Comparative efficacy and safety of treatments for malignant gastric outlet obstruction: a systematic review and network meta-analysis

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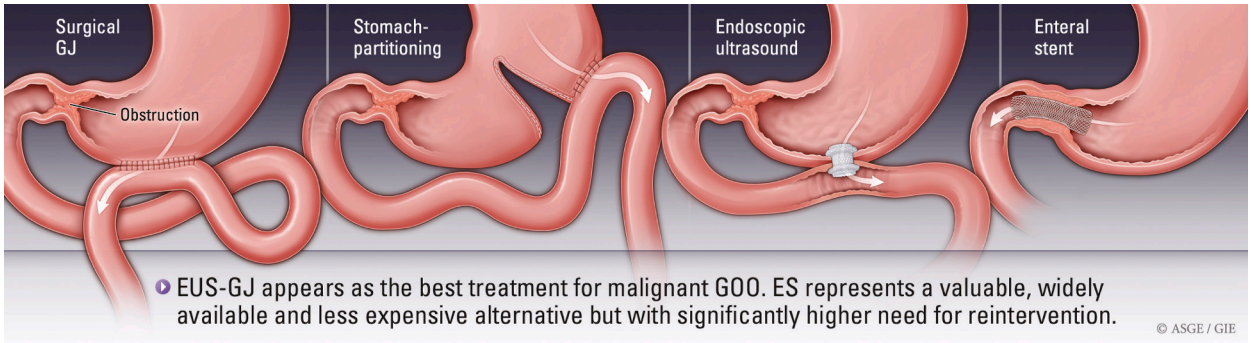
GRAPHICAL ABSTRACT



Background and Aims: It is unclear which is the best treatment for palliation of malignant gastric outlet obstruction (GOO). We performed a network meta-analysis combining direct and indirect comparisons among the different techniques.

Methods: We identified 8 randomized controlled trials (430 patients) comparing surgical gastrojejunostomy (GJ), stomach-partitioning GJ, EUS-GJ, and enteral stent placement (ES) with each other. The clinical success was the primary outcome, whereas technical success, severe adverse events (SAEs), reintervention rate, and length of hospital stay were secondary outcomes. The results were expressed in terms of risk ratio (RR) or standardized mean difference with relevant 95% CIs.

Results: All the treatments resulted in being significantly inferior to EUS-GJ in terms of clinical success (GJ vs EUS-GJ: RR, 0.82; 95% CI, 0.75-0.90; partitioning GJ vs EUS-GJ: RR, 0.83; 95% CI, 0.75-0.93; ES vs EUS-GJ: RR, 0.91; 95% CI, 0.85-0.98). Surgery was also significantly inferior to ES (RR, 0.89; 95% CI, 0.81-0.98). No difference was observed for technical success and SAEs. ES was associated with a significantly increased risk of reintervention as compared with EUS-GJ (RR, 7.69; 95% CI, 1.81-33.3) and surgical GJ (RR, 6.66; 95% CI, 2.04-20). Again, EUS-GJ appeared as the best treatment in terms of reintervention rate (surface under the cumulative ranking curve, 0.81). Surgery and partition-

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ing GJ determined a significant increase in the length of hospital stay. The quality of evidence was mainly deemed as moderate because of the risk of imprecision.

Conclusions: EUS-GJ appears to be the best treatment for malignant GOO. ES represents a valuable, widely available, and less expensive alternative, but with a significantly higher need for reintervention. (Gastrointest Endosc 2026;104:182-9.)

INTRODUCTION

Malignant gastric outlet obstruction (GOO) is associated with dismal prognosis in several abdominal malignancies, such as pancreatic or gastric cancer, and it is characterized by nausea, bloating, vomiting, and difficulty in oral intake caused by the obstruction of gastric emptying.[1]

Palliative procedures for patients with GOO include enteral stent placement (ES), which re-enables the passage of food at the obstructed location, and gastrojejunostomy (GJ), either surgical or EUS guided, which creates a new GI pathway that bypasses the obstruction. In particular, EUS-guided GJ has recently emerged as a promising technique, avoiding the surgical morbidities while showing a longer-lasting stent patency than ES,[2] and the recent European Society of Gastrointestinal Endoscopy guidelines recommend EUS-GJ as an alternative to surgery or ES in centers with adequate expertise.[3]

A previous network meta-analysis of randomized controlled trials (RCTs) and retrospective studies suggested stomach-partitioning GJ and EUS-GJ as the most valuable options for palliation of malignant GOO,[4] results confirmed in a simulation analysis based on a Markov model.[5] However, the very limited number of RCTs, and particularly the lack of RCTs testing EUS-GJ, weakened the conclusions of the aforementioned meta-analyses.[4]

Three RCTs have recently compared EUS-GJ with surgical GJ[6,7] or with ES[8] demonstrating the promising efficacy and safety profile of this technique; therefore, we decided to conduct a systematic review and network meta-analysis of only RCTs comparing the different treatments for malignant GOO. This method involves the simultaneous analysis of direct evidence (from RCTs directly comparing treatments of interest) and indirect evidence (from trials comparing treatments of interest with a common comparator) to calculate a mixed-effect estimate as the weighted average of the 2. In contrast to pairwise meta-analyses, network meta-analysis can also provide indirect evidence about the comparative effectiveness of multiple interventions and synthesize available data across a network of RCTs.

