Stents and surgical interventions in the palliation of gastric outlet obstruction: a systematic review

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Background and study aims: Palliative treatment of gastric outlet obstruction can be done with surgical or endoscopic techniques. This systematic review aims to compare surgery and covered and uncovered stent treatments for gastric outlet obstruction (GOO).

Patients and methods: Randomized clinical trials were identified in MEDLINE, Embase, Cochrane, LILACs, BVS, SCOPUS and CINAHL databases. Comparison of covered and uncovered stents included: technical success, clinical success, complications, obstruction, migration, bleeding, perforation, stent fracture and reintervention. The outcomes used to compare surgery and stents were technical success, complications, and reintervention. Patency rate could not be included because of lack of uniformity of the extracted data.

Results: Eight studies were selected, 3 comparing surgery and stents and 5 comparing covered and uncovered stents.The meta-analysis of surgical and endoscopic stent treatment showed no difference in the technical success and overall number of complications. Stents had higher reintervention rates than surgery (RD: 0.26, 95% CI [0.05, 0.47], NNH: 4). There is no significant difference in technical success, clinical success, complications, stent fractures, perforation, bleeding and the need for reintervention in the analyses of covered and uncovered stents. There is a higher migration rate in the covered stent therapy compared to uncovered self-expanding metallic stents (SEMS) in the palliation of malignant GOO (RD: 0.09, 95% CI [0.04, 0.14], NNH: 11). Nevertheless, covered stents had lower obstruction rates (RD: –0.21, 95% CI [-0.27, –0.15], NNT: 5).

Conclusions: In the palliation of malignant GOO, covered SEMS had higher migration and lower obstruction rates when compared with uncovered stents. Surgery is associated with lower reintervention rates than stents.

Introduction

Advanced stage malignancy in the gastrointestinal tract may result in gastric outlet obstruction (GOO), which is characterized by symptoms like abdominal pain, weight loss, nausea and vomiting [1]. Considering that many cases of GOO are unfit for surgical resection, palliative treatment is indicated in order to provide better quality of life [2]. Palliation can be done with surgical or endoscopic stent treatment [3–7].

Surgical gastrojejunostomy is considered a more aggressive choice by some authors, with reports of considerable morbidity and mortality [8,9]. Endoscopic treatment with self-expandable metallic stents (SEMS) is a valid method to palliate malignant gastric outlet obstruction [10]. This method is associated with rapid relief of symptoms and low complication rates in the short term [11], although, many patients refuse surgical intervention [12]. However, endoscopic stents, despite the lower initial morbidity, demonstrated complications like obstruction, migration, bleeding and stent fractures [13].

The perfect treatment should combine high technical and clinical success, with low complication rates and low need for reintervention. The rationale is that endoscopic stenting is a less invasive option for treatment than surgery, but one key point is the patency rate and need for reintervention.

Another point to highlight is the choice of different kinds of stents. Uncovered SEMS presents higher obstruction rates because of tumor ingrowth through the mesh. Covered SEMS present lower obstruction, but higher migration rates [14].

With the development of new technologies and new randomized trials, we expect changes in the management of gastric outlet obstruction, a fact that demands analysis of which kind of therapy is better and if there is a difference between cov-

ered and uncovered stents [15 – 17]. The published systematic reviews with meta-analyses about this subject does not include those new randomized clinical trials and considered analysis with non-randomized trials together [18 – 24]. Our systematic review aims to compare the outcomes of randomized studies of surgical versus endoscopic stenting and covered versus uncovered stents.

Methods

Systematic review conducted in accordance with the PRISMA (preferred reporting items for systematic reviews and meta-analyses) recommendations and registered on the PROSPERO international database (CRD42016032939) [25].

Eligibility criteria

Inclusion criteria: only complete published randomized clinical trials (RCT) comparing palliative treatment of malignant GOO with surgery and covered and uncovered stent treatment. No restrictions for language or year of publication were applied. Exclusion criteria: abstracts, studies including patients with prior stent or surgical treatment for GOO.

Outcome measures for surgical and stent comparison: number of patients with complications, technical success and reintervention.

Outcome measures for covered and uncovered stents: technical success, clinical success, complications, migration, obstruction, bleeding, perforation, fracture and reintervention.

Search and information sources

Studies were identified by searching electronic databases (MEDLINE, Embase, Cochrane, Scopus, LILACS, BVS and CINAHL). The grey literature search included chapters of endoscopy and gastroenterology books, theses and references in the selected articles and in published systematic reviews. Last search was run on October 31, 2015.

Search terms included in the MEDLINE were (gastric outlet obstruction OR gastric outlet obstructions OR duodenal obstruction) AND (endoscopy OR endoscopic OR endoscopic surgical procedure OR endoscopic surgical procedures OR stent OR stents) AND random*. In the other databases, the same strategy was used with a few modifications. Full search strategy is available in **Appendix 1**.

Study selection and data collection process

Two reviewers performed eligibility assessment and selection of screened records independently in an unblinded, standardized manner. Disagreements were resolved by consensus. In case of duplicated publications, the most complete and recent was selected. The same authors extracted data from selected studies using a standardized form (Supplementary Information Sheet). Disagreements were resolved by consensus.

Data items

Information was extracted from each trial on: (1) characteristics of the trials participants and trial's inclusion and exclusion criteria; (2) type of intervention and control groups (results divided into groups, one with surgical and stent comparison, another with covered and uncovered stents); (3) type of outcome measures. Technical success was defined as an adequate and accurate stent positioning in the stricture area or adequate gastrojejunostomy. Clinical success was defined as the clinical relief of obstruction symptoms after intervention. Complications were considered as reported or the sum of all adverse events informed. Perforation and fracture were accounted as reported and were considered absent if not specified. Stents were classified as covered and uncovered. Covered stents included in the studies are not fully covered.

Risk of bias in individual studies

Two reviewers analyzed together the quality of the studies with the Jadad scale, in order to certify the adequacy of randomization, concealment of allocation, blinding and follow up report. This score varies from 0 to 5, with scores below 3 indicating poor methodological quality.

Summary measures and planned methods of analysis

All statistical calculations were carried out using the computer software programs OpenEpi and RevMan five version 5.3. The meta-analyses were performed with Review Manager 5.3 software (RevMan), which was obtained from Cochrane Informatics & Knowledge Management Department (http://tech.cochrane.org/revman). Dichotomous data was analyzed by computing Risk differences (RD) with a fixed effect model, Mantel-Haenszel test and intention-to-treat analysis (ITT).

We calculated 95 % confidence intervals (95 % CI), number necessary to treat (NNT) or to harm (NNH) for each outcome and study. Graphical analysis with funnel plot and forest plot were generated. Inconsistency (heterogeneity) was calculated using the Chi-square test (Chi^2) and the Higgins method (I^2). The advantages of the Higgins method are that it does not depend on the number of studies and it is accompanied by an uncertainty interval. A cut-off point of $I^2 < 50\%$ was established as acceptable.

Risk of bias across studies

A graphical method was used (forest plots) to evaluate the relation between sample size and effect size for each outcome. Funnel plots were used for evaluate the risk of publication bias across the studies outcomes. The graphical method analysis involved a plot of the trials mean differences and search for asymmetry.

Quantification of heterogeneity is another component of the investigation of variability across studies. Considering the clinical implications of the observed degree of inconsistency across studies, the cutoff value of 50 % was considered adequate for this meta-analysis. If the heterogeneity of the results of a meta-analysis (I^2) was over 50 %, a sensitivity analysis was executed, excluding the reports located outside the funnel (outliers) and then performed another meta-analysis without the given report. In case of persistent high heterogeneity after this process or if we could not detect outliers, true heterogeneity was presumed and a random model was assumed.

We acknowledge that other factors could produce asymmetry in funnel plots leading to a high heterogeneity (true study heterogeneity), such as differences in the population studied, differences in trial quality or even different techniques studied under the same endoscopic modality (different stents).

