Introduction

Fibroid treatment with MR-guided focused ultrasound (MRgFUS; syn.: HIFU = high-intensity focused ultrasound) is a thermoabla-
tive method in which the tissue to be treated is heated by focused ultrasound in single small volume increments (sonifications, syn: sonications) under constant MRI control until complete dena-
turation of the planned fibroid volume is achieved. After thermo-
ablation, imaging showed a lack of contrast enhancement of the
treated tissue (NPV = non-perfused volume).

MRgFUS is organ-preserving and noninvasive and can be per-
formed on an outpatient basis.

The treatment method is offered only by a few specialized
centers.

The goal of MRgFUS treatment is to reduce or eliminate
fibroid-related symptoms in affected women. A reduction in
fibroid size can be achieved with ultrasound treatment. Complete
fibroid regression is not to be expected and is also not the goal of
the treatment.

The disciplines of gynecology and radiology agree that the
indication for the treatment of uterine fibroids should be deter-
bined by a gynecologist following examination and counseling
of the patient. Comprehensive patient counseling regarding the
treatment options in symptomatic uterine fibroids should include
medication, surgery, and the two non-surgical treatment options
uterine artery embolization (UAE) and MRgFUS. The decision for
or against a treatment alternative should be made under consid-
eration of the patient’s wishes and with knowledge of other treat-
ment options, the chance of success, limitations, typical side
effects, and possible complications (informed consent).

MRgFUS treatment provides a treatment method for patients
with fibroid-related symptoms and allows further treatment
individualization for uterine fibroids in Germany, Austria, and
Switzerland.

Goal of the consensus meeting

The intention of this third consensus meeting was to evaluate
and categorize MRgFUS in the fibroid treatment spectrum. The
12 participants of the radiological-gynecological expert meeting
came to a consensus following thorough discussion with evalua-
tion of the current literature1 and their own experiences.

The group of experts was aware that the possibilities and lim-
itations of a radiological treatment method was being discussed
together with gynecology specialists who do not actually perform

* To be differentiated from non-MR-guided focused ultrasound.

1 The appendix contains references to select relevant publications.
the procedure but have expertise and experience with the diagnosis and medication-based and surgical treatment of diseases of the female genitals.

The expert group comprised of 4 radiologists and 8 gynecologists that met on January 14, 2017 in Berlin for the third radiological-gynecological consensus meeting regarding MRgFUS treatment also included gynecologists from Switzerland.

Following extensive and at times also controversial discussion, the group agreed in consensus upon the following recommendations. The consensus paper is supported by the gynecologists and radiologists listed at the end of the article. The paper reflects the current state of knowledge.

### Structural requirements for performing MRgFUS treatment

MRgFUS should only be performed at hospitals with the necessary expertise and experience. This also includes the conservative and surgical management of side effects and complications. Moreover, there should be options for introducing postinterventional pain therapy.

### Examinations required prior to MRgFUS treatment

Treatment decisions are based on gynecological examination including vaginal and/or abdominal ultrasound (depending on the size of the uterine fibroid). An MRI scan with contrast agent ideally in prone position must be acquired for planning purposes. The contrast-enhanced image helps to assess whether and to what degree the fibroid is perfused.

Prior to every MRgFUS procedure, the indication for hysteroscopy and fractionated abrasion should be examined as a function of bleeding pattern and endometrium thickness and structure. A cytological smear of the cervix uteri with a normal result needs to have been performed within the last 12 months.

During the informed consent discussion prior to MRgFUS, the patient should also be informed of the lack of preinterventional histological confirmation, as in all other organ-preserving fibroid treatment methods.

### Indications for MRgFUS treatment

A symptomatic uterine fibroid with an anatomical position allowing safe access for MRgFUS is an indication for MRgFUS treatment. Treatment is complicated by the presence of more than five fibroids. In the case of fibroids with a diameter of more than 10 cm, the indication for MRgFUS treatment should be carefully considered due to the large fibroid volume and the associated long treatment time.

MRgFUS represents an alternative to surgical and medication-based methods such as UAE. Treatment decisions should be based on the treatment objective and the wishes of the patient. If technically feasible, MRgFUS is a good option for patients desiring the least invasive treatment possible.

### Success criteria for MRgFUS treatment

The goal of treatment with focused ultrasound is to achieve the greatest possible NPV (= non-perfused volume).

