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NEW CONCEPT

Minimizing the Access Trauma of Laparoscopic Sleeve Gastrectomy: the Transoral Specimen Extraction Technique

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Abstract
Background Laparoscopic sleeve gastrectomy has become a popular stand-alone procedure among bariatric surgeons. Recently, Natural Orifice Specimen Extraction laparoscopic surgery has been introduced to avoid minilaparotomy, possibly reducing postoperative pain, hospital stay, and improving QoL and cosmetics. Operative steps and preliminary results of NOSE sleeve gastrectomy are described and reported.
Methods Five patients underwent NOSE LSG from November 2014 to March 2015. Selection criteria were as follows: age <60 years, ASA score ≤III, BMI <50. Operative steps are the same of standard LSG, but the stomach transection that starts higher on the greater curvature. A 2–3 cm width opening is created on the exceeding antrum and the resected stomach sutured to the calibration probe tip, which is pull back allowing transoral specimen extraction. The exceeding antrum is stapler-trimmed, allowing breach closure and completion of tubulization.
Results Mean age was 41.6 years (median 43), average weight was 123.6 Kg (median 114), mean BMI 43.6 Kg/m^2 (median 44). Mean operation time was 72 min (median 75). Mean and median postoperative stay were 4.6 and 5. No intraoperative nor postoperative complications occurred. Postoperative day 1 mean and median VAS pain score at were 1.4 and 1, respectively. Follow-up ranged 1–5 months (mean and median 3), average weight loss was 19.8 Kg (median 19), and excess weight loss 36.2 % (median 32 %).
Conclusions NOSE LSG potential advantages are as follows: improved cosmetics, decreased postoperative pain, possible incisional hernia rate reduction. No objective data are available to confirm these theoretical benefits; larger observational studies and RCTs are mandatory before clinical validation.

Keywords Laparoscopic sleeve gastrectomy · NOSE · Natural orifice specimen extraction · NOSE sleeve gastrectomy · Transoral specimen extraction · Transgastric specimen extraction · Reduced port surgery

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Introduction

Laparoscopic sleeve gastrectomy (LSG) is a relatively new procedure that was initially introduced as the first step of a duodenal switch and has recently become a popular stand-alone procedure among bariatric surgeons to surgically treat morbid obesity. After LSG, the resected portion of the stomach is usually removed with a retrieval bag through a small minilaparotomy created extending a laparoscopic incision. Laparoscopy has significantly decreased wound infection and incisional hernia rate occurred after open bariatric procedures, nevertheless, these complications at the trocar sites are yet reported with an up to 5 % rate [1–3] . Furthermore, closure of small minilaparotomies in morbid obese patients may

be challenging, and, notwithstanding the efforts to do it properly, it is plausible that widening a laparoscopic incision may contribute to the occurrence of postoperative hernias at this site.

Natural Orifice Specimen Extraction (NOSE) laparoscopic surgery is arising as a new and promising technique that avoids minilaparotomy, possibly reducing postoperative pain, hospital stay, and improving quality of life and cosmetics [4–6]. We found only one published article reporting on NOSE after laparoscopic sleeve gastrectomy, where a gastroscope was used to harvest and withdraw the specimen to be removed with a snare under endoscopic guidance [7]. A new approach to NOSE LSG, that makes the procedure faster, easier, and cost effective, is described and the preliminary results are reported here below.

Methods

Five patients underwent NOSE LSG from November 2014 to March 2015. Patients selection criteria for NOSE sleeve gastrectomy were similar to those of standard LSG: age <60 years, ASA score ≤III, and body mass index (BMI) <50, binge and sweet eaters being excluded from selection. All patients fitting these criteria were offered the opportunity to undergo a NOSE procedure. All patients gave their signed consent after being extensively informed about the technique of NOSE LSG, and the procedures performed were in accordance with the institutional ethical standards and with the 1964 Helsinky Declaration and its later amendments. The following intraoperative and postoperative parameters were assessed: length and site of the skin incisions, necessity for extra ports, operating time, intraoperative complications, conversion rate, postoperative complications, mortality rate, length of hospital stay, and pain evaluated on postoperative day 1 with a visual analog scale ranging from 1 to 10, with 1 being the least and 10 the most pain.

Patients perioperative management followed the principles of early recovery after bariatric surgery (ERABS) with inferior limb wrapping, deep venous thrombosis prophylaxis, antibiotic prophylaxis, removal of nasogastric tube on postoperative day 1, liquid diet resuming (small sips of water or tea) started on postoperative day 2, early mobilization, avoidance of fluid overload, and use of prokinetics [8, 9]. All patients were followed up, and their overall weight loss and excess weight loss (EWL) were assessed.

