by the emergency physician. **Results:** 56 years old male, former drug injecting addict, fully weaned for years, with HIV infection stage C3, with co-HCV infection, good adherence of antiretroviral therapy, maintaining undetectable viral load and CD4 count of 142 cells/uL, attended the emergency room with abdominal pain on the left side, initially labelled as renal colic. The patient was clinically stable, the laboratory results and radiography were normal, but the patient did not respond adequately to analgesic treatment, so the emergency physician performed a point-of-care ultrasound scan, observed a triangular image with peripheral base, hypoechoic inside the spleen, this data was compatible with splenic infarction, the patient was left in observation and anticoagulated. The evolution was favorable without further complications and he was discharged from the hospital a few days after admission. **Conclusions:** Ultrasound in the Emergency Room is a powerful tool, which together with its low cost and the absence of any adverse effects, is essential in our daily clinical practice. This is not to discuss the indications, in an urgent context of a classical ultrasound that requires high professional qualifications that must be performed by an experienced sonographer and involves the use of a high-end equipment; but we firmly believe in this resource as an extension of the emergency physician hand and it would be very beneficial to integrate the ultrasound in the medical process of determining diagnosis for urgent diseases.

P6-16

**Portal venous gas detected by bedside ultrasonography by emergency physicians**Oviedo García AA<sup>1</sup>, Algaba Montes M<sup>1</sup>, Patricio Bordonás M<sup>1</sup><sup>1</sup>Hospital de Valme, UGC Urgencias, Sevilla, Spain

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**Purpose:** Intestinal pneumatosis (IP) defined as the presence of gas within the bowel wall and the presence of gas in the portomesenteric vein complex, a rare clinical condition that are typically associated with intestinal ischemia (II) and a fatal outcome. We present a case of IP, diagnosed at emergency room, through the use of US scanning by emergency physicians (EP). **Material and methods:** A patient with abdominal pain, with a final diagnosis of a IP assessing US, performed by EP. **Results:** 82 years old woman, with abdominal pain from 12 hours. The patient presented malaise, affected by pain, hypotensive and tachycardic. The EP made a bedside abdominal ultrasound scan that showed many small echogenic mobile pictures that moved through the portal vein and its branches, and in the left hepatic lobe level we saw also multiple linear echogenic pictures in the portal branches with posterior acoustic shadows. Suspecting IP and gas in the abdominal venous complex portomesenteric urgent contrast CT was made, which confirmed the diagnosis. **Conclusion:** CT and US are the most commonly used imaging modalities in patients with acute abdomen and even if CT represents the gold standard in the evaluation of patients with II. However, there are some disadvantages associated with this technique, such as radiation exposure, potential nephrotoxicity and the risk of an allergic reaction to the contrast agents. Thus, not all patients with suspected bowel ischaemia can be subjected to these examinations. Despite its limitations, bedside ultrasound performed by EP could constitute a good imaging method as first examination in acute settings of suspected mesenteric ischemia. Ultrasonography by EP, can be a useful tool in cases with serious diseases. Incorporate ultrasound in the ER lowers overall service times, since the EP is more effective, efficient and dynamic management "time-dependent" emergency, providing greater clinical patient safety.

P6-17

**Acute aortic syndrome and bedside ultrasonography in emergency department**Oviedo García AA<sup>1</sup>, Algaba Montes M<sup>1</sup>, Patricio Bordonás M<sup>1</sup><sup>1</sup>Hospital de Valme, UGC Urgencias, Sevilla, Spain

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**Purpose:** Aortic dissection is relatively rare, but may occur as a catastrophic condition for the patient's prognosis, so an early diagnosis and treatment is crucial to their survival. We used two systems of classification of this pathology, being the most used sorting Stanford: type A dissection, if it affects the ascending aorta; type B and all other types of dissection. **Material and methods:** We studied the diagnosis of an aortic dissection type B of Stanford by a bedside ultrasound performed by emergency physician. We have an ultrasound-Sonosite M-Turbo, P21 probe of between 1 and 5 MHz, with and echocardiography software. **Results:** A 76 years old male, admitted to the emergency room because he suffers intense, transfixing, oppressive central chest pain radiating to the back. He had normal vital signs. Analysis revealed a dimer D 6222, with normal cardiac enzymes and electrocardiogram, but showing an aortic elongation mediastinal widening on chest radiograph, so the emergency physician performed an ultrasound scan that showed a double light in the abdominal aorta, until iliac. A thoracoabdominal CT scan was immediately performed with contrast confirmed type B aortic dissection, from the left subclavian to the iliac bifurcation, with false light in a posterior position, without involvement of supra-aortic arteries and visceral branches. The patient was admitted to the ICU, opting for traditional treatment, was discharged without later complications. **Conclusions:** Ultrasound has become, in the last few years, an indispensable tool for the emergency physician, and there is broad international supporting literature that recommends and requires that us, all the emergency physicians, use ultrasound for the benefit of our patients; but its use is not infallible, so performing the technique and interpretation by not medical experts, must be supervised by others with more experience to guide them so possible diagnostic errors are avoided.

P6-18

**Clinical ultrasound in emergency room to a septic patient**Oviedo García AA<sup>1</sup>, Algaba Montes M<sup>1</sup>, Patricio Bordonás M<sup>1</sup><sup>1</sup>Hospital de Valme, UGC Urgencias, Sevilla, Spain

