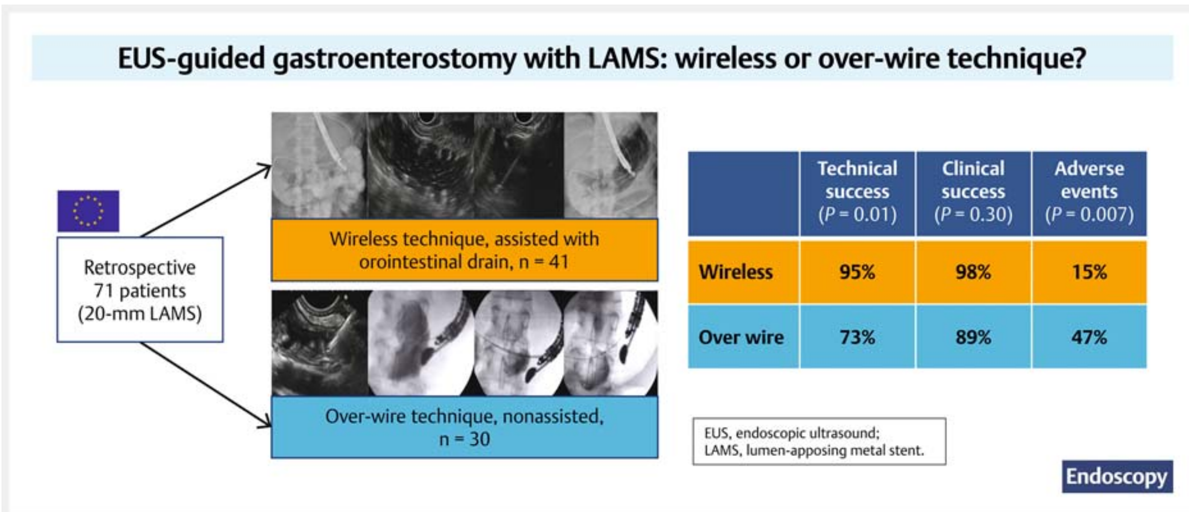
Accepted Manuscript online: 2023-06-28 Article published online: 2023-08-01

Endoscopic ultrasound-guided gastroenterostomy with lumen-apposing metal stents: a retrospective multicentric comparison of wireless and over-the-wire techniques

GRAPHICAL ABSTRACT



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submitted 21.12.2022
accepted after revision 28.6.2023
accepted manuscript online 28.6.2023
published online 1.8.2023

Bibliography
Endoscopy 2023; 55: 991–999
DOI 10.1055/a-2119-7529
ISSN 0013-726X

Figs. 1 s-3 s
Supplementary material is available under https://doi.org/10.1055/a-2119-7529

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ABSTRACT

Background Endoscopic ultrasound-guided gastroenterostomy (EUS-GE) using lumen-apposing metal stents (LAMSs) appears to be effective and safe in gastric outlet obstruction (GOO); however, the EUS-GE procedure is not standardized, with the use of assisted or direct methods still debated. The aim of this study was to compare the outcomes of EUS-GE techniques focusing on an assisted with orointestinal drain wireless endoscopic simplified technique (WEST) and the nonassisted direct technique over a guidewire (DTOG).

Method This was a multicenter European retrospective study involving four tertiary centers. Consecutive patients who underwent EUS-GE for GOO between August 2017 and May 2022 were included. The primary aim was to compare the technical success and adverse event (AE) rates of the different EUS-GE techniques. Clinical success was also analyzed.

Results 71 patients (mean [SD] age 66.2 [10] years; 42.3 % men; 80.3 % malignant etiology) were included. Technical success was higher in the WEST group (95.1 % vs. 73.3 %; estimate of relative risk from odds ratio (eRR) 3.2, 95 %CI 0.94–10.9; $P = 0.01$). The rate of AEs was lower in the WEST group (14.6 % vs. 46.7 %; eRR 2.3, 95 %CI 1.2–4.5; $P = 0.007$). Clinical success was comparable between the two groups at 1 month (97.5 % vs. 89.3 %). The median follow-up was 5 months (range 1–57).

Conclusion The WEST resulted in a higher technical success rate with fewer AEs, with clinical success comparable with the DTOG. Therefore, the WEST (with an orointestinal drain) should be preferred when performing EUS-GE.

Introduction

Gastric outlet obstruction (GOO) can be due to benign or malignant diseases and represents a challenging clinical setting. Surgical gastroenterostomy (SGE) or enteral stenting are offered according to patient's characteristics, oncological status, and local expertise. SGE, which achieves better long-term outcomes, has been indicated particularly for those patients with a good general condition and life expectancy. Higher rates of adverse events (AEs) and mortality have however been described with the surgical approach [1]. Conversely, enteral stenting has fewer complications and offers better short-term outcomes, but has higher reintervention rates owing to lower patency related to local tumor progression [2].

