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Original article

Routine single-port sleeve gastrectomy: a study of 60 consecutive patients

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Abstract

Background: Single-port surgery has been developed for many digestive procedures, such as cholecystectomy and colectomy. Our objective was to present our preliminary results for laparoscopic single-port sleeve gastrectomy (SPSG), performed in our department for the treatment of morbid obesity, at Antoine Beclere Hospital and Paris XI University.

Methods: From July 2010 to February 2011, all patients evaluated by our multidisciplinary team for morbid obesity and eligible for sleeve gastrectomy underwent SPSG. The data were collected prospectively.

Results: Sixty consecutive patients underwent SPSG. The median age was 40.1 years; 6 patients were men and 48 were white. The median body mass index was 46.5 kg/m^2. The co-morbidities included diabetes in 12, essential hypertension in 31, sleep apnea in 39, dyslipidemia in 33, and coronary artery disease in 9. Of the 60 patients, 9 had previously undergone laparotomy and 5 had undergone bariatric surgery. The median operating time was 86 minutes. All procedures were achieved laparoscopically, with 10 patients requiring a second trocar and 3 patients 2 additional trocars. No conversion to open surgery was required. One leak was reported, and 1 patient experienced cubital nerve compression. The median hospital stay was 4 days. During a median follow-up of 8 months, most preoperative co-morbidities resolved, and the Bariatric Analysis and Reporting Outcome System score for care efficacy was 6.8 of 9.

Conclusion: SPSG is feasible in routine bariatric surgery. The results for weight loss and co-morbidity resolution seem to be equivalent to those with "multiple port" laparoscopy. New instruments and specific training are required. We believe that this technique is a natural evolution of minimally invasive surgery requiring additional investigation in prospective studies. (Surg Obes Relat Dis 2013;9:385–389.)

Keywords: Obesity; Laparoscopy; Single-port; Sleeve; Gastrectomy

The development of minimally invasive options for the treatment of morbid obesity is continuing, with the description of many laparoscopic techniques during the past decade [1–7]. Single-incision laparoscopic surgery was first described in 1991 by Pelosi and Pelosi [8–10], who performed single-puncture laparoscopic appendectomy and hysterectomy. The first single-incision laparoscopic sleeve gastrectomy was first described in 2008 by Saber et al. [11]. This new approach minimized scars and was considered minimally invasive. Today, single-port surgery can be performed with existing technology using refinements of traditional laparoscopic instruments. Surgery can be performed through a single skin incision at the umbilicus or by way of a pre-existing scar.

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The use of single-site surgery techniques has expanded rapidly, and various procedures have been performed with this approach. Small clinical series have demonstrated the feasibility of single-site surgery for many abdominal procedures, including appendectomy and cholecystectomy, and its potential for improving cosmesis and decreasing postoperative pain [11–14]. This new technique also aimed to reduce morbidity and decrease the hospital stay, with encouraging results [11–13].

Sleeve gastrectomy is an emerging procedure for the treatment of obesity that provides rapid and satisfactory weight loss without malabsorption. The single-incision laparoscopic approach was applied to sleeve gastrectomy because an incision has always been required for extraction of the resected gastric tube from the abdomen [15]. However, limited data are available concerning the use of this technique for bariatric surgery. Only some case reports and small series of sleeve gastrectomy have described the use of laparoendoscopic single-site (LESS) surgery [12–14,16,17].

The aim of the present study was to report our initial experience with single-port sleeve gastrectomy (SPSG) for morbid obesity in 60 consecutive patients followed up prospectively at our institution.

Methods

From July 2010 to February 2011, 60 consecutive patients with morbid obesity underwent SPSG in our department. The indications for bariatric surgery were consistent with the French recommendations: a body mass index (BMI) >40 or >35 kg/m^2 associated with severe co-morbidities [18]. A multidisciplinary team evaluated all patients. The preoperative assessment included abdominal ultrasonography, esophagogastroduodenoscopy, echocardiography, pulmonary functional tests, including a sleep disorder study, and endocrinologic, nutritional, and psychiatric evaluations. All patients were informed about this innovative technique and gave written informed consent before surgery.

