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# Scarless Bariatric Surgery

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## 1. Introduction

Bariatric surgery has been established as the best and most effective treatment for morbid obesity. It leads to sustained weight loss, life style changes and improves quality of life. Since Wittgrove et al. introduced the laparoscopic Roux-en-Y gastric bypass technique in 1994, the number of operations performed has grown rapidly, and there has been a rapid reduction in the number of complications with quicker recovery. At present, the laparoscopic approach has become the most popular technique in performing bariatric surgery in the world. However laparoscopic technique requires five to seven abdominal incisions to facilitate placement of the multiple trocars. Because of the need for the numerous ports, the cosmetic results are unacceptable to some patient subgroup, like young females. These visible scars may fade over time; however, the healing process is highly individualistic, and the cosmetic outcome may not be appealing to all patients. In recent years, concept of “No scar surgery” is quickly expanding in various surgical fields, including weight loss surgery.

Newer techniques have eliminated the need for multiple ports and the inevitable scarring that follows. Natural orifice transluminal endoscopic surgery (NOTES), which produces no scarring, has been considered to be a landmark in the advancement of laparoscopy. Recently, another emerging procedure, single-incision laparoscopic surgery (SILS), has been used for appendectomy, cholecystectomy and colectomy. This new approach minimizes the scars and is considered minimally invasive. In bariatric surgeries, the SILS technique has been employed to perform adjustable banding, sleeve gastrectomy, Roux-en-Y gastric bypass and biliopancreatic diversion procedures. Here we will review the surgical techniques and results of various scarless bariatric surgery, including NOTES and SILS.

## 2. NOTES bariatric surgery

Since the introduction of NOTES in 2004, researchers have used it for various surgical interventions [1-3]. This new approach minimizes the scars and is considered minimally invasive. Even with the worldwide popularity of NOTES, the present techniques and instruments used are still under-developed before making it really applicable in clinical employment. There is also ethical concern because of transvaginal or transrectal approach, sacrificing the integrity of organ. There is also technical difficulty due to the long distance between vagina/rectum and stomach making instrument handling and tissue manipulation

more complicated with present technology, and there is also concern about the closure of orifice. The implication on bariatric surgery was only reported in sleeve gastrectomy and adjustable gastric banding with hybrid method, combining laparoscopic and endoscopic approach [4-6]. For more complicated procedures, such as gastric bypass are still at experimental stage [7].

### 3. SILS bariatric surgery

Single-incision laparoscopic surgery (SILS) was first described as early as 1992 by Pelosi et al. performed single-puncture laparoscopic appendectomy and hysterectomy [8, 9]. Currently SILS is considered to be a bridging technique to natural orifice transluminal endoscopic surgery (NOTES). It has emerged as another modality of carrying out the bariatric procedures. SILS can be performed using refinements of existing technology and experienced surgeons can perform SILS even with traditional laparoscopic instruments. Applications of SILS have expanded rapidly and various procedures including bariatric surgery have been carried out with this technique. Initially, SILS was used in bariatric procedures such as adjustable gastric banding (AGB) and sleeve gastrectomy because these procedures require the extension of a trocar incision for the placement of a subcutaneous port or for extracting the resected gastric specimen [10-12]. The incision was mainly in the upper abdomen in the beginning in this single-incision transabdominal (SITA) laparoscopic approach. It was felt that the patients would have a better cosmetic outcome if the SILS could be performed via a transumbilical incision as the umbilicus can hide the surgical wound, leaving no visible abdominal scars. Single incision transumbilical (SITU) laparoscopic procedures seem to attract more surgeons because of the higher satisfaction from patients. Recently surgeons started to perform SILS in more complex bariatric procedures such as gastric bypass and biliopancreatic diversion procedures that require gastrointestinal anastomosis [13-14]. Here we review the surgical technique of SITA and SITU bariatric surgery.

#### 3.1 Liver retraction in SILS bariatric surgery

For upper gastrointestinal laparoscopic surgery, liver retraction is necessary to ensure adequate working space. In morbidly obese patients, the hypertrophic left lobe of liver invariably hinders the surgeon's view of the entire stomach. In multi-port bariatric procedures, most surgeons use a Nathanson's liver retractor via a subxiphoid incision to retract liver. To avoid the incision in SILS, retraction of the liver is a major challenge. Sakaguchi et al [15] invented a device for the retraction of the liver during conventional laparoscopic gastrectomy. However, in morbidly obese patients, the technique, which involves the dissection of the left triangular ligament of the left liver lobe, is more difficult to employ because most of these patients have a hypertrophic left liver lobe. Tacchino *et al.* used a transfixation suture, applied on the right crus and suspended outside as a liver retractor suture [14, 16-17]. We have invented a new liver suspension tape technique via puncturing liver at peripheral area that can be used to lift even massive livers in morbidly obese patients. [Figures 1-3] [13]. Another non-puncturing method with a penrose drain and endo-hernia stapler has also been reported by us [18]. These techniques have been proved to be a quick and safe method in SILS bariatric surgery.

