

Smaller Staple Height for Circular Stapled Gastrojejunostomy in Laparoscopic Gastric Bypass: Early Results in 1,074 Morbidly Obese Patients

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Abstract

Background Anastomotic leaks, stenosis, and bleeding from the gastrojejunal anastomosis (GJA) after gastric bypass may carry high morbidity and mortality. To date, the standard operation with the circular stapler (CS) used the 25 mm with a staple height of 4.8 mm. We present herein our experience with the 3.5-mm staple height.

Methods A total of 1,074 morbidly obese patients who underwent fully stapled laparoscopic Roux-en-Y Gastric Bypass over a period of 18 months were included in the study. Mean body mass index was 41.9 (range 28.6–70.7). Mean age was 40.9 years (range 15–74 years). Mean operating time was 73 min (range 43–210 min) and the mean length of stay was 4.2 days (range 1–25 days). The 30-day complication rate associated with GJA was prospectively analyzed.

Results Twenty patients (1.86%) developed postoperative bleeding. Four developed GJA bleeding (0.37%). One leak was recorded from the vertical staple line of the gastric pouch, but no leaks from the GJA were seen. Conversion to open approach was required in two patients (0.18%). Reoperation and readmission rates were 1.7% and 1.8%, respectively. Perioperative complications were observed in 34 patients (3.1%). One case of clinical GJA stenosis was detected in a mean follow-up of 10.5 months (range 5–20 months). There was no mortality in our series.

Conclusion Compared to our previous experience with 4.8 mm CS, creating the GJA using a smaller staple height significantly reduced the bleeding rate and seems to be a safe technique that potentially reduces other complications related to the GJA as reported in the literature.

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Introduction

Morbid obesity (MO) has become a major health problem worldwide with a rapidly increasing prevalence [1]. Bariatric surgery is the most effective way to maintain significant weight reduction in the long term, while nonoperative methods have shown low rates of success [2, 3]. Laparoscopic Roux-en-y gastric bypass (LRYGB) is considered the “gold standard” and the most commonly performed operation for the treatment of MO in the USA [1, 2]. It remains the most preferred bariatric procedure worldwide as well [4–7].

All operative maneuvers and methods must be learned and systematized. But the learning curve for LRYGB is one of the longest in laparoscopic surgery and is estimated to be between 75 and 100 cases [8, 9]. Pulmonary emboli, anastomotic leaks, and respiratory failure account for 80% of all postoperative deaths. Mortality rates for gastric bypass average 0.5% at high-volume centers, with overall complication rates of 7–14% [10–13].

LRYGB was originally described in 1994 by Wittgrove and Clark [14]. They used a 21-mm circular stapler with insertion of the anvil transorally to create the gastrojejunal anastomosis (GJA). Since then, several techniques for performing GJA were described, including hand sewing and mechanical stapling using either linear or circular staplers. Currently, the circular stapler is the most commonly used and reported technique in the literature [15, 16].

Being a controversial issue, the GJA is one of the most technically challenging steps in LRYGB, and might carry risks of serious complications, including leakage, bleeding, and stenosis. Until recently, the standard operation used the 25-mm circular stapler with a staple height of 4.8 mm.

The aim of this study is to describe our results of GJA performed with 25-mm circular stapler (CS), 3.5-mm staple height and to evaluate the short-term complications of this anastomosis.

Patients and Methods

All patients met the criteria recommended for obesity surgery by the National Institute of Health Consensus Guidelines [17]. Standardized fully stapled (FS)-LRYGB was performed by three surgeons (N.S., A.A., and B.D.) in three institutes (HYMC, RHCC, and AZ Sint-Jan AV) between August 2008 and January 2010. The operative technique of the FS-RYGB has been previously described in detail by Dillemans et al. [18]. A five-port approach was used to perform the operation (Fig. 1 and 2).

Briefly, the technique involves a transabdominally introduced circular stapler (DST™ Series EEA™ circular stapler 3.5 mm; Covidien, USA) through an enlarged left lateral port site. The GJA is created after performing a gastrotomy at the left lower corner of the gastric pouch secured with a purse-string suture and the Roux limb is fashioned in an antegastric antecolic manner. A 2.5-mm staple height linear stapler is used to perform the jejunojunctionostomy (JJ). After completing the GJA, anastomotic leak is checked intraoperatively using methylene blue dye. Postoperative upper GI studies are not performed and closed-suction drainage is routinely used. All patients received perioperative prophylaxis with low-molecular-weight heparin (LMWH). In addition, patients received prophylaxis with Proton Pump Inhibitors for 8 weeks.

