



# Transumbilical Sleeve Gastrectomy with an Accessory Lateral Port: Surgical Results in 237 Patients and 1-Year Follow-up

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## Abstract

**Background** The transumbilical approach has recently been shown to be safe for several surgical procedures. Case series of sleeve gastrectomy (SG) with a transumbilical approach (TUSG) has been reported with various techniques. The objective of this report is to present the technique, surgical results, and 1-year follow-up results of simplified TUSG using rigid instruments.

**Methods** All of the patients who had undergone SG since July 2010 were offered a transumbilical approach. The operative technique involves a transumbilical incision and the introduction of a SILS® or GelPoint® multiport and a 5-mm metallic accessory trocar laterally in the left flank. Rigid instruments were used in all patients. Gastric transection was made 4–5 cm proximal to the pylorus, calibrated with a 36-Fr bougie. Selected hemostasis to the staple line was achieved with metallic clips.

**Results** A total of 237 patients underwent TUSG. Patient body mass index ranged from 30 to 46 kg/m<sup>2</sup>. The mean operative time was 49.5±14.9 min. Six patients presented

with early complications, including hemoperitoneum in three cases, antral leak in one case, intestinal perforation in one case, and portal vein thrombosis in one case. Conversion to the multitrocar technique was required in one patient. There were no mortalities. The mean length of hospital stay was 2.2±1 days. The cosmetic result was satisfactory for all of the patients.

**Conclusions** TUSG is a safe and feasible procedure using the described technique. The insertion of a 5-mm assistance trocar simplifies the procedure, allowing the use of rigid instruments.

**Keywords** Bariatric surgery · Sleeve gastrectomy · SILS · LESS · Transumbilical surgery

## Introduction

Building on advances from laparotomic to laparoscopic surgery in the late 1980s with the introduction of laparoscopic cholecystectomy, surgeons have progressively made surgery less invasive. As early as the 1990s, attempts at single-incision laparoscopic surgery (SILS) were documented with the goal of minimizing the esthetic sequelae of procedures, such as appendectomies [1, 2] and cholecystectomies [3]. After 2004, when natural orifice transluminal endoscopic surgery (NOTES) was presented to the surgical community, interest in laparoscopic surgery with virtually no visible scars increased. However, NOTES had several technical and safety limitations that delayed its acceptance as a routine procedure [4]. Laparoscopic surgeons, therefore, sought safer and more feasible procedures, such as SILS. In this area, the transumbilical approach has been of particular interest: By using a previously existing scar (the

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umbilicus), the incision is almost completely hidden and it is possible to use conventional laparoscopic instruments. For bariatric surgery, sleeve gastrectomy (SG) is of special interest for SILS. SG is considered a relatively simple bariatric procedure that does not require an anastomosis. Since 2008, several examples of single-incision laparoscopic SG have been published. These mostly include small series and mean operative times of more than 2 h [5–12]. We started our experience with the transumbilical approach in laparoscopic surgery in July 2010, with cholecystectomies, appendectomies, and SG. The aim of this study is to describe a simplified surgical technique for SG with a transumbilical approach (TUSG) using a lateral 5-mm accessory port and conventional laparoscopic instruments and to evaluate this procedure's safety and short-term follow-up.

## Methods

Data on all patients who underwent TUSG from July 2010 to May 2012 were collected from our prospective bariatric surgery electronic database and analyzed. In the analysis, we reviewed demographic data and surgical results, including the operative time, conversion to a multitrocar or an open technique, early and late complications, and mortality. Early complications were defined as those produced within the first 30 postoperative days, and late complications were defined as those produced after this period. Surgery-related mortality was considered death by any cause that occurred within the first 30 postoperative days. Ideal weight was considered the weight necessary for the patient to have a body mass index (BMI) of 25 kg/m<sup>2</sup>. Excess weight was calculated as the difference between preoperative weight and ideal weight, and percentage of excess weight loss (%EWL) was calculated by dividing postoperative weight loss by preoperative excess weight, expressed in percent. Institutional review board approval was obtained (Hospital Clínico de la Fuerza Aérea de Chile, Santiago, de Chile, IRB Comm. No. 43-a, June 2010).

### Patients

The patients were selected by our multidisciplinary team, which followed the local Chilean guidelines for the surgical treatment of obesity: patients with BMI  $\geq 40$  kg/m<sup>2</sup> and obese patients with BMI  $< 40$  kg/m<sup>2</sup> and associated comorbidities [13]. The main benefit of the transumbilical approach is primarily cosmetic, with other benefits, such as decreased inflammatory response or pain, that have not clearly shown to be clinically significant. Therefore, TUSG was offered to all patients who were evaluated for SG and

interested in a better cosmetic result. The inclusion criteria were as follows:

- BMI between 30 and 46 kg/m<sup>2</sup>;
- a xiphumbilical distance  $< 25$  cm;
- the absence of abdominal scars of significant size or other elements that compromised the final cosmetic result.