Additional analyses

For the comparison of stents, a subgroup analysis was generated with the trials that included only patients with gastric cancer.

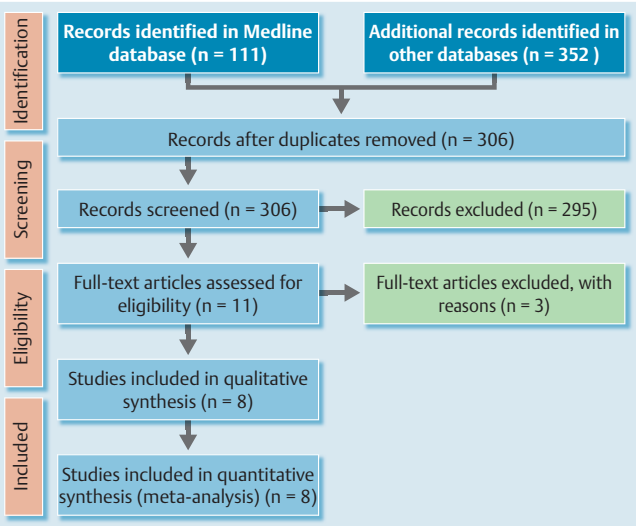

Fig. 1 Flow diagram of study selection

Results

The literature search resulted in 111 records in MEDLINE and 352 in the other databases. Six trials were included in the initial selection of articles on surgery and stents [11, 12, 26 – 29]. One was excluded because it used randomized and observational samples together [29]. Two studies were duplicated [11, 28]. The most recent and complete were included for meta-analysis. Finally, 5 clinical randomized trials were selected for covered and uncovered SEMS, including 443 patients [15 – 17, 30, 31]. Three studies were considered for comparison between surgery and stents, with a total of 84 patients [12, 26, 27]. In the grey literature search, there was no new complementation. The study selection process is illustrated in **Fig. 1**. Study characteristics, risk of bias and individual results are represented on **Table 1**, **Table 2**, **Table 3**.

Surgical treatment versus stents

Technical success

For both groups there is a high success rate, with no significant difference (RD: – 0.05, 95 % CI [-0.16, 0.07], I^2: 0 %) (**Fig. 2**).

Complications

For this outcome we noticed high heterogeneity (I^2: 85 %). There is one outlier trial [26]. After excluding this study, there is no significant difference (RD: 0.07, 95 % CI [-0.17, 0.31], I^2: 0 %) (**Fig. 3**).

Reintervention

Results are favorable to the surgery group, with less need for re-interventions (RD: 0.26, 95 %CI [0.05, 0.47], I^2: 0 %, NNH: 4) (**Fig. 4**).

Covered versus uncovered stents

Technical and Clinical Success

High technical success was noticed, with no significant difference between covered and uncovered SEMS (RD: 0.00, 95 % CI [-0.04, 0.04], I^2: 0 %). no significant difference was attributed for clinical success (RD: 0.02, 95 % CI [-0.03, 0.07], I^2: 0 %). Both had high success rates and low heterogeneity. (**Fig. 5** and **Fig. 6**).

Table 1 Characteristics of selected studies.

Study	Population (N)	Intervention (N)	Comparison (N)	Outcomes	Follow up	Centers
Covered and uncovered stents						
Shi 2014	65	Tailored covered stents Micro-Tech (33)	Uncovered stents MTN-CG-S-20 /100 Micro-Tech (32)	Technical success, clinical success, complications, obstruction, migration, bleeding, perforation, fracture, reintervention	Until death	Multicenter (3 centers)
Lim 2014	134	Covered double layered – Niti-S ComVi pyloric Stent (66)	Uncovered Niti-S pyloric/ duodenal D-type stent (68)	Technical success, clinical success, complications, obstruction, migration, bleeding, perforation, fracture, reintervention	Unclear	Multicenter (4 centers)
Kim 2010	80	Covered Niti-S pyloric Stent and Niti-S ComVi pyloric Stents (40)	Uncovered enteral Wallstents and Wallflex duodenal stents (40)	Technical success, clinical success, complications, obstruction, migration, bleeding, perforation, fracture	Unclear	Single-center
Maetani 2014	62	Covered triple layered ComVi stent (31)	Uncovered Niti-S stent (31)	Technical success, clinical success, complications, obstruction, migration, bleeding, perforation, fracture	Until death	Multicenter (2 centers)
Lee 2015	102	Bonastent WAVE-covered SEMS (51)	Bonastent uncovered SEMS (51)	Technical success, clinical success, complications, obstruction, migration, bleeding, perforation, fracture, reintervention	Until death or censoring date of 30 november 2014	Multicenter (5 centers)
Surgery and stents						
Mehta, 2006	27	Uncovered Enteral Wallstent (13)	Laparoscopic GJJ (14)	Technical success, complications	not clear	Not described
Jeurnink, 2010	39	Uncovered Enteral Wallstent (21)	Open or laparoscopic GJJ (18)	Technical success, complications, reintervention	Until death	Multicenter (21 centers)
Fiori, 2013	18	Ultraflex Covered Stent (9)	Open GJJ (9)	Technical success, complications, reintervention	Until death	Single-center

GJJ: gastrojejunostomy.

Table 2 Risk of bias and Jadad.

Study	Population (N)	Question	Randomization	Allocation	Blinding	Losses	Prognostic	ITT	Sample size	Selection bias	JADAD
Covered and uncovered stent studies											
Shi 2014	65 (33 covered and 32 uncovered)	To compare the efficacy and safety of "outlet-shape" tailored stents with standard stents for the management of distal gastric cancer causing GO with varying gastric cavity shapes and sizes	Table of random numbers	Not described	Not described	1 covered (3,03 %) and 1 uncovered (3,12 %)	Homogeneous	No	Yes	Only gastric cancer	3
Lim 2014	134 (66 covered and 68 uncovered)	To evaluate outcomes after placement of conformable covered and uncovered self-expandable metallic stents for palliation of malignant GOO	Computer-generated list	Not described	Patient	7 covered (10,6 %) and 7 uncovered (10,29 %)	Homogeneous	No	Yes	No	3
Kim 2010	80 (40 covered and 40 uncovered)	To compare the effectiveness and side effects of covered and uncovered SEMSs for the palliation of malignant pyloric obstruction	Computer-generated list	Not described	Patient blinded	2 uncovered (5 %) and 5 covered (12,5 %)	Homogeneous	No	Yes	only gastric cancer	3
Maetani 2014	62 (31 covered and 31 uncovered)	To compare the efficacy and safety of a triple-layered covered versus uncovered SEMS	sealed envelops	Equal ratio consecutively by using sealed envelopes	Blinded in follow up	0	Homogeneous	Yes	Yes	No	3
Lee 2015	102 (51 covered and 51 uncovered)	to evaluate and compare the efficacy of WAVE covered SEMS with uncovered SEMS in GOO	Computer-generated list	Equal ratio, Computer-generated, with a block size of four	Patients	1 covered (1,96 %) and 4 uncovered (7,84 %)	Homogeneous	Yes	Yes	Only gastric cancer	3
Surgery and Stent Studies											
Mehta, 2006	27 (13 stent and 14 surgery)	To compare laparoscopic gastrojejunostomy with duodenal stenting	Computer generated lists	Not described	Researcher	1 stent (7,69 %) and 1 surgical (7,14 %)	Homogeneous	Yes	Not mentioned	No	3
Jeurnink, 2010	39 (21 stent and 18 surgery)	To compare GJJ and stent placement	Computer generated lists	Not described	Not described	0	Homogeneous	Yes	Not mentioned	No	3
Fiori, 2013	18 (9 stent and 9 surgery)	To compare the endoscopic placement of self-expandable stents with open surgical GJJ	Random number tables	Not described	Patients/ researcher	0	Homogeneous	Yes	Not mentioned	Symptomatic primary adenocarcinoma of the antropyloric region	3

Table 3 Results of individual studies.