DOI: 10.1055/s-0036-1587965

**Purpose:** Emphysematous cholecystitis (EC) is an entity with high morbidity and mortality, and therefore require a diagnosis agile and dynamic, allowing appropriate management to avoid complications. The emergency ultrasound (US) allows a versatile and comprehensive management, improving the prognosis of this disease in the majority of cases. **Material and methods:** A patient with abdominal pain, with a final diagnosis of an EC assessing US performed by EP. **Results:** We report the case of a 72 year old patient with prior stroke without sequelae and hypertensive, with abdominal pain of 7 days duration, high fever and bilious vomiting, and clinical condition of septic shock. The emergency physician performed a bedside ultrasound that showed a thickened gallbladder wall (8 mm), well-circumscribed, oval, distended and gas in the same wall, compatible with emphysematous cholecystitis. Support measures were initiated, antibiotics and emergency surgery was indicated. **Conclusion:** EC is a rare entity that represents 1% of all cholecystitis, clinically indistinguishable, but with a worse prognosis (25% mortality) and more complications. Here debut comes as poorly controlled diabetes. The use of abdominal US in ER allows for both a rapid and versatile, with proper treatment start, this being vital to good patient outcomes. Incorporate Emergency ultrasound may facilitate the early diagnosis of acute cholecystitis, preventing its severe clinical complications and providing greater patient safety. Therefore, the authors believe that the use of abdominal ultrasound in the emergency should be extended to all because it allows us a quick and versatile diagnosis, appropriate treatment with early onset with severe patients, as in the case presented, this being vital for a better prognosis and a good outcome for our patients.

P6-19

**Autoimmune nonpuerperal mastitis**Rott H<sup>1</sup>, Marzotko E<sup>2</sup><sup>1</sup>GP Rott & Schön, Köln, Germany; <sup>2</sup>Praxis für Gynäkologie und Geburtshilfe, Erfurt, Germany

DOI: 10.1055/s-0036-1587966

**Purpose:** To share our experiences with this rare disorder. **Material and methods:** We want to present three cases of rare autoimmune mastitis nonpuerperalis, the clinical picture, the ultrasound findings, therapy options and a comparison with the literature. **Results:** All three patients stayed breast-conserving. One patient developed a contralateral breast cancer. **Conclusion:** It is a rare illness, often recurrent. Most commonly a cortisone therapy is done, smoking cessation seems necessary and complementary medicine an accompanying option. Individual treatment strategies similar to already described forms of therapy should be made.

P6-20

**Usefulness of bedside ultrasonography in the emergency room**Oviedo García AA<sup>1</sup>, Algaba Montes M<sup>1</sup>, Patricio Bordonás M<sup>1</sup><sup>1</sup>Hospital de Valme, UGC Urgencias, Sevilla, Spain

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**Purpose:** Bedside emergency renal ultrasonography (BERU) performed and interpreted by emergency physicians with limited training and experience is increasing in use and gaining acceptance. BERU concentrates on the focused presence or absence of hydronephrosis as is often seen in patients with acute flank pain secondary to renal colic. ED visit rates for urolithiasis increased from 178 to 340 visits per 100,000 individuals from 1992 – 2009. Therefore, it is a common condition in the ED. In many patients, BERU may obviate the need for further diagnostic workup and speed the diagnosis and treatment of an emergency patient. We present a case of patient admitted at ED with right flank pain and hematuria, the typical presentation of renal colic. **Material and methods:** renal calculi are the most common cause of flank pain and hematuria, it is prudent to also closely examine the kidneys on bedside emergency ultrasound for abnormal findings beyond the mere presence or absence of hydronephrosis. **Results:** 53 year old male, was admitted to the ER by right flank pain and hematuria. Bedside emergency ultrasound initially performed to look for hydronephrosis, showed a large right renal mass, and prompted further workup with CT of abdomen and pelvis. While ultra-

sound is less sensitive than CT for detecting renal masses, it is a convenient imaging modality with many potential benefits for the initial ED workup of flank pain and hematuria. **Conclusion:** BERTU helped to identify a renal mass in a patient who presented with hematuria and left flank pain, initially thought to be renal colic on clinical evaluation. Like most renal tumors, this patients symptoms overlapped with the typical presentation of renal calculi. It was the findings on clinical emergency ultrasound, that helped to identify the correct diagnosis and prompted the appropriate consultations to urologist, with a final diagnostic of Renal Cell Carcinoma.

P6-21

### Severe intracranial haemorrhage with cerebral parenchymal necrosis in fetal alloimmune thrombocytopenia – a case report

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**Purpose:** In fetal/neonatal alloimmune thrombocytopenia (FNAIT) maternal alloantibodies destroy fetal platelets, which harbour the paternal inherited agent (in 80% HPA-1a). The frequency is approximately 1:1000, but FNAIT is supposedly highly underdiagnosed. In contrast to rhesus incompatibility, this disease may already occur in the first pregnancy. Since screening is not available, FNAIT is currently not diagnosed before the occurrence of intracranial haemorrhage that may result in lifelong disability or death. Our case report intends to emphasize the importance of FAIT, especially with respect to future options in prevention and prophylaxis. **Materials and methods:** We report on a 29-year-old pregnant woman, III/G/OP, who was referred to us in week 30 with suspected hydrocephalus. The ultrasound showed an appropriately developed fetus with isolated unilateral hydrocephalus. Hyperechoic intraventricular formations raised the suspicion of intraventricular haemorrhage. Additionally, the cerebral cortex was narrow (9 mm). 3rd and 4th ventricle and the other brain structures were unremarkable. **Results:** Maternal antibodies against HPA-1a were detected and human platelet antigen genotyping of DNA extracted from the amniotic fluid verified the inherited paternal HPA-1a antigen on fetal platelets. Fetal cMRI confirmed intracranial haemorrhage and revealed cerebral necrosis throughout the middle cerebral artery territory. Due to the poor prognosis and maternal desire the fetal demise was induced. At this time, the child presented a severe thrombocytopenia (11/nl). **Conclusion:** FNAIT is considered an important differential diagnosis of intracranial haemorrhage and hydrocephalus and should always be clarified, in particular with regard to therapeutic and preventive measures in the next pregnancy. The potential of a screening program and immune prophylaxis in HPA-1a-negative women, similar to rhesus prophylaxis, will be investigated by the PROF-NAIT study and implying a growing importance of FNAIT.