Recently, endoscopic ultrasound-guided gastroenterostomy (EUS-GE) has been described as an alternative minimally invasive approach [3]. This technique allows the creation of access between the stomach and a jejunal limb using a lumen-apposing metal stent (LAMS) [4–6]. The reported technical success rate of EUS-GE is around 90 %–95 % [7, 8]. Compared with enteral stenting, EUS-GE has shown higher clinical success rates and lower stent dysfunction rates, with similar levels of safety [9–11]. Indeed, the longer patency of an EUS-GE compared with enteral stenting allows enteral feeding to be maintained for longer periods without reintervention. Moreover, the rapid deployment and shorter size of the LAMS allows rapid restoration of an oral diet, improving the quality of life of patients in poor general condition. In addition, EUS-GE can also be used as a "temporary" treatment of GOO of benign origin, while healing of the duodenal digestive lumen occurs [12]. A comparable clinical success with fewer AEs compared with SGE has also been reported in the literature [13–15].

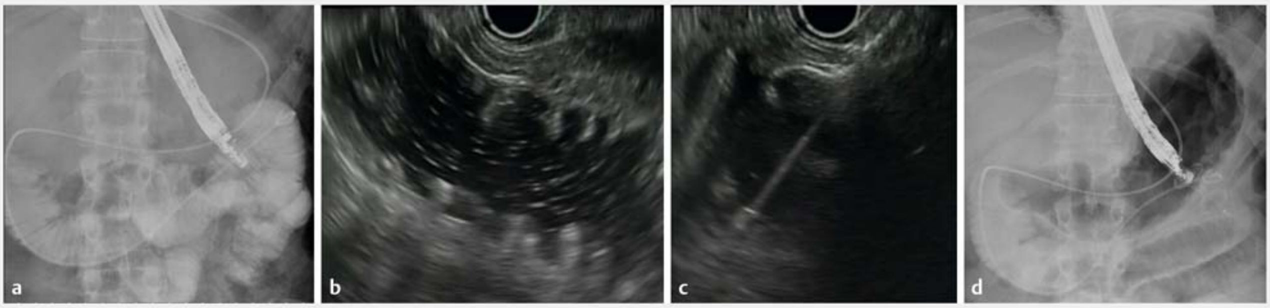
In contrast to SGE, however, little is known about the best approach to perform an EUS-guided anastomosis, as the procedure is not standardized [16]. In addition, severe AEs can occur, and these may be related to the endoscopic technique and patient characteristics. Indeed, various techniques have been described [17, 18]. Device-assisted EUS-GE techniques, such as EUS-guided double balloon-occluded gastrojejunostomy bypass (EPASS) [6, 19] and the orointestinal drain technique [9, 20, 21] have been evaluated. According to recent European recommendations [22], these modalities allow the size of the target limb to be increased using saline instillation and should be preferred. However, the assisted technique cannot be performed if the duodenal stricture cannot be crossed. In such cases, an intravenous anticholinergic agent is used to reduce bowel movements, allowing the direct technique over a guidewire (DTOG) to be performed to create the EUS-GE. With or without an assisted technique, debate continues as to the best way to create the EUS-GE: the wireless endoscopic simplified technique (WEST) using "freehand" insertion of the electrocautery-enhanced LAMS into the targeted jejunal limb or the DTOG [23].

Regardless of the EUS-GE approach, recent data suggest the use of large LAMSs (20-mm diameter) may allow a more advanced diet [24]. The technical success rates for the direct approach and balloon-assisted method seem to be comparable [25]. The DTOG needs more exchanges and, if the axis of the LAMS insertion is not straight, the limb can be pushed during the maneuvers, leading to lower EUS visibility and increased misdeployment. On the other hand, the guidewire allows the scope position to be stabilized and better fluoroscopy control, and it can be necessary in distal jejunal limbs or for small targets where the WEST is more challenging.

The aims of this European multicenter retrospective study were to compare the outcomes of EUS-GE using the assisted (with an orointestinal drain) WEST and the nonassisted DTOG in patients with GOO.