Operative technique

This step-by-step technique is similar to that used in our department for laparoscopic sleeve gastrectomy, initially performed with 5 trocars, but gradually developing into a 3-trocar technique. This continuous progression led to the development of a single-site (3 instruments) technique. The patients were placed in a seated position, at an angle of 55° to the table. Access was obtained using a 25-mm skin incision and an open technique, by way of the umbilicus or a pre-existing scar. The access port (LESS TriPort or QuadPort, Olympus Medical, Nagano, Japan) was then placed within the abdominal cavity, using the dedicated introducer to bury the inner ring of the device under the fascia. The choice of the port was related to the type of laparoscope available. The tri-port was used with a 5-mm camera, and a Quadriport (additional 12-mm port) was necessary when a 10-mm laparoscope was used. It should be noted that even when the Quadriport was used, only 3 ports were needed. A rigid 5-mm, 30° scope or a flexible 10-mm scope (LTF-VH or EndoEYE LS, Olympus Medical) was used. We used a double-curved atraumatic grasper in the left hand for exposure and a 5-mm thermofusion device (LigaSure, Covidien, France) or the stapler in the right hand. The omentum was initially separated from the stomach, and the corpus was freed up to the left crus of the diaphragm. The sleeve of the stomach was created over a 36F bougie. A roticulating 3.5-mm stapler (Endo-GIA blue cartridges, Covidien, Elancourt, France) was used to initiate the sleeve gastrectomy on the greater curvature, beginning 6–7 cm proximal to the pylorus and heading toward the left side of the gastroesophageal junction (Fig. 1). The specimen was removed through the single-site trocar. The patients were discharged from the operating room without a nasogastric tube or drainage.

Postoperative management and follow-up

An abdominal computed tomography scan was routinely performed 2 days after surgery. All patients were evaluated by a dietary specialist 8 and 15 days after surgery and every month thereafter. The patients were seen by the surgeon on day 15 and at 1, 3, and 6 months postoperatively. The anatomic result on the stomach was assessed by a follow-up study of esophagogastroduodenal transit at 3 months. The efficacy of care was assessed by calculating the Bariatric Analysis and Reporting Outcome System (BAROS) score 6 months after surgery [19,20]. The BAROS is a specific validated system for measuring the quality of life after bariatric surgery. It includes 5 categories of results (failure, fair, good, very good, and excellent). It explores 3 major fields: the quality of life, excess weight loss, and medical co-morbidity evaluation, each of them quoted for 3 points.

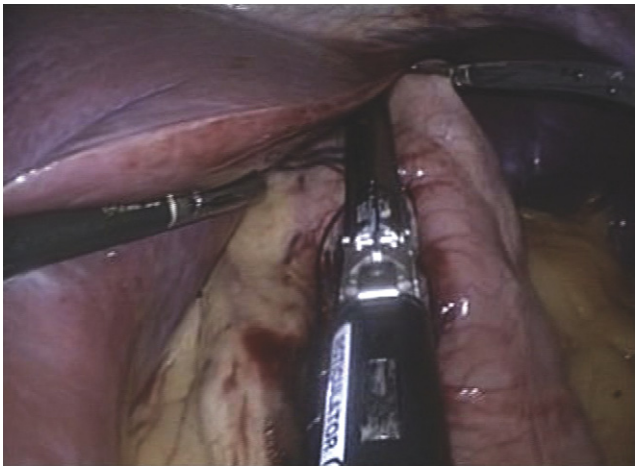

Fig. 1. Final section of stomach with Endo-GIA 3.5-mm stapler.

Statistical analysis

The variables evaluated were operating time, estimated blood loss, transfusion rate, number of stapler refills used, specific and general morbidity, perioperative mortality, postoperative pain medication requirement, and length of hospital stay. Continuous variables are expressed as the median and range.

Results

Demographic characteristics

Sixty consecutive patients were included in our study (Table 1). Their median age was 40.1 years (range 21–63), and 54 (90%) were women. The median weight was 138.5 kg (range 85–222), with a median BMI of 46.5 kg/m^2 (range 36–87). Six patients (10%) were superobese (>55 kg/m^2). The co-morbidities were diabetes in 12 (20%), hypertension in 31 (51.6%), sleep apnea in 39 (65%), hyperlipidemia in 33 (55%), degenerative osteoarthritis in 18 (30%), back pain in 25 (41.6%), thromboembolic disease in 9 (15%), coronary artery disease in 9 (15%), and nonalcoholic and nonhepatic cirrhosis in 1 (1.6%). Five patients (8.3%) had previously undergone gastric banding. The gastric band was removed 3 months before SPSG. Nine patients (15%) had previously undergone upper abdominal surgery, including open cholecystectomy in 6 and xyphopubic incision in 3, who had undergone surgery for an aortic aneurysm, intestinal occlusion, and emergency splenectomy, respectively.