### Ultrasound of the Head and Neck and Vascular Ultrasound – Clinical Investigations and Case Reports

P7-11

### Coronary artery disease associated with Carotid artery disease and lower extremity peripheral artery disease: Preliminary result study

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**Purpose:** To identify statistically significant correlation if any, between Coronary Artery Disease CAD (based on coronary angiography results) and Carotid Artery Disease (assessed by duplex ultrasonography) and between Coronary Artery disease and Periphery artery disease, respectively. **Materials and methods:** The study population in this ongoing prospective study is consisted of 40 patients, 26 male and 14 female, greek ethnicity, with mean age 69.8 years (32y -86y). Patients based on coronary angiography results were divided into two groups: Group A consisted of 26 patients with abnormal findings (8 patients had 1-vessel disease, 9 patients had 2-vessel disease, 6 patients had 3- vessel disease and 3 had left main stem disease) and group B of 14 patients with normal findings in angiography, comprised our control group. Both groups had undergone duplex ultrasonography evaluation for carotid

artery disease and lower extremity periphery artery disease. **Results:** A significant positive correlation was established between the severity of CAD and the severity of periphery artery disease (> 50% stenosis) with an increased absolute risk of 5 in the study population. A higher prevalence of the medium severity carotid artery disease (30 – 50% stenosis) is noticed in the abnormal coronary artery disease group in comparison to the control group.

### Interventional/Neurological and Pediatric Ultrasound – Clinical Investigations and Case Reports

P8-09

### Optic Nerve Sheath Diameter (ONSD) changes in patients with normal pressure hydrocephalus – a useful supplement to the spinal tap test

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Normal pressure hydrocephalus (NPH) is defined by the clinical triad of characteristic gait disturbance, incontinence and cognitive decline. The clinical diagnosis is supported by a specific imaging pattern. Therapy of choice is cerebrospinal fluid (CSF) removal, for evaluation of permanent shunting the spinal tap test is one of the established diagnostic tests. In spite of exact patient selection a certain amount of patients do not respond significantly to CSF-removal. A possible explanation might be a reduced compliance of the cerebral ventricles, which is already discussed as part of the pathophysiology of NPH. Ocular ultrasound with measurements of the Optic Nerve Sheath Diameter (ONSD) is an elegant, non-invasive technique to monitor intracerebral pressure (ICP) changes. Therefore we tried to pursue the hypothesis that changes in the ONSD – as a correlate of the ventricular compliance – prior to spinal tap test might predict the patients' response to the test. Here we present the data of a prospective study with 91 patients (31 patients with NPH and 60 healthy age matched volunteers). Ocular ultrasound might be a useful, noninvasive supplement to the spinal tap test for selection of patients suitable for shunt surgery.

P8-10

### Neonatal ultrasound screening for newborns conceived via Assisted Reproductive Technology (ART)

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The ultrasonography is the most frequently used diagnostic method for children due to its high sensitivity, reliability and application without any contraindications in emergency situations shortly after birth. **Purpose:** We sought to investigate the benefits of infantile ultrasonography in newborns conceived via ART. **Material and methods:** 294 newborn children born via ART received a cranial and abdominal ultrasonography as well as an ultrasound screening for developmental dysplasia of the hip (DDH) between the 3<sup>rd</sup> and the 5<sup>th</sup> day postpartum in the period 01.01.2007 – 31.12.2013. They were divided into 5 categories: gender, gestational age, birth weight, birth mechanism and perinatal complications. The ultrasonography was performed with GE, Logiq200 Pro device ultrasound machine with a 3.5 – 7.5 MHz transducer. **Results:** 95, 6% of the abdominal examinations showed no pathological findings. The most frequent result among the 4.4% with positive findings was pyelectasis (1.9%), followed by hydronephrosis 1<sup>st</sup>/2<sup>nd</sup> degree (1.5%). The following results were observed as well: hydronephrosis 4<sup>th</sup>/5<sup>th</sup> degree (2 children), multicystic dysplasia (2 children), right renal hypoplasia (1 child), left renal aplasia (1 child) and a right kidney cyst (1 child). 3 newborns were diagnosed with an adrenal hemorrhage, 4 children with pyloric stenosis and 6 children with gastroesophageal reflux disease. The cranial sonography showed no pathological findings in 91% of the term babies- the other 9% had a slight lateral cerebral ventricular dilatation. The results in the preterm newborn group showed that 7% had a cerebral intraventricular hemorrhage 2<sup>nd</sup> degree and 5.8% had a 3<sup>rd</sup> degree hemorrhage. 1.5% of all premature babies were diagnosed with periventricular leukomalacia (PVL). The screening for DDH demonstrated DDH in 0, 5% of the children and unstable hips in 30% of them. **Conclusion:** The neonatal ultrasound screening is an excellent and accessible tool to diagnose severe diseases and certain congenital malformations.



## P8-11

**The sonographic diagnosis of the tumoral calcosinosis**Lemmer AIKD<sup>1</sup><sup>1</sup>Helios Klinikum Erfurt, Klinik für Kinder- und Jugendmedizin, Erfurt, Germany

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**Purpose:** Tumoral calcosinosis shows a typical sonographic appearance but it is also a very rare disease with a high risk of misdiagnosis and an inadequate therapy. Sonography is an important imaging modality in the diagnostic procedure. The presentation of characteristic sonographic criteria for tumoral calcosinosis increases the certainty of diagnosis and is the basis of a quick and proper therapy. **Method:** We present typical clinical aspects of this disease in connection with characteristic imaging findings especially using sonography. **Results:** Typical sonographic signs of tumoral calcosinosis are massive extraosseous hyperechoic lesions of soft tissues with an acoustic shadowing phenomenon. The own demonstrated case impressively illustrates the possible manifestation during childhood. **Conclusion:** The sonographic examination is an essential pillar in the diagnosis of tumoral calcosinosis syndrome. In adults but also in children the emergence of massive tumorlike calcium deposits in soft tissues is possible.