Methods

This is a retrospective multicenter observational study involving four centers who used different EUS-GE techniques. All



▶ **Fig. 1** Images during an endoscopic ultrasound-guided gastroenterostomy (EUS-GE) procedure using the assisted (with orointestinal drain) wireless endoscopic simplified technique (WEST) showing: **a** on fluoroscopic image, the jejunal limb filled with saline–methylene blue and contrast instilled via an orointestinal drain placed beyond the duodenal stenosis and connected to a water-pump; **b** on EUS image, the increased visibility and size of the target jejunal limb following instillation of fluids that allows the electrocautery-enhanced lumen-apposing metal stent (LAMS) to be advanced in pure cut mode; **c** on EUS image, the distal flange of the LAMS deployed in the jejunal lumen, with the proximal flange then opened in the gastric lumen; **d** on fluoroscopic image, the anastomosis between the gastric and jejunal lumens.

consecutive adult patients who underwent EUS-GE for benign or malignant GOO with a 20-mm LAMS (Hot-Axios, Boston Scientific, Massachusetts, USA) between August 2017 and May 2022 were included. Patients with altered anatomy who underwent EUS-guided gastrogastrostomy or jejunogastrostomy for EUS-directed transgastric interventions or who presented with afferent limb syndrome were excluded. Data were collected on demographic characteristics, the etiology of the GOO, time to onset of GOO, presence of peritoneal carcinomatosis or ascites, and prior endoscopic treatment.

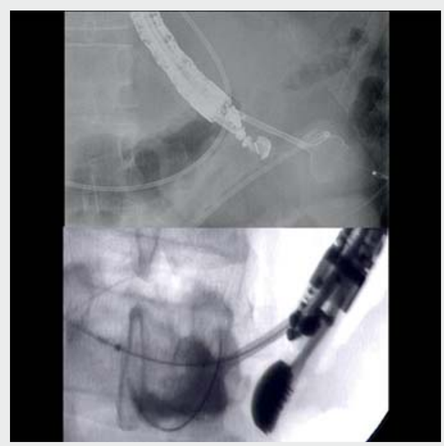
The present study was approved by the Local Ethical Committee (2022/02DEC/463) according to the Declaration of Helsinki.

EUS-GE anastomosis

All patients received intravenous antibiotics prior to the procedure. All EUS-GE procedures were performed by expert endoscopists, with the patient under general anesthesia and with endotracheal intubation. A therapeutic EUS scope was used to perform the procedure (GF-UCT 180, Olympus, Tokyo, Japan; or EG-3870UTK, Pentax, Tokyo, Japan). An anticholinergic agent such as hyoscine butylbromide was used during the procedure to reduce the motility of the target limb. The choice of EUS-GE technique was at the discretion of the endoscopist. The time for the procedure, the need for salvage therapy, and procedure-related AEs were considered.

For the WEST (▶ **Fig. 1**; ▶ **Video 1**), an orointestinal drain was inserted into the target limb through the duodenal stricture to instill saline, with or without methylene blue and contrast medium. The EUS-GE was then created using freehand insertion of the electrocautery-enhanced LAMS, using electrosurgical current in pure cut mode (effect 3–4, 100–120 W), between the target limb and the gastric lumen. Finally, the LAMS was deployed between the lumen of the stomach and the jejunum.

For the DTOG (▶ **Fig. 2**; ▶ **Video 1**), the jejunal limb was located by EUS in the transgastric position and punctured using a 19-gauge needle. The jejunal limb was filled with contrast medium through the needle, and a guidewire was then inserted into the lumen under fluoroscopic control. The electrocautery-enhanced LAMS catheter was advanced over the guidewire into the jejunal limb in pure cut mode (effect 3–4, 100–120 W). Lastly, the LAMS was deployed between the jejunal and gastric lumens.



▶ **Video 1** Endoscopic ultrasound-guided gastroenterostomy procedures are performed using the assisted (with an orointestinal drain) wireless endoscopic simplified technique (WEST) and the nonassisted direct technique over a guidewire (DTOG).
Online content viewable at:
https://doi.org/10.1055/a-2119-7529

Techniques other than those just described were not considered in the present study to ensure the homogeneity of the population and validity of the results.

After the procedure

Patients were systematically treated with an intravenous antiemetic (alizapride 50 mg three times a day and/or ondansetron

8 mg twice a day) for a variable period depending on the center. All patients were kept fasted for 24 hours after the procedure. After this, oral intake was progressively started, with a gradual increase in the texture of the diet over a variable period depending on the center. Patients were discharged 3–5 days after the procedure unless AEs occurred. All patients were followed-up in the Oncology or Gastroenterology clinic. The follow-up time, the time to oral intake, the type of diet, and the reintervention rate (endoscopy or surgery) were recorded.

Study end points and definitions

The primary aim was to compare the technical success and AE rates between the WEST and DTOG groups. The clinical success rate was also analyzed.

Technical success was defined as the creation of the gastroenteroanastomosis with the LAMS without salvage therapy being required. Salvage therapy was defined as another endoscopic procedure that was required to finalize the creation of the gastroenteroanastomosis. A "stent-in-stent technique" was performed for LAMS misdeployment types II or III, graded according to the classification of the EUS Study group [26]. A redo EUS-GE was defined as a second attempt to perform the EUS-GE during the same procedure or at a later time for misdeployment types I or II.

