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NEW CONCEPT

Submucosal Tunnel Endoscopic Resection of Gastric Lesion Before Obesity Surgery: a Case Series

Gianfranco Donatelli[1] · Fabrizio Cereatti[1,2] · Jean-Loup Dumont[1] · Nelson Trelles[3] · Panagiotis Lainas[4] · Carmelisa Dammaro[4] · Hadrian Tranchart[4] · Filippo Pacini[5] · Roberto Arienzo[5] · Jean-Marc Chevalier[5] · David Danan[1] · Jean-Marc Catheline[6] · Ibrahim Dagher[4]

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Abstract

Background Submucosal tumors (SMTs) of the gastrointestinal tract are a rare pathological entity comprising a wide variety of neoplastic and non-neoplastic lesions. Even if most SMTs are benign tumors (e.g., leiomyomas), a smaller portion may have a malignant potential (e.g., gastrointestinal stromal tumor (GIST)). Preoperative diagnosis of SMT in bariatric patients may arise challenging clinical dilemmas. Long-term surveillance may be difficult after bariatric surgery. Moreover, according to SMT location, its presence may interfere with planned surgery. Submucosal tunneling endoscopic resection (STER) has emerged as an effective approach for minimally invasive en bloc excision of SMTs. This is the first case series of STER for SMTs before bariatric surgery.

Methods Seven female patients underwent STER for removal of SMTs before bariatric surgery. All lesions were incidentally diagnosed at preoperative endoscopy. STER procedural steps comprised mucosal incision, submucosal tunneling, lesion enucleation, and closure of mucosal defect.

Results En bloc removal of SMT was achieved in all cases. Mean procedural time was of 45 min (SD 18.6). No adverse event occurred. Mean size of the lesions was 20.6 mm (SD 5.8). Histological diagnoses were 5 leyomiomas, 1 lipoma, and 1 low grade GIST. Bariatric procedure was performed after a mean period of 4.1 months (SD 1.6) from endoscopic resection.

Conclusion STER is a safe and effective treatment for the management of SMT even in bariatric patients awaiting surgery. Preoperative endoscopic resection of SMTs has the advantages of reducing the need for surveillance and removing lesions that could interfere with planned surgery. STER did not altered accomplishment of bariatric procedures.

Keywords Submucosal tumors · STER · Endoscopy · Sleeve gastrectomy · Bypass · POEM · Leiomyoma · GIST

Introduction

Many bariatric centers routinely perform preoperative upper gastrointestinal (GI) endoscopy to rule out the presence of lesions that may interfere or delay bariatric procedures. However, its real beneficial role is under review with contrasting recommendations from different scientific societies. The American Society of Gastrointestinal Endoscopy (ASGE) and

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✉ Gianfranco Donatelli
donatelligianfranco@gmail.com

[1] Unité d'Endoscopie Interventionnelle, Hôpital Privé des Peupliers, Ramsay Santé 8 Place de l'Abbé G. Hénocque, 75013 Paris, France

[2] Gastroenterologia ed Endoscopia Digestiva ASST Cremona, Cremona, Italy

[3] Service de Chirugie Générale et Digestive, Centre Hospitalier Rene Dubos, Pontoise, France

[4] Department of Minimally Invasive Digestive Surgery, Antoine Beclere Hospital AP-HP, Clamart, France

[5] Centre Obésité Paris Peupliers, Hôpital Privé des Peupliers, Ramsay Santé, Paris, France

[6] Department of Digestive Surgery, Centre Hospitalier de Saint-Denis, Saint-Denis, France

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the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) recommend preoperative endoscopy (EGD) in selected cases with symptomatic gastric disease [1]. Whereas the European Association for Endoscopic Surgery (EAES) recommends either EGD or upper GI series for all patients before bariatric surgery [2].

Incidence of pathologies that may delay or modify surgical strategy ranges from 7.6 to 16% of cases [3, 4]. Among these pathologies, submucosal tumors (SMTs) represent a very small share that nonetheless may entail sensitive clinical decisions.