Covered and uncovered stents										
	Shi 2014		Lim 2014		Kim 2010		Maetani 2014		Lee 2015	
	Covered	Uncovered	Covered	Uncovered	Covered	Un covered	Covered	Uncovered	Covered	Uncovered
Total	33	32	66	68	40	40	31	31	51	51
Technical success	32	31	59	61	40	40	31	31	50	49
Clinical success	31	30	59	60	38	36	27	29	49	46
Complications	28	11	13	13	16	19	6	10	7	16
Obstruction	1	7	4	13	1	16	0	6	3	14
Migration	2	0	8	0	10	3	2	1	4	2
Bleeding	11	2	0	0	0	0	0	1	0	0
Perforation	0	0	0	0	1	0	1	0	0	0
Fracture	0	0	1	0	3	0	1	2	0	0
Reintervention	3	7	13	13	NR	NR	NR	NR	10	10

Surgery and stents						
	Mehta 2006		Jeurnink 2010		Fiori 2013	
	Stent	Surgery	Stent	Surgery	Stent	Surgery
Total	13	14	21	18	9	9
Technical success	10	13	20	17	9	9
Complications	0	8	8	5	6	6
Reintervention	NR	NR	7	2	4	1

NR: not reported.

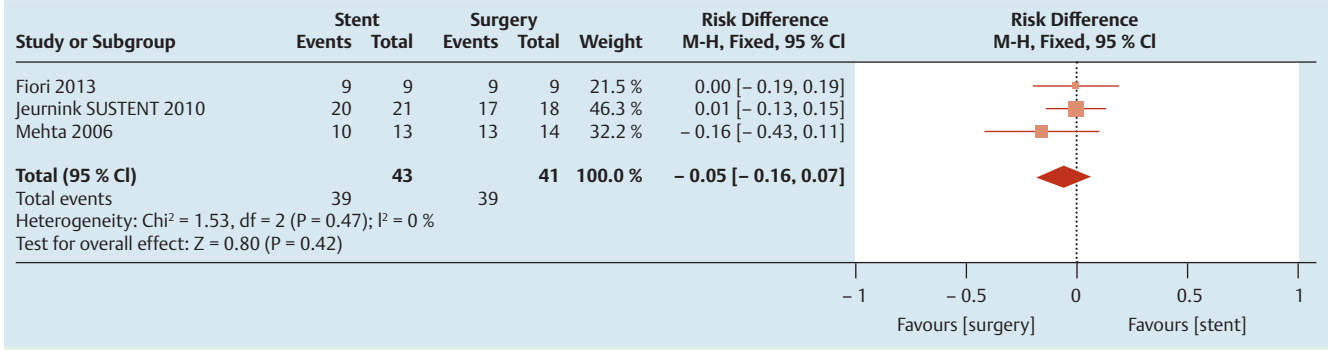

Fig. 2 Forest plot of technical success of surgery and stents, with fixed effect.

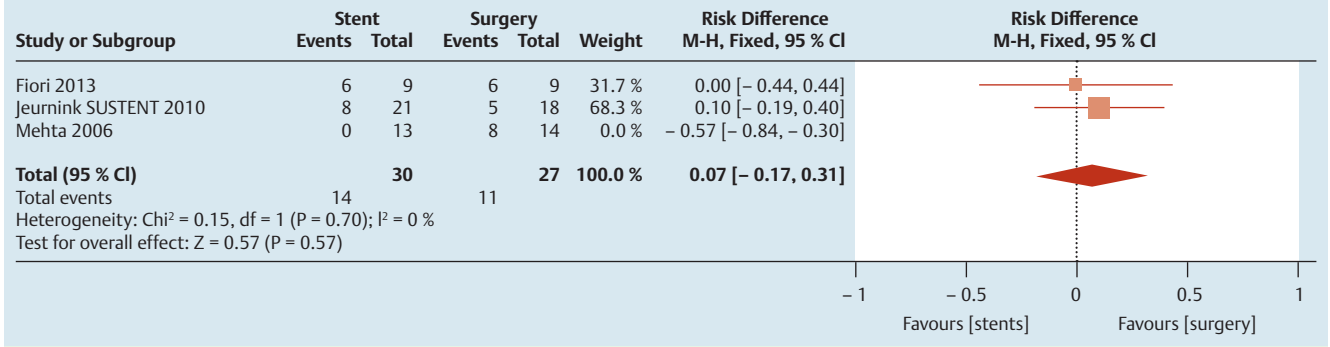

Fig. 3 Forest plot of complications of surgery and stents, with fixed effect, after excluding outlier study.

Complications

In this analysis, high heterogeneity was found (I^2: 87 %), with one outlier study [16]. After excluding this trial, there is no significant difference between the stents (RD: – 0.08, 95 % CI: [-0.17, 0.00], I^2: 6 %) (**Fig. 7**).

Obstruction

Obstruction is one of the key outcomes. Results are favorable to the covered group, with a significant difference (RD: – 0.21, 95 % CI [-0.27, – 0.15], I^2: 36 %) and a NNT of 5 (**Fig. 8**).

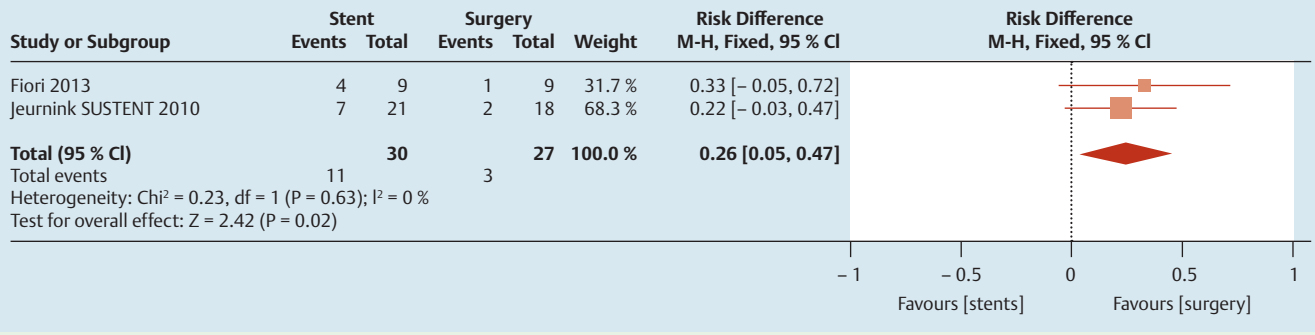

Fig. 4 Forest plot of reinterventions of surgery and stents, with fixed effect.

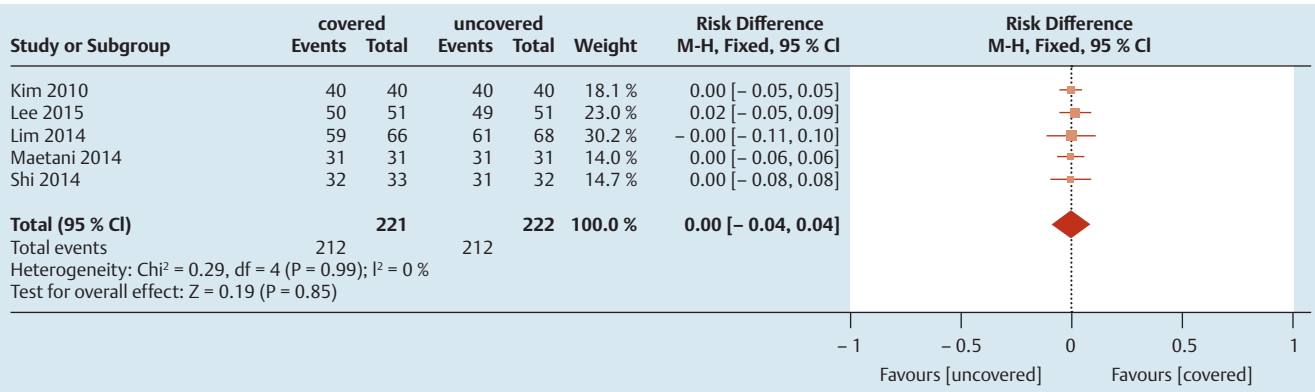

Fig. 5 Forest plot of technical success of covered and uncovered stents, with fixed effect.