Data on AEs were collected during the follow-up period and evaluated according to the AGREE classification [27]. They were considered as minor (AGREE grades I–II) or major (AGREE grade >II).

Clinical success was defined as the resumption of oral feeding (liquid and/or solid) without nausea or vomiting at 1 month after the procedure in a patient with previous technical success including after salvage therapy.

Statistical analysis

Categorical variables were compared using χ^2 or Fisher exact tests. Normal and non-normally distributed variables are presented as mean (SD) and median (range). They were analyzed using the Student's *t* test, Mann–Whitney *U* test, or Kruskal–Wallis test as appropriate. A deep analysis with the logit model of all variables was performed to identify potential cofactors impacting the results between the two groups. A two-sided *P* value < 0.05 was considered statistically significant. An estimation of the relative risk from the odds ratio (eRR) was calculated using a log-binomial model for categorical variables when indicated [28]. Statistical analyses were carried out using TIBO Statistica v13.3 software (University of Montpellier, research laboratory MRE-TRIS, France).

Results

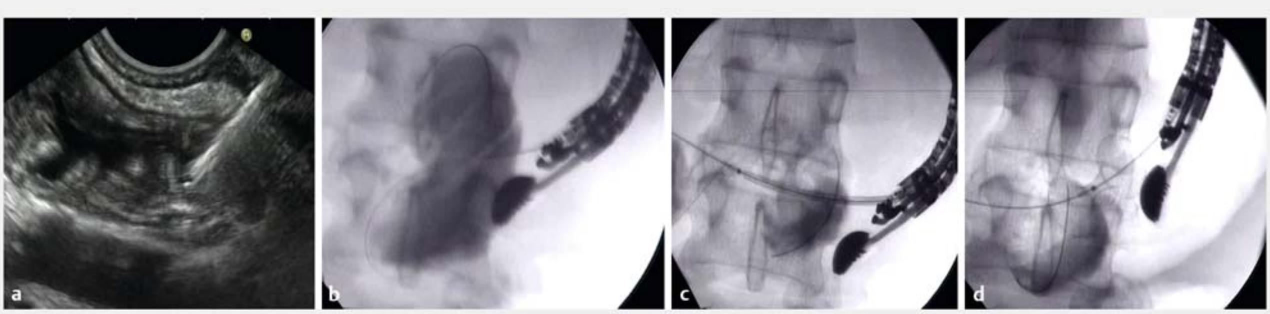
Patients

During the study period, 99 patients underwent an EUS-GE for GOO. Among them, 28 patients were excluded because of the use of a LAMS of < 20 mm (n = 14) or a different EUS-GE technique from those described above (n = 14). Finally, a total of 71 patients (mean [SD] age 66.2 [10] years; 42.3 % men) were included. There were four centers that contributed patients who underwent WEST (centers A [n = 18], B [n = 13], C [n = 3], and D [n = 7]), whereas three centers contributed cases that used the DTOG (centers A [n = 1], B [n = 6], and C [n = 23]) (**Fig. 1 s**, see online-only Supplementary material).

The indication for EUS-GE was malignant GOO in most cases (80.3 %). Of these, 10 patients (17.5 %) had GOO at the time of their baseline diagnosis. For the remaining 47 patients, the GOO occurred at a median of 4 months after the diagnosis of the malignant disease. Patient baseline characteristics and the etiologies of the GOO are shown in ▶ **Table 1**. Previous treatments had been performed in 19 patients (26.8 %): duodenal stent (n = 13), gastric peroral endoscopic myotomy (n = 3), EUS-GE with < 20-mm LAMS (n = 2), and SGE (n = 1).

The EUS-GE procedure

The WEST and DTOG were performed in 41 patients (57.7 %) and 30 patients (42.3 %), respectively (▶ **Fig. 3**). No dilation of the LAMS was performed at the end of the procedure. Overall, the mean (SD) time of the entire procedure was 57.3 (22.1) minutes. There were no clinically relevant differences regarding the ma-



▶ **Fig. 2** Images during an endoscopic ultrasound-guided gastroenterostomy (EUS-GE) procedure using the nonassisted direct technique over a guidewire (DTOG) showing: **a** on EUS image, direct puncture of the target jejunal lumen, which has been located without previous filling, using a 19G needle, with contrast then injected to confirm the position; **b–d** on fluoroscopic images: **b** a guidewire inserted into the jejunal lumen through the needle; **c** an electrocautery-enhanced lumen-apposing metal stent (LAMS) inserted into the jejunal limb over the guidewire using pure cut mode; **d** the LAMS deployed between jejunal and gastric lumens.

▶ **Table 1** Baseline characteristics of the patients who underwent an endoscopic ultrasound-guided gastroenterostomy using the wireless endoscopic simplified technique (WEST) or direct technique over a guidewire (DTOG).