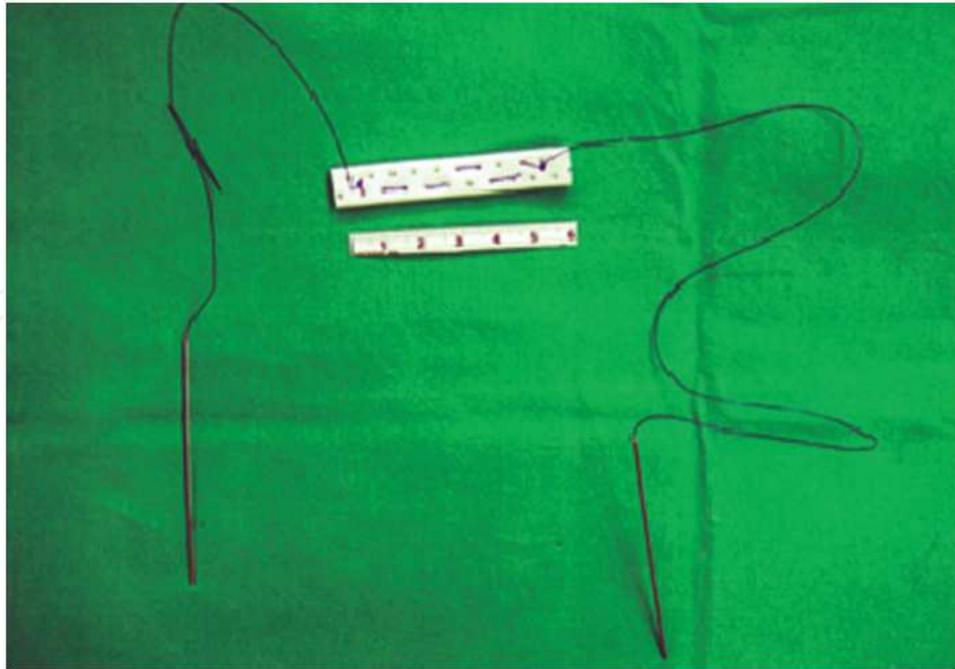


Fig. 1. Design of liver suspension tape developed by Huang et al.

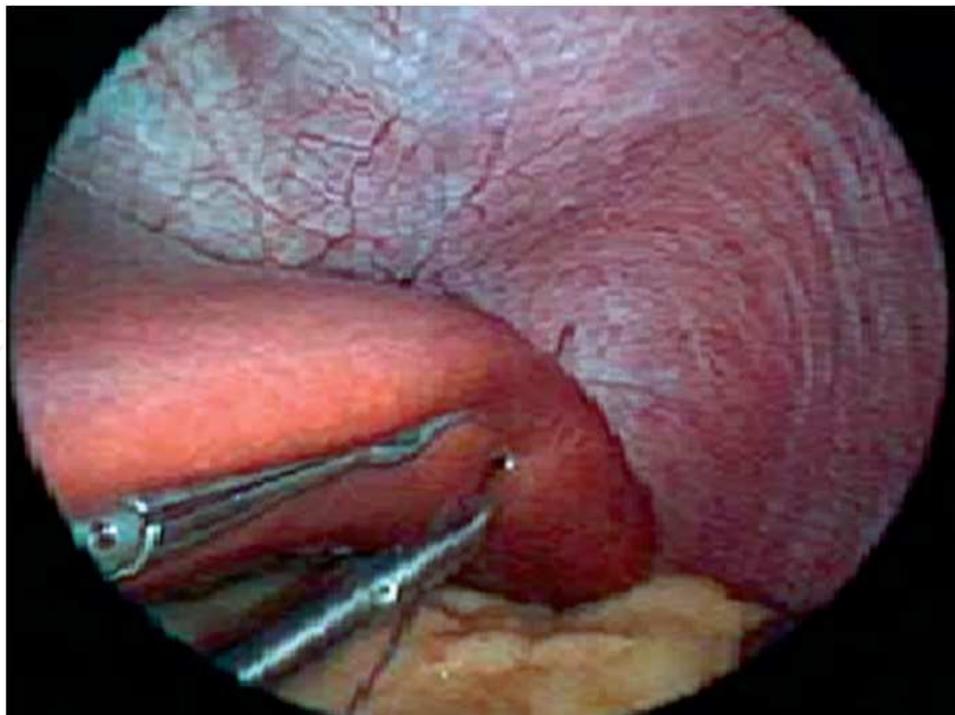


Fig. 2. We measure a 6-cm length of a Jackson-Pratt drain, cut it and fix a with 2-0 polypropylene suture on either side.



