EDITORIAL

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Bariatric Surgery Following Endoscopic Gastroplasty: Any Space for a Bridge?

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Obesity represents one of the constantly growing healthcare problems in the modern world. Worldwide trends are showing significant increase in obesity, in the last 40 years, in all the areas epidemiological data are available from [1]. Body mass index (BMI) of 30–35 kg/m², has been associated with reduced median survival by 2–4 years while BMI of 40–45 kg/m² reduces survival by 8–10 years [2]. This effect has been mainly attributed to the increase in the incidence of vascular diseases [2]. However, obesity is a well-recognized risk factor for diabetes mellitus, arterial hypertension, non-alcoholic fatty liver disease [3], as well as multiple types of cancer [4]. The cost of annual medical care for the obese adults in the United States is estimated to be 100% higher in average, compared to normal weight individuals, significantly increasing with class of obesity, up to 233.6% for the class 3 [5]. Therefore, it is one of the main tasks for the healthcare system and medical professionals worldwide to address this issue timely and efficiently.

Nowadays, a number of options is available to treat obese patients, varying from weight management programs, low-calorie diet and pharmacotherapy to bariatric surgery, mainly represented by Roux-en-Y gastric bypass (RYGB) surgery and laparoscopic sleeve gastrectomy (LSG). Bariatric surgery is generally recommended for those with a BMI ≥ 40 kg/m², BMI 35-40 kg/m² with significant co-morbidities, or BMI 30–35 kg/m² and type 2 diabetes and/or arterial hypertension with poor control despite optimal medical therapy [6]. It results in sustained weight loss, reduction of co-morbidities, and prolonged life expectancy [7-8]. Furthermore, it has been associated with a low perioperative morbidity and mortality in high volume canters [9-10]. Both LSG and RYGB are shown to have similar performance [11].

Nevertheless, extreme visceral obesity and/or enlarged liver in super-obese patients, as well as presence of advanced comorbidities including end-organ damage, can affect bariatric surgical procedures, leading to increased morbidity and mortality [12-16]. Bridging therapy has therefore been proposed in these patients, in order to facilitate weight loss prior to bariatric surgery and treat comorbidities, consequently lowering intra and peri-operative risks. Initially the bridging procedures included intragastric balloon (IGB) placement, first-step laparoscopic sleeve gastrectomy and liquid low-calorie diet program. Most available data are represented by the bridging performances of IGB with controversial results. The initial meta-analysis published in 2019 revealed that IGB placement prior to bariatric surgery did not significant lead to weight reduction [17]. An updated meta-analysis of 2022 showed IGB to be effective as a bridging therapy [18]. Nevertheless, further studies are required in order to evaluate the risk reduction for bariatric surgery and long-term weight-loss outcomes [18].

In the last decade endoscopic sleeve gastroplasty (ESG) established itself as a valuable alternative to bariatric surgery in mildly to moderately obese patients. Although it has been associated with lower short- and mid-term weight loss when compared to LSG, it showed acceptable safety profile with fewer adverse events, including GERD [19]. Given its stomach-sparing nature, ESG is a less-invasive, repeatable, and reversible and therefore, associated with a low morbidity and a shorter in-hospital length of stay [19-21]. These features are making the ESG a very good potential candidate for the bridging therapy in selected patients with extreme obesity, especially when we have in mind a questionable IGB performance in these settings. With mean excess weight loss 12 months after ESG reported to be up to 62.60% [20], we could expect a substantial reducing of intra/peri operative risk as well as the risk determined by comorbidities.

However, some issues have been raised by both the surgeons and the endoscopists regarding bariatric surgery in obese patients previously subjected to bariatric endoscopic procedures. Most of them concerned missing sutures, anchors, and cinches in laparoscopic view that would obstruct the staple line, risking a misfire, or be retained within the gastric sleeve, risking a stricture. Stapler misfire has been reported as a serious adverse event potentially leading to major morbidity [22]. Limited data is available so far on technical aspects and effectiveness of bariatric surgical procedures in patients previously subjected to bariatric endoscopy [23-26]. Initial data came from the authors describing laparoscopic RYGB after the transoral vertical gastroplasty (TOGA) [23-24]. The TOGA is an endoscopic procedure performed in order to acquire tissue along the anterior and posterior stomach walls, fold the tissue, and staple it to create a restrictive pouch [28]. Transoral vertical gastroplasty has been reported to lead to up to 44.8% excess body weight loss at one year [28]. Nevertheless, need for surgical revision with RYGB due to weight regain has been reported [23-24]. Although presence and location of the initial staple lane in TOGA patients, as well as its proximity to the gastroesophageal junction and the lesser curve, provided technical challenge for the surgeons in forming a gastric pouch, Closset et al. [23] and Meister et al. [24] reported procedure to be safe and feasible in 4 and 1 patients, respectively.