Feature	Total cohort n = 71	WEST n = 41	DTOG n = 30	*P* value
Age, mean (SD), years	66.2 (10)	67.3 (10)	64.7 (10)	0.41
Sex, male, n (%)	30 (42.3 %)	15 (36.5 %)	15 (50.0 %)	0.34
Etiology of GOO, n (%)				0.38
▪ Benign	14 (19.7 %)	6 (14.6 %)	8 (26.7 %)	
▪ Chronic pancreatitis	5 (7.0 %)	2	3	
▪ Acute pancreatitis	1 (1.4 %)	1	0	
▪ Refractory gastroparesis	3 (4.2 %)	1	2	
▪ Crohn's disease	2 (2.8 %)	0	2	
▪ Aortomesenteric syndrome	1 (1.4 %)	0	1	
▪ Other inflammatory conditions	2 (2.8 %)	2	0	
▪ Malignant	57 (80.3 %)	35 (85.4 %)	22 (73.3 %)	
▪ Pancreatic adenocarcinoma	39 (54.9 %)	25	14	
▪ Metastatic cancer[1]	6 (8.5 %)	5	1	
▪ Gastric cancer	5 (7.0 %)	2	3	
▪ Biliary tract cancer	3 (4.2 %)	3	0	
▪ Neuroendocrine tumor	3 (4.2 %)	0	3	
▪ Ampulloma	1 (1.4 %)	0	1	
BMI, n (%), kg/m^2				0.24
▪ Underweight (< 18.5)	14 (19.7 %)	6	8	
▪ Normal (18.5–24.9)	39 (54.9 %)	22	17	
▪ Overweight (25–29.9)	13 (18.3 %)	10	3	
▪ Obese (30–34.9)	3 (4.2 %)	3	0	
▪ Severely Obese (35–39.9)	2 (2.8 %)	0	2	
Time from primary disease to development of GOO, median (range), months	4 (0–360)	8 (0–120)	1.5 (0–360)	0.04
Peritoneal carcinomatosis, n (%)	26 (36.6 %)	11 (26.8 %)	15 (50.0 %)	0.08

GOO, gastric outlet obstruction; BMI, body mass index.
[1] The primary diseases were ovarian (n = 1), rectal (n = 1), cervical (n = 1), uterus (n = 1), breast (n = 1) and colonic cancers (n = 1).

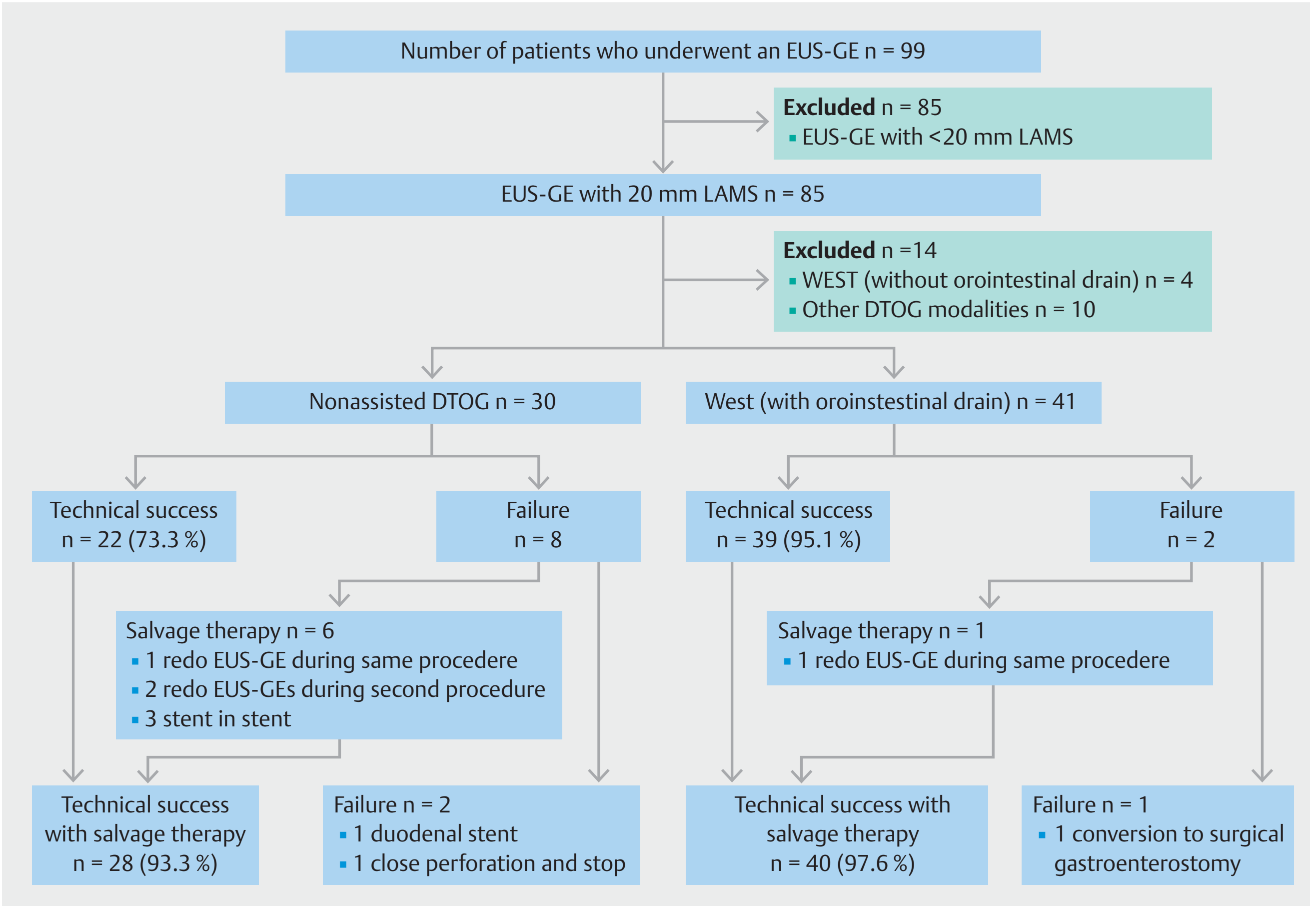
lignant etiology for the two techniques (85.4 % vs. 73.0 %, respectively).