We also used Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) criteria[9] for network meta-analysis to appraise the quality of evidence.

METHODS

This systematic review is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[10]

Selection criteria

Studies included in this meta-analysis were RCTs published in the English language meeting the following inclusion criteria: (1) patients: adults with malignant GOO needing palliation; (2) interventions: surgical GJ, stomach-partitioning GJ (the stomach is partitioned from the greater curvature to the lesser curvature, leaving only a tunnel 2-3 cm from the lesser curvature and GJ is then performed in the proximal part of the stomach), EUS-GJ, and ES; (3) comparators: another of the above-reported techniques; and (4) outcomes: clinical success as the primary outcome whereas technical success, severe adverse events (SAEs), reintervention rate, and length of hospital stay were secondary outcomes. Noncomparative observational and retrospective studies, trials comparing different techniques for the same treatment, and studies focused on benign GOO were excluded.

Search strategy

The search strategy was conducted on several databases with variant-controlled vocabularies, expanded terminology, varying algorithms, and keyword capabilities, for RCTs published from inception through September 2025. A complementary manual search was performed in additional databases (Google Scholar, Cochrane Library) and by checking the references of all the main review articles on this topic in order to identify possible additional studies. The detailed literature search strategy is reported in the Online Supplement (Supplementary Table 1, available online at www.giejournal.org).

Data were abstracted onto a standardized form by 2 authors independently (A.F. and S.F.C.). The risk of bias of individual studies was assessed using the Cochrane Risk of Bias 2.0 assessment tool[11] by 2 authors (A.F. and G.D.A.). In the case of disagreements, the decision was based on a third author's (A.A.) opinion.

Outcomes

Primary outcome was the clinical success, defined as achievement of GOO score (GOOS) $\geq$2 on a 4-point scale with 0 for no oral intake, 1 for liquids only, 2 for soft solids only, and 3 for low-residue or full diet.[12] The RCT by Teoh et al[8] defined clinical success as the improvement of at least 1 point in GOOS within 3 days after stent insertion, but for the purpose of this analysis, the proportion of patients who could assume a solid diet at discharge was considered.

Secondary outcomes were technical success, defined as the successful completion of the procedure, the SAE rate