SMT has a broad differential diagnosis comprising leiomyomas, lipomas, ectopic pancreatic tissue, gastrointestinal stromal tumors (GIST), and schwannomas. SMT incidence has shown a recent increase in general population reaching up to 3% of cases. A similar data can be related to improvement of diagnostic modalities [5]. Interestingly, the incidence of GISTs seems higher within the bariatric population compared with the general one [6]. SMTs less than 3 cm in size are generally considered benign lesions. Nonetheless, SMT may have a malignant potential (e.g., GISTs). SMT, depending on its localization and features, could be either removed with surgical intervention, in particular in case of vertical sleeve gastrectomy (VSG), or left in place and surveilled. In case of Roux-en-Y gastric bypass (RYGB), subsequent surveillance could be more difficult because of excluded stomach and altered anatomy. Moreover, SMT located near the esophagogastric junction (EGJ) or near the pylorus may affect the feasibility of planned surgery [7] or may increase the risk of stenosis if surgically removed especially if a wedge resection prior VSG is performed. Submucosal tunneling endoscopic resection (STER) has recently emerged as a safe and effective mini-invasive approach for the management of gastric and esophageal SMT [8]. Here, we report a case series of bariatric patients who underwent to STER for SMT detected during preoperative EGD. STER was performed before bariatric surgery because SMT location could have hampered planned bariatric procedure.

Material and Methods

Study Methodology

From January 2017 to May 2020, at our center, all patients who underwent STER for SMT before bariatric surgery were retrospectively analyzed. Study received IRB approval of Ramsay Santé committee. Informed consent was obtained from all individual participants included in the study. The primary goal of the study was to evaluate technical success of preoperative STER for SMT in a bariatric population. The secondary aim was to evaluate adverse event rate and how STER influenced subsequent bariatric procedures. Finally, we proposed a standardized treatment approach for submucosal gastric lesion before obesity surgery.

Statistical Analysis

SSPS version 20.0 (IBM Corp., Armonk, New York, USA) was employed to run statistical analyses. Descriptive statistics were calculated for all demographics and clinical variable data and expressed as means with standard deviation (SD) and median with interquartile range (IQR) for continuous variables or as proportions (%) for categorical variables.

Technical Description

All SMTs were incidentally diagnosed at preoperative EGD (Fig. 1). No upper GI symptoms related to SMT were reported before endoscopy. In case of large SMT (more than 3 cm), a CT scan or abdominal MRI was performed.

EUS evaluation was always performed before STER with a submersion technique [9]. EUS imaging was conducted in order to allow a presumptive diagnosis of tumor etiology and to rule out features of malignancy that would contraindicate endoscopic resection. The following properties were considered: size, shape, layer of origin, lesion echogenicity border/internal features, and loco regional lymph nodes. EUS-guided tissue acquisition was not performed due to limited size of the lesions (Fig. 2). STER procedure was performed under general anesthesia with oro-tracheal intubation with the patient in left lateral or supine position. Intravenous antibiotics were administered prior the procedure in all patients. All procedures were performed by an experienced interventional endoscopist (GD) with a caseload of more than 80 therapeutic luminal procedures per year (e.g., esophageal-gastric-colonic ESD; POEM and STER). Procedural steps were as follow (video 1): (i) creation of a submucosal bleb 5 cm above the target SMT with a mixture of saline solution, Indigo carmine dye 0.4%, and adrenalin 1:100,000; (ii) performance of mucosal incision and submucosal tunnel with Dual Knife J® (Olympus®, Tokyo, Japan) 2 cm beyond target lesion using spray mode coagulation (ERBE VIO 300, Spray Coagulation 50 W, Effect 2); (iii) en bloc enucleation of the lesion using Dual Knife J; and (iv) closure of the mucosal flap with endoscopic clips (Revolution 360™, Boston Scientific, MA, USA) (Fig. 3).

Oral diet was introduced the day after and hospital discharge was scheduled at post-procedural day 2 with proton pump inhibitors therapy. Obesity surgery was scheduled 3 months after STER.