Overall outcomes

Overall, technical success was accomplished in 61 procedures (85.9 %). Of 10 technical failures, there were two misdeployments type I (20 %), five misdeployments type II (50 %), one misdeployment type III (10 %) and two patients with puncture of the limb without deployment of the stent (20 %). Among these, there were seven patients in whom an endoscopic salvage therapy was performed as follows: "stent-in-stent technique" (n = 3), redo EUS-GE during the index (n = 2) or a second procedure (n = 2). The total rate of technical success including the salvage therapy was 95.8 %. For the remaining two patients, one was treated with a duodenal stent and one underwent SGE.

According to the AGREE classification, the overall AE rate was 28.9 %, with events classified as: AGREE I events (n = 7: 5 abdominal pain and 2 vomiting), AGREE II (n = 6: 1 delayed bleed, 3 peritonitis, 2 infections of other sites), AGREE IIIa (n = 2: both stent occlusions), AGREE IIIb (n = 1: perforation), AGREE IVb (n = 1: infection of other site), and AGREE V (n = 3: 1 LAMS migration with peritonitis, 1 gastrocolonic–jejunal fistula, 1 massive jejunal ischemia). The mortality rate related to EUS-GE was 4.2 % (n = 3).

The cofactors identified as influencing the outcomes are presented in ▶ **Table 2**. Carcinomatosis was identified as a feature associated with technical failure and AE rates (odds ratio



▶ **Fig. 3** Flowchart showing the inclusion of patients in the study and the outcomes for the two techniques.
EUS-GE, endoscopic ultrasound-guided gastroenterostomy; LAMS, lumen-apposing metal stent; WEST, wireless endoscopic simplified technique; DTOG, direct technique over a guidewire.

[OR] 15.5, 95 %CI 1.5–161.9; *P* = 0.02 and OR 10.8, 95 %CI 2.12–54.9; *P* = 0.004), respectively). Malignant disease was also identified as a cofactor influencing the AE rate (OR 8.53, 95 %CI 1.22–59.7; *P* = 0.03).

Comparison between WEST and DTOG groups

Technical success was higher in the WEST group (95.1 % vs. 73.3 %; eRR 3.2, 95 %CI 0.94–10.9; *P* = 0.01) (▶ **Table 3**). However, the technical success rates with salvage therapy were 97.6 % and 93.3 %, which were not statistically significantly different (*P* = 0.57).

Misdeployment was diagnosed in two patients (4.9 %) in the WEST group and six patients (20 %) in the DTOG group; however, the difference was not statistically significant (*P* = 0.15). Two patients also had a technical failure due to transgastric puncture without stent deployment. In terms of AEs, the rate was significantly higher in the DTOG group compared with the WEST group (46.7 % vs. 14.6 %; eRR 2.3, 95 %CI 1.2–4.5; *P* = 0.007). Similarly, the major AEs rate was higher with the DTOG than with the WEST (13.3 % vs. 7.3 %; *P* = 0.22), but this was not statistically significant. The procedure-related mortality rate was comparable in the two groups (6.7 % vs 2.4 %; *P* = 0.57). The evolution of these techniques during the study period is reported in **Figs. 2 s** and **3 s**.