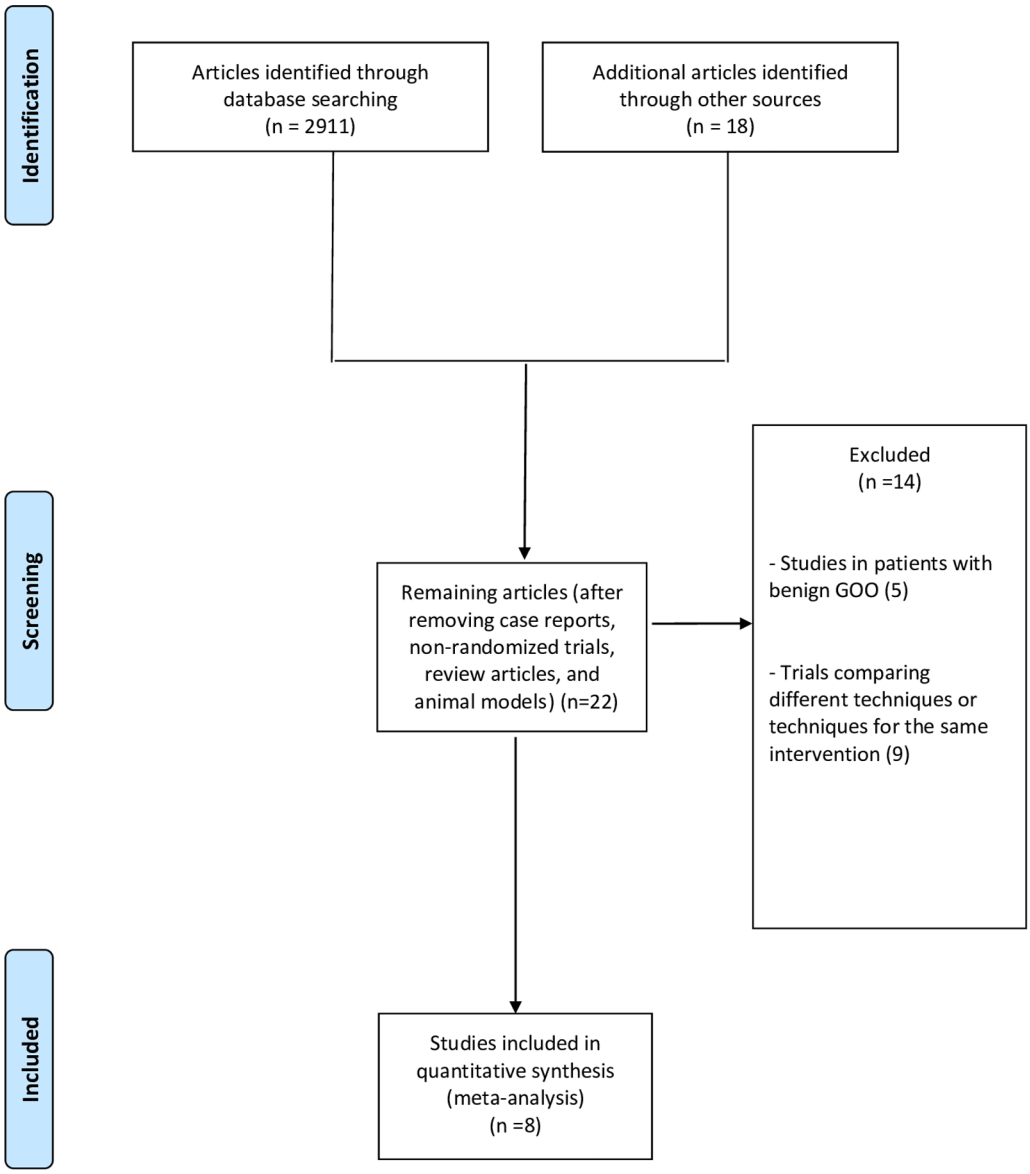

Figure 1. Flowchart of the included trials. *GOO*, Gastric outlet obstruction.

(AE defined as life threatening or requiring hospitalization), the reintervention rate during follow-up, and the length of hospital stay.

Statistical analysis

The network meta-analysis was performed using a multivariate random-effects meta-regression with a frequentist approach based on a random-effects consistency model, and the results were expressed as risk ratio (RR) or standardized mean difference along with 95% CIs.[13] A comparison of direct and indirect treatment estimates was performed (when available) to assess the consistency of network meta-analysis by using a node-splitting technique. We assessed the statistical heterogeneity using the I^2 statistic, with values over 50% indicating substantial heterogeneity, and small study effects were assessed by examining funnel plot asymmetry.[14]

Methods ranking was based on the surface under the cumulative ranking curve (SUCRA) score analysis, measured on a scale from 0 (worst) to 1 (best).[15]

Network meta-analysis was conducted with the R package netmeta (R Foundation for Statistical Computing, Vienna, Austria).

Quality of evidence

The quality of evidence derived from the pairwise and network meta-analysis was judged using the GRADE framework.[9] In this approach, the evidence from RCTs starts at high quality and can be rated down based on risk of bias, indirectness, imprecision, inconsistency (or heterogeneity), or publication bias, to levels of moderate, low, and very low quality (Supplementary Table 2, available online at www.giejournal.org).

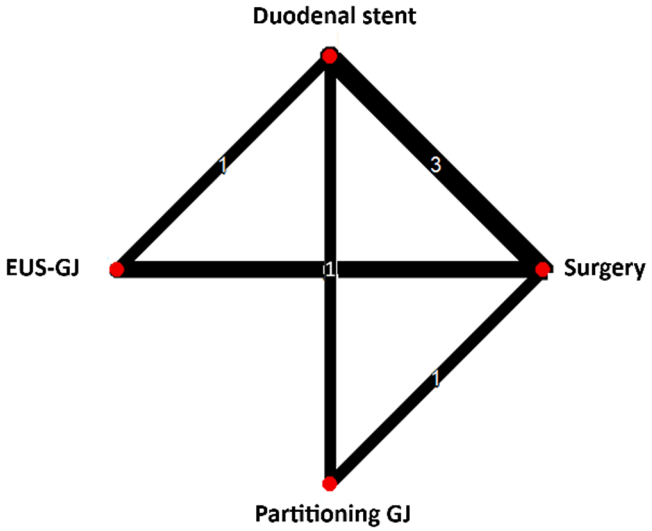

Figure 2. Network of the included trials. Network of included studies with the available direct comparisons between treatments for malignant gastric outlet obstruction. The size of the nodes and the thickness of the edges are weighted according to the number of studies evaluating each treatment and direct comparison, respectively. *EUS-GJ*, EUS-guided gastrojejunostomy; *GJ*, gastrojejunostomy.

RESULTS

Of 2929 articles initially identified using the search strategy, we finally included 8 RCTs in the network meta-analysis.[6-8,16-20] Figure 1 details the study selection flowchart, and Figure 2 shows the available direct comparisons and network of trials.

Characteristics of included studies

Table 1[6-8,16-20] summarizes the baseline characteristics of the RCTs included in the network meta-analysis. Overall, the 8 included trials enrolled 430 patients. Three RCTs compared surgical GJ versus ES[16-18] (of which 2 RCTs[16,17] compared laparoscopic or open GJ vs uncovered self-expandable metal stent and 1 RCT[18] compared open GJ vs covered ES), 1 RCT compared stomach-partitioning GJ versus ES,[19] 1 RCT compared stomach-partitioning GJ versus GJ,[20] 1 RCT compared EUS-GJ versus ES,[8] and 2 RCTs compared EUS-GJ versus GJ.[6,7]

The baseline patient characteristics were homogeneously distributed between the intervention and comparator groups and across different trials (Table 1). Five RCTs were conducted in Europe,[7,16-19] and the recruitment period ranged from 2006 to 2024. The follow-up length was 6 months in 5 RCTs,[6-8,17,19] till death in 1 RCT,[18] and 1 year in 1 RCT.[16] The etiology of GOO was mainly caused by pancreatic or gastric cancer.