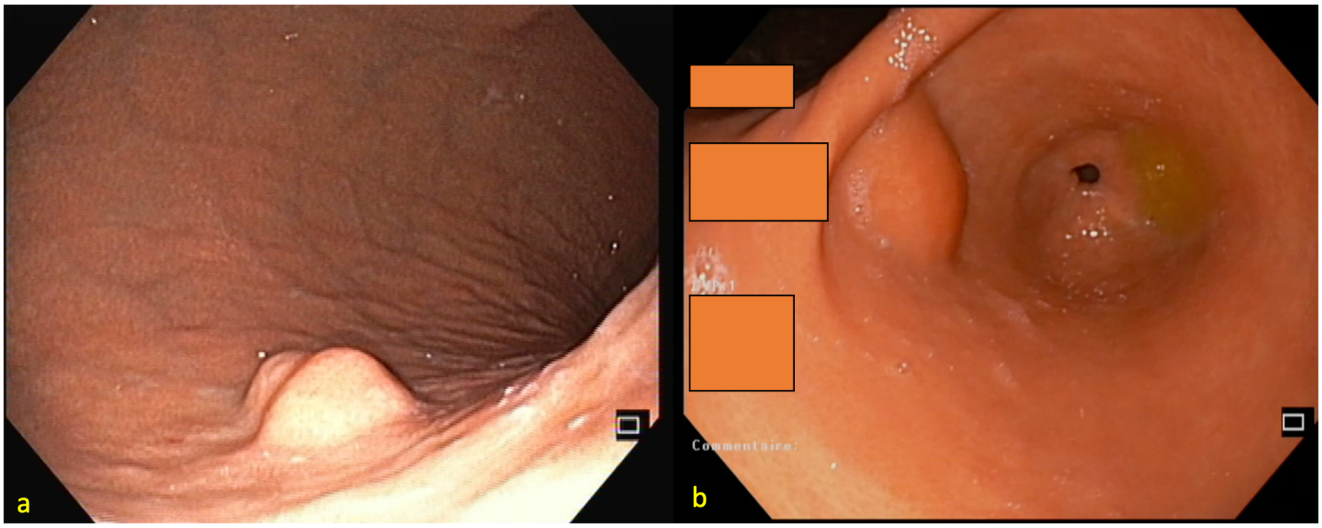

Fig. 1 Endoscopic appearance of submucosal gastric lesion. **a** SMT just below the cardial region. **b** SMT of the antrum just below incisura angularis

Results

Study population Table 1 consisted of 7 consecutive women with an average age of 42.2 (SD 13.4). Mean preoperative body mass index (BMI) was 44.3 (SD 5) kg/m^2. Six out of 7 patients presented major comorbidities, namely diabetes (3 pts), hypertension (4 pts), and sleep apnea (2 pts).

Lesion location was as follows: antrum/incisura angularis in 4 cases and subcardial region in the remaining 3 cases. Mean size of the lesions was 20.6 mm (SD 5.8) (range 13–31). EUS evaluation highlighted a round well-defined hypoechogenic mass within the third gastric layer in 6 cases and a round well-defined hyperechogenic mass developing from the fourth gastric layer in 1 case. A subcentimetric