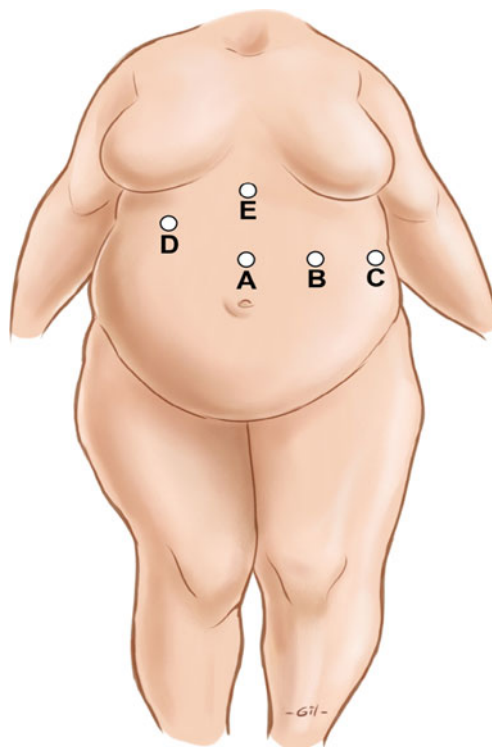


Fig. 1 Trocar layout. A, 10-mm trocar (camera). B, C, D, 12-mm trocar. E, 5-mm trocar

For this investigation, a retrospective analysis of prospectively collected data was performed for the first 1,074 patients using a smaller staple height for circular stapled GJA. Preoperative data were recorded including age, gender, associated comorbidities, previous bariatric, and other abdominal surgery, body mass index (BMI), operative time, intraoperative mishaps and complications, length of hospitalization, and the 30-day morbidity and mortality. In addition, with regards to the complications attributed to the

Fig. 2 Fully stapled laparoscopic Roux-en-Y gastric bypass



GJA, a comparison was made between this present experience and our previous series of 2,606 patients (18). Differences between the two series were assessed using Fisher exact test and the χ^2 test. Differences were considered to be significant when $P < 0.05$.

Results

A total of 1,074 patients underwent LRYGB using a 25-mm CS with 3.5-mm staple height; 953 in Belgium and 121 in Israel. The perioperative data are depicted in Table 1.

There were no intraoperative complications except for a positive blue dye test in one patient. Intraoperative repair of the leaking site was done before completion of the procedure. Two patients were converted to open technique (0.18%) and none was related to the GJA. The reason for conversions were difficulty with exposure, attributed to a severely enlarged fatty liver and multiple dense adhesions in the upper abdomen secondary to previous upper abdominal and bariatric operations. The LRYGB was the primary procedure in 913 (85%) patients. In 161 (15%) patients, the procedure was done as a conversion from a previous failed restrictive bariatric procedure (LAGB, 108; VBG, 46; and LSG, 7). Simultaneous cholecystectomy was performed in 26 (3.3%) patients. Overall, 240 patients (22.5%) had previously undergone abdominal operations.

Table 1 Study population: demographics and clinical features ($n=1,074$)

Characteristics	Number (%)
Gender	
Female	768
Male	306
Mean age, years (range)	40.9 (15–74)
≥ 55	136
Mean BMI (range)	41.9 (38.6–70.7)
BMI ≥ 50	150
Length of stay, day (range)	4.16 (1–25)
Operating time, min (range)	73 (43–210)
Conversion to open approach	2 (0.18%)
Previous abdominal procedures	240 (22.5%)
Redo surgery	161 (15%)
Simultaneous cholecystectomy	26 (3.3%)
Comorbidities	
Hypertension	312 (29%)
Diabetes mellitus	154 (14.3%)
Dyslipidemia	454 (42.2%)
Obstructive sleep apnea	387 (36%)
GERD/hiatal hernia	411 (38.2%)