As described in Supplementary Table 3[6-8,16-20] (available online at www.giejournal.org), all studies were considered at low risk of bias.

Clinical success

As reported in Table 2, all the treatments resulted significantly inferior to EUS-GJ in terms of clinical success (GJ vs EUS-GJ: RR, 0.82; 95% CI, 0.75-0.90; partitioning GJ vs EUS-GJ: RR, 0.83; 95% CI, 0.75-0.93; ES vs EUS-GJ: RR, 0.91; 95% CI, 0.85-0.98). Surgery was significantly inferior also to ES (RR, 0.89; 95% CI, 0.81-0.98; Fig. 3A), whereas the other comparisons did not show significant differences.

As a consequence, the SUCRA ranking showed EUS-GJ as the best treatment (SUCRA, 0.98), followed by the ES (SUCRA, 0.66), with the 2 surgical treatments (partitioning GJ and surgical GJ) as the worst interventions (SUCRA, 0.23 and 0.11, respectively; Table 3).

Secondary outcomes

Supplementary Table 4 (available online at www.giejournal.org) reports the results of the network meta-analysis concerning the technical success. No difference was observed among the several interventions tested (Supplementary Fig. 1, available online at www.giejournal.org), and ES showed a slightly higher SUCRA score in the ranking (SUCRA, 0.79), with the other interventions presenting a similar SUCRA score (around 0.40; Supplementary Table 5, available online at www.giejournal.org).

No difference was observed in terms of SAEs (Table 2), again with ES showing a slight superiority in the SUCRA ranking (SUCRA, 0.67 with the 2 surgical procedures showing the lowest SUCRA score; Table 3). Surgical reintervention caused by SAEs was observed only in 3 cases. One patient who had undergone gastroenterostomy developed bleeding at the anastomotic site and required a new laparotomy in the study by Fiori et al,[18] whereas surgical gastroenterostomy resulting from LAMS maldeployment was needed in 1 patient after EUS-GJ, and the surgical construction of a gastrostomy caused by persistent gastroparesis was needed after GJ in another patient in the study by van de Pavert et al.[7]

ES was associated with a significantly increased risk of reintervention as compared with EUS-GJ (RR, 7.69; 95% CI, 1.81-33.3). Likewise, surgical GJ outperforms ES in terms of reintervention rate (RR, 0.15; 95% CI, 0.05-0.49; Table 2 and Supplementary Fig. 2, available online at www.giejournal.org). No other differences were detected. As a consequence, EUS-GJ (SUCRA, 0.81) followed by surgical GJ (SUCRA, 0.60) and partitioning GJ (SUCRA, 0.57) were the best treatments, whereas ES performed poorly in terms of need for reintervention (SUCRA, 0.01; Table 3).

Surgery and partitioning GJ determined a significant increase in the length of hospital stay (5.56, 2.57-8.54 days and 6.56, 0.78-12.33 days vs EUS-GJ) and (5.74, 3.14-8.34 days and 6.74, 1.16-12.33 days vs ES; Table 2 and Supplementary Fig. 3, available online at www.giejournal.org). Length of hospital stay was significantly longer also after surgical GJ than after partitioning GJ (6.48, 3.6-9.35 days). Therefore, ES and EUS-GJ showed the highest SUCRA scores (0.84 and 0.80,

TABLE 1. Characteristics of included randomized controlled trials

Author, year	Study period; country	Treatments	No. patients	Main malignancy type	Follow-up duration	Age	Sex male	Definition of clinical success	Technical success/ clinical success rate
Mehta 2006[16]	NR; United Kingdom	Laparoscopic GJ vs uncovered SEMS	13 12	Pancreatic (55.6%) Gastric (14.8%)	1 y	67.6 ± 2.9 70.4 ± 4.9	8 (61%) 5 (41.6%)	NR	13/13 10/13 10/12 10/12
Jeurnink 2010[17]	2006-2008; Netherlands	Laparoscopic GJ vs uncovered SEMS	18 21	Pancreatic (71.8%) Duodenum (10.3%)	180 d	66 ± 11 66 ± 13	9 (50%) 11 (52%)	GOOS ≥ 2	17/18 15/18 20/21 17/21
Fiori 2013[18]	NR; Italy	Open GJ vs covered SEMS	9 9	Gastric (100%)	Till death	70 72	7 (77.7%) 6 (66.6%)	GOOS ≥ 2	9/9 6/9 9/9 8/9
Fiori 2021[19]	NR; Italy	SEMS vs partitioning GJ	13 14	Gastric (100%)	6 mo	77 (8) 73 (10)	8 (61.5%) 9 (64.2%)	GOOS ≥ 2	13/13 13/13 14/14 13/14
Ramos 2025[20]	2013-2020; Brazil	Open or laparoscopic GJ vs partitioning GJ	25 27	Gastric (100%)	NR	61.4 ± 11.7 66.1 ± 8.1	21 (84%) 17 (63%)	GOOS ≥ 2	25/25 24/25 27/27 26/27
Teoh 2025[8]	2020-2022; Hong-Kong, Italy, Belgium, Brazil, India, Spain	EUS-GJ vs uncovered SEMS	48 49	Pancreatic (45.4%) Gastric (28.9%)	6 mo	69.5 ± 12.6 64.8 ± 13	25 (52%) 21 (43%)	Improvement of at GOOS within 3 d after stent insertion	46/48 48/48 49/49 45/49
Bang 2025[6]	2022-2024; USA, Germany, India	EUS-GJ vs laparoscopic or open GJ	38 36	Pancreatobiliary (58%) Gastroduodenal (25%)	6 mo	65.3 ± 15.1 61.5 ± 12.3	23 (60.5%) 21 (58.3%)	GOOS ≥ 2	38/38 38/38 36/36 29/36
Van de Pavert 2025[7]	2022-2024; Netherlands	EUS-GJ vs laparoscopic GJ	48 50	Pancreatic (54%) Duodenal (12%)	6 mo	69.4 ± 9.2 70.6 ± 10.5	28 (58%) 27 (54%)	GOOS ≥ 2	43/48 43/48 45/50 40/50