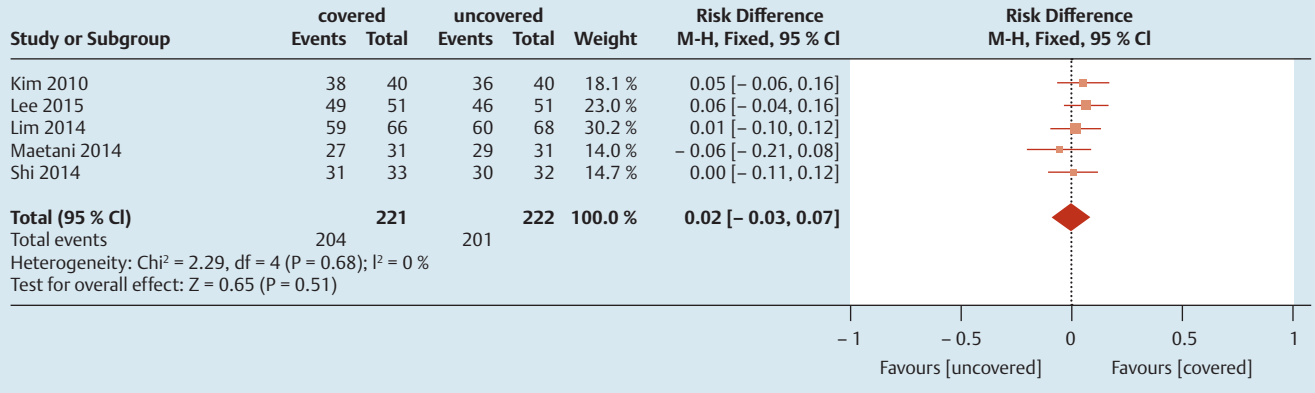

Fig. 6 Forest plot of clinical success of covered and uncovered stents, with fixed effect.

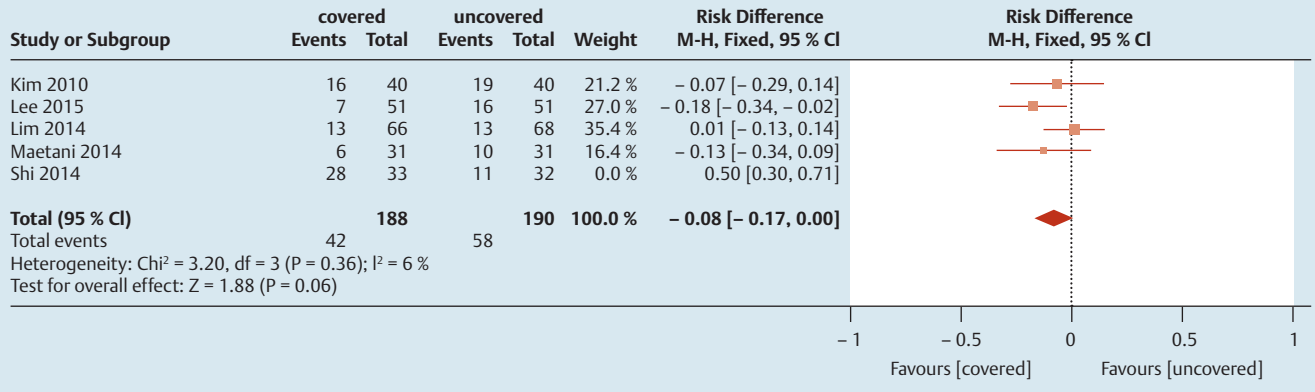

Fig. 7 Forest plot of complications of covered and uncovered stents, with fixed effect, after excluding outlier study.

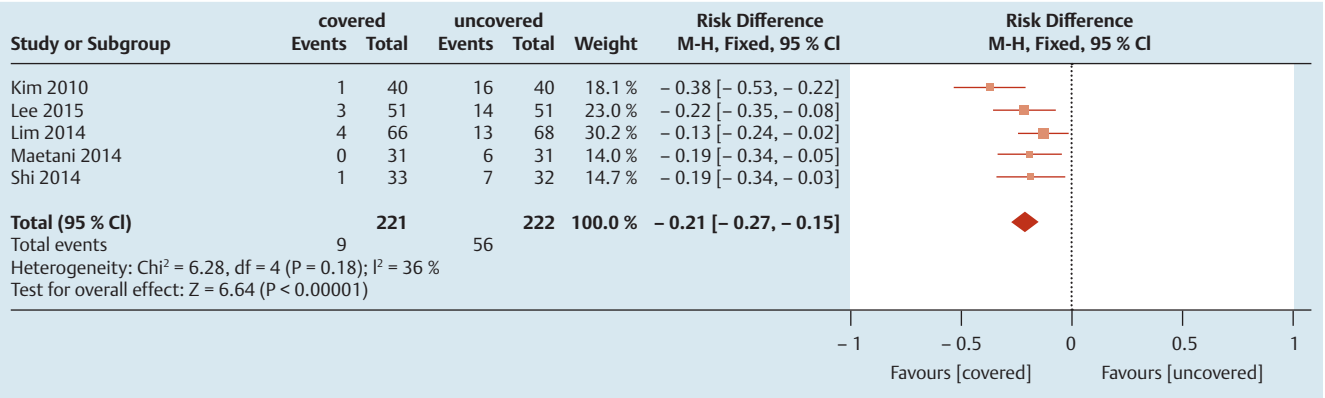

Fig. 8 Forest plot of obstruction of covered and uncovered stents, with fixed effect.

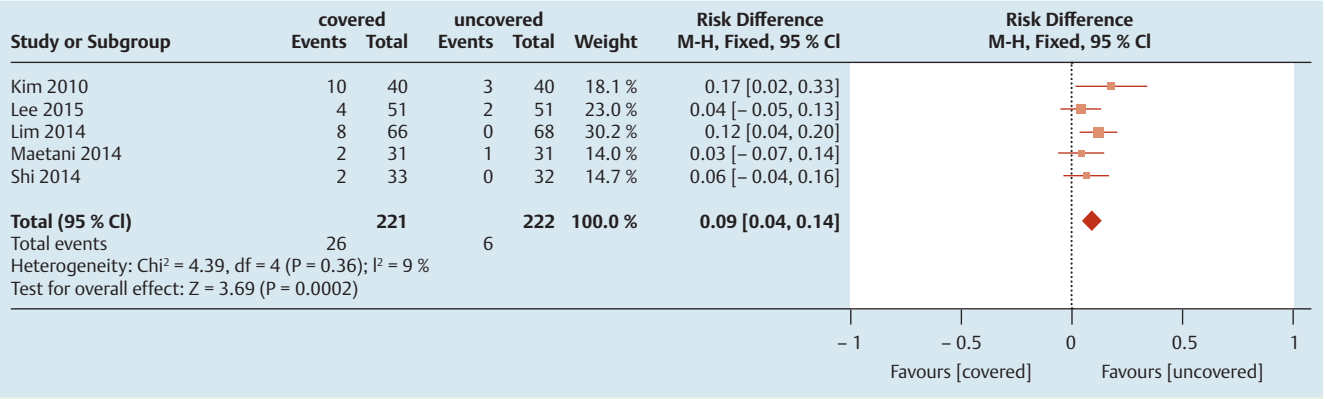

Fig. 9 Forest plot of migration of covered and uncovered stents, with fixed effect.