Fig. 3. The lateral segment of the left liver is suspended by passing the suture through it.

### 3.2 Adjustable gastric bading

Laparoscopic AGB (LAGB) is considered to be the most physiological and safe bariatric surgery, not involving cutting and anastomosis of gastrointestinal tract [19]. Although the weight loss observed is slower, the procedure is popular. In AGB, the surgeons utilize the pars flaccida approach to place a band and then place 2-3 gastro-gastric sutures to hold it in place. It was believed that LAGB is a good surgery for bariatric surgeons to start the SILS bariatric

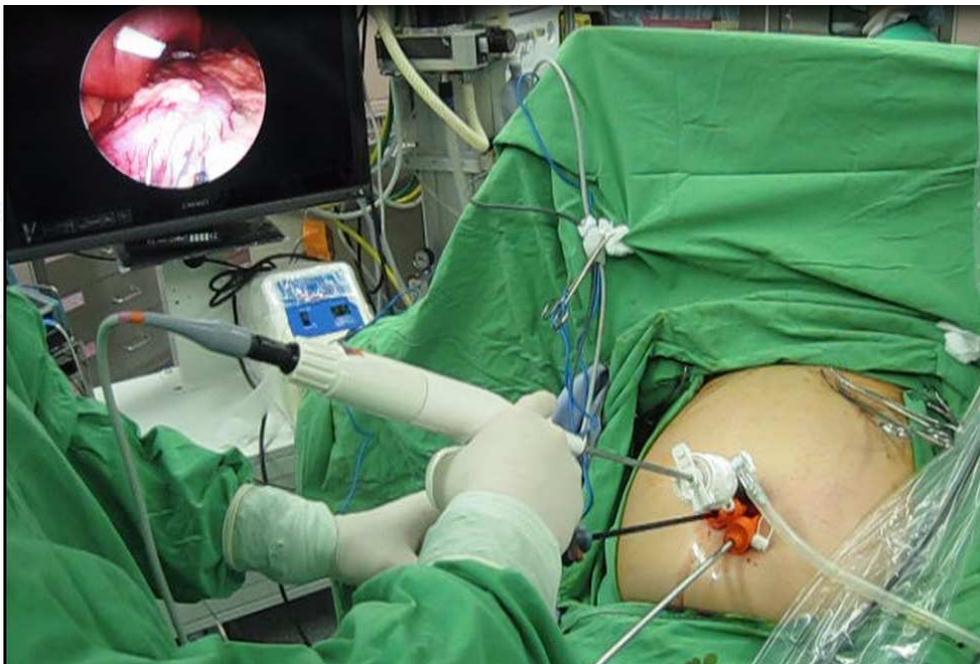


Fig. 4. Port positioning for SILS procedure.

procedure because it is a technically less demanding procedure and a 4-cm incision is required for placement of the port. Nguyen et al [10] reported the first case of single-incision laparoscopic AGB. This is also believed to be the first SILS bariatric surgery reported. Although the procedure was performed with a SITA method, it opened up the possibility of SILS in bariatric surgery. Keidar et al [20] also used the SITA method by adding a liver retractor incision and the operative time was about 60 minutes. SITU-LAGB was reported by Teixeira et al [21] and the patients included had neither hepatomegaly nor central obesity. Super-obese patients were also not considered for inclusion in this study. One conversion was observed in 22 reported patients. We also reported two cases with SITU method where through single transumbilical incision multiple fascial punctures were performed to carry out the procedure (Figure 4) [22]. Tacchino et al used SILS port for the procedure [16]. But till now, there are no reported series comparing the outcomes of SILS LAGB and multiple-port LAGB.