## P8-12

**Ultrasound examination of musculoskeletal adverse side effects after vaccination in babies**Grujoska Veta D<sup>1</sup>, Georgieva D<sup>1</sup>, Dzoleva R<sup>1</sup>, Dimitrieska Kiprovskaa S<sup>1</sup>, Poposka A<sup>1</sup><sup>1</sup>University Clinic for Orthopaedic Surgery, Skopje, Macedonia, the Former Yugoslav Republic of

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**Purpose:** The aim of this study was to evaluate the usefulness of ultrasound in follow-up of adverse side effects in musculoskeletal system after vaccination in babies. **Material and methods:** Patients were babies aged 0–12 months, who were referred for ultrasound screening for DDH. Inclusion criteria for US examination of both lower legs in a prospective trial, were babies with suspect of nodules or diffuse enlargement of muscles where the shot was given. The examination was carried out with a 7.5 MHz real-time linear probe using the apparatus SONOLINE Versa Ultrasound Imaging System, SIEMENS AG, Erlangen, BRD. X-ray and blood tests were performed in three babies with suspect of cellulites of thigh and osteomyelitis of femur. Clinical and ultrasound examination were performed by orthopaedic surgeons experienced in musculoskeletal ultrasound. **Results:** Redness, swelling, soreness and tenderness where the shots were given, were seen in most of the patients. Decreased range of leg movements were associated in 3 patients with cellulites of thigh muscles and in one patient with osteomyelitis of femur. US examination showed nodules of different sizes and echogenicity or diffuse soft tissue enlargements in gluteal or anterolateral thigh region. Periosteal reaction of femur was also detected with US. US examination was used in follow-up of those patients on regular time interval or according to clinical signs. **Conclusion:** Ultrasound is useful and safe method in diagnosis and follow-up of musculoskeletal adverse side effects of vaccination in babies.

**Prenatal Ultrasound – Clinical Investigations and Case Reports**

## P9-15

**Continuous amniocentesis via a subcutaneously implanted port system with PPRM and anhydramnios <28+0 weeks of gestation: an international prospective randomized trial**Göbel S<sup>1</sup>, Naberezhnev Y<sup>1</sup>, Seliger G<sup>1</sup>, Tchirikov M<sup>1</sup><sup>1</sup>University Clinic of Obstetrics and Prenatal Medicine, Center of Fetal Surgery, University Hospital Halle (Saale), Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

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Mid-trimester PPRM occurs in 1% of pregnancies leading to a high neonatal mortality and morbidity rate, causing extreme preterm birth combined with the “fetal inflammatory response syndrome” (FIRS), thus inducing lung hypoplasia. **Purpose:** The evaluation of continuous amniocentesis therapy joining a 7 day lasting antibiotic treatment with PPRM and oligo-/anhydramnios (SDP = single deepest pocket <2 cm) between 22+0 until 27+6 weeks of gestation compared to the antibiotic therapy appropriate to national guidelines is the objective of this pro-

spective randomized trial. **Material and methods:** 48 patients will participate in this study, divided into an intervention or control group, each containing 24 women. Entry criteria: Singleton pregnancies, classic PPRM and proven oligo-/ anhydramnios between 22+0 to 27+6 weeks of gestation. Exclusion criteria: fetal chromosomal aberrations, malformations, high PPRM, AIS, premature labour. The comparison of both groups regarding the PPRM-delivery-latency in days and appearance of FIRS will be the primary endpoint of this investigation. The ultrasound-based subcutaneous implantation of the port system is conducted in local anaesthesia. A hypotonic amniotic fluid-like solution (100 ml/h) is used for permanent amniocentesis (J Perinat Med 2013;41:657–63). **Results:** An earlier retrospective analysis showed a significant prolongation of the PPRM-delivery-interval for 49 days and a better neonatal outcome without lung hypoplasia or contractures, applying continuous amniocentesis with 2.4 litres/day (“flush-out”). **Conclusion:** Flushing-out bacteria and inflammatory products out of the amniotic cavity could extend pregnancy, prevent lung hypoplasia and improve neonatal outcome clearly. This assumption is to be verified in this study. Patient recruitment shall be completed by the end of 2017. Several physicians from 5 countries have been instructed in the method of port implantation at the Center of Fetal Surgery, University Clinic of Obstetrics and Prenatal Medicine, Martin-Luther- University Halle-Wittenberg. **Sponsoring:** Center of Fetal Surgery, University Hospital Halle (Saale) and Russian Science Foundation, Grant- Nr. 15 – 15 – 00137.

## P9-16

**Prenatal diagnosis of renal cysts and diabetes syndrome (RCAD) managed by continuation of pregnancy and adapted perinatal comfort care**Hildebrandt MD<sup>1</sup>, Horling K<sup>2</sup>, Hildebrandt H<sup>3</sup>, Feyerabend B<sup>2</sup>, Schwärzler P<sup>1</sup><sup>1</sup>Asklepios Hospital Barmbek, Gynaecology and Obstetrics, Hamburg, Germany; <sup>2</sup>MVZ Hanse Histologikum GmbH, Pathology, Hamburg, Germany; <sup>3</sup>Practice Dr. Hildebrandt, Gynaecology and Obstetrics, Hamburg, Germany  
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**Purpose:** Urogenital dysplasia is the third most common of all congenital malformations and can be detected by ultrasound at an early stage. If no renal function is present the termination of pregnancy would be recommended. This can lead to versatile mental, social, and also healthy problems. Continuation of pregnancy and vaginal delivery with specialized perinatal palliation may be an appropriate option. For this reason we present a case of prenatally diagnosed complex renal dysplasia with fatal prognosis. **Material and methods:** After the cystic dysplastic kidney (CDK) was detected by ultrasound in the 18+5 week of gestation the patient (inconspicuous medical history) was closely followed up. A midwife, specialized on psychologic antenatal care, and neonatologists were involved in patient-centered care early. Amniocentesis and postmortem fetal examination of the urogenital tract were carried out.