Migration

Migration is another important outcome that must be considered. The uncovered SEMS showed better results (RD: 0.09, 95% CI [0.04, 0.14], I^2: 9%), with a NNH of 11.This outcome had low heterogeneity and significant difference (**Fig. 9**).

Bleeding

Analysis is compatible with high heterogeneity (I^2: 80%). An outlier study was detected and removed [16], resulting in low heterogeneity and no difference between groups (RD: – 0.01, 95% CI: [-0.03, 0.02], I^2: 0%) (**Fig. 10**).

Perforation

No significant difference was found between the covered and uncovered stents (RD: 0.01, 95% CI: [-0.01, 0.03], I^2: 0% (**Fig. 11**).

Fracture

For this outcome, there is no significant difference between the covered and uncovered stents (RD: 0.01, 95% CI: [-0.02, 0.04], I^2: 0%) (**Fig. 12**).

Reintervention

The covered group showed lower rates of reintervention, with no significant difference. (RD: – 0.03, 95% CI: [-0.11, 0.06], I^2: 0%) (**Fig. 13**).

Additional analyses

A subgroup analysis of trials with SEMS, which included only gastric cancer patients, was performed [15, 16,31]. Results of this analysis are very similar to the global analysis (**Appendix 2**).

Discussion

Palliation of malignant gastric outlet obstruction can be achieved by surgical and endoscopic techniques [3 – 7]. Some authors argue that endoscopic treatment is less invasive and should be considered for palliation, since many patients have poor clinical conditions and surgical intervention is associated with higher morbidity and mortality [8,10]. Others have a major concern about stent patency, clinical results and the need for reintervention [12]. In our meta-analysis we were able To compare technical success, complications and reinterventions of both techniques. There is a high rate of technical success with both techniques, with few cases of failure and no statistical difference between them. The analysis of complications showed a high heterogeneity between studies. This included an outlier [26], the only one with favorable results for stents. After excluding that one from analysis, there is no significant difference. In the study design, we notice that the follow up time is not until death, so it is possible those results are different because the time of observation was not sufficient to detect complications like obstruction, migration and stent fracture. Early and late publications of one included study showed different results; with a higher number of complications when considering follow up until death [11,27]. Besides, analysis can be influenced by other biases because the selected studies used different kinds of stents (covered and uncovered) and included open and laparoscopy gastrojejunostomy. Considering the need of reintervention, results are favorable to the surgery group, with a significant difference.

When comparing stents and surgery, we also noticed that stents had different results for hospital stay in all included trials [12,26,

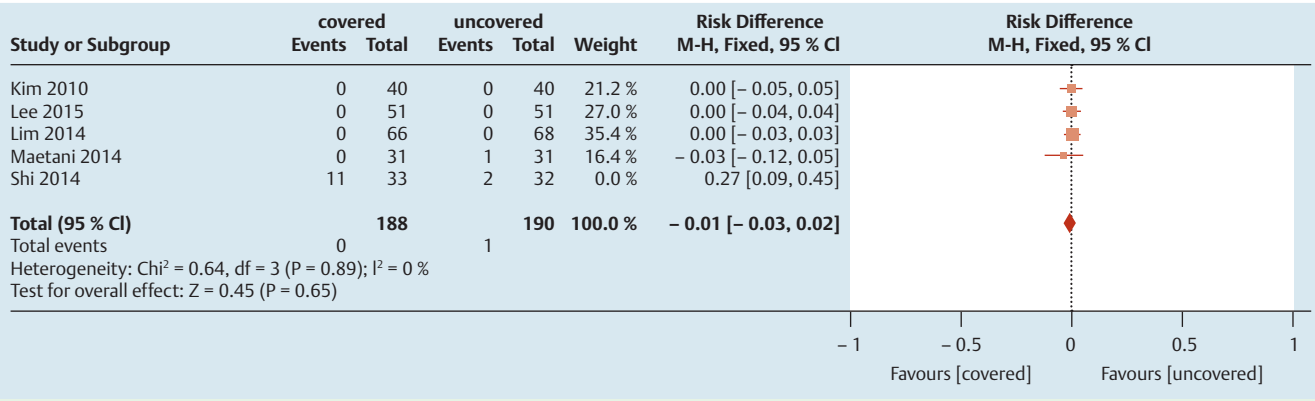

Fig. 10 Forest plot of bleeding of covered and uncovered stents, with fixed effect, after excluding outlier study.

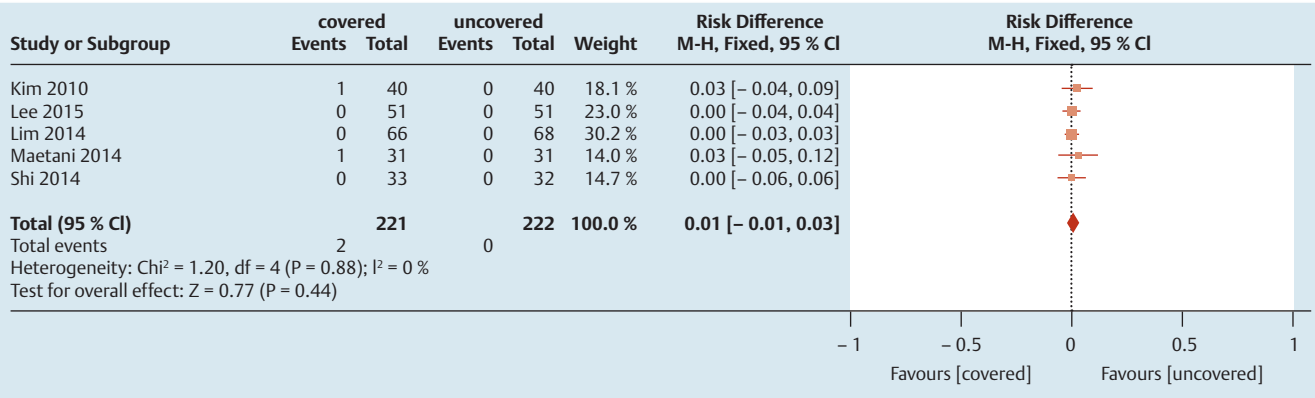

Fig. 11 Forest plot of perforation of covered and uncovered stents, with fixed effect.

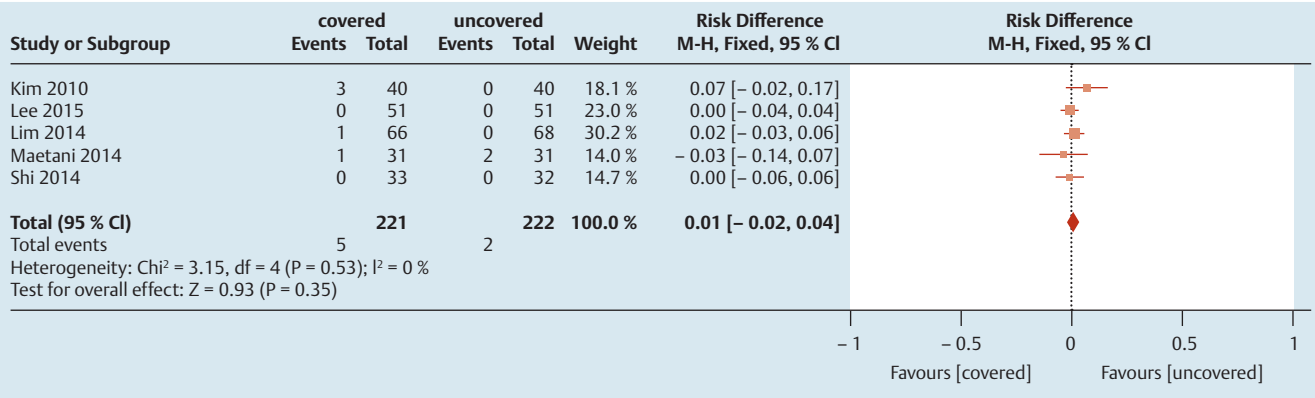

Fig. 12 Forest plot of fracture of covered and uncovered stents, with fixed effect.