BMI, body mass index (kg/m²); GERD, gastroesophageal reflux disease

Postoperative complications were seen in 34 patients (3.1%; Table 2). This included one leak in a male patient from the middle portion of the vertical staple line of the gastric pouch. The leak was diagnosed on the third postoperative day and the patient underwent a laparoscopic suture of the staple line. This was done in conjunction with antibiotics and drainage. The patient was discharged after 6 days. Postoperative bleeding was demonstrated in 20 patients; four of them developed a bleeding from the GJA and all of them required blood transfusion. The onset of bleeding in two patients was within the first 24 h. In the others, the bleeding occurred 3 days and 3 weeks postoperatively. The bleeding was managed endoscopically in three cases: two patients by endoclips and one by Argon plasma coagulation to the bleeding site. In the last patient with late presentation (3 weeks), the bleeding source was identified as an anastomotic ulcer and it stopped spontaneously. Overall, 14 patients required transfusion of packed cells, while six patients were managed without transfusion. In two patients, a laparoscopic reoperation was necessary to

Table 2 Thirty-day complication rate

Characteristics	Number (%)
GJA-related complications	
Leaks	0
Stenosis	1 (0.09%)
Bleeding	4 (0.37%)
Ulcer	1 (0.09%)
Other complications related to LRYGB	
Leaks	1 (0.09%)
Bleeding	20 (1.86%)
Bleeding requiring transfusion	14 (1.3%)
Intraluminal (GI) bleeding	9 (0.83%)
Extraluminal bleeding	11 (1.02%)
DVT/PE	1 (0.09%)
Trocar site hernia	5 (0.46%)
Internal hernia	0
Wound infection	5 (0.46%)
Food intolerance	3 (0.28%)
UTI	2 (0.18%)
Pancreatic injury/leak	1 (0.09%)
Intra-abdominal abscess	2 (0.18%)
Pneumonia	1 (0.09%)
Reoperation rate	18 (1.67%)
Readmission rate	19 (1.77%)
Overall complication rate	34 (3.1%)
Death	0

GJA, gastrojejunal anastomosis; LRYGB, laparoscopic roux-en-y gastric bypass; GI, gastrointestinal; DVT/PE, deep vein thrombosis/pulmonary embolism; UTI, urinary tract infection

control bleeding from the JJ staple line and from the gastric pouch vertical staple line.

Clinical presentations in those patients were melena, hematemesis, and hypotension.

The LMWH treatment was discontinued and their postoperative course thereafter was uneventful. One patient suffered from early marginal ulcer at the GJA and was treated with PPIs. Other unrelated complications to the GJA are detailed in Table 2.

The 30-day reoperation rate was 1.7% (18 patients), readmission rate was 1.8% (19 patients). In a mean follow-up of 10.5 months (range 5–20 months), one patient with clinical stenosis was diagnosed 2.5 months after surgery. This was successfully managed with two sessions of balloon dilations. No mortalities were recorded in this series.

Comparison with our previous experience with regards to GJA-related complications revealed a significant difference only in hemorrhage rate (Table 3).

Discussion

The LRYGB is considered to be one of the more technically difficult laparoscopic procedures. Constructing and completing the GJA is a particularly challenging step. There is much controversy as to which is the best technique for GJA. To date, the available evidence does not indicate which GJA technique is superior.

Circular mechanical anastomosis is the most commonly used technique when RYGB is done via laparoscopy [15, 16]. With regards to CS, and until recently, the only staple size used was 4.8 mm, and all the publications reported the utilization of this staple size. To the best of our knowledge, there are no studies reporting the use of CS 3.5-mm staple height for GJA.

Complications in the GJA following RYGB are attributed, in general, to injury or ischemia due to tension, regional sepsis, and technical errors [4, 19, 20].

The GJA is the most frequent leakage site following RYGB [12, 16, 19]. It is considered to be the second leading cause of death following RYGB surgery, preceded only by pulmonary embolism [4, 19, 21]. Staple line failure has been reported to occur in 0.5–6% of LRYGB procedures [2, 22, 23], leading either to gastrointestinal leaks or bleeding.