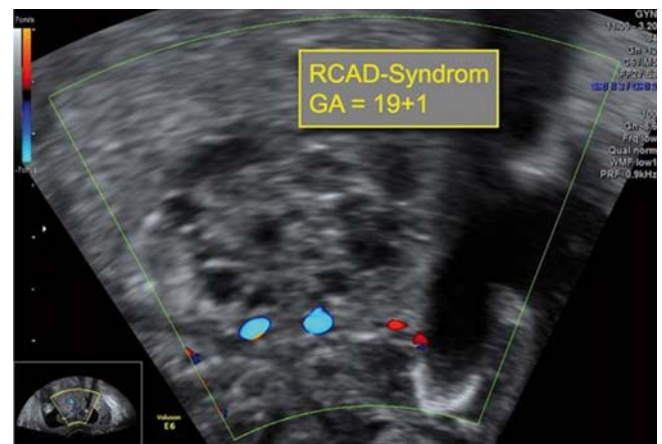


Fig. 1: Ultrasound of RCAD

**Results:** Ultrasound images showed a dystopic CDK in pelvic area and absence of bladder fillings. There was increasing oligohydramnios and restricted fetal growth during the entire period of gestation. Amniocenteses confirmed lack of renal function but no chromosomal aberrances. After stillbirth with 33 weeks of gestation the histopathological examination revealed dextral dystopic CDK combined with sinistral kidney

agenesis, ureter agenesis, and unilateral paraganglioma in the abdomen and retroperitoneum". The patient evaluated the pregnancy-continuation and the postpartum farewell to be positive. **Conclusion:** For some women with lethal fetal malformations performance of vaginal delivery and support of specific perinatal comfort care may be more favorable and ethical than pregnancy termination. \*Some genetic assays are pending and will be brought to the convention.

## Young Investigators

### E9-01

#### Primary liver tumors and percutaneous ablative treatment: an 18-year Bulgarian experience

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**Introduction:** Prevalence of primary liver tumors (PLT), treatment options and aggressive decisions for better results has grown for the last decades in Bulgaria. We introduce our experience in one-shot-large-volume percutaneous ethanol (Shot-PEI), radiofrequency (RF) and microwave (MW) ablation of PLT. **Purpose:** To compare different techniques in terms of technical effectiveness, oncologic results and safety in the treatment of PLT. **Methods:** In 1997 – 2015 327 patients (80.4% male), aged 26 – 84 (mean 64.2), were diagnosed, using CEUS/CECT, histology/immunohistochemistry, with PLT (89.4% HCC, 9.9% cholangiocarcinoma, 0.7% mixed HCC/CC), and coexisted cirrhosis (Child A 59.7%; B 35.4%, 81.6% viral infection: HBV 53.3%; HCV 32.4%), solitary lesion 69.4%, 52.6% ≥ 5 cm, BCLC: A-21.7%; B-38.5%; C-32.2%, D-7.7%. RFA (monopolar/multipolar/expandable) was used in 40.1%, MWA-6.4%, shot-PEI-17.2%. 39% of RFA-treated-lesions were > 5 cm; half of MWA-treated were large and/or difficult/risky located. **Results:** Follow-up was 1 – 72 months (mean 13). Complete destruction was achieved in 61.9%/59.5%/43% for MWA/RFA/Shot-PEI, in 94.4%/54.1%/48.6% – for BCLC-A/B/C. Major complications occurred in 13.1%/7.7%/4.4%/0%/0% after Shot-PEI/monopolar/multipolar/expandable RFA/MWA reflecting learning curve. Local tumor progression (LTP) occurred after mean 12.2 months in 19.0%/13.7% following MWA/RFA; new lesions – in 19.0% and 22.1% respectively after mean 10.1 months. Median survival was 59 months. 12-, 24-, 36-months survival was 81%, 81%, 79%, similar for both thermal techniques. **Conclusion:** MWA is equal to RFA in terms of technical and oncologic effectiveness, offering advantage in difficult/risky locations. Expandable RFA ensures less LTP rates in medium-sized lesions. Patients with BCLC B-C could benefit from ablation-based treatment.

### E9-02

#### The Value of ElastPQ for the Evaluation of Liver Fibrosis in Patients with B and C Chronic Hepatopathies

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**Purpose:** The aim of this study was to evaluate the diagnostic performance of a point shear wave elastography using ARFI technique- ElastPQ, in patients with B and C chronic hepatopathies, using Transient Elastography (TE) as the reference method, since it is a validated method for liver fibrosis assessment. **Methods:** The study included 193 consecutive subjects with chronic hepatopathies (32.6% HBV, 67.4% HCV) from whom 42.5% had liver cirrhosis. Liver stiffness (LS) was evaluated in the same session by means of 2 elastographic methods: TE (Fibroscan, Echosens) and ElastPQ (Philips, Affinity) techniques. Reliable LS measurements were defined as follows: for TE – the median value of 10 LS measurements with a success rate ≥ 60% and an interquartile range < 30%. For ElastPQ- the median value of 10 LS measurements in the liver parenchyma, at least 1 cm below the capsule, avoiding large vessels. For TE M and XL probes were used. For differentiating between stages of liver fibrosis we used the following cut-off values for TE – mild fibrosis (F1)–6.1 kPa,

moderate fibrosis (F2)– 7.2 kPa, severe fibrosis (F3)–9.6 kPa and for liver cirrhosis (F4) –14.5kPa (1). **Results:** Reliable liver stiffness measurements were obtained in 93.8% (181/193) by means of TE and in 98.4% (190/193) with ElastPQ. In our cohort the ElastPQ values ranged from 2.32 to 44.07 kPa (median = 8.37 kPa). Based on TE cut-off values we divided our cohort into 4 groups: F1: 69/181 (38.1%); F2: 10/181 (5.5%) F3: 29/181 (16.1%); F=4: 73/181 (40.3%). The areas under the receiver operating characteristic curve were: 0.89 ± 0.02 for patients with mild fibrosis (F1), 0.93 ± 0.02 for moderate fibrosis (F2), 0.95 ± 0.01 for severe fibrosis (F3) and 0.95 ± 0.01 for cirrhosis. The best cut-off values for discriminating mild, moderate, severe fibrosis and cirrhosis were 6.5, 7.2, 8.6 and 9.9 kPa respectively. **Conclusion:** ElastPQ is a method that seems to be good for the diagnosis of all stages of liver fibrosis with good diagnostic accuracy.