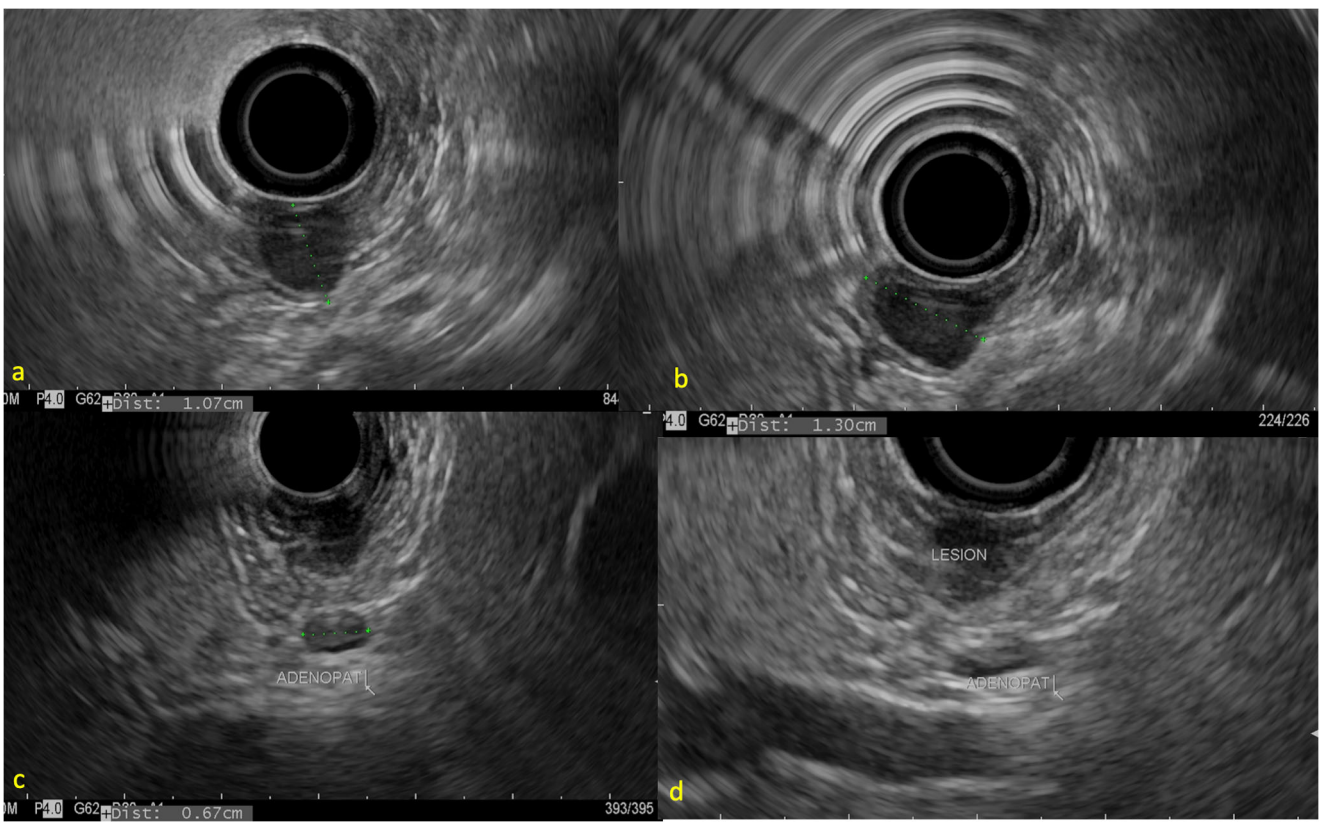

Fig. 2 EUS evaluation. **a**, **b** Submucosal hypoechogenic solid mass (13 mm × 10.7 mm in size) originating from the third layer of the gastric layer. **c**, **d** Locoregional (perigastric) enlarged lymphnode with benign features (6.7 mm in size)