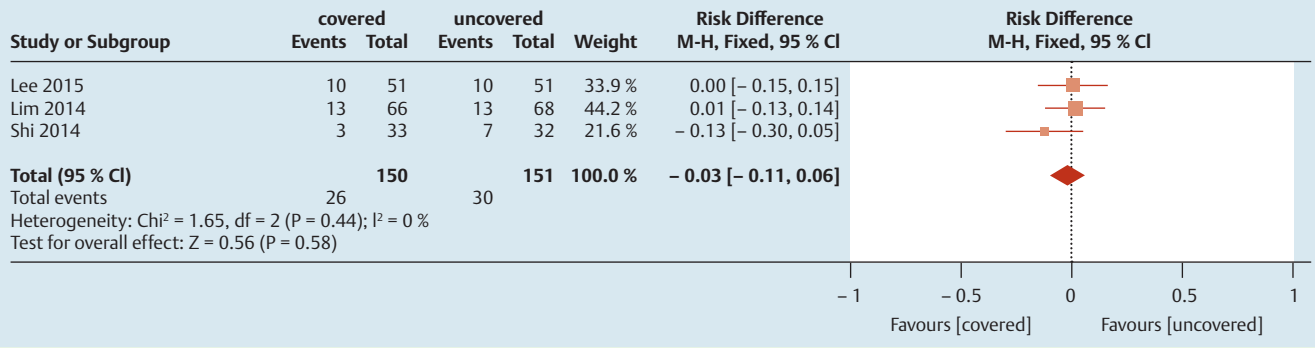

Fig. 13 Forest plot of reintervention of covered and uncovered stents, with fixed effect.

27]. The series reported 4.8 to 7 median days for stents and 11.4 to 15 for surgery. These data were not included for meta-analysis because standard deviation was not published.

Endoscopic therapy with stents is a valid method for palliation of malignant gastric outlet obstruction [10,13]. With new stents available, we question which is the best to use. In this meta-analysis, there are high technical and clinical success rates for SEMS, of around 95% and 90%, respectively. There is no significant difference between groups.

Complications are one of the key elements for analysis. Studies reported perforation, bleeding, abdominal pain, obstruction and migration of the SEMS [13,32–35]. High heterogeneity was observed in the overall complications analysis. This was attributed to 1 trial [16], which is the only one favorable to the uncovered group. After a sensitivity analysis, we excluded this study for this outcome, with no significant difference. When assessing the individual characteristics of this trial, we observe that this is the only one with power for this outcome (98.70%) and the stent used is a tailored one. This author reported complications in 84.35% of covered and 34.38% of the uncovered stents group. The difference is attributed to bleeding and abdominal pain, with 33.3% and 39.39% of all patients submitted to covered SEMS, respectively.

When exploring the possible complications, obstruction and migration must be considered. The studies have a major concern with these outcomes. Uncovered stents had more cases of obstruction and covered stents had higher migration rates, both with significant difference. For every five covered SEMS used, there is an obstruction outcome benefit for one patient. However, for every 11 covered stents used, one patient is harmed, as a result of migration. Looking at the trials individually, the worst reported results showed 25% of migration of covered stents and 40% obstruction of the uncovered SEMS [31].

A higher number of stent fractures was noted in the covered group, but with a low number of cases (2.26% in the covered and 0.90% in the uncovered group), with no significant difference. The rate of reintervention was lower in the covered group, but with a small and non-significant difference. Despite that, the risk of this outcome is around 20% for covered or uncovered SEMS, which means that 1 in 5 cases will need some kind of reintervention.

Unfortunately, patency rate could not be included in this systematic review. There is a lack of uniformity of this data, with different forms to express those results and standard deviation is missing in some reports. The patency rate, expressed in median was 68 days for covered and 88 for uncovered ones in the trial with the worst result [17]. Another RCT showed 95 days for covered and 92 for uncovered SEMS [30]. One study expresses the total patency for patients, favoring covered SEMS, with 14/31 (45.2%) patent cases for covered and 13/36 (36.1%) for uncovered [31]; but considering intention to treat analysis, results are similar. Another way to interpret the patency rate is correlating with periods. One author showed an 8-week patency rate of 37/51 (72.5%) for covered and 32/51 (62.7%) for uncovered SEMS and 16 week patency rates of 35/51 (68.6%) and 21/51 (41.2%), respectively [15]. Results are seemingly not so favorable for either stents in the long term.

Subgroup analysis of trials that included only gastric cancer patients produced very similar results to the complete meta-analysis, with no significant difference for technical and clinical success, complications, fracture and migration. There was a high heterogeneity in complications, which was interpreted with a random effects model. Similar results were noticed, favoring covered SEMS in the obstruction outcome and uncovered SEMS in the migration outcome.

Strengths and limitations

The strengths of this systematic review are the inclusion of only randomized clinical trials and global analysis of the palliative treatment of malignant gastric outlet obstruction, which included the surgery, and covered and uncovered stents. One limitation is the selection bias for some studies. In the stents group, 3 studies included only patients with gastric cancer. In addition, the comparison between covered and uncovered stents used different kinds of stents, like tailored ones and those with an anti-migration design. A subgroup analysis was done to verify this bias. Some outcomes could not be compared, including Gastric Outlet Obstruction Scoring System (GOOSS) post procedure, GOOSS change, patency rates and mean survival because lack of uniformity and standard deviation. It would be interesting to have more randomized trials comparing surgery and SEMS, since there are few studies, with low number of patients, resulting in a limited analysis.

Conclusion

When comparing stent types, there is a higher migration rate in the covered stent therapy compared to uncovered stents in the palliation of malignant GOO. Nevertheless, covered SEMS had lower obstruction rates. There is no significant difference in technical success, clinical success, complications, bleeding, perforation, stent fracture and need for reintervention. Surgery is associated with lower rates of reintervention than stents. Both methods present high technical success. Although endoscopic and surgical complications are different, the frequency of this outcome is similar.

Competing interests: None

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Appendix 1: Full strategy search

Databases: Medline, Scopus, Embase, BVS, LILACS, Cochrane and Cinahl.

Searched until 31.10.2015

Medline:

(Gastric Outlet Obstruction OR Gastric outlet obstructions OR Duodenal obstruction) AND (Endoscopy OR Endoscopic OR endoscopic surgical procedure OR endoscopic surgical procedures OR stent OR stents) AND random*

Scopus:

(Gastric Outlet Obstruction OR Gastric outlet obstructions OR Duodenal obstruction) AND (Endoscopy OR Endoscopic OR endoscopic surgical procedure OR endoscopic surgical procedures OR stent OR stents) AND random*

Field: Title, abstract, subject.

Embase:

gastric AND outlet AND ('obstruction'/exp OR obstruction) OR gastric AND outlet AND obstructions OR duodenal AND ('obstruction'/exp OR obstruction) AND ('endoscopy'/exp OR endoscopy OR endoscopic AND surgical AND ('procedure'/exp OR procedure) OR endoscopic AND surgical AND ('procedures'/exp OR procedures) OR 'stent'/exp OR stent OR 'stents'/exp OR stents) AND random*

BVS:

(Gastric Outlet Obstruction OR Gastric outlet obstructions OR Duodenal obstruction) AND (Endoscopy OR Endoscopic OR endoscopic surgical procedure OR endoscopic surgical procedures OR stent OR stents) AND random*

Field: Title, abstract, subject.

LILACS:

(Gastric Outlet Obstruction OR Gastric outlet obstructions OR Duodenal obstruction) AND (Endoscopy OR Endoscopic OR endoscopic surgical procedure OR endoscopic surgical procedures OR stent OR stents)

Field: words.