### E9-03

#### Abstract title: Elastography and diffusion-weighted MRI in patients with normal, testicular microlithiasis and testicular cancer

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**Purpose:** Today a combination of ultrasonography and elastography is becoming more and more applicable, and both techniques can help to improve an early detection of testicular cancer. Recently, studies have showed higher velocity stiffness in testicular tumours compared with normal testicular tissue. Ultrasound is the primary modality when investigating scrotum, however other modalities and techniques such as diffusion-weighted MRI can be a useful tool in evaluating testicular malignancies. The relationship between velocity stiffness and MRI diffusion is not well established. Our aim was to compare shear wave elastography with MR diffusion weighted apparent diffusion coefficient (ADC). **Materials and Methods:** We prospectively examined 126 patients with both ultrasound including a shear wave elastography (Acoustic Radiation Force Impulse) and a MRI diffusion examination of the scrotum. We performed three ARFI measurements in each testicle, and we measured the MRI ADC values in each testicle in three different images. All MRI images were evaluated using an Easy Vis Impax PACS workstation. The patients were divided into three groups; 52 men with normal testicular tissue, 21 men with testicular cancer, and 53 men with testicular microlithiasis. Histology reports from the 21 men with testicular tumours showed 10 seminomas, 9 non- seminoma and 2 of unknown origin. The ADC values were measured in three different images with a region of interest of 3.0 mm, and by freehand whole testicular volume. **Results:** The mean age from the three groups was 46.8 years. The mean tumour elasticity was 2.1 m/s (SD: 0.91) and the mean ADC with a Region of interest of 3.0 mm was 0.801 mm<sup>2</sup>/s (SD: 0.23), and with ADC freehand 0.851 (SD 0.22). **Conclusion:** Typically a high measured elastography value indicates increased testicular stiffness, and a low MRI ADC indicates increased testicular stiffness in tumours. But there are exceptions.

### E9-04

#### Role of transperineal ultrasonography (TPUS) in follow up of IBD patients with perianal disease

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**Introduction:** The assessment of perianal disease is very important in IBD patients. In clinical practice, the outcome of medical or surgical treatment is evaluated mainly on the basis of physicians' subjective judgment. However, some objective scores for evaluating the efficacy of treatment have been proposed such as the Fistula Drainage Assessment (FDA) and the Perianal Disease Activity Index (PDAI). Specifically, FDA focuses on fistula drainage: a significant clinical improvement is present when at least 50% of fistulae is cured whereas complete remission is achieved when all fistulae are closed at the digital pressure in two consecutive

visits. However, both FDA and PDAI give no information on the anatomical evolution of fistulae during medical treatment. Moreover, physical examination of the perineum is generally unable to differentiate between simple and complex fistulae according to the AGA classification although this information is crucial to assess the relationship between fistulae and anal sphincters and to determine the clinical outcome of IBD patients with perianal disease. Nowadays, clinical evaluation combined with MRI findings is considered as the gold standard method to evaluate the treatment outcome of the perianal disease. In fact, several studies have shown that MRI is useful in the pre-operative setting to determine the severity of fistulizing disease and could be used to study how fistulae evolve during medical treatment (1–3). Nevertheless, the use of MRI seems to be unfeasible in clinical practice especially during long term antibiotic therapy for active perianal disease. Recently, TPUS has been recognized as accurate as MRI not only in diagnosis and staging the perianal disease (4,5), but also in predicting the outcome of the disease during infliximab treatment (6). **Purpose:** The aim of this retrospective single-center study was to evaluate the accuracy of TPUS in IBD patients with active perianal disease during antibiotic treatment. **Methods:** All IBD patients with active perianal disease referred to our IBD unit for starting antibiotic treatment between January 2014 and December 2015 were included in this study. All enrolled patients underwent both gastroenterological and surgical evaluation. PDAI and FDA scores were calculated. According to Present's study (7), a cut-off value of PDAI  $\leq 5$  was chosen to establish the clinical remission after medical treatment. TPUS was performed by an experienced operator. All patients were re-evaluated with the same protocol 30 days after the antibiotic treatment introduction. A Fleiss Kappa test was used to evaluate the agreement between FDA, PDAI and TPUS evaluations. **Results:** All IBD patients with active perianal disease referred to our IBD unit for starting antibiotic treatment between January 2014 and December 2015 were included in this study. All enrolled patients underwent both gastroenterological and surgical evaluation. PDAI and FDA scores were calculated. According to Present's study (7), a cut-off value of PDAI  $\leq 5$  was chosen to establish the clinical remission after medical treatment. TPUS was performed by an experienced operator. All patients were re-evaluated with the same protocol 30 days after the antibiotic treatment introduction. A Fleiss Kappa test was used to evaluate the agreement between FDA, PDAI and TPUS evaluations. **Conclusion:** TPUS is able to accurately evaluate the short-term evolution and predict the outcome of perianal disease after antibiotic treatment. In the future we need to elaborate and validate a score useful for a more objective evaluation of TPUS findings in order to standardize the operators' findings between the IBD units.

## E9-05

### In vitro quantification of tissue elasticity using three shear wave elastography platforms on liver fibrosis phantoms

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**Introduction:** To assess and validate the reproducibility of quantitative elastography measurements, using shear-wave methods on four individual tissue-mimicking liver fibrosis phantoms with known Young's modulus. **Methods:** We used three different shear wave elastography platforms: GE Logiq E9 SWE, Philips iu22 XM ARFI and Samsung RS80A. Both linear (high frequency) and curvilinear (low-frequency) probes were applied. The objects were four individual tissue mimicking liver fibrosis phantoms with different Young's modulus within the range of soft biological tissue (2.7kPa, 11.5kPa, 24.8kPa, 46.3kPa). Two individual investigators performed all measurements in parallel. Each investigator made ten non-continued measurements of each phantom. The platforms were evaluated for inter- and intraobserver variability, coefficient of variation, ICC and Bland-Altman using the median value. Statistical analysis was performed with SPSS. **Results:** All three elastography platforms showed excellent intra- and interobserver agreement (interclass correlation 0.981–1.000 and intraclass correlation 0.987–1.000). All four liver fibrosis phantoms could be differentiated by quantitative elastography, by all platforms ( $p < 0.001$ ). In the Bland-Altman analysis the differences in measurements were larger for the phantoms with higher Young's modulus. All platforms had a coefficient of variation in the range 0.00–0.21 for all four phantoms, equivalent to low variance and high reproducibility (see table 1).