Surgical Procedure

The patient lay on the table in a reverse Trendelenburg position with the surgeon standing between the patient's legs and the assistant on the patient's right side. A 3-cannula approach to LSG is carried out, the first cannula being placed with an open laparoscopy technique, keeping the CO2 pressure at 15 mmHg during the whole procedure. When available, a long, 5-mm, rigid or articulated (Olympus Endo-eye) 30° video laparoscope is used; this allows to insert two 5 mm cannulas for the working instrument and the optic and one 10–12 mm cannula for the stapling device. As an alternative, a standard 10-mm laparoscope is used, which requires two 10–12-mm cannulas for the insertion of the optic and the stapling device, and one 5 mm cannula for the working instruments. Dissection is carried out by ultrasonically activated shears (Harmonic ACE, Johnson & Johnson, Ethicon EndoSurgery, Norderstedt, Germany). The operative steps are similar to those of standard LSG with complete fundectomy as previously described by the Authors [10]. The liver retraction is accomplished by a transfixing stitch passed through the abdominal wall and the liver parenchyma and tightened enough to lift the left lobe up to the anterior wall of the abdomen, according to the technique described for single-site LSG by the Authors [10]. The greater curvature is dissected free starting at 3 cm proximal to the pylorus. Once the stomach is fully dissected free, the viscus is transected along its longitudinal axis, under the guidance of a large-bore probe or drain

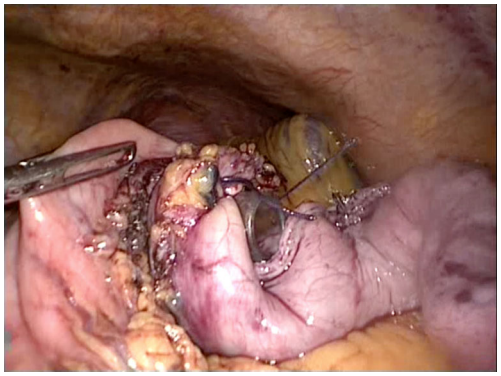

Fig. 1 A 2 cm opening is created at the level of the antrum on the greater curvature side to allow the passage of the 36 F probe used for gastric tube calibration. Hence, the specimen is sutured to the probe with two 0 polyglactin (Vicryl–Ethicon Inc.) stitches tied by either intracorporeal or extracorporeal knots

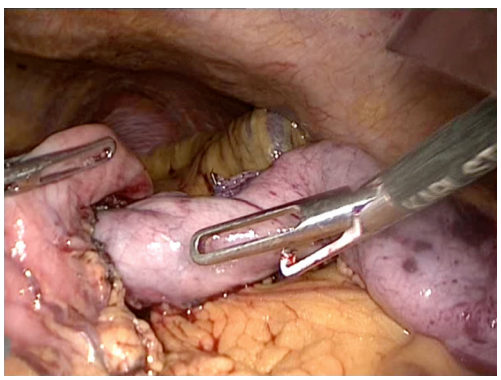

Fig. 2 The specimen is gently pushed trough the small gastric opening while pulling the probe back to ease the transgastric passage

Fig. 3 Transoral specimen extraction of the resected stomach

inserted transorally and kept close to the lesser curvature (boogie size 32 to 36 French). Differently from standard LSG, the stapler division starts less proximal to the pylorus, preserving a short distal segment of the dissected greater curvature. Vertical gastrectomy with fundectomy is completed as usual. Up to five shots of an Echelon stapling device (Ethicon EndoSurgery) loaded with 45 mm gold cartridges are required to complete the division of the stomach. Then, a 2–3 cm width opening is created on the exceeding part of the antrum, close to the dissected greater curvature, by the harmonic scalpel (Fig. 1). The content of the gastric remnant is sucked, and the tip of the large-bore probe passed through the opening. The resected stomach is double-fixed to the probe with two

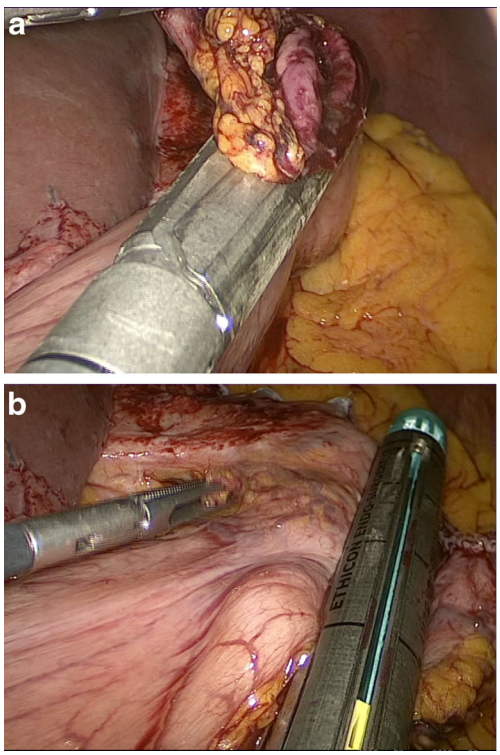

Fig. 4 One or two further stapler shots allow both closing the small opening (**a**) and trimming the exceeding antral tissue, thus completing the tubulization of the distal stomach (**b**). The small residual specimen will be easily withdrawn through the laparoscopic incision