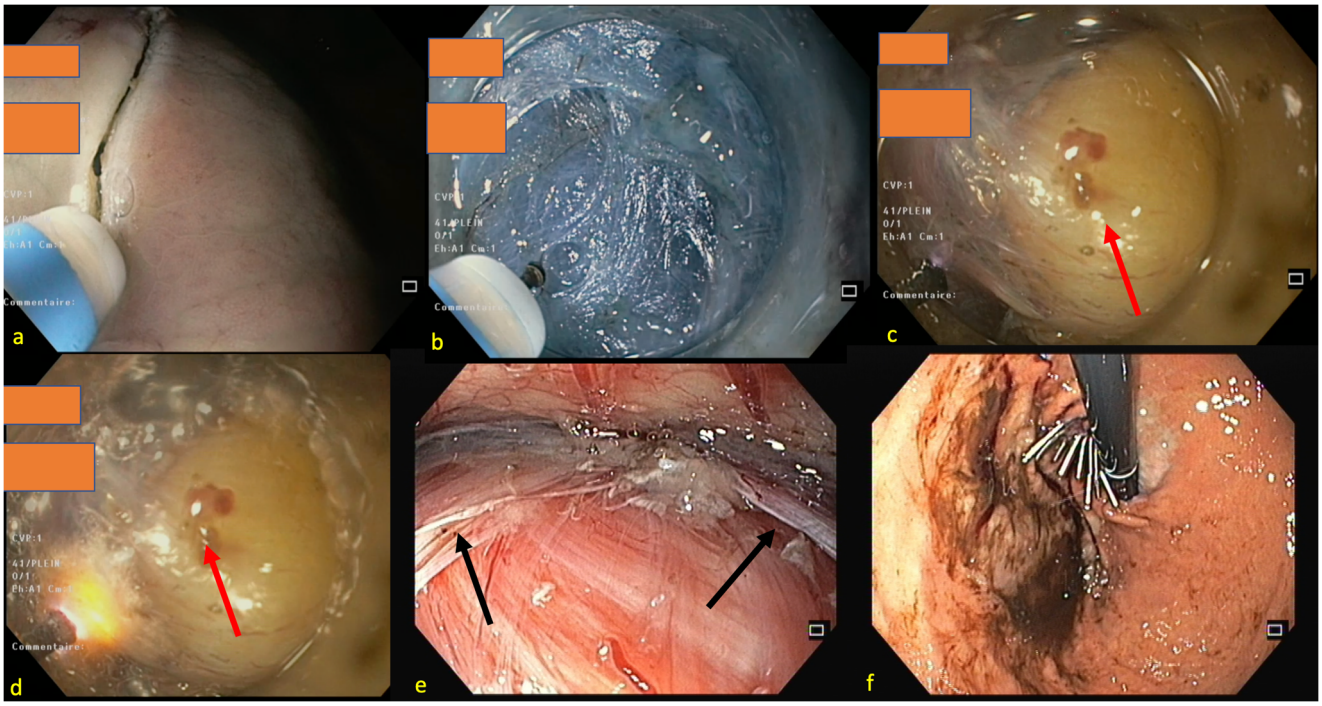

Fig. 3 STER procedure. **a** Mucosal incision. **b** Submucosal tunneling. **c**, **d** Complete enucleation of the submucosal lesion (red arrows). **e** En bloc excision of the lesion with visualization of the dissected inner circular smooth muscle fibers (black arrows). **f** Closure of the mucosal incision with multiple standard trough-the-scope endoclips

benign appearing perigastric lymph node was detected in one patient (Fig. 3).

STER procedure was feasible in all cases. Complete resection rate and en bloc resection were both 100% of cases (Fig. 4). The average operational time was of 45 min (SD 18.6) (range 21–85). Minor bleeding occurred during the procedure in 1 patient and was managed endoscopically. No major bleeding occurred. Post-procedural transient abdominal pain was observed in 1 case. No long-term adverse event occurred. Definite histological diagnoses were 5 leiomyomas, 1 lipoma, and 1 GIST (low malignant). Six out 7 patients had an uneventful postoperative course and were discharged on postoperative day 2 whereas 1 patient presented postprocedural abdominal pain requiring analgesic medicaments. The patient was discharged at postoperative day 3 after a negative abdominal CT scan. One patient only repeated EGD 6 weeks after STER revealing only a well re-epithelialized scar at the site of mucosal incision. In all other cases, bariatric surgery was performed without any other endoscopic evaluation. Delay between STER and surgery ranged from 3 to 8 months (average

Table 1 Population demographics and results

	Sex (M/F)	Age (years)	BMI (kg/m$^{2)}$	Location	Size (mm)	Histology	Obesity surgery	Delay (months)
1	F	31	44.3	Angulus/antrum	15	Leyomioma	SG	3
2	F	51	40.8	Cardia	13	Leyomioma	SG	4
3	F	19	39.2	Cardia	31	Leyomioma	RYGB	3
4	F	56	49.7	Angulus/antrum	25	GIST	SG	4
5	F	60	48.4	Angulus/antrum	20	Leyomioma	SG	8
6	F	42	50.8	Cardia	17	Leyomioma	SG	4
7	F	38	37.3	Angulus/antrum	23	Lipoma	RYGB	3
Mean		42,2	44.3		20.6			4.1
SD (±)		13.4	5		5.8			1.6
Median		42	44.3		20			4
IR		25	10.5		10			1
%	100							

F female, *M* Male, *SD* standard deviation, *IR* interquartile range, *SG* sleeve gastrectomy, *RYGB* Roux-Y-gastric bypass