Cochrane:

(Gastric Outlet Obstruction OR Gastric outlet obstructions OR Duodenal obstruction) AND (Endoscopy OR Endoscopic OR endoscopic surgical procedure OR endoscopic surgical procedures OR stent OR stents) AND random*

Field: search all text.

Cinahl:

(Gastric Outlet Obstruction OR Gastric outlet obstructions OR Duodenal obstruction) AND (Endoscopy OR Endoscopic OR endoscopic surgical procedure OR endoscopic surgical procedures OR stent OR stents) AND random*

Field: TX all text

Grey search literature

Search executed from chapters of endoscopy and gastroenterology books, thesis and references from selected articles and systematic reviews. No complementation to the initial search were added.

Theses:

Searched at university of São Paulo Bank of Thesis (http://www.teses.usp.br/)

Search strategy: obstrução OU gástrica OU gastroduodenal (resumo).

Search strategy: obstruction OR gastric OR gastroduodenal (abstract).

Results: 331 records.

Books:

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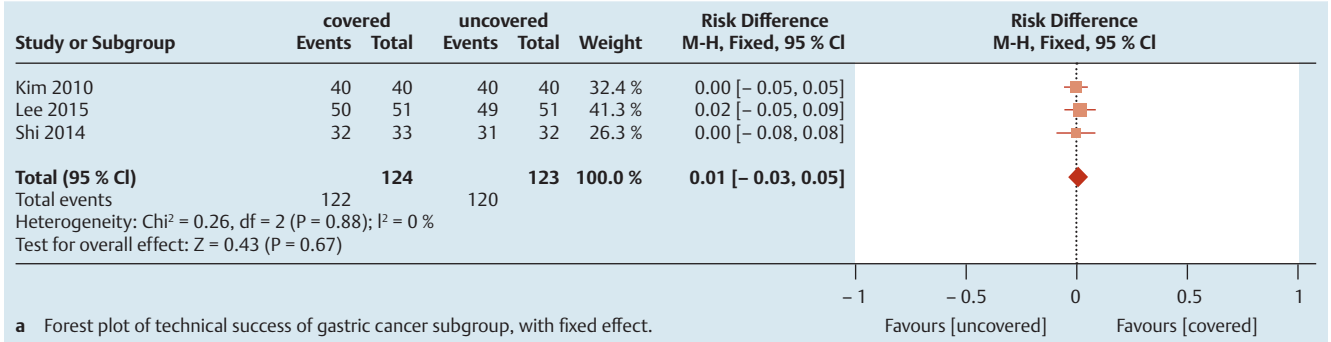
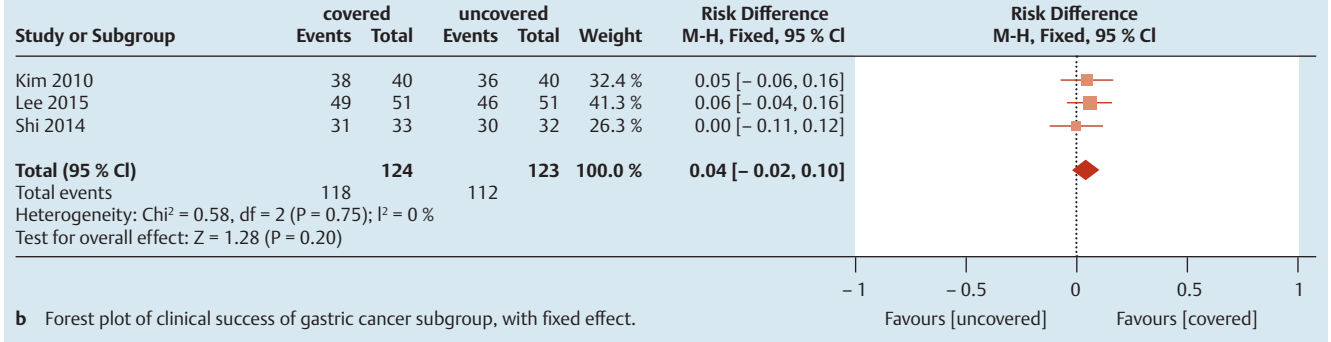
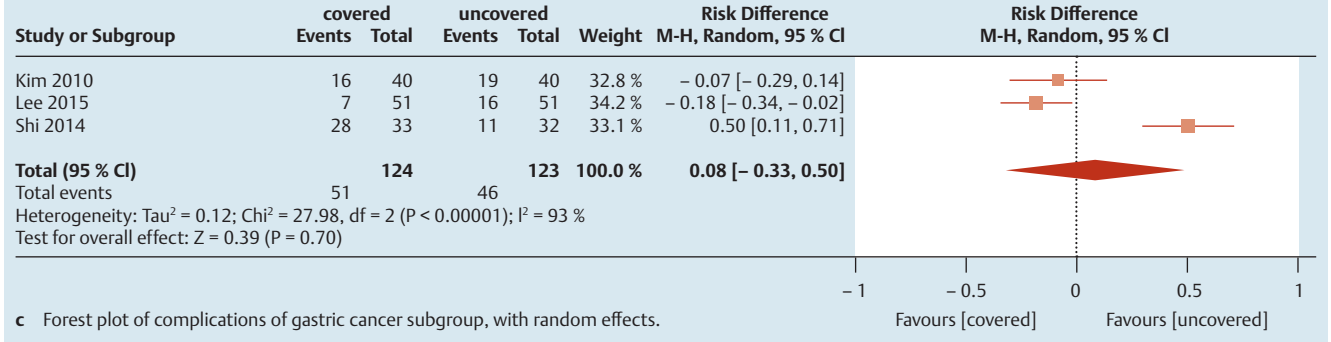
Appendix 2: Subgroup analysis of gastric cancer patients



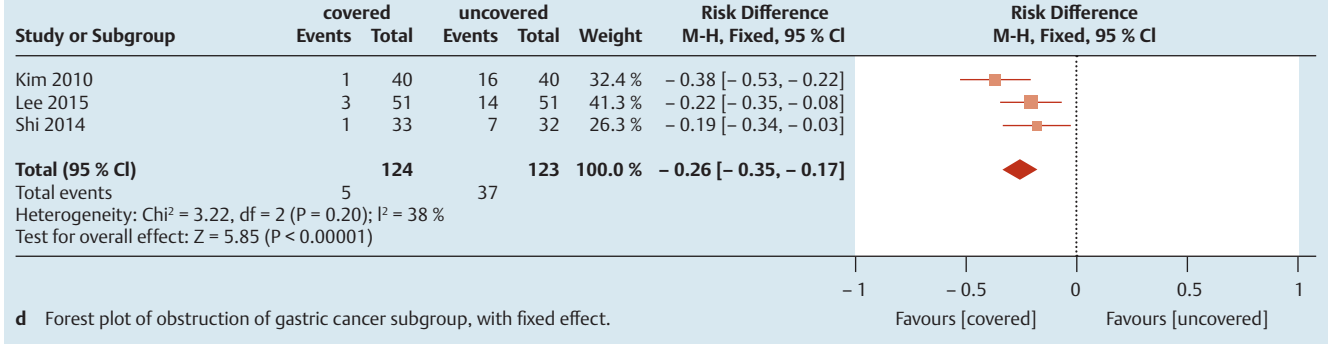
a Forest plot of technical success of gastric cancer subgroup, with fixed effect.



