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Three trocar laparoscopic Roux-en-y gastric bypass: A novel technique en route to the single-incision laparoscopic approach

Alan A. Saber*, Mohamed H. Elgamal, Tarek H. El-Ghazaly, Alain R. Elian, Aditya V. Dewoolkar, Abir Hassan Akl

Michigan State University, Kalamazoo Center for Medical Studies, 1000 Oakland Drive, Kalamazoo, MI 49008, USA

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ABSTRACT

Background: Laparoscopic Roux-en-Y gastric bypass is the gold standard bariatric procedure. Typically, the procedure necessitates five to seven small skin incisions for trocar placement. The senior author (AA Saber) has developed a three-trocar approach for laparoscopic Roux-en-Y gastric bypass.
Methods: Sixteen patients underwent triple-incision laparoscopic Roux-en-Y gastric bypass between May 2009 and August 2009. The same surgeon performed all surgical interventions. The umbilicus was the main point of entry for all patients and the same operative technique and perioperative protocol were used in all patients.
Results: A total of sixteen triple-incision laparoscopic Roux-en-Y gastric bypasses were performed. The procedures were successfully performed in all patients. Mean operating time was 145.4 min. None of the patients required conversion to an open procedure. There were no mortalities or post-operative technical complications noted during the immediate post-operative period.
Conclusion: Three trocar laparoscopic Roux-en-Y gastric bypass is safe, technically feasible and reproducible. This technique may be considered a "precursor" to single-incision laparoscopic Roux-en-Y gastric bypass.

1. Introduction

Laparoscopic Roux-en-Y gastric bypass is the gold standard bariatric procedure. Several studies have shown the advantages of laparoscopic Roux-en-Y gastric bypass over the open approach.[1,2] Traditional laparoscopic surgery has been shown to lead to reduced post-operative pain, reduced hospital stay and a quicker return to normal physical activities and work. The increasingly popular trends that facilitate abdominal trocar reduction in bariatric surgery have complemented and expanded the benefits of traditional laparoscopic surgery that stem from less abdominal trauma. Our experience with the laparoscopic Roux-en-Y gastric bypass has progressed from a conventional multiport approach to a single port approach.[3]

Typically, the laparoscopic procedure necessitates five to seven small skin incisions to place five to seven laparoscopic trocars.[1,2,4] As a bridge to single-incision laparoscopic surgery (SILS), the senior author (Saber) has developed a three trocar approach to perform laparoscopic Roux-en-Y gastric bypass using the umbilicus as the main portal of entry. With laparoscopic Roux-en-Y gastric bypass being the most technically demanding of all common bariatric procedures, this 3-trocar approach is a reasonable step to implement en-route to a single-incision laparoscopic approach.

The rationale of this communication is to evaluate the safety and feasibility of our initial experience with this novel approach that we have developed. To the best of our knowledge, this is the first report of triple-trocar laparoscopic Roux-en-Y gastric bypass.

2. Materials and methods

Sixteen consecutive patients underwent triple-trocar laparoscopic Roux-en-Y gastric bypass between May 2009 and August 2009. All surgical interventions were performed by the same surgeon (Saber). The same operative technique and perioperative protocol was used in all patients as described herein. The procedure was offered to all patients that were eligible for the standard laparoscopic Roux-en-Y gastric bypass without any specific exclusion criteria. Risks and benefits of the procedure as well as the alternatives were discussed in detail.

A Gastrografin swallow was obtained on post-operative day 1 to check for leaks, obstruction or gastro gastric fistula.

* Corresponding author. Tel.: +1 (269) 337 6260; fax: +1 (269) 337 6441.
E-mail address: Saber6231@gmail.com (A.A. Saber).

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3. Operative technique

The patient is placed in the supine position. The surgeon stands on the right side of the patient and the assistant on the left side. Using an open Hasson technique, a 2.5-cm intraumbilical incision is made and deepened to the linea alba where a 1-cm fascial incision is made. The peritoneum is incised and the 12-mm blunt trocar is deployed. Carbon dioxide insufflation with a pneumoperitoneum pressure of 15 mm/Hg is achieved. A 5-mm flexible tip video laparoscope (Olympus Surgical, Orangeburg, NY) is inserted. Under direct visualization, a 5-mm DEXIDE™ threaded laparoscopic trocar (Covidien, Norwalk, CT, USA) is placed through the same umbilical skin incision but different fascial defect. A 12-mm trocar is placed in the right upper quadrant. The patient is placed in the reverse Trendelenburg position and rotated toward the right for optimal exposure of the esophagogastric junction. A Nathanson liver retractor (Mediflex, Islandia, NY, USA) is inserted through a 5-mm subxiphoid skin puncture with no port placement (Fig. 1).