Table 1
Patient characteristics

Characteristic	Value
Patients (n)	60
Age (yr)	
Median	40.1
Range	21–63
Gender (n)	
Female	54
Male	6
Weight (kg)	
Median	138.5
Range	85–222
Superobese patients (BMI >55 kg/m^2) (n)	6 (10)
BMI (kg/m^2)	
Median	46.5
Range	36–87
Co-morbidities (n)	
Diabetes	12 (20)
Hypertension	31 (51.6)
Sleep apnea	39 (65)
Hyperlipidemia	33 (55)
Degenerative osteoarthritis	18 (30)
Back pain	25 (41.6)
Thromboembolic disease	9 (15)
Coronary artery disease	9 (15)
Nonalcoholic and nonhepatic cirrhosis	1 (1.6)
Previous gastric band	5 (8.3)
Open surgery (n)	9 (15)

Data in parentheses are percentages.

Table 2
Perioperative results after single-port sleeve gastrectomy (n = 60)

Variable	Value
Operating time (min)	
Median	86
Range	52–205
Triport (n)	12 (20)
Quadriport (n)	48 (80)
Blood loss (mL)	
Median	10
Range	10–20
Transfusion (n)	0
Staplers used (n)	
Median	5
Range	4–7
Endo-GIA 3.5-mm staples (n)	60 (100)
Additional trocars (n)	
Total	13
1	10 (16.6)
2	3 (5)
Conversion to open surgery (n)	0 (0)
Nasogastric or urinary tube (n)	0 (0)
Analgesia (mg of morphine/kg)	
Median	.38
Range	0–1.4
Median interval to re-alimentation (d)	2
Complications (n)	
Hemorrhage	0 (0)
Leaks	1 (1.6)
Other	1 (1.6)
Hospital stay (d)	
Median	4
Range	3–9
Deaths (n)	0 (0)

Data in parentheses are percentages.

Intraoperative and postoperative results

The detailed results are listed in Table 2. The median operating time was 86 minutes (range 52–205). The blood loss was minimal (range 10–50 mL), and none of the patients required blood transfusion. No intraoperative complications developed. All 60 SPSGs were performed without the need for conversion to open surgery. Thirteen patients (21.6%) required 1 or 2 additional trocars (9 of the first 20 patients and 4 of the next 40 patients). An additional trocar was placed in the epigastrium, to retract the left liver lobe, in all 13 patients. In 3 patients (2 of whom were superobese), a third trocar was placed in the left hypochondrium for the introduction of the stapler, owing to conflict with the other instruments. The median number of 3.5-mm stapler refills used was 5 (range 4–7). The surgical specimen was removed intact through the single-port trocar site in all cases, without extending the incision.

The median postoperative analgesia requirement was .38 mg/kg (range 0–1.78) intravenous morphine sulfate equivalent. Two patients had postoperative complications. The

Table 3
Follow-up results 6 months after single-port sleeve gastrectomy (n = 60)

Variable	Value
Patients with 1-yr follow-up (n)	8 (13.3)
Preoperative BMI (kg/m^2)	
Median	46.5
Range	36–87
Postoperative BMI (kg/m^2)	
Median	31
Range	26–34
Reduction of excess weight (%)	
Median	65.8
Range	54–71
Diabetes resolved (n)	6 (50)
Hypertension resolved (n)	20 (64.5)
Sleep apnea resolved (n)	27 (69.2)
Hyperlipidemia resolved (n)	23 (69.6)
Degenerative osteoarthritis resolved (n)	4 (22.2)
Back pain resolved (n)	21 (84)
Death (n)	0 (0)
BAROS score	
Median	6.8 of 9
Range	6.5–8

BMI = body mass index; BAROS = Bariatric Analysis and Reporting Outcome System.
Data in parentheses are percentages.

first was a leak on the upper gastric zone that was successfully treated by a covered endoscopic prosthesis. The second was hand paresthesia due to cubital nerve compression. This disappeared spontaneously 6 hours after surgery. No death occurred in the postoperative period. The median length of hospital stay was 4 days (range 3–9).