EUS-GJ, EUS-guided gastrojejunostomy; *GJ*, gastrojejunostomy; *GOOS*, gastric outlet obstruction score; *NR*, not reported; *SEMS*, self-expandable metal stent.

respectively), whereas surgery and partitioning GJ were the poorest performers (SUCRA, 0.18 and 0.17, respectively; Table 3).

Small study effects, network coherence, and quality of evidence

There was no evidence of small study effects based on funnel plot asymmetry (data not shown), although the number of studies included in each comparison was small. There were no significant differences between direct and indirect estimates in closed loops that allowed assessment of network coherence (*P* value for difference between groups where both direct and indirect estimates were available ranging from 0.66 to 0.93 for clinical success; Supplementary Table 6, available online at www.giejournal.org).

The quality of evidence was mainly judged as moderate because of the risk of imprecision (broad 95% CIs crossing the unity or low number of events not reaching the required information size). The very low number of events and the broad 95% CIs led to a further downgrading of the quality of evidence from moderate to low in the analysis of SAEs (Table 2).

DISCUSSION

Palliation of GOO can be achieved through the creation of a surgical or EUS-guided GJ or via the endoscopic placement of a duodenal stent across the luminal narrowing. The minimally invasive approach of EUS-GJ makes it an attractive therapeutic option in these patients, with expected fewer SAEs and decreased need for reintervention,

TABLE 2. Grading of Recommendations, Assessment, Development, and Evaluation summary of findings reporting the comparative efficacy and safety of different techniques for the management of malignant gastric outlet syndrome

Comparison	Clinical success		Severe adverse events	
	RR (95% CI)	Quality of evidence	RR (95% CI)	Quality of evidence
All treatments vs EUS-GJ				
Surgery	**0.82 (0.75-0.90)**	Moderate	1.06 (0.29-3.84)	Low
Partitioning GJ	**0.83 (0.75-0.93)**	Moderate	1.26 (0.12-12.5)	Low
Enteral stent placement	**0.91 (0.85-0.98)**	Moderate	0.75 (0.20-2.77)	Low
All treatments vs enteral stent placement				
Surgery	**0.89 (0.81-0.98)**	Moderate	1.42 (0.39-5.26)	Low
Partitioning GJ	0.91 (0.82-1.01)	Moderate	1.66 (0.20-14.28)	Low
Partitioning GJ				
Surgery	0.98 (0.89-1.08)	Moderate	1.19 (0.16-8.33)	Low

	Reintervention rate		Length of hospital stay	
	RR (95% CI)	Quality of evidence	SMD (95% CI)	Quality of evidence
All treatments vs EUS-GJ				
Surgery	1.16 (0.42-3.12)	Moderate	**5.56 (2.57-8.54)**	Moderate
Partitioning GJ	0.52 (0.02-11.7)	Moderate	**6.56 (0.78-12.33)**	Moderate
Enteral stent placement	**7.69 (1.81-33.3)**	Moderate	−0.18 (−3.52 to 3.16)	Moderate
All treatments vs enteral stent placement				
Surgery	**0.15 (0.05-0.49)**	Moderate	**5.74 (3.14-8.34)**	Moderate
Partitioning GJ	0.07 (0.01-1.15)	Moderate	**6.74 (1.16-12.33)**	Moderate
Partitioning GJ				
Surgery	2.22 (0.10-50)	Moderate	**6.48 (3.6-9.35)**	Moderate

Results reaching the significance threshold are reported in bold.
EUS-GJ, EUS-guided gastrojejunostomy; *GJ*, gastrojejunostomy; *RR*, risk ratio; *SMD*, standardized mean difference.