The various operative steps employed in this triple-incision procedure are similar to standard laparoscopic Roux-en-Y gastric bypass.[2–4] Using a 5-mm LigaSure (Covidien), the phrenoesophageal ligament is taken down, exposing the left crus of the diaphragm. A 20-ml, vertically-oriented gastric pouch, based on the lesser curvature of the stomach, is created using a long laparoscopic reticulating 60-mm XL endo GIA stapler with blue cartridge 3.5 mm (Covidien) and Duet TRS™ preloaded synthetic absorbable polymer buttressing material (Covidien). The stapler is inserted through the 12-mm right upper quadrant trocar for the horizontal fire to create the gastric pouch. A 34-French orogastric tube is inserted transorally and placed against the lesser curvature. This will calibrate the size of the gastric pouch, prevent constriction at the gastroesophageal junction and stent the gastrojejunostomy during suture closure of the gastrojejunal defect. Through the 12-mm umbilical trocar, a long laparoscopic reticulating 60-mm XL endo GIA stapler with blue cartridge 3.5-mm and Duet buttressing material reinforcements is fired consecutively in a cephalad direction along the length of the 34-French orogastric tube until the angle of His is reached. Retrogastric adhesions are taken down with the LigaSure to allow complete mobilization of the stomach, eliminate any redundant posterior wall of the pouch and exclude the fundus from the gastric pouch.

Using 5-mm articulating/reticulating instrumentation (Roticulator Endo Dissect, Endo Grasp, and Endo Mini Shears, Covidien, Norwalk, CT, USA) is essential in creating suitable operative angles that facilitate surgical manipulations through a limited number of trocars.

Fig. 1. Intraoperative picture of trocar placements.

The greater omentum is divided vertically in the midline into halves, starting from the inferior edge of the greater omentum to the transverse colon. The jejunum is divided 50 cm distal to the ligament of Treitz using a laparoscopic reticulating 60 mm XL endo GIA stapler with white cartridge 2.5 mm endo GIA stapler (Covidien). The Roux limb is then brought up between the two halves of the omentum in an antecolic, ante gastric fashion to verify its reach to the gastric pouch without tension. Gastrojejunostomy is created using a laparoscopic reticulating 30-mm XL endo GIA stapler with blue cartridge 3.5 mm endo GIA stapler (Covidien). The gastrojejunal defect is closed using 2-layer intracorporeal absorbable sutures. The integrity of the gastrojejunostomy is tested by insufflating air under saline and infusing 30 cc of methylene blue. The gastrojejunal anastomosis is reinforced with an omental wrap as we previously described.[5]

The jejunojejunostomy is created 100–150 cm distal to the gastrojejunostomy, depending on the patient's body mass index. This is performed using a laparoscopic reticulating 60-mm XL endo GIA stapler with white cartridge 2.5 mm endo GIA stapler (Covidien). The intermesenteric defect and Petersen's defect -which is the space between the mesentry of the Roux limb and the transverse mesocolon- are closed using continuous non-absorbable intracorporeal sutures.

A 19-French Blake drain is placed along the gastrojejunostomy and exteriorized through the right upper quadrant incision. The fascial defect of the 12-mm umbilical trocar site is closed with a figure of eight 2/0 non-absorbable suture to prevent port site hernia. Skin is closed in subcuticular fashion.

Some modifications of the conventional laparoscopic approach are required. Long instruments and equipment (dissectors, staplers, scope and clip appliers) are required due to the fact that in the morbidly obese patient the umbilicus is usually located far from the gastroesophageal junction. Frequent realignment of the instruments and scope relative to each other is also crucial to provide optimal visualization and to minimize clinching of the instruments and the laparoscope.

All patients have a routine Gastrografin swallow on post-operative day 1; they are commenced on oral foods if the results are normal. On average, most patients are discharged home by post-operative day 2 and the drain is removed prior to the patient's discharge.

4. Results

A total of 16 patients underwent triple-trocar laparoscopic Roux-en-Y gastric bypass. All procedures were performed by the same surgeon (Saber). The patients included 12 females and 4 males. The mean patient age was 47 years (range 39–54 years), mean weight was 269 lbs (range 249–284 lbs) and the mean preoperative body mass index was 42.4 (range 39–44.6). Seven patients had previous abdominal surgeries. These included 6 cholecystectomies (one open and 5 laparoscopic), 2 hysterectomies, 2 cesarean sections and one ventral hernia suture repair. Comorbidities included arthritis (12 patients), gastroesophageal reflux disease (8 patients), back pain (6 patients), sleep apnea (5 patients), diabetes (8 patients), hypertension (5 patients) and stress incontinence (4 patients).