In terms of clinical success at 1 month, the rate was higher in the WEST group compared with the DTOG group (97.5 % vs. 89.3 %; *P* = 0.30), but without a statistically significant difference. Overall, the median follow-up of all patients was 5 months (range 1–57 months). During the follow-up, nine patients had died within the first 3 months and five had died by 8 months.

Discussion

In the present multicenter study, we compared the WEST and DTOG for creation of an EUS-GE in a cohort of 71 patients presenting with GOO, finding a higher technical success rate (95.1 % vs. 73.3 %) and lower AE rate (14.6 % vs. 46.7 %) in the WEST group, with comparable clinical success rates. To the best of our knowledge, only one previous study has compared assisted and direct techniques for EUS-GE, with similar technical success being found for both approaches [25]. In contrast to the study by Chen et al., our study showed a significant difference in technical success between the assisted method (WEST) and

▶ **Table 2** Cofactors identified using a logit model among the entire cohort of patients who underwent an endoscopic ultrasound-guided gastroenterostomy (n = 71) that were associated with: **a** technical failure; **b** adverse events.

a Technical failure

	Odds ratio (95 %CI)	*P* value
Age	0.98 (0.91–1.05)	0.57
Body mass index	1.05 (0.88–1.24)	0.58
Sex, male	4.15 (0.75–23)	0.10
Diabetes	0.69 (0.13–3.57)	0.65
Abdominal surgery	0.98 (0.2–4.86)	0.98
Malignant etiology	0.29 (0.02–4.67)	0.38
Carcinomatosis	15.5 (1.5–161.9)	**0.02**

b Adverse events

	Odds ratio (95 %CI)	*P* value
Age	0.95 (0.89–1)	0.09
Body mass index	0.96 (0.83–1.09)	0.52
Sex, male	0.26 (0.06–1.05)	0.06
Diabetes	1.13 (0.32–4.01)	0.86
Abdominal surgery	1.42 (0.41–4.92)	0.58
Malignant etiology	8.53 (1.22–59.7)	**0.03**
Carcinomatosis	10.8 (2.12–54.9)	**0.004**

the nonassisted direct technique. In addition, in our study, for the sake of homogeneity of technique, techniques other than WEST and DTOG were excluded.

Although the condition of a patient and their individual anatomy can impact the choice of EUS-guided technique for the creation of a digestive anastomosis, the freehand approach is gaining ground in most situations as the safest modality. A favorable risk–benefit profile has been described [29]; however, few studies have compared the freehand and wire-guided approaches. A careful evaluation to assess the anatomic landmarks and the expected difficulty of the procedure seems mandatory. A retrospective study of 51 patients evaluated the feasibility of the procedure in patients with distal GOO, who sometimes require more complex procedures, and concluded that EUS-GE can be challenging but safe and effective when carried out by experienced endoscopists in this setting [30].

Regarding the feasibility of the procedure, although the reported rate of technical success in the literature is high, it is important to highlight that a technical failure can lead to severe AEs through symptomatic LAMS misdeployment or unexpected perforation. Furthermore, most reported series have a retrospective design in expert centers, so this rate may be an underestimate. In our series, the overall technical success rate was 85.9 %. Notably, most failures were due to LAMS misdeployments that could be resolved during the same procedure by salvage techniques. Indeed, there was only one patient (10 % of the 10 failures) who needed surgery in the WEST group.

With regard to the comparison between the WEST and DTOG, WEST achieved a higher technical success rate (95.1 % vs. 73.3 %; $P = 0.01$); however, the success of DTOG increased to 93.3 % when salvage therapies and redo EUS-GE were considered. In this sense, the use of a guidewire can be critical after a LAMS-induced perforation or even after the creation of the anastomosis by WEST to secure the trajectory and allow further wire-guided rescue techniques (e. g. stent in stent). Conversely, the use of the guidewire in the direct method can cause the target jejunal limb to be pushed away during LAMS insertion, increasing the risk of misdeployment. The improvement in visualization of the target limb when using an orointestinal drain has allowed a simplification of the EUS-GE procedure, which has become comparable to EUS-guided drainage of pancreatic fluid collections [31].

The learning process for EUS-GE has been impacted by the introduction of the WEST, which has allowed faster acquisition of the different steps, resulting in an improvement in the learning curve. The evolution of the EUS-GE techniques in our study over time is shown by the "technology adoption life-cycle." The gradual adoption of the WEST modality instead of the DTOG is only possible if the advantages of this approach are understood by an operator with appropriate training.