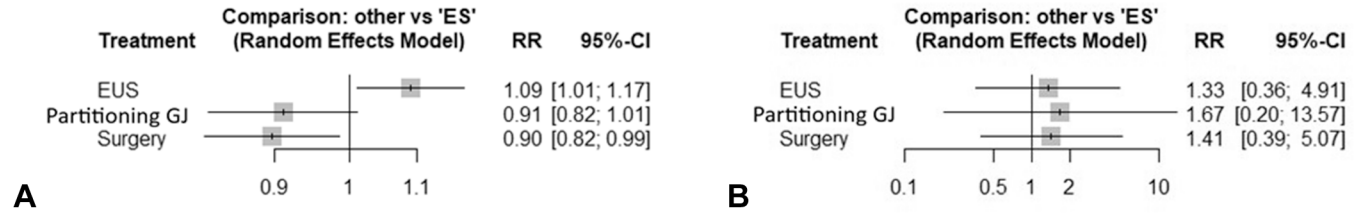

Figure 3. Forest plots reporting estimates derived from network meta-analysis assessing **(A)** clinical success and **(B)** severe adverse event rate. Enteral stent placement (ES) was used as a reference. Results were expressed in terms of risk ratio (RR) and 95% CIs.

TABLE 3. SUCRA rankings

Clinical success	SUCRA	Severe adverse events	SUCRA	Reintervention	SUCRA	Length of hospital stay	SUCRA
EUS-GJ	0.98	Enteral stent placement	0.67	EUS-GJ	0.81	Enteral stent placement	0.84
Enteral stent placement	0.66	EUS-GJ	0.54	Surgery	0.60	EUS-GJ	0.80
Partitioning GJ	0.23	Surgery	0.48	Partitioning GJ	0.57	Surgery	0.18
Surgery	0.11	Partitioning GJ	0.38	Enteral stent placement	0.01	Partitioning GJ	0.17

EUS-GJ, EUS-guided gastrojejunostomy; *GJ*, gastrojejunostomy; *SUCRA*, surface under the cumulative ranking curve.

as suggested in preliminary studies[21,22]; as a consequence, current guidelines recommend its use as an alternative to ES or surgery in the expert setting.[3,23] However, the limited evidence, based mainly on indirect comparisons or nonrandomized studies, weakens the recommendation supporting the use of EUS-GJ, and

which treatment is best for palliation of malignant GOO remains unclear.

The recent publication of several RCTs in the field made it possible to perform a systematic review and network meta-analysis comparing all the available treatments in patients with malignant GOO.

Through a network meta-analysis and using GRADE criteria to appraise the quality of evidence, we made several key observations. EUS-GJ significantly outperformed all the other treatments in terms of clinical success. Of note, surgery was also significantly inferior to ES (RR, 0.89; 95% CI, 0.81-0.98), and the SUCRA ranking suggested EUS-GJ as the best treatment (SUCRA, 0.98), followed by ES (SUCRA, 0.66), with the 2 surgical treatments (stomach-partitioning and surgical GJ) as the worst interventions. EUS-GJ also shows the lowest rate of reintervention compared with surgical approaches, with the ES requiring the highest rate of intervention. Our results confirm the excellent efficacy and safety profile of EUS-GJ, with a considerable shortening of the length of hospital stay in comparison to surgery. EUS-GJ is a technically challenging procedure that can be performed in centers with adequate expertise[24]; ES represents a quick, less expensive, and relatively easy technique, which commonly leads to a prompt resumption of oral diet and shorter hospitalization but stent migration, tumor ingrowth, and outgrowth may lead to stent blockage and require reintervention, as confirmed in our analysis. The similar results observed in terms of technical success among all the procedures confirm that EUS-GJ can be routinely performed after adequate training and in expert centers.

Our safety analysis focused only on severe AEs, that is, those significantly impacting the clinical course of the patient, and no differences were observed among the treatments. However, ES and EUS-GJ showed the most favorable safety profile and ranked better than the surgical interventions.

A previous network meta-analysis mainly based on retrospective studies suggested stomach-partitioning GJ as a valuable alternative option to EUS-GJ in centers without an advanced endoscopy[4]; however, our analysis did not confirm these findings. The stomach-partitioning GJ creates the anastomosis far from the tumor site, and the remaining 2- to 3-cm tunnel in the lesser curvature facilitates further endoscopy for re-evaluation or reintervention.[25] The excellent safety and efficacy results with EUS-GJ shown in the recently published RCTs,[6-8] not available in the previous meta-analysis,[4] clearly demonstrated the superiority of this approach and limited the impact of the stomach-partitioning technique in the analysis of the network of RCTs.

Unfortunately, the time to food resumption was not available in all the studies and could not be analyzed here; however, the aforementioned RCTs[6-8] showed that EUS-GJ rapidly restores the oral diet intake, and the shorter length of hospital stay observed in our meta-analysis could be considered a reliable proxy of this important parameter.

The inclusion of only RCTs and the robustness of the analysis allowed us to provide a strong recommendation with moderate quality of evidence (mainly because of the imprecision related to the difficult recruitment of patients in the RCTs) in favor of EUS-GJ over the other alternative options for the palliation of malignant GOO. However, the analysis of the safety profile led only to low-quality evidence because of the very low number of events; therefore, although ES and EUS-GJ appear as less morbid options, further RCTs are needed to draw definitive conclusions about the comparative safety of these techniques.