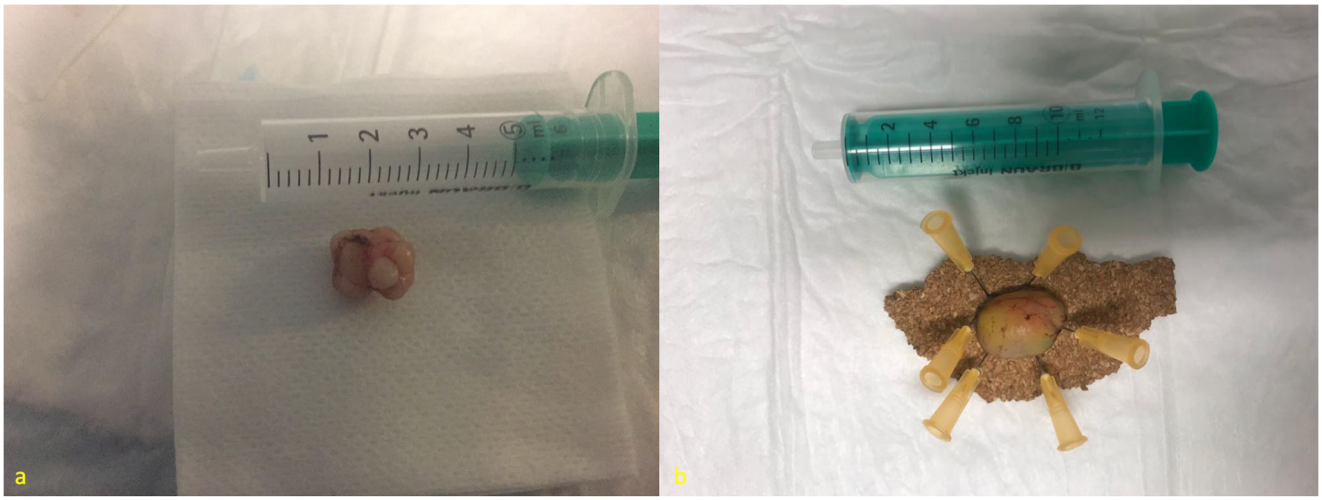

Fig. 4 **a**, **b** Collected specimens of 2 submucosal tumors resected with STER technique

4.1; SD 1.6). Five patients underwent sleeve gastrectomy (SG) whereas 2 Roux-Y-gastric bypass (RYGB). Histological examination after SG did not show residual or concomitant submucosal lesions. In all patients, the planned technique was performed. STER procedure did not negatively influence technical success of the surgical procedure. Bariatric surgeons did not reported any anatomical alterations of the gastric wall nor any abdominal adhesions related to STER. After an average follow-up of 19 months (SD 7) (range 8–32), neither recurrences nor metachronous SMTs were detected. Weight loss was recorded in all patients with an average BMI of 28 kg/m^2 (range 23–33) at follow up.

Discussion

Preoperative EGD is routinely performed before bariatric surgery in most centers, especially in Europe; however, a clear consensus on its real need is lacking. The presumed rationale of endoscopic evaluation is to diagnose and/or treat lesions that could potentially affect the surgical technique; that could cause complications in the immediate postoperative or cause intolerable symptoms after bariatric surgery [10]. SMTs are a rare pathological entity encompassing a wide variety of neoplastic and non-neoplastic lesions [11].

In particular, SMTs are detected in only 0.03 to 0.07% [12] of preoperative EGD performed in bariatric population. However even if the majority of SMTs are benign lesions (e.g., leiomyomas), a smaller portion of SMTs may have a malignant potential (e.g., GISTs) [13]. Moreover, preoperative diagnosis of SMT may play an important role in bariatric surgery because such lesions, originating from the third or fourth layer of the gastric wall, are only rarely visible on the serosal surface and therefore can be missed during laparoscopic surgery Several series have reported incidental detection of SMTs (e.g., GIST) during bariatric surgery [14] or after histological examination of the resected specimens in case of VSG [15].