### 3.3 Sleeve gastrectomy

Sleeve gastrectomy is an emerging procedure for weight loss that provides rapid and satisfactory weight loss without any long-term vitamin deficiency. The procedure starts by mobilizing the greater curvature starting 4-6-cm from the pylorus till the angle of His. A vertical gastrectomy is then performed with endoscopic staplers. The resected stomach is extracted via an incision. The SILS approach was applied to sleeve gastrectomy as an incision was required for extraction of the resected gastric tube anyway. Saber et al reported both SITU and SITA combined with a single port or multiple trocars [23, 24]. They also compared the result of SILS and multiport sleeve gastrectomy. Single-incision laparoscopic sleeve gastrectomy was associated with less postoperative pain, a lower need for analgesics and a decreased length of hospital stay compared to the conventional multi-port laparoscopic sleeve gastrectomy [25]. In these studies, most patients were superobese and one patient developed wound infection that required drainage [26]. We are also doing SITU procedures for sleeve gastrectomy in selected patients and trocar positioning is similar as AGB.

### 3.4 Gastric bypass

Laparoscopic Roux-en-Y gastric bypass (LRYGB) has been considered as the gold standard of bariatric surgery. In the standard Roux-en-Y gastric bypass, a 25-ml pouch is constructed and anastomosed to a Roux loop of jejunum. This is followed by closure of the mesenteric and Peterson's defect. Till now only two authors have reported the results of the SILS approach for gastric bypass. Tacchino et al elongated the gastric pouch to 6 cm in length to speed up the dissection and decrease the tension on the gastrojejunal anastomosis. Two gastric bypass procedures were adopted - 16 patients receiving a single loop and two receiving a double loop. The single-loop gastric bypass involved only one anastomosis, and was thought to decrease the difficulties of technique [27]. We also developed a novel method using a SITU approach and subsequently performing an omega-umbilicoplasty for the Roux-en-Y gastric bypass [22, 28]. The increased space of manipulation in the 6-cm incision and subsequent umbilicoplasty design makes the procedure easier, saves time and is still scarless [Figures 5-6]. It could be offered as a bridge surgery in the early learning curve of performing SITU procedures, and then you can directly go to the 4 cm umbilical incision without need of umbilicoplasty. In fact, the

procedures might need some modifications including use of an Endostich device for suturing and some stay sutures for counter traction. No complications were observed in these two reports.

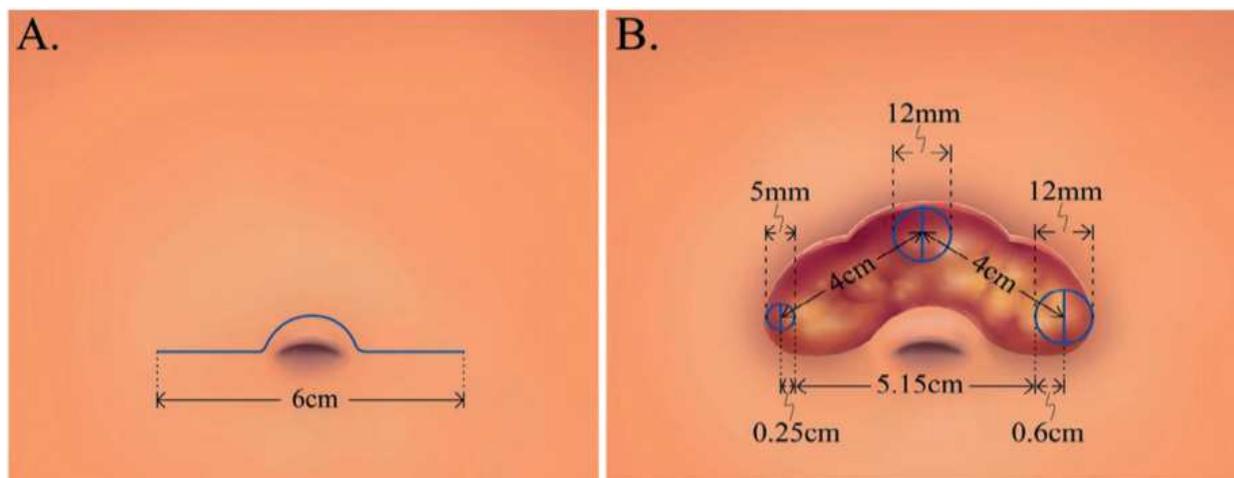


Fig. 5. Design of single-incision transumbilical laparoscopic bariatric surgery (multiple ports) by Huang et al. Schematic of a 4-6-cm  $\omega$ -incision in the supra-umbilical area. (A) Schematic of the distance between the trocars (5 mm, 12 mm, 12 mm) that can reach (B) 4-cm more with this design thus increasing the space for manipulation.



Fig. 6. Closure of the  $\omega$ -incision (A) At the conclusion of the surgery the trocars are removed and the fascia is repaired. The subcutaneous fat and skin at the angle is removed (Green area). (B) An umbilicoplasty is performed. (C) The wound becomes circular and is buried in the umbilicus.