Follow-up

The outcomes, after a median follow-up of 8 months (range 6–12), are summarized in Table 3. Most of the preoperative co-morbidities resolved during follow-up, including 50%, 64.5% 69.2%, 69.6%, 22.2%, and 84% of the diabetes, hypertension, sleep apnea, hyperlipidemia, degenerative osteoarthritis, and back pain cases, respectively. No death or complications were reported during follow-up. The efficacy of SPSG for improving quality of life, weight loss, and decreasing co-morbidities was evaluated by calculating the BAROS score after 6 months of follow-up. All patients improved, with 77% having a BAROS score for quality of life exceeding 2.5 of 3 (range 2–3). At least 1 major co-morbidity disappeared in 38 of the 41 patients with co-morbidities. The mean reduction in excess weight was 65.8%, with all 60 patients losing >50% of their excess weight. The mean BAROS score was 6.8 of 9, corresponding to a very good result [20].

Discussion

We report the largest series of prospectively studied SPSG cases in routine bariatric clinical practice and have confirmed the feasibility and efficacy of this technique. Our population had similar demographics, and the frequency of previous gastric banding or upper abdominal surgery was similar to those of other published traditional sleeve gastrectomy series [21,22]. For patients with previous gastric banding, we chose the 2-stage option, because Goitein et al. [23] reported a leak rate of 8% for the subgroup of patients undergoing single-stage surgery. The operating time was very similar to that for classic laparoscopic sleeve gastrectomy in our experience, with a median of 86 minutes. This operating time was in line with that of other published series [11,12,24]. Lakdawala et al. [17] showed a shorter operative time in a series of selected patients, excluding those with previous laparotomy or a BMI of ≥60 kg/m^2. The operating time decreases rapidly with experience and was 68 minutes for our last 30 patients.

In a small series by Saber et al. [25], single-incision laparoscopic sleeve gastrectomy was associated with lower levels of postoperative pain, lower analgesia need, and a shorter hospital stay than conventional multiport laparoscopic sleeve gastrectomy. The recent study by Lakdawala et al. [17] compared SPSG and conventional laparoscopic sleeve gastrectomy and found similar results. They also confirmed the results in pain reduction [17,25]. The pain reduction probably results from the single-site incision, with lower levels of abdominal trauma and a weaker leverage effect on the abdominal wall.

In our series, the complication rate was low (3.3%), with 1 leak and 1 case of reversible cubital paresthesia, no wound infections, and no bleeding. We did not observe any incisional hernia during the follow-up period. SPSG, therefore, appears to be safe and effective, with results similar to those for conventional laparoscopy and the advantage of better cosmesis [4,15,17,25,26].

Single-port surgery is the result of advances in equipment and laparoscopic skills. It can be seen as a positive evolution of conventional laparoscopy, and we developed a 3-port laparoscopic technique before using the single-port technique. Because gastric dissection is mostly posterior, the liver can be retracted by lifting up the stomach with the left-hand instrument without the need for an additional trocar in most cases [25]. In the present study, 13 patients (21.6%) had a large left lateral lobe requiring the use of an additional trocar, probably corresponding to the use of a fourth trocar in the “3-port laparoscopic technique.” The use of an additional trocar facilitated the adaptation of the LESS surgical technique without the need to extend the operating time or convert to open surgery. The total number of trocars was reduced for 95% of the patients compared with classic laparoscopy. At the beginning of our series, some patients required additional trocars that we eventually found unnecessary with our growing experience. LESS surgery might have a short learning curve for those with considerable experience in conventional laparoscopy. This is because similar technical challenges, relating to intraperitoneal ac-

cess, instrument exchange, and coordination with the camera driver are present for both conventional laparoscopy and LESS surgery [12,16,17].

In our experience, the correct positioning of the single port is essential and should be decided according to patient morphology. For the superobese, the positioning of the trocar in the left upper abdominal quadrant gives an optimal stapler axis, preventing problems due to wall thickness and abdominal ptosis. Consequently, the position of the trocar is more important for LESS than for conventional laparoscopy to preserve the parietal work space. LESS surgery might have a benefit in patients with previous surgery. It is not necessary to dissect the adhesions in the whole abdominal cavity to introduce the trocars and a limited space, we termed a "surgical corridor," is probably sufficient.

Conclusion

We believe that this technique is a natural progression of laparoscopy. Single-incision surgery requires advanced technology and specific training. It seems to reduce the postoperative pain and has an obvious advantage in better cosmesis, with similar results in terms of weight loss and co-morbidity improvement. Additional prospective studies are required to determine whether LESS surgery significantly improves outcomes and patient satisfaction.

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