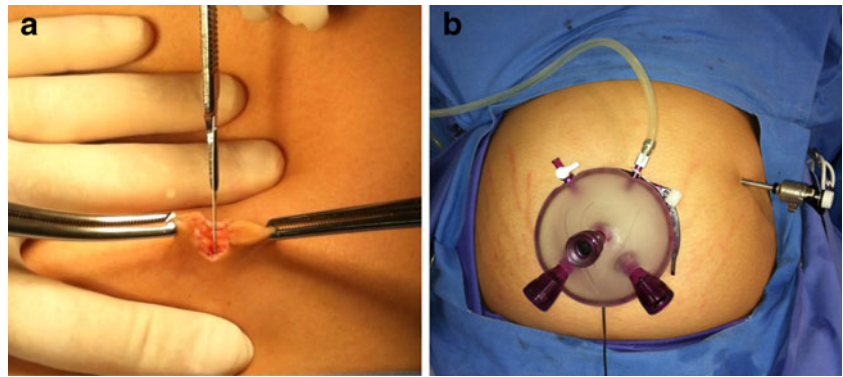
### Surgical Technique

The surgeon stands between the patient's legs, and the second and third surgeons stand at the left and right sides of the patient, respectively. The procedure begins with a vertical transumbilical incision down to the aponeurosis (Fig. 1a). Access to the peritoneal cavity is obtained via a 2.5- to 3-cm incision, followed by the insertion of a single-port device. We initially used SILS® (Covidien) but converted to GelPoint® (Applied Medical), which is currently our standard single-port device for all transumbilical procedures. Under laparoscopic vision, a 5-mm metallic assistance trocar is inserted in the anterior axillary line of the left flank. We use 5 mm and 30° optic and conventional rigid instruments (Fig. 1b). A camera is introduced in the left GelPoint trocar and a grasper at the right GelPoint trocar. An Enseal device is introduced in the lateral accessory trocar to obtain triangulation. Dissection of the greater curvature of the stomach begins 4 cm proximal to the pylorus (Fig. 2a) and moves up to the left crus to obtain complete gastric fundus liberation (Fig. 2b). During dissection, the liver is retracted by lifting the greater curvature of the stomach with the grasper in the right GelPoint trocar (Fig. 2a, b). A tubular gastrectomy is achieved with a gastrointestinal stapler Echelon Flex™ (Ethicon Endo-Surgery) using an orogastric transpyloric 36-Fr bougie. A grasper in the lateral accessory port is used for presentation and traction of the greater curvature of the stomach. A green cartridge is used for the antrum, and blue cartridges are used in the direction to the angle of His until the gastrectomy is completed (Fig. 2c). Hemostasis of the stapler line is achieved with metallic clips and Surgiflo™ (Ethicon Endo-Surgery). No leak test is performed, and no drains are installed. The stomach is easily extracted through the umbilical incision with the single-port device (Fig. 2d). The umbilical incision was initially closed with Vicryl 1-0 and later switched to PDS 1-0. A final revision is made with the 5-mm optic through the assistance trocar, assuring a correct staple line and umbilical incision hemostasis.

### Postoperative Period

Patients begin getting up and walking 6 h postoperatively. Fractioned water intake begins the first postoperative day,