Triple-incision Roux-en-Y gastric bypass was successfully performed in all patients. Mean operating time was 145.4 min (range 118–210 min). The mean operative blood loss was 38 cc. No conversion to an open or conventional laparoscopic procedure was required. Mean hospital stay was 2.8 days (range 2–4 days) following the procedure. There was no mortality. Apart from one patient who developed umbilical port infection and another with post-operative atrial fibrillation, there was no post-operative morbidity. All patients were satisfied with the cosmetic results with the main scar being hidden in the umbilicus (Fig. 2).

Fig. 2. The resulting scars 1 month postoperatively.

5. Discussion

Roux-en-Y gastric bypass is the most common bariatric procedure performed in the United States, with about 140,000 cases performed in 2005.[6] This procedure provides a durable weight loss of up to 80% of initial excess weight within the first year, with subsequent control of 95% of preoperative obesity related comorbidities.[7–9] However, the conventional laparoscopic procedure requires the use of 5–7 trocars distributed on both sides of the abdomen as well as the midline.[4]

The numerous advantages of laparoscopic procedures compared to their open counterparts have inspired an interest in even more minimally invasive surgical approaches. This interest has facilitated the birth of two lines of thought: natural orifice transluminal endoscopic surgery (NOTES)[10–12] and single-access laparoscopic surgery.[13–27] While NOTES is in an experimental stage, the safety and feasibility of single-access laparoscopy in urology[13–17] as well as in some general surgical procedures have been documented.[18–20] The potential advantages of this approach are related to limiting the port incisions to one; this is in addition to the advantages of traditional minimally invasive surgery.

The senior author (Saber) has developed a port reduction strategy for laparoscopic Roux-en-Y gastric bypass performed through three incisions; this strategy is implemented without compromising the safety or efficacy of the procedure. With our novel technique, we are able to combine all of the standard laparoscopic entry points into two ports of entry, i.e., the umbilicus and right upper quadrant. This decreases the number of incisions required for laparoscopic Roux-en-Y gastric bypass from six or seven incisions to three incisions. This substantial reduction in abdominal wall trauma can be translated to less post-operative pain, early ambulation, rapid recovery and better cosmesis. In addition, limiting lateral port placement minimizes the risk of epigastric vessel injury.[28]

This approach does have some technical challenges requiring ambidexterity on the part of the surgeon. Some modifications from the conventional laparoscopic technique are needed to overcome these obstacles. The use of reticulating instruments and a flexible 5-mm laparoscope is recommended to improve maneuverability. Coordination between the surgeon and the camera person for switching the 5-mm instrument between the laparoscopic ports is essential to optimize the instrument's range of motion for better ergonomics and to avoid clashing of the instruments and the laparoscope during the procedure. This approach has a unique learning curve, principally to overcome the technical challenges of navigating instruments within a limited range of motion. Proficient multiport laparoscopic skills are critical to safely introduce this new technique without added complications. It must be noted that flexible staplers and laparoscopes are being used for conventional multiport laparoscopic Roux-en-Y gastric bypass procedures, which do not offer the potential benefits of reduced analgesia and hospital stay associated with single-incision laparoscopic surgery which would potentially counteract possible additional costs. However, studies assessing the cost-effectiveness of this single-incision laparoscopic approach have understandably not been carried out yet, owing to the relatively young nature of the approach.

6. Conclusion

Three trocar laparoscopic Roux-en-Y gastric bypass is safe, technically feasible and reproducible. This technique may be considered as a "precursor" to the single-incision laparoscopic approach. However, additional work must be done before these techniques achieve the level of standardization. Prospective randomized studies with large numbers of patients and long-term follow-up comparing this novel technique with the conventional laparoscopic Roux-en-Y gastric bypass are needed to confirm our initial experience.

Conflict of interest
None declared.

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Ethical approval
IRB Approval has been granted from the following institutions: Michigan State University – Kalamazoo Center for Medical Studies; ref# N/A; "Single Port Access Laparoscopic Surgical Procedures". Bronson Hospital; ref# BMH-2009-0375; "Single Port Access Laparoscopic Surgical Procedures". Borgess Methodist Hospital; ref# 2009-7; 76; "Single Port Access Laparoscopic Surgical Procedures".

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