**Tab. 1:** Median (min-max) elasticity measurements performed with three elastography platforms on liver fibrosis phantoms

Elastography system	Probe shape	Observer	Phantom 1 2.7 kPa $\pm 5\%$	Phantom 2 11.5kPa $\pm 5\%$	Phantom 3 24.8 kPa $\pm 5\%$	Phantom 4 46.3 kPa $\pm 5\%$
Philips iu22 XM ARFI	curvilinear	A	1.93kPa (1.76–2.23)	8.29 kPa (7.35–9.66)	20.46 kPa (18.2–34.88)	47.09 kPa (38.29–50.75)
		B	1.89 kPa (1.8–2.01)	7.73 kPa (7.23–7.92)	19.68 kPa (18.88–23.9)	44.74 kPa (36.73–46.85)
		A + B	1.9 kPa (1.76–2.23)	7.82 kPa (7.23–9.66)	20.19 kPa (18.2–34.88)	45.5 kPa (36.73–50.75)
Samsung RS80A SWE	curvilinear	A	2.1 kPa (2–2.3)	7.6 kPa (7.2–8.9)	18.40 kPa (17–20)	43.85 kPa (40.9–45.8)
		B	2.1 kPa (2–2.2)	7.65 kPa (7–8.1)	18.15 kPa (17.6–20.7)	43.65 kPa (40.9–47.8)
		A + B	2.1 kPa (2–2.3)	7.6 kPa (7–8.9)	18.30 kPa (17–20.7)	43.7 kPa (40.9–47.8)
GE E9 Logiq SWE	linear	A	1.9 kPa (1.85–2.98)	7.02 kPa (6.98–7.09)	17.06 kPa (16.9–17.16)	35.93 kPa (35.52–36.47)
		B	1.97 kPa (1.93–2.05)	6.88 kPa (6.79–6.91)	17.05 kPa (16.83–17.27)	36.47 kPa (36.3–36.82)
		A + B	1.89 kPa (1.85–2.98)	6.94 kPa (6.79–7.09)	17.06 kPa (16.83–17–27)	36.37 kPa (35.52–36.82)
	curvilinear	A	1.86 kPa (1.83–1.94)	7.24 kPa (7.15–7.28)	18.92 kPa (18.25–19.52)	39.44 kPa (38.5–40.44)
		B	1.92 kPa (1.85–1.94)	7.21 kPa (7.15–7.23)	18.47 kPa (17.96–18.97)	38.67 kPa (37.84–39.54)
		A + B	1.95 kPa (1.83–1.94)	7.23 kPa (7.15–7.28)	18.75 kPa (17.96–19.52)	38.9 kPa (37.84–40.44)

**Conclusion:** All systems used in this study provided a high reproducibility in quantitative measurements in a liver fibrosis phantom and excellent inter- and intraclass correlations. The GE Logiq E9 SWE had the best inter- and intraclass correlation, whilst Philips iu22XM ARFI and Samsung R08A provided elasticity measurements closest to the elasticity values provided by the manufacturer of the phantom.

## E9-06

### The use of SMI in surveillance of endovascular aneurysm repair (EVAR)

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**Introduction:** Endovascular aneurysm repair (EVAR) is the treatment of choice in the repair of abdominal aortic aneurysms. Re-intervention rate is higher for EVAR patients compared with open repair requiring lifelong surveillance. This usually consists of a combination of computed tomography angiography (CTA), colour Doppler ultrasound (CDUS) and plain projection radiography. Due to high cumulative radiation dose and nephrotoxicity of CTA and the poor sensitivity of CDUS, other imaging strategies have been proposed. This study reports the use of a new imaging modality (SMI) for the surveillance of EVAR. **Methods:** A retrospective audit was conducted comparing endoleak detection rates with CTA and US (CDUS and SMI) over a 2 year period. A standard scanning protocol was adopted where the presence of endoleaks and the maximum diameter of the aneurysm sac were reported for CDUS, SMI and contemporaneous CTA scans. **Results:** Of the 195 EVARs scanned, 25 demonstrated an endoleak on SMI (13%) and 13 demonstrated an endoleak on CDUS (7%). Therefore SMI detected almost twice as many endoleaks (similar to literature results when comparing contrast enhanced ultrasound (CEUS) to CDUS). As a comparison of SMI with CTA, 49/195 patients had a contemporaneous CTA. 34 demonstrated no endoleak on SMI and 33 demonstrated no endoleak on CTA (US failing to detect 1 endoleak). Of the 15 SMI demonstrated endoleaks only 9 were visible on CTA (60% failure) and of the 6 undetected, at least 2 patients had expanding sac sizes (indication of late aneurysm rupture). **Conclusion:** SMI was demonstrated to be an effective and safe tool for endoleak detection. SMI surpassed CDUS in sensitivity and in some circumstances outperformed CTA where literature outlines similarity of SMI with CEUS. This has led to a change in our local surveillance protocol (replacing 1 and 6 month follow-up CTA scans with SMI).