**Fig. 1** Transumbilical access. **a** Transumbilical incision. **b** GelPoint® device and 5-mm assistance trocar

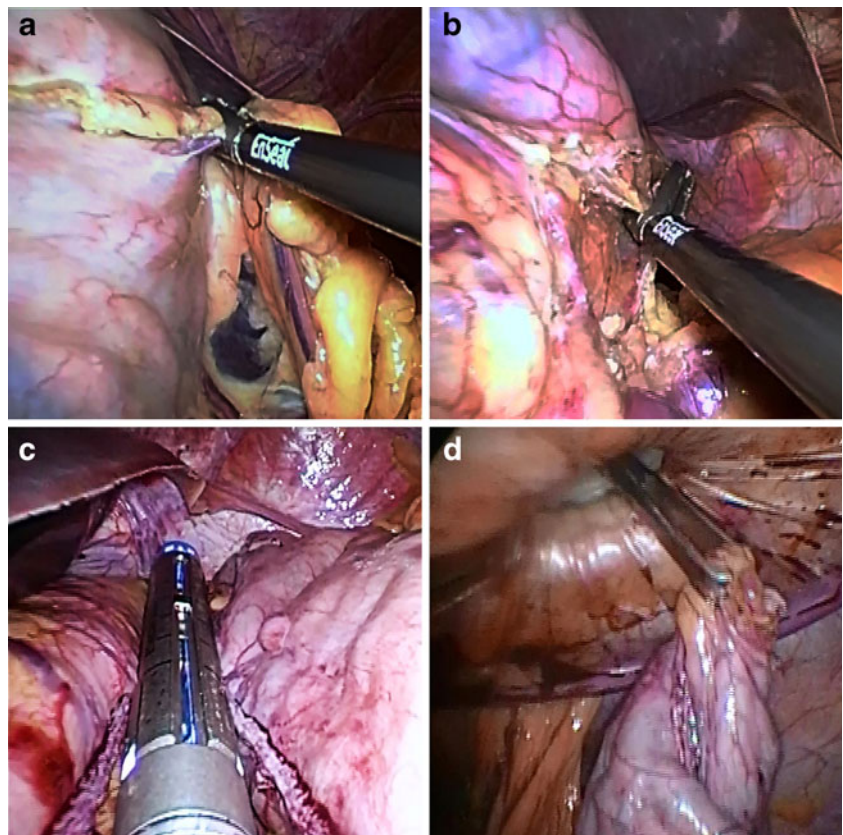


with a maximum volume of 600 cc. Free liquid intake begins the second postoperative day, and meal consistency is progressively increased. Patients are discharged when they achieve adequate oral intake and pain control with oral analgesics, which typically occurs on the second or third postoperative day.

#### Image Control

In all of the multitrocar SG procedures, we attempted to achieve a tubular gastric tube shape according to the radiologic pattern described by Werquin et al. [14]. Ten randomly chosen patients who underwent TUSG had an X-ray series to confirm achievement of the correct tubular shape.

**Fig. 2** The steps of the transumbilical SG procedure. **a** Greater curve dissection. Observe the left liver lobe retraction by lifting the gastric fundus. **b** Left crus dissection with a clear view of the angle of His. **c** A stapler positioned in the upper third of the sleeve. **d** View from the left flank 5-mm assistance trocar of the stomach extraction



#### Follow-up

The first control was at 10 days postoperative to check for surgical complications. Standard follow-up was established at 1, 3, 6, and 12 months and then annually by our multidisciplinary team.

#### Results

A total of 237 patients underwent TUSG; 221 were women (93.2 %) and 16 were men (6.8 %). The mean age and BMI were  $36 \pm 10.2$  years and  $33.5 \pm 3.3$  kg/m<sup>2</sup> (range, 30–46.3 kg/m<sup>2</sup>), respectively (Table 1). The obesity-



**Table 1** Demographic data

Patients	237
Female	93.2 % ( <i>n</i> =221)
Male	6.8 % ( <i>n</i> =16)
Age	36±10.2 years
BMI	33.5±3.3 kg/m <sup>2</sup>
BMI <35	65.8 % ( <i>n</i> =156)
BMI >35	34.2 % ( <i>n</i> =81)

related comorbidities are described in Table 2. A cholecystectomy was performed in 12 patients (5.1 %) at the same time as the TUSG using the same ports described for TUSG alone. The mean operative time for TUSG as a stand-alone procedure was 49.5±14.9 min. The mean operative time was 67.7±9.9 min (range, 50–80 min) with a simultaneous cholecystectomy. The mean length of hospital stay was 2.2±1 days. A conversion to the multitrocar technique was required in one patient with a previous abdominoplasty that caused insufficient intra-abdominal working space. No patients were converted to the open technique.

Early and late complications presented in 3 and 0.8 % of patients, respectively. Three patients required reintervention. One patient experienced an antral leak due to the failure in firing of the second stapler; another patient's surgery was complicated by an intestinal perforation due to damage with a Bozeman clamp at the SILS port introduction; and one patient had hemoperitoneum secondary to bleeding of the stapler line. All reoperated patients underwent multitrocar laparoscopic exploration with satisfactory outcomes. Three patients with hemoperitoneum but without hemodynamic instability were treated with a low-molecular-weight heparin suspension, volume reposition, and tranexamic acid and intravenous iron supplementation. One patient presented with intrahepatic portal vein thrombosis 15 days postoperatively and was treated successfully with low-molecular-weight heparin and an oral anticoagulant. Two patients had late complications that corresponded to incisional hernias at 4 and 5 months postoperatively, respectively (0.8 %). After these two patients, the suture material used in the umbilical incision was changed from Vicryl 1-0 to PDS 1-0. We did

**Table 2** Comorbidities

Comorbidities	Percent
Insulin resistance <sup>a</sup>	62
Dyslipidemia	46
Fatty liver <sup>+b</sup>	45
GERD	22
T2DM	0.8
Osteoarticular	8
Hypertension	6

<sup>a</sup>Insulin resistance was defined as a homeostatic model assessment test of 2.6 or higher

<sup>b</sup>Fatty liver<sup>+</sup> was defined as hepatic fat infiltration identified by abdominal ultrasound

not observe further incisional hernias after this change in the suture material.