Technical leaks occur within the first 1–2 days of surgery, while ischemic leaks are typically encountered 5–7 days postoperatively [4, 24]. The use of the intraoperative blue dye test is aimed at diagnosing and managing early leaks, which are the result of technical errors. As to late leaks, it seems that a properly performed tension-free, well-vascularized anastomosis, with an appropriate staple size, is the key for the prevention of GJA-related complications. Obviously, staple size must be selected appropriately for the tissue on which it is to be used.

With the assumption that it's more appropriate to use the 3.5-mm staple height for anastomosing the upper part of the stomach to the small bowel, we have decided to undersize the staple height for creating the GJA. Intuitively, the 48-mm staples were supposed to be less suitable, particularly for the small bowel. In the previous large series by Dillemans et al., using the same operative technique (FS-LRYGB) with 4.8-mm staples height for circular stapled GJA, the rate of leakage from the GJA was 0.15% [18]. The absence of leakage in the present experience is remarkable. Most probably, this is largely, but not solely, attributable to the use of the CS 3.5-mm staple height.

Early postoperative bleeding is not uncommon following LRYGB. Gastrointestinal (GI) bleeding from GJA generally presents with hematemesis and/or melena. Most cases respond to conservative therapy, and reoperation is rarely indicated. Management depends on the clinical presentation and timing [25]. The bleeding rate from GJA in the present series (0.37%) is significantly lower than that from our previous experience [18] using the 4.8-mm staples (2.45%). In the literature, the reported incidence of GI bleeding after LRYGB ranges from 1.1% to 4.4% [15, 19, 25, 26]. In this experience, the bleeding rate from GJA compares favorably with the accepted average.

In order to minimize postoperative GI tract oozing from staple-line edges, it seems that the current trend is to use staplers with a shorter staple height (3.5 mm for the stomach and 2.5 mm for the small bowel). This provides more compression of the tissues and hence, should potentially result in better hemostasis.

Anastomotic stenosis has been reported in 3% to 27% of patients with all techniques used to perform GJA [19, 21, 27, 28]. Nguyen et al. [29] compared the use of different sizes of CS and found a higher rate of stenosis with the 21-mm CS

Table 3 GJA-related complications: comparison between the present series and our previous experience

Complication of GJA	Present experience (N=1,074 patients)	Previous experience (N=2,606 patients)	P value
Hemorrhage	4 (0.37%)	64 (2.45%)	<i>P</i> <0.001
Leakage	0 (0%)	4 (0.15%)	<i>P</i> =0.32
Stenosis	1 (0.09%)	4 (0.15%)	<i>P</i> =1.0

GJA gastrojejunal anastomosis

(26.8%) than with the 25-mm CS (8.8%). Other studies using the 21-mm CS showed an incidence of stenosis ranging between 3.4% and 9.4% [30, 31]. Nevertheless, this diameter has not been shown to affect rates of weight loss [32, 33]. The etiology of stenosis is probably multifactorial, including technical errors, size of the stapler/anastomosis local ischemia, ulceration, and leakage. GJA stricture is suspected in patients with dysphagia, postprandial vomiting, or epigastric abdominal pain. Strictures are usually and easily treated by endoscopic dilatation, which has a success rate of 70%–100% [34].

The anastomotic diameter and size of the GJA is very important to reduce the rate of stenosis.

The CS has the advantage of creating a well-defined size of the anastomosis.

We prefer a 25-mm circular stapler, leaving an internal anastomotic diameter lumen of roughly 16.6 mm, which results in a low rate of stricture formation and, probably, dumping syndrome as well. In our series, with a mean follow up of 10.5 months, only one case of stenosis was diagnosed and managed with dilatation. We are aware of the fact that this is a too short time period to fully evaluate the true incidence of stenosis. Despite this, it seems that the trend is promising.

The current study was performed as a nonrandomized concurrent cohort trial. A larger comparative study might identify other clinical predictors of morbidity that this study was unable to demonstrate. As reported in our previous study including 2,606 patients [18], we truly believe that performing the FS-LRYGB in a high volume and strictly standardized manner affects the rate of complications. Our utilization of the CS with smaller staples in the present study has further reduced the incidence of complications attributed to the GJA.

The results of this initial experience in regard to the complications of GJA were favorable and encouraging. We believe that the creation of a GJA using the smaller CS 3.5-mm staple height has the potential to decrease the risk of staple line failure including bleeding and other complications as well.

Conflict of interest The authors report no potential conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.

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