Most of the studies reported a follow-up length of 6 months, considering that patients with malignant GOO rarely present a longer overall survival. The improvement in the chemotherapeutic regimens will likely increase the median survival of these patients in the future, and whether EUS-GJ could be a better option than surgery in these longer-surviving patients is still unclear.

It should be noted that there are several technical approaches to EUS-GJ. The initial technique was the direct approach consisting of puncturing the jejunal lumen with a 19-gauge needle, then filling it with saline solution, placing a wire, and finally deploying the stent. However, this technique may determine a nonnegligible rate of stent misdeployment. In recent years, a new technique has been introduced, based on the wire endoscopic simplified technique, in which an over-the-wire nasobiliary drain is placed into the jejunum to fill it with water, creating a cystic-like target to perform EUS-GJ.[26] This novel approach seemed to decrease the risk of stent misdeployment in a few retrospective studies, although robust evidence is still lacking.[27,28] This aspect introduces a further source of potential heterogeneity in our analysis.

There are certain limitations related to both the network analysis and individual studies, which merit further discussion. First, the paucity of direct head-to-head trials for certain comparisons and the limited sample size of the studies downgraded the quality of evidence, thus posing a note of caution in the interpretation of our results. Second, network meta-analyses may be subject to misinterpretation because of conceptual heterogeneity, related to considerable differences in participants, interventions, co-interventions/background treatment, and outcome assessment, which may limit comparability of trials. For example, the underlying etiology of malignant GOO was not homogeneous in the included RCTs, although pancreatic and gastric cancers represented the most common cause of the obstruction. Finally, the survival outcomes and the time to resumption of the oncological therapy could not be explored in our analysis because of the lack of data and the heterogeneity of the oncological cause of the obstruction.

However, in spite of these limitations, this study represents the first network meta-analysis of only RCTs comparing different treatments for the palliation of malignant GOO. We observed that EUS-GJ represents the most favorable

therapeutic option, showing the highest clinical success rate with a limited need for reintervention and short hospital stay. ES constitutes an effective and safe approach but with higher rates of reintervention than the other options, whereas the surgical options are associated with the longest hospital stay and the least clinical effectiveness. Of note, although EUS-GJ seems to require fewer reinterventions, ES remains an appropriate option in patients with poor general condition, significant ascites, anatomy unsuitable for EUS-GJ, or limited life expectancy. Given the low-to-moderate quality of evidence, further RCTs, particularly directly comparing ES and EUS-GJ, are needed to confirm these results.

DISCLOSURE

All authors disclosed no financial relationships.

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Abbreviations: AE, adverse event; ES, enteral stent placement; GJ, gastrojejunostomy; GOO, gastric outlet obstruction; GRADE, Grading of Recommendations, Assessment, Development and Evaluation; RCT, randomized controlled trial; RR, risk ratio; SAE, severe adverse event; SUCRA, surface under the cumulative ranking curve.

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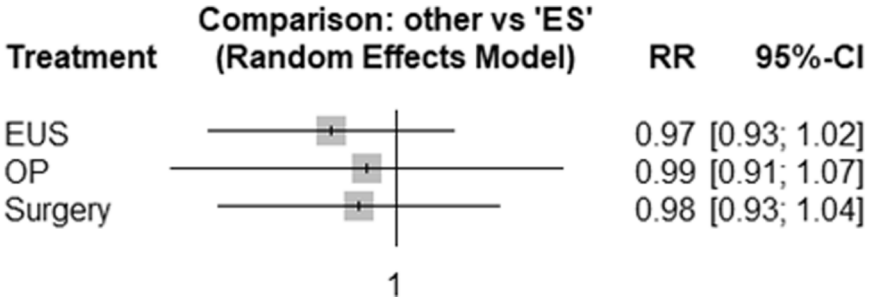
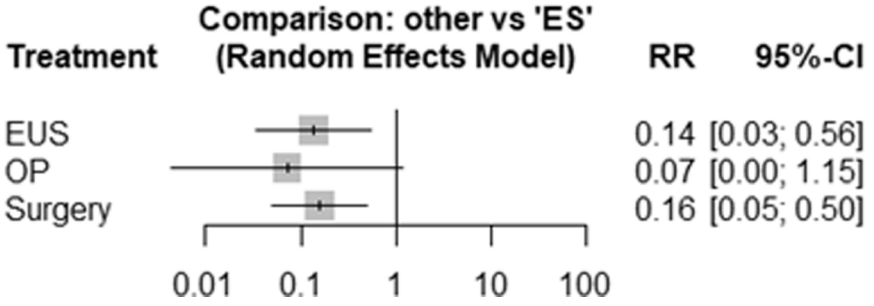
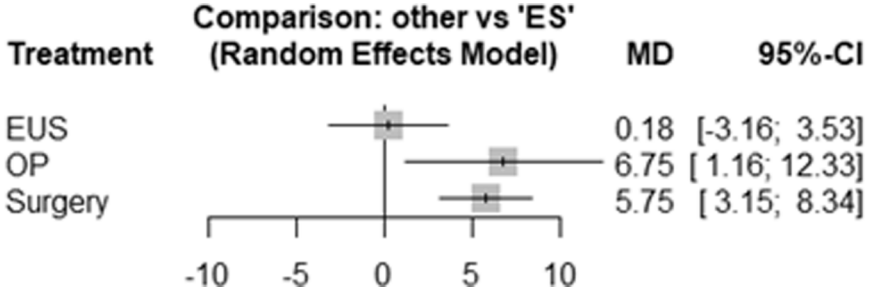


Supplementary Figure 1. Forest plot of technical success.