### 3.5 Biliopancreatic diversion

Biliopancreatic diversion is a malabsorptive technique of bariatric surgery that has gained wide acceptance especially in super-obesity. It is performed by carrying out a horizontal transaction of stomach combined with a gastroenterostomy and enteroenterostomy. The surgery is considered to be the most complex bariatric procedure. Tacchino et al reported the first case with SITU / single-port method [14] in a 57-year-old man with a body mass index of 43 kg/m<sup>2</sup>. The procedure took 130 minutes to finish and there were no complications.

#### 4. Discussion

SILS has recently gained acceptance in bariatric surgery as the procedure has possible benefits. It is an alternative to NOTES - an experimental procedure whose feasibility is frequently debated. [21, 22] The surgical technique involved is almost identical to that required for conventional laparoscopic surgery. If the surgery is performed transumbilically, the surgical scar is almost completely hidden inside the belly button and the surgical site is scarless. Although some surgeons argue that very obese patients are not concerned about the scarring up to 70% of patients undergoing bariatric procedures are women and consider scarring to be an important factor. We have done a comparative study in SITU-LRYGB and 5-port LRYGB [29]. Also, though the operation times were longer, the recovery and hospitalization was similar in both groups. The promising result showed better patient satisfaction regarding the cosmesis in the SITU group (Figure 7). Despite its advantages in SILS bariatric surgery, the small umbilical incision tends to “crowd” the trocars in a very limited surgical field. The resulting reduced instrument triangulation and inability to retract tissue by the assistant make this procedure more arduous. At first, it is essential to use a 30° 5-mm laparoscope to avoid conflict with other surgical instruments. Some surgeons have used a semi-flexible endoscopic camera system to make the procedure more comfortable. Second, handling a hypertrophic liver and abundant visceral fat is also critical in morbidly obese patients. Third, longer endoscope, longer graspers and longer linear staplers are also highly recommended. In addition, patient selection is important for this surgery and some patients are not well-suited for these procedure. Most authors do not recommend this procedure for those with a BMI greater than 50 kg/m<sup>2</sup>. Not only because of abundant abdominal fat that makes surgery very difficult, especially for a LRYGB, which needs anastomosis technique, also mostly postoperative abdomino-plasty is inevitable in super-obese patients after gravid weight loss. Due to the longer-than-normal working distance between the angle of His and the umbilicus in the SILS procedure, it should be avoided in tall patients (height >180 cm). As this procedure requires far more skill than a conventional 5-port surgery, it should only be undertaken by very experienced bariatric surgeons.



Fig. 7. Scar of SITU LRYGB in follow up.

To start with the 3-ports surgery could make surgeons more familiar with the surgical setting without assistant's counter-traction and could bring you steady to the success of SILS procedure.

## 5. Conclusions

In conclusion, no scar bariatric surgery is a new unavoidable trend because of concern about the privacy and quality of life. At present, SILS bariatric has been shown to be a technically more feasible and reproducible procedure for a select group of morbidly obese patients than NOTES. Because of the abundant visceral and subcutaneous fat and multiple co-morbidities in morbid obesity, it is more challenging for surgeons to perform the procedures with SILS. It is clear that extensive development of new instruments and technology will make these procedures easier to perform. Careful selection of candidate is a key for the success of this surgery. Nevertheless, randomized studies to compare the SILS bariatric procedures with traditional multi-port surgery are essential to further develop this highly technique-dependent surgery.

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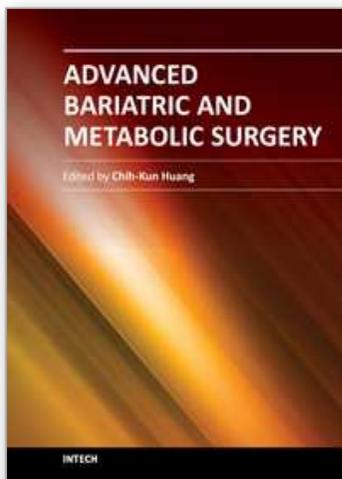
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Bariatric surgery has gained importance in the last 20 years because of the high prevalence of global obesity, and the vast understating of the physiological and pathological aspects of obesity and associated metabolic syndromes. This book has been written by a number of highly outstanding authors and pioneering bariatric surgeons from all over the world. The intended audience for this book includes all medical professionals involved in caring for bariatric patients. The chapters cover the choice of operation, preoperative preparation including psychological aspect, postoperative care and management of complication. It also extends to concept and result of metabolic surgery and scarless bariatric surgery.

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