The improvement or elimination of fibroid-related symptoms is viewed as treatment success following MRgFUS treatment. A volume reduction is desired but is considered a secondary treatment goal.

### Contraindications for MRgFUS treatment

- Primarily Malignancy (absolute)
- Pregnancy (absolute)
- Acute inflammatory process (absolute)
- Subserosal pedunculated fibroids (absolute)
- Submucosal fibroids type 0 and I (relative; absolute in case of a desire to have children)
- Insufficient acoustic window for treatment (e.g. bowel overlaying the fibroid) (absolute)
- More than 5 fibroids (relative, decided on a case-by-case basis)
- Uterine fibroids with a diameter greater than 10 cm (relative, decided on a case-by-case basis)
- Large scars in the acoustic window (relative)
- Fibroid positioned near the os sacrum (relative)
- General contraindications to MR contrast agents (relative)
- Relative and absolute MRI contraindications

Ulipristal acetate can result in increased perfusion of fibroids; consequently the evaluation of the feasibility of MRgFUS treatment and the actual treatment can be negatively affected.

In the case of suspicion of a malignancy of the uterus, MRgFUS is absolutely contraindicated.

### MRgFUS treatment in patients with a desire to have children

There is no published prospective data regarding women who wish to have children and have been treated with MRgFUS/HIFU. Therefore, MRgFUS/HIF treatment cannot be recommended prior to a planned pregnancy. However, if a patient wants to become pregnant after MRgFUS/HIFU treatment, a minimum wait time of approximately 6 months between fibroid treatment with MRgFUS and conception should probably be observed.

### Side effects/complications of MRgFUS treatment

Relevant side effects and complications during and after MRgFUS treatment are rare:

- Pain
In addition to increased and/or irregular bleeding within three months after treatment, fibroid treatment with MRgFUS can result in discharge of (necrotic) fibroid material in terms of a "fibroid in the nascent state" that is unpleasant and painful for the patient. Uterus-preserving ablation performed via the vagina possibly also in combination with surgical hysteroscopy is also possible here. Perioperative antibiotic prophylaxis is recommended in these cases.

Follow-up after MRgFUS treatment

Follow-up by a specialist after MRgFUS is recommended. Imaging methods are helpful (e.g. ultrasound in connection with Doppler ultrasound, MRI). If treatment is not successful (no improvement in symptoms and/or increase in fibroid size) or in the case of pathologies on imaging (increase in size of fibroid(s) or uterus), further diagnostic workup is required.

Future

The recommendations regarding MRgFUS treatment of fibroids are to be revised in approximately two years under consideration of the data and experiences available at that time.

Appendix

Participants in the consensus meeting 2017

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Dr. med. Alexander Burges/ Munich
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Prof. Dr. med. Markus Düx/ Frankfurt a.M.
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Prof. Dr. med. Peyman Hadjii/ Frankfurt a.M.
Dr. med. Thomas Hess/ Winterthur (CH)
PD Dr. med. Peter Hunold/ Lübeck
Dr. med. Hans-Christian Kolberg/ Bottrop
Dr. med. Matthias Matzko/ Dachau
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Prof. Dr. med. Uwe Ulrich/ Berlin

Participating societies and working groups:

AGE, Arbeitsgemeinschaft Gynäkologische Endoskopie der DGGG
AG URZ, Arbeitsgemeinschaft Universitärer Reproduktionsmedizinischer Zentren der DGGG
Berufsverband der Frauenärzte (BVF)
DeGiR, Deutsche Gesellschaft für Interventionelle Radiologie und minimal-invasive Therapie
DGGEF, Arbeitsgemeinschaft Gynäkologische Endokrinologie und Fortpflanzungsmedizin e.V.
DGGG, Deutsche Gesellschaft für Gynäkologie und Geburtshilfe
DRG, Deutsche Röntgengesellschaft
SGGG, Schweizerische Gesellschaft für Gynäkologie und Geburtshilfe

References to relevant publications

6. G-BA-Beschluss (Dezember 2016) betreffend „Erprobung-Richtlinie zur Behandlung von Uterusmyomen mittels MRgFUS“: https://www.g-BA.de/institution/presse/pressemitteilungen/657/

Conflict of Interest

The authors declare that they have no conflict of interest.