The concept of therapeutic EUS procedure-related AEs is evolving. Two recent systematic reviews and meta-analyses reported a pooled incidence of 10.6 %–12 % [7, 8], but it can be up to 55 % [30]. About half of these AEs are severe and are related to misdeployment of the LAMS in most cases (e. g. peritonitis). However, most misdeployments are type I (63 %), occur during the learning curve [25], and can be solved endoscopically without further clinically relevant AEs. In contrast, in our series, 50 % of misdeployments were type II (deployment of the LAMS distal flange in the peritoneum and proximal flange in the stomach despite an enterotomy). Accordingly, the higher rate of misdeployments in patients who underwent the DTOG led to the higher AE rate in this group (46.7 % vs. 14.6 %). Overall, almost a third of AEs were severe (AGREE > 2), a proportion that was slightly lower than in the literature [7]. All deaths related to EUS-GE occurred in patients with advanced malignant disease and carcinomatosis. Of these, two were related to LAMS misdeployment (one misdeployment type II and one colonic interposition between the gastric and jejunal lumen). The third patient died secondary to massive jejunal ischemia occurring 20 days after the EUS-GE and leading to intraperitoneal stent migration. Therefore, beyond the technique, the poor clinical condition of the patient should also be considered before performing an EUS-GE.

Although a deep statistical analysis allowed us to identify cofactors impacting the technical success and AE rates, a careful interpretation seems mandatory, as we have analyzed the ORs for several exposures and potential confounders from a single logistic regression. Carcinomatosis was a cofactor that impacted the technical success and AE rates. Similarly, malignant GOO was associated with the AE rate. Nevertheless, there was no significant difference between the WEST and DTOG groups

▶ **Table 3** Outcomes of endoscopic ultrasound-guided gastroenterostomy (EUS-GE) with the assisted wireless endoscopic simplified technique (WEST) or nonassisted direct technique over a guidewire (DTOG).

Outcome	Total cohort (n = 71)	WEST (n = 41)	DTOG (n = 30)	eRR (95 %CI)	*P* value
Technical success, n (%)	61 (85.9)	39 (95.1)	22 (73.3)	3.2 (0.94–10.9)	**0.01**
Technical failure (n, %)	10 (14.1)	2 (4.9)	8 (26.7)		
▪ Misdeployment	8	2	6		
– Type I	2	0	2		
– Type II	5	2	3		
– Type III	1	0	1		
– Type IV	0	0	0		
▪ Puncture without stent deployment	2	0	2		
Salvage therapy	7	1	6		
▪ Stent in stent	3	0	3		
▪ Redo EUS-GE	2	1	1		
▪ Redo EUS-GE second time	2	0	2		
Other therapy	2	1	1		
▪ Duodenal stent	1	0	1		
▪ Surgical gastroenterostomy	1	1	0		
Technical success with salvage therapy, n (%)	68 (95.8)	40 (97.6)	28 (93.3)	1.8 (0.4–8.6)	0.57
Adverse events according to AGREE classification, n (%)	20 (28.2)	6 (14.6)	14 (46.7)	2.3 (1.2–4.5)	**0.007**
▪ AGREE I	7	3	4		
▪ AGREE II	6	0	6		
▪ AGREE IIIa	2	1	1		
▪ AGREE IIIb	1	1	0		
▪ AGREE IVa	0	0	0		
▪ AGREE IVb	1	0	1		
▪ AGREE V	3	1	2		
Clinical success at 1 month, n (%)	64 (94.1)	39 (97.5)	25 (89.3)		0.30

eRR, estimated relative risk from odds ratio.

for these two cofactors. The difference found between the two modalities, concerning technical success and AEs, seems to depend only on the technique used.

We report comparable clinical success rates for the WEST and DTOG. This seems reasonable as the technique may impact the technical success or AEs, but once the anastomosis has been successfully created, similar clinical outcomes are to be expected.

The limitations of this study, besides its retrospective design, are the variety of GOO indications and the 36.7 % rate of nonextensive peritoneal carcinomatosis, resulting in a heterogeneous population with a long time interval between the primary disease and GOO presentation. In addition, slight differences in local protocols and a selection bias could have impacted our outcomes; however, to ensure a reliable comparison with further applicability in daily practice, we have included and assessed only the two most relevant EUS-GE techniques using 20-mm LAMSs in a relatively large number of patients.

In conclusion, the WEST for EUS-GE resulted in higher technical success with fewer AEs, with a clinical success rate comparable to the DTOG. Most technical failures can be successfully resolved endoscopically. Therefore, the assisted WEST should be preferred in daily practice.

Competing Interests

L. Monino is a consultant for Prion Medical and Braun Medical and has received speaker's fees from Olympus Belgium and Olympus Europe. E. Pérez-Cuadrado-Robles and J.-M. Gonzalez are consultants for Boston Scientific. P. H. Deprez is a consultant for Boston Scientific and Olympus Europe. T. G. Moreels has received speaker's fees from Olympus Belgium and Olympus Europe. M. Barthet is a consultant for Boston Scientific.C. Snauwaert, H. Alric, M. Gasmi, S. Ouazzani, H. Benosman, G. Rahmi, and C. Cellier declare that they have no conflict of interest.

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