First experience on LSG patients treated with ESG has been reported by Ferre-Marquez et al. [25]. In both patients included in their series, pre-procedural radiological studies suggested normal anatomy. During the dissection, adhesions to surrounding structures have been observed and at least one endoscopic suture. Nevertheless, in both patients LSG was conducted without any major intra or post-operative complications. However, Ferre-Marquez et al. [25] did not perform pre or intraoperative esophagogastroduodenoscopy (EGD) in their patients, leaving the possibility to potentially miss anchors or stitches in the staple line. Therefore, Algahtani et al. [26] suggested a mandatory intra-operative EGD in all the patients undergoing LSG after ESG,in order to remove all the sutures and anchors that may come in the way of the staple line or be retained within the gastric sleeve. They reported data on 20 patients treated with LSG after ESG using a combined laparoscopic-endoscopic technique that identifies plication orientation and the location of anchors and sutures, thus preparing the stomach for safe stapling. This approach in their case series appears to be safe and feasible without mortality, prolonged hospital stay, adverse events, reoperations, or readmissions [26]. Nevertheless, Kourshedeen et al. [27] on their case series of patients treated with LSG after ESG conducted only preoperative but not intraoperative EGD, reporting LSG to be safe and feasible even without combined laparoscopic-endoscopic approach. Papers reporting bariatric surgical procedures in patients previously treated by bariatric endoscopy are summarised in Table I.

The limitation factor for LSG in patients with previous ESG could be the presence of eventual technical complication during the endoscopic intervention. According to our findings, minor intraprocedural technical complications are common occurrences in EG being encountered in more than 50% procedures with different features depending on the technique used [29]. The inability to pass the needle through the tissue while performing ESG was encountered mainly when the scope was in an "up" position in the anterior gastric wall or when the tissue bite was too abundant to be caught; this could result by repeated passages of needle through the gastric wall and increased probability for submucosal hematoma formation or serosa cicatrization, which could be responsible for following peritoneal adhesions. The quality of wires used in most common ESG techniques represents potential mechanical and chemical issues that could impair the tissue quality, including augmented cicatrization. The composition of suture wire in ESG varies from surgical suture EP1.5 (USP 4-0 braided polyester non absorbable, EndoTools®, Belgium) and 2/0 polypropylene non absorbable (Apollo Endosurgery®, USA) to polyethylentereftalate non absorbable (USGI®, USA). Another potential issue that could lead to potentially complicated LSG is tag/anchor submucosal or extramural migration. In this case those particular "foreign bodies" could be responsible for inflammatory and granulation process in the gastric wall, leading to its increased rigidity. Endoscopic tissue graspers

Table I. Papers reporting bariatric surgical procedures in patients previously treated by bariatric endoscopy

Author	Year	Number of patients	Methodology	Conclusion
Closset et al. (Belgium)	2011	4	Laparoscopic Roux-en-Y gastric bypass (LRYGB) after transoral endoscopic vertical gastroplasty (TOGA)	LRYGBP post TOGA apparently can be done without any trouble. The performance of TOGA does not seem to interfere with the short-term results of the LRYGBP.
Meister et al. (USA)	2017	1	LRYGB after TOGA	Laparoscopic conversion of TOGA to a RYGB is a safe and feasible.
Ferrer Marquez et al. (Spain)	2016	2	Laparoscopy sleeve gastrectomy (LSG) after failed endoscopic sleeve gastroplasty (ESG).	LSG after failure of ESG does not offer great variation from the standard technique.
Alqahtani et al. (Saudi Arabia)	2019	20	LSG after ESG	Based on this combined laparoscopic-endoscopic technique, LSG is a safe and feasible revision option for patients who fail ESG.
Khoursheed et al. (Kuwait)	2022	2	LSG after ESG	LSG is a safe revisional procedure after failed ESG, without the need to perform a combined laparoscopic-endoscopic technique

TOGA: transoral endoscopic vertical gastroplasty; LRYGB: Laparoscopic Roux-en-Y gastric bypass; LSG: laparoscopic sleeve gastrectomy; ESG: endoscopic sleeve gastroplasty.

which are used in the variety of ESG techniques are all different; the USGI® grasper's characteristics (helical coil, diameter 2.4 mm, length 7.1 mm), compared to those of (helical coil, diameter 1.6 mm, length 6.9 mm) and EVG (forceps Raptor; US Endoscopy, Mentor, Ohio, USA; opening diameter 10 mm; sheath diameter 2.4 mm), can justify its more frequent entrapment in the tissue as major intraprocedural technical complication, that could subsequently lead to submucosal hematoma formation and excessive cicatrization of serosa layer that sometimes could be even far away from the site of tissue bite.

Having all this in mind, it may be a time to legitimately consider ESG as standard bridging procedure for extremely obese patients prior to LSG. Prior to make any recommendation more data are needed, preferable from randomized clinical studies, in order to address this issue correctly and enlighten all of its potential advantages and pitfalls.

Conflicts of interest: None to declare.

Authors' contribution: M.B. conceived the idea for the manuscript. N.P. reviewed the literature and drafted the manuscript. S.F.V.diP. and B.M. revised the manuscript. All the authors approved the final version of the manuscript.

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