Table 1 Patient Demographics and summary of results

Patient #	Age	Gender	ASA	BMI	Weight	Number and trocar size	OP time[a]	Conversion	IO complications	PO complications	PO pain[b] (VAS 1–10)	Lenght of stay	FU (months)	EWL (%)[c]	Weight loss (Kg)
1	43	m	2	45	147	10,10,5	90	no	no	no	2	5	5	55	31
2	46	f	2	42	114	10,10,5	75	no	no	no	2	5	4	47	25
3	37	f	2	44	132	10,10,5	75	no	no	no	1	5	3	32	19
4	49	f	2	43	113	10,10,5	60	no	no	no	1	4	2	29	14
5	33	f	2	44	112	10,10,5	60	no	no	no	1	4	1	18	10

[a] minutes, operating time calculated with 5 min intervals, [b] at postoperative day 1 (1 being the least pain and 10 the most pain), [c] decimals are not calculated

0 polyglactin sutures. At this point, the anesthesiologist is asked to pull the probe back carefully and the specimen is pushed gently through the small gastric opening (Fig. 2), thus easing its transgastric passage; the specimen attached to the probe is harvested transorally after completing the probe extraction (Fig. 3). One or two further stapler shots allow both closing the small opening and trimming the exceeding antral tissue, thus completing the tubulization of the distal stomach (Fig. 4). Hence, the staple line is reinforced with either a second layer of interrupted polidioxanone 3–0 Lembert stitches tightened by extracorporeal slip knots or a running suture.

Results

Tabel 1 summarizes patients demographics and early results. Mean patients age was 41.6 years (median 43, range 33–49 years). Average patients weight was 123.6 Kg (median 114, range 112–147 Kg) with a mean BMI 43.6 Kg/m^2 (median 44, range 42–45 Kg/m^2).

Mean operation time was 72 min (median 75, range 60–90 min). Postoperative stay ranged 4 to 5 days (mean 4.6, median 5 days). No intraoperative nor postoperative complication occurred. Mean and median VAS pain score at postoperative day 1 were 1.4 and 1, respectively.

Follow-up ranged 1–5 months (both mean and median 3 months), average weight loss was 19.8 Kg (median 19, range 10–31 kg) with a mean excess weight loss (EWL) of 36.2 % (median 32 %, range 18–55 %).

Conclusion

LSG has been performed more and more frequently over the past 8 years; this procedure has been shown to lead to satisfactory weight loss without any long-term vitamin deficiencies [11]. In an attempt to minimize the access trauma of LSG, several techniques have been introduced encompassing single-site laparoscopy and reduced port laparoscopy. Specimen extraction with a retrieval bag after LSG requires a small minilaparotomy, which is created extending one laparoscopic incision. Proper closure of larger incisions in obese patients may be difficult, and incisional hernia rate after laparoscopic bariatric procedures is up to 5 % [1, 2]. Over the last years, other procedures, alternative to bag extraction, have been proposed to avoid or minimize incision widening, including specimen slicing [12] and direct extraction through the incision after removing the cannula; these procedures appear either cumbersome or may cause specimen disruption [13]. NOSE laparoscopy allows specimen extraction avoiding laparoscopic incisions enlargement, thus resulting in potential reduction of postoperative wound infection and incisional hernia. Transoral specimen extraction after sleeve gastrectomy was first reported by Dotai et al.[7], nevertheless, the technique described in their paper requires the use of intraoperative gastroscopy to harvest the specimen and retrieve it through the stomach and the mouth. This makes the whole procedure more time-consuming and expensive. We found simpler and highly reliable retrieving the specimen through the small opening created on the antrum after fixing it to the calibration tube inserted through the mouth at the beginning and pull back at the end of the operation by the anesthesiologist. The average operating time in our series of NOSE LSG was similar to that of conventional LSG. After completion of the learning curve, it appears to be around 60 to 70 min. In this small and preliminary series of selected patients, the early functional results of NOSE LSG with a mean follow-up of 3 months were satisfactory and did not differ significantly from those of standard LSG. A further benefit, not yet assessed in studies published to date, may be improvements in patient quality of life after NOSE LSG; our preliminary data show a very low pain score at postoperative day 1 in all patients. Length of hospital stay was longer than usually reported for patients managed with ERABS policy; most of patients treated in our department are from faraway regions, and the longer postoperative stay was just a matter of caution.

The main potential advantages of NOSE LSG are improved cosmetic outcomes and a decrease in postoperative pain, with possible reduction of incisional hernia rate. To our knowledge, transoral specimen extraction after sleeve gastrectomy, requiring endoscopic guidance, has been reported only once in the literature. This is the first time that a simpler and faster approach to NOSE LSG is reported, showing that this procedure may be easily performed without the use of a gastroscope and may be easily reproducible by experienced bariatric surgeons. Nevertheless, NOSE LSG has yet to compete with conventional sleeve gastrectomy which is a successful and well-established operation with documented results and safety. At present, no objective data are available to confirm the theoretical benefits of such a technique, and larger observational studies and prospective randomized trials comparing NOSE LSG to conventional sleeve gastrectomy are mandatory before clinical validation of this procedure.

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Compliance with Ethical Standards All the procedures performed were in accordance with the institutional ethical standards and with the 1964 Helsinky Declaration and its later amendments.

Conflict of Interest The authors declare that they have no competing interests.

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

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