Supplementary Figure 2. Forest plot for reintervention rate.



Supplementary Figure 3. Forest plot for length of hospital stay.

SUPPLEMENTARY TABLE 1. Details of the search strategy

PUBMED (((gastric outlet obstruction)) OR ((gastric outflow obstruction)) OR ((duodenal obstruction))) AND (((gastrojejunostomy)) OR ((gastroenterostomy)) OR ((stomach partitioning)) OR ((gastric partitioning)) OR ((stent)) OR ((endosonography)) OR ((endoscopic ultrasound)) OR ((palliative care)))
EMBASE # Searches 1 "Gastric outlet obstruction"/exp 2 "gastric outflow obstruction"/exp 3 "duodenal obstruction"/exp 4 #1 OR #2 OR #3 5 "gastrojejunostomy"/exp 6 "gastroenterostomy"/exp 7 "stomach partitioning"/exp 8 "gastric partitioning"/exp 9 "stent"/exp 10 "endosonography"/exp 11 "endoscopic ultrasound"/exp 12 "palliative care"/exp 13 #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12

SUPPLEMENTARY TABLE 2. GRADE categories of quality of evidence

GRADE quality of evidence	Meaning	Interpretation
High	We are very confident that the true effect lies close to that of the estimate of the effect.	Further research is very unlikely to change our confidence in the estimate of effect
Moderate	We are moderately confident in the estimate of the effect; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.	Further research is likely to have an impact on our confidence in the estimate of effect and may change the estimate
Low	Our confidence in the estimate of the effect is limited; the true effect may be substantially different from the estimate of the effect.	Further research is very likely to have an impact on our confidence in estimate of effect and is likely to change the estimate
Very low	We have very little confidence in the estimate of the effect; the true effect is likely to be substantially different from the estimate of the effect.	Any estimate of effect is very uncertain

GRADE, Grading of Recommendations, Assessment, Development, and Evaluation.

SUPPLEMENTARY TABLE 3. Risk of bias

Study	D1	D2	D3	D4	D5	Overall
Mehta 2006[16]	+	+	+	+	+	+
Jeurnink 2010[17]	+	+	+	+	+	+
Fiori 2013[18]	+	+	+	+	+	+
Fiori 2021[19]	+	+	+	+	+	+
Ramos 2025[20]	+	+	+	+	+	+
Teoh 2025[8]	+	+	+	+	+	+
Bang 2025[6]	+	+	+	+	+	+
Van de Pavert 2025[7]	+	+	+	+	+	+

SUPPLEMENTARY TABLE 4. Technical success

Comparisons	Technical success	
	RR (95% CI)	Quality of evidence
All treatments vs EUS-GJ		
Surgery	1.02 (0.94-1.03)	Moderate
Partitioning GJ	1.02 (0.91-1.06)	Moderate
Enteral stent placement	1.03 (0.92-1.05)	Moderate
All treatments vs enteral stent placement		
Surgery	0.98 (0.92-1.04)	Moderate
Partitioning GJ	0.98 (0.91-1.07)	Moderate
All treatments vs partitioning GJ		
Surgery	0.99 (0.93-1.06)	Moderate

EUS-GJ, EUS gastrojejunostomy; *GJ*, gastrojejunostomy; *RR*, risk ratio.

SUPPLEMENTARY TABLE 5. Ranking in terms of technical success

	Technical success
Enteral stent placement	0.79
Partitioning GJ	0.47
Surgery	0.46
EUS-GJ	0.44

EUS-GJ, EUS gastrojejunostomy; *GJ*, gastrojejunostomy.

SUPPLEMENTARY TABLE 6. Consistency of the network

Comparison	*K*	Prop	NMA	Direct	Indir	RoR	*z*	*P* value
EUS-GJ vs ES	1	0.81	1.09	1.09	1.10	0.99	−0.08	.93
Partitioning GJ vs ES	1	0.55	0.91	0.93	0.89	1.05	0.43	.66
Surgery vs ES	3	0.25	0.90	0.87	0.91	0.96	−0.36	.71
EUS-GJ vs surgery	2	0.67	1.21	1.22	1.21	1.01	0.08	.93
Partitioning GJ vs surgery	1	0.73	1.02	1.00	1.05	0.95	−0.43	.66

Comparison, Treatment comparison; *direct*, estimated treatment effect (risk ratio [RR]) derived from direct evidence; *ES*, enteral stent placement; *GJ*, gastrojejunostomy; *indir*, estimated treatment effect (RR) derived from indirect evidence; *k*, number of studies providing direct evidence; *NMA*, estimated treatment effect (RR) in network meta-analysis; *prop*, direct evidence proportion; *P* value, *P* value of test for disagreement (direct vs indirect); *RoR*, ratio of ratios (direct vs indirect); *z*, *z* value of test for disagreement (direct vs indirect).