SMT larger than 3 cm require EUS fine needle aspiration (FNA) or fine needle biopsy (FNB) to reach definite diagnosis due to increased risk of malignant potential. SMTs smaller than 3 cm are mainly benign lesion; therefore, periodic follow-up with EGD or EUS is acceptable. Nowadays, EUS should be preferred over EGD because it allows a more precise characterization. Due to negligible risk of malignancy, FNA/FNB is not recommended. FNA/FNB has a reduced diagnostic yield due to small size of the lesion, and it may carry a risk of damaging the integrity of the lesion [11]. Endoscopic resection with STER technique is indicated for SMTs less than 3–4 cm causing symptoms, increasing in size during follow-up or with high-risk features [16]. STER has been as well proposed for smaller low-risk SMT [17] because en bloc resection of SMTs less than 2 cm in size allows a definitive histological diagnosis thus ruling out the need of life-long surveillance [18]. Preoperative detection and treatment of SMT have further clinically relevant implications when managing bariatric patients. Follow-up of small SMT may be cumbersome, if the lesion is left in place, after both SG and RYGB, respectively, due to altered anatomy. In particular, a narrow gastric remnant after SG or a small gastric pouch after RYGB may limit endoscopic/EUS evaluation especially in particular region (e.g., subcardial) [19] and make any subsequent endoscopic resection more complex. Moreover, SMT location (e.g., subcardial and incisura angularis) may interfere with planned staple line of the VSG. Performing an "extended" sleeve gastrectomy to include the SMT within the specimen may increase the risk of postoperative morbidity due to pyloric deformities or development of functional "helix" stenosis [20]. Another issue is to avoid SMT inclusion within the staple line during bariatric surgery. Bariatric surgeons may be distressed to include a SMT in the staple line with a hypothetical risk of incomplete SMT resection or impairment of the

staple line/gastrojejunal anastomosis [21]. SMT inclusion within the staple line could potentially increase the risk of leaks similarly to reported case series of erroneous orogastric tube stapling [22].

Tumors located in the fundus or greater curvature are included in the specimen during VSG or can be resected with wedge/partial resection in case of RYGB. However, as mentioned before, laparoscopic wedge resection may increase the risk of pyloric deformity or stenosis for tumors near the EGJ or the pylorus. Laparoscopic transgastric SMT resection in the course of SG has been successfully described in few case reports [7, 23].

These mini-invasive approaches seem feasible and effective but unfortunately cannot be always adopted depending on SMT location. Until now, there is no general consensus nor society recommendation on how to manage SMT in overweight patients undergoing bariatric surgery. SMT management greatly varies among bariatric surgeon mainly according to local expertise and propensity, and availability of an interventional endoscopist.

STER allows a safe and effective approach for SMT removal trough a submucosal tunnel. Xu et al. [24], based upon the per oral endoscopic miotomy experience, firstly described SMT en bloc removal through a mucosal incision far from the lesion. Since then, tunneling technique has been used, for esophageal, gastric SMT and even recurrent lesions after surgical removal [25, 26]. To our knowledge, this series is the first in literature systematically performing STER for SMT removal in a bariatric population before surgery. Moreover, differently from other studies [27], we performed all the different procedural steps (e.g., mucosal incision, injection, submucosal tunneling, and lesion enucleation) using solely one device thus considerably reducing overall costs. Despite the absence of malignant lesions in the resected specimens of our series, STER proved to be effective in the preoperative removal of SMT in a bariatric population awaiting surgery. STER should be always performed by an experienced endoscopist since up to 11% of procedure-related adverse events have been reported in literature [28]. The most frequent adverse events are gas-related complications, perforation, and bleeding. All aforementioned adverse events can be managed endoscopically in most cases. Endoscopic resection did not induced significant anatomical alterations of the gastric wall nor adhesions thus allowing normal performance of the planned surgical procedure.

The main limitations of the study are its retrospective design, the single-center nature, and the relatively small size of study population. These limitations do not allow definitive conclusions to be drawn about the efficacy and safety of STER. However, STER could be an adjunctive string to the bow for the management of SMTs before bariatric surgery. Nonetheless, several different surgical approaches are feasible for SMT resection, in the setting of simultaneous bariatric surgery; therefore, a careful preoperative disease stadiation and a multidisciplinary discussion on the most suitable therapeutic strategy is mandatory.

Conclusion

STER for the management of SMTs was a safe and effective treatment in this case series of bariatric patients. It can be useful for both bariatric surgeons and patients because it guarantees performance of "standard" bariatric surgeries without the risk of lesion inclusion within the staple line/GI anastomosis or need for more complex concomitant transgastric surgical resections. Moreover, it permits to leave the patients tumor-free thus reducing the burden of long-term surveillance. Nonetheless, being SMT lesions with low malignant potential, a multidisciplinary decision on the most suitable approach (conservative, endoscopic, or surgical) should be always undertaken.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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