A total of 155 and 78 patients were followed up at 6 months and 1 year with a %EWL of 107±41 and 116±38 %, respectively. The mean BMI at the 6-month and 1-year follow-up was 25.3 and 24.3 kg/m<sup>2</sup>, respectively. All of the patients were no longer obese (BMI <30 kg/m<sup>2</sup>) 1 year after surgery. The success rate (%EWL ≥50 % at the 1-year follow-up) was 100 %.

A radiograph series confirmed the adequate tubular shape of the gastric tube in the ten patients evaluated (Fig. 3). The cosmetic result was rated as satisfactory by all patients (Fig. 4).

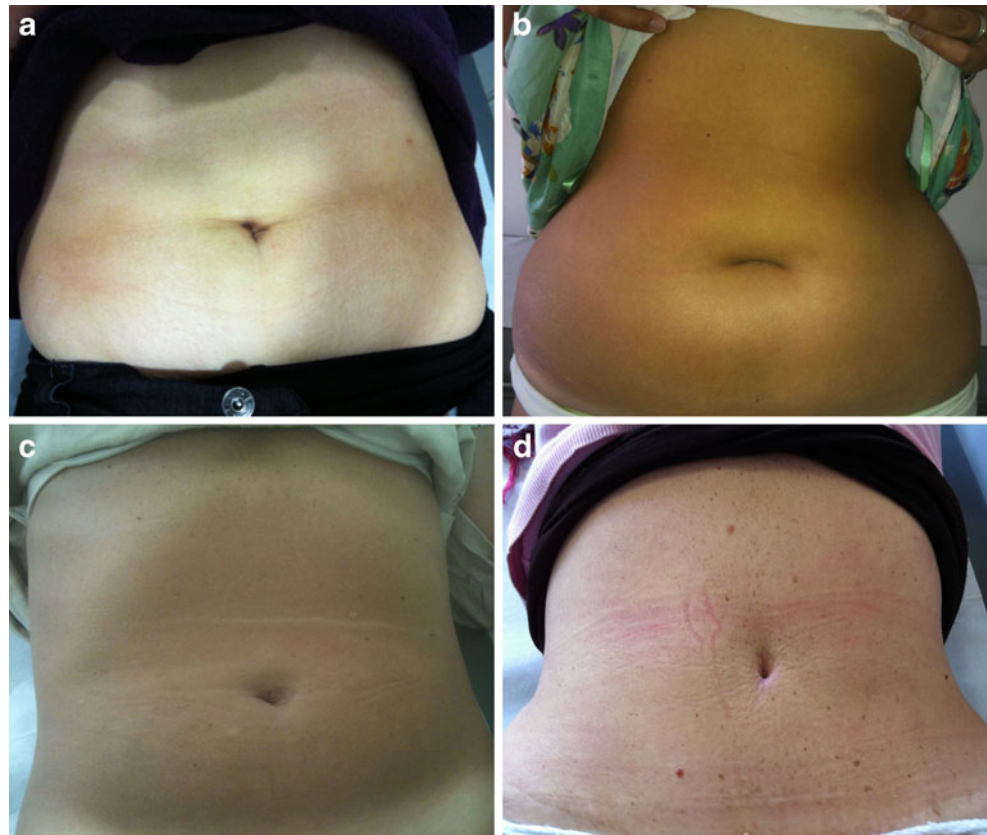
## Discussion

The transumbilical approach has become a very attractive alternative in minimally invasive laparoscopic surgery. The procedure can be performed safely with conventional laparoscopic instruments. The multitrocar technique can also be replicated without the need to perforate the hollow viscera for intra-abdominal access.

SILS involves several challenges, including loss of triangulation, conflicts between instruments inside and outside the abdomen, and a reduction of the number of instruments available for traction and countertraction. The loss of triangulation and conflicts between the instruments have been managed with the use of flexible or curved instruments, instrument crossover, and the addition of a 3- or 5-mm assistance trocar. The difficulty associated with traction and countertraction has been solved using the weight or natural fixations of the organs

**Fig. 3** Example of a radiograph following TUSG

**Fig. 4** Cosmetic results after TUSG. In these images, we observe the cosmetic results of four different patients. **a** Three months postoperative. **b, c** Six months postoperative. **d** Six months postoperative after TUSG in a patient who underwent a preoperative abdominoplasty



being manipulated and the use of percutaneous sutures or intra-abdominal metallic hooks.