## E9-07

### Echogenic Material in fetal gallbladder: Is there any association with dietary Na+ and Ca++ uptake?

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**Purpose:** To determine the prevalence of echogenic material in the fetal gallbladder, to analyse its association with perinatal factors such as maternal dietary Na, Ca ingestion and to present its sonographic findings and postnatal outcomes. **Methods:** We performed a prospective study with 5893 pregnant patients. Maternal and umbilical cord blood were taken after delivery in examined group and Na, Ca, PTH, calcitonin, vit D



levels in both maternal and cord blood were determined. All of the placentas were sent for pathological examination. Perinatal data (antibiotic usage, maternal diseases, amount of dietary Na/Ca uptake) was obtained from all of the patients. Postnatal ultrasonography was performed in identified cases. **Results:** There was no echogenic material in fetal gallbladder before 29 weeks. In the subgroup of 1983 fetuses (29–42 gestational weeks), 13 fetuses were found to have echogenic contents in gallbladder with a prevalence of 0.6%. It was shown that all of the examined group was drinking the same water, a kind of well water. The analyses of the drinking water revealed a relatively higher Na<sup>+</sup> ratio than the ordinary drinking waters (Ca<sup>++</sup> level: 16 mg/L, and Na: 7.043 mg/L). Postnatal follow-up was carried out in all of the examined group and the echogenic material in the gallbladder was resolved in all of them within one month. **Conclusion:** Na<sup>+</sup>/Ca<sup>++</sup> exchanger which is found in plasma membrane of hepatocytes and placenta are mainly responder of Ca<sup>++</sup> extrusion, which is a prothogenic factor. Therefore it may be postulated that increased Na<sup>+</sup> uptake by drinking water causes Ca<sup>++</sup> efflux to fetal gallbladder by Na<sup>+</sup>/Ca<sup>++</sup> channels. Further experimental studies may reveal the exact mechanism of fetal gallbladder sludge/stone formation in fetuses with excess maternal intake of Na.

## E9-08

### Patient-Specific Mechanical Characterization Of Abdominal Aortic Aneurysms Using 4D Ultrasound

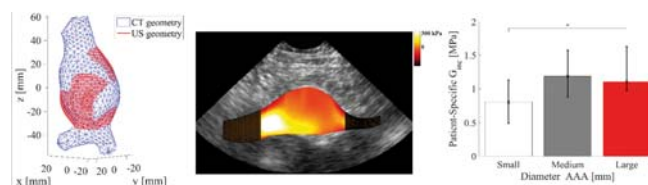
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**Introduction:** Abdominal aortic aneurysms (AAA) are silent killers and the 13<sup>th</sup> cause of death in Western society. In this study, methods for wall stress analysis (WSA) and elastography (EL) were developed using 4D ultrasound (US) to determine patient-specific wall stresses and material properties. These techniques were introduced in the clinic and tested in a subgroup of patients in an ongoing study with 300 patients in follow-up. **Methods:** In forty patients (AAA diameter 27–52 mm), 4D-US data were measured using a Philips iU22 (X6–1 transducer). The brachial blood pressure was measured using an arm cuff. The US data were manually segmented. The patient-specific geometry was tracked over time to estimate its displacement field using 3D speckle tracking. Subsequently the diastolic geometry was converted into a finite element model. WSA was performed assuming a neo-Hookean material model. The model was optimized by iteratively adapting the material properties until the model output matched the 3D displacements. For seven patients, computed tomography (CT) data were available and used to compare the US-based geometries and wall stresses. **Results:** The 4D-US based 99<sup>th</sup> percentile wall stress ranged between 198 to 390 kPa, and the patient-specific material property ( $G_{inc}$ ) had a median of 1.1 MPa (IQR: 0.7–1.4 MPa). Geometry based on US data showed good similarity indices (0.90–0.96) with CT, and the 25<sup>th</sup> to 95<sup>th</sup> percentile wall stresses were in good agreement. Small aneurysms revealed stresses similar to those in large AAAs. Furthermore, the arterial stiffness increased with respect to AAA diameter. **Conclusion:** This study shows that 4D US-based WSA and EL of AAAs is feasible and has the potential to aid in AAA rupture risk assessment by identifying patients at risk, and to monitor patients over time by detecting changes in wall stress and material properties. Ongoing work includes a novel automatic segmentation and registration algorithm and long-term follow-up.



**Fig. 1:** a) Segmentation obtained from CT-data (blue) and US-data (red) with a similarity index of 0.96; b) The Von-Mises wall stress distribution is shown for a typical AAA geometry; c) The shear modulus ( $G_{inc}$ ) is equally divided in three groups with respect to the anterior-posterior (A-P) diameter. The AAAs with a large diameter reveal a significant increase in wall stiffness compared to the small AAAs.

## E9-09

### Relations between ultrasonographic, elastographic and electromyoneurographic parameters in patients with carpal tunnel syndrome

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**Introduction:** To test the new proposed ultrasonographic (US) diagnostic algorithm for carpal tunnel syndrome (CTS) (Goldberg G, 2016), to compare cross-sectional area (CSA), wrist-to-forearm CSA ratio (WFR) and the elasticity of the median nerve (MN) between 2 groups: healthy volunteers and patients with electrodiagnostically proven CTS. **Methods:** 10 patients with CTS (20 hands) and 12 healthy volunteers (24 hands) underwent US of the MN. The CSA and MN strain was measured (MN strain was measured three times) by a radiologist (with 30 years of experience) and by medical resident. Examiners were blinded to the diagnosis of CTS and US measurements made by each other. The mean value was used for the analysis. Patients having had a prior wrist trauma, operation or rheumatic diseases were excluded. **Results:** Both hands in 10 patients diagnosed with CTS at the EMG service (9 women and 1 men, mean  $\pm$  SD age  $62.3 \pm 5.3$  years, range 56–72 years, 15 hands with mild, 2 moderate, 2 severe CTS) and in 12 healthy volunteers (8 women and 4 men, mean  $\pm$  SD age  $60.6 \pm 8.7$  years, range 51–82 years) were studied. CSA and WFR in the patients with CTS were significantly higher than those in the healthy volunteers ( $p < 0.05$ ) according to both examiners. The MN strain in the patients with CTS were not significantly higher than those in the healthy volunteers ( $p > 0.05$ ) according to both examiners. Sensitivity of the algorithm was 89%, specificity 24%. **Conclusion:** US can provide improvement in patients' selection for the EMG examination. Yet our study suggests that selection criteria (CSA and WFR values) should be reconsidered separately by each clinic performing the examination. Elastography may not be helpful for diagnosing mild CTS.

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