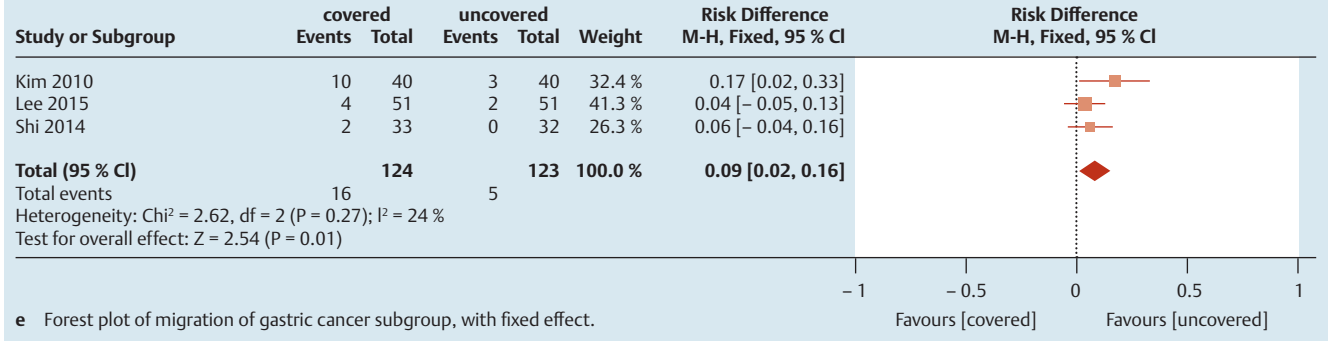
b Forest plot of clinical success of gastric cancer subgroup, with fixed effect.



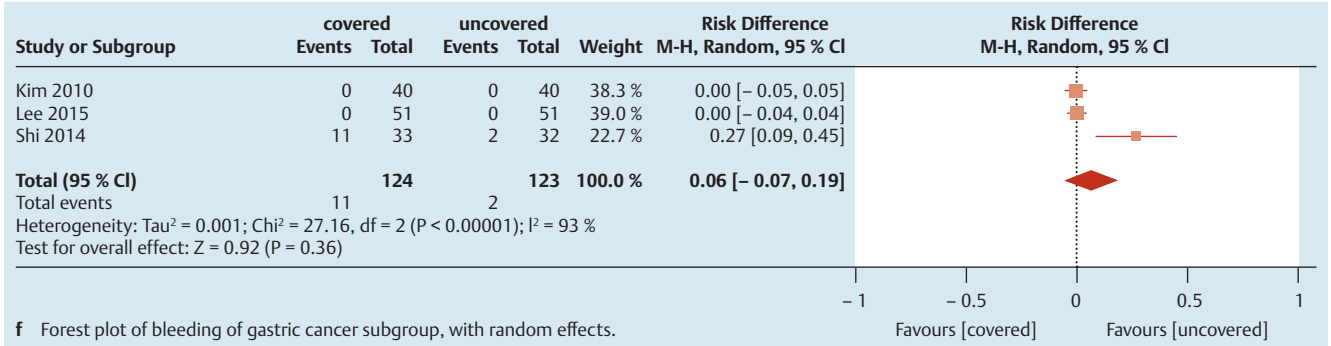
c Forest plot of complications of gastric cancer subgroup, with random effects.



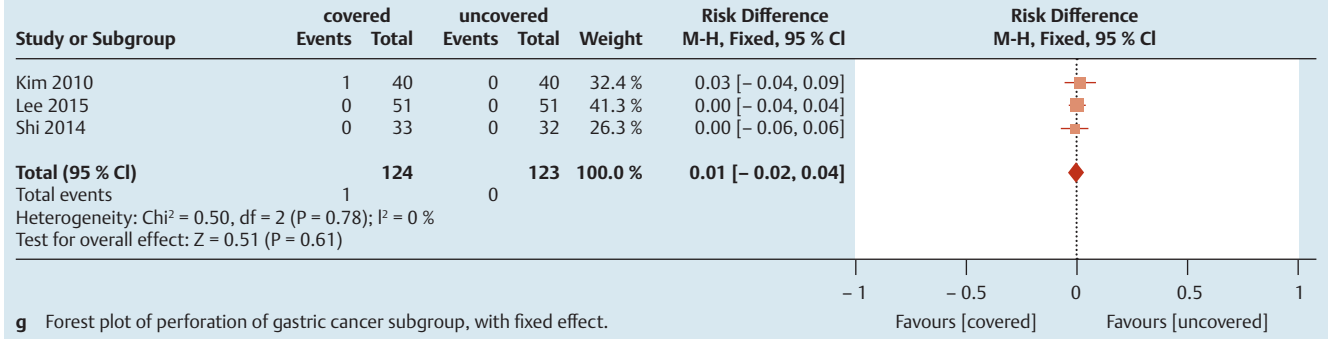
d Forest plot of obstruction of gastric cancer subgroup, with fixed effect.



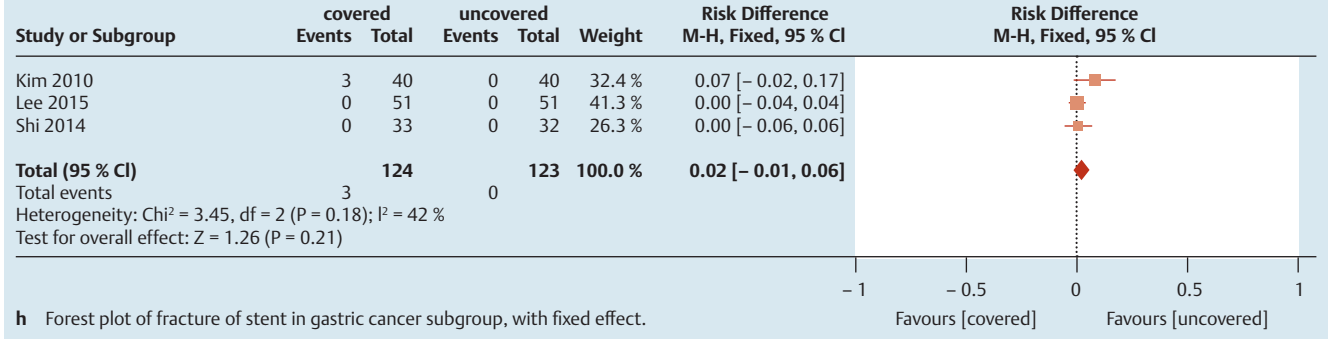
e Forest plot of migration of gastric cancer subgroup, with fixed effect.



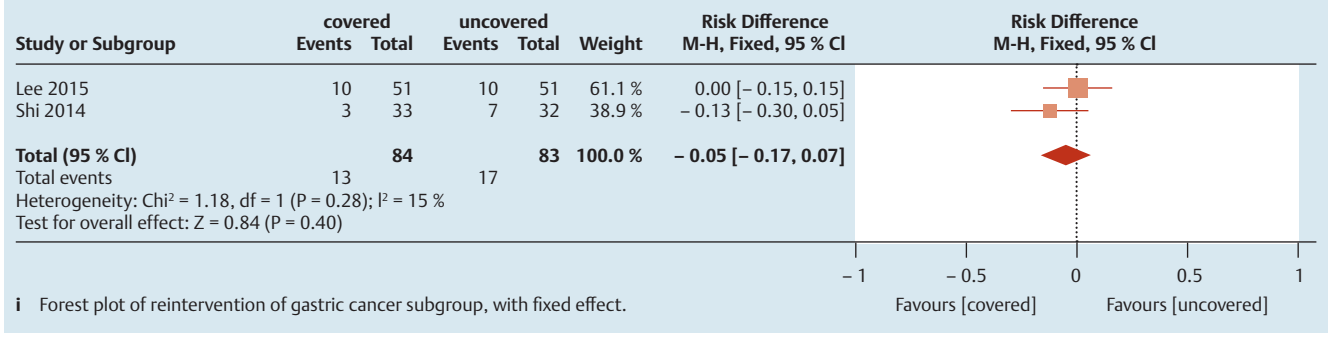
f Forest plot of bleeding of gastric cancer subgroup, with random effects.



g Forest plot of perforation of gastric cancer subgroup, with fixed effect.



h Forest plot of fracture of stent in gastric cancer subgroup, with fixed effect.



i Forest plot of reintervention of gastric cancer subgroup, with fixed effect.