The introduction of transumbilical surgery was initially described in relatively simple procedures, such as appendectomies [1, 15, 16] and cholecystectomies [3, 17–20]. However, its application for transumbilical surgery has been extended to more complex procedures, including colectomies [21–26], nephrectomies [27–29], Nissen fundoplications [30, 31], splenectomies [32, 33], hysterectomies [34, 35], and hepatectomies [36]. Bariatric surgery is no exception, with several reports in the literature of successful experiences with adjustable gastric banding [37–39] and SG [6, 9, 10, 12].

The main challenge of the transumbilical approach in bariatric surgery is the increased xiphoumbilical distance, which reduces the laparoscopic viewing angle in relation to the working plane and increases the distance to the angle of His [40]. There is a frequent presence of fatty liver, usually associated with a large left hepatic lobe. The issues associated with the xiphoumbilical distance have been resolved by the patient selection criteria, longer instruments, flexible optics, or changing the incision over the umbilicus [5, 41]. Liver retraction has been resolved with sutures, percutaneous liver retractors, an assistant trocar, or by using the stomach for liver retraction [11, 42]. In our opinion, adequate liver retraction is

mandatory to access the angle of His in bariatric surgery, and inadequate exposure adds unnecessary risk to the procedure.

The possible advantages of SILS include better cosmetic results, less postoperative pain, and faster recovery [40]. The undisputed benefit of a single port or reduced port laparoscopic surgery is a better cosmetic result. The transumbilical approach decreases the incision size from five or more 5- to 10-mm incisions to a 2.5- to 3-cm incision, which is hidden inside the umbilicus. In the described technique, we use a 5-mm accessory trocar in the left flank, which is the only incision potentially visible to the naked eye. The end result observed in our patients is usually a hidden umbilical scar and an imperceptible scar on the left flank. Therefore, we believe that the technique we have described produces superior cosmetic results. We do not believe that the postoperative pain and recovery time are reduced in a clinically relevant way. In conventional SG and TUSG, patients without complications do not require opiates 24 h after surgery and have very little pain. Patients are not discharged earlier than 48 h after any bariatric surgery, even if they demonstrate excellent recovery, because we believe this is the minimum reasonable time of observation.

The possible disadvantages of the procedure include safety concerns and an increased incidence of incisional

hernia. Major surgical complications observed were one antral leak, one intestinal perforation, and one hemoperitoneum with hemodynamic instability. In this series, an incidence of 0.4 % for leaks was observed. This result is comparable to a large series of SG and not specifically related to the transumbilical approach. Small bowel perforation was specifically related to our initial technique (SILS device introduced with Bozeman forceps). This complication occurred in our 48th patient, and the procedure for access to the abdominal cavity was changed after this incident. We now use the single-port device GelPoint, which is introduced manually without a sharp or traumatic instrument. After this change, there have been no complications related to accessing the abdominal cavity. Complications of hemoperitoneum are similar to those in our series of over 800 patients treated with the conventional multitrocar technique, indicating that the transumbilical approach does not increase the risk of this complication. Finally, regarding the safety of the technique, except for the intestinal perforation, no other elements related to the transumbilical approach increased the incidence of early surgical complications. Incisional hernias are a main concern as a late complication. In this series, a 0.8 % incidence of incisional hernias was observed, similar to the incidence reported in other series of conventional SG. However, we believe that the two cases of incisional hernia could be prevented with the use of a more appropriate suture material, such as PDS.

The presented technique uses the transumbilical approach as the primary means of intra-abdominal access with a 5-mm assistance trocar. Although this technique does not correspond to pure SILS, this technique achieves all of the cosmetic advantages of the single-incision approach and adds better instrument triangulation as well as very good visualization and exposure. This approach has reasonable operating times (usually <50 min) and the versatility of adding simultaneous procedures (e.g., cholecystectomy) without excessively increasing the duration of the procedure. In our opinion, this technique is simple, easily performed with conventional instruments, and reproducible by a trained laparoscopic bariatric surgeon.

Currently, we use the TUSG technique for approximately 90 % of our SGs, and we believe that this procedure could be routinely incorporated as an alternative to current bariatric procedures. A comparative study between this technique and conventional SG is necessary to establish the advantages of TUSG and to compare the long-term results.

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**Conflict of Interest** None.

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