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Original article

Shorter circular staple is height associated with lower anastomotic stricture rate in laparoscopic gastric bypass

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Abstract

Background: Anastomotic stenosis, leak, and hemorrhage are common stapler-related complications of laparoscopic Roux-en-Y gastric bypass. In May 2007, we transitioned from a 25-mm diameter, 4.8-mm-height circular stapler to a 25-mm, 3.5-mm-height circular stapler. We hypothesized that the staple height would be associated with a decreased incidence of perioperative complications.

Methods: The records of 360 consecutive patients who had undergone laparoscopic Roux-en-Y gastric bypass from May 1, 2006 to March 31, 2008 were retrospectively abstracted. The National Surgical Quality Improvement Project and Michigan Bariatric Surgery Collaborative databases were used to collect the patient demographics and track complications of laparoscopic Roux-en-Y gastric bypass. Data were collected on the rates of anastomotic stenosis requiring dilation of the gastrojejunostomy, anastomotic leak, hemorrhage requiring transfusion, and wound infection. Patients with a 4.8-mm staple height gastrojejunostomy were compared with those with a 3.5-mm staple height gastrojejunostomy for differences in complications.

Results: The groups were similar with respect to age, gender, body mass index, hypertension, hyperlipidemia, diabetes, sleep apnea, and surgery duration. In the 4.8- and 3.5-mm staple height groups, 15% and 6.1% required gastrojejunal dilation, respectively ($P = .01$). A trend was seen toward a decrease in postoperative hemorrhage (5% versus 2.8%) with the shorter staple height. No anastomotic leaks occurred, and the incidence of wound infection (1.7% versus 2.2%) was similar between the 2 groups.

Conclusion: In the present study, the use of a 25-mm, 3.5-mm staple height circular stapler was associated with a decreased rate of anastomotic stenosis. (Surg Obes Relat Dis 2012;8:181–184.)

Keywords: Laparoscopic Roux-en-Y gastric bypass; Perioperative complications; Gastric bypass circular stapling devices; Gastrojejunostomy stenosis

A wide variety of technical variations exist in the performance of laparoscopic Roux-en-Y gastric bypass (LRYGB) [1–6]. Three different techniques are commonly used to create the gastrojejunostomy: the hand-sewn, linear-stapled, and circular-stapled approaches. Complications have been reported with all 3 techniques [7–9]. Stenosis of the gastrojejunostomy is one of the most common complications after RYGB [10]. At our institution, LRYGB was traditionally performed with a stapler that contained staples with a height of 4.8 mm. We sought to determine the effect of the stapler height (4.8 versus 3.5 mm) on the incidence of gastrojejunostomy stenosis, hemorrhage requiring transfusion, wound infection, and anastomotic leakage. The manufacture of the

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stapling devices discontinued the 4.8-mm staple height and switched to production of the 3.5-mm staple height, which we began to use in May 2007.

Methods

After approval by William Beaumont Hospital's institutional review board, data were retrospectively collected from 360 consecutive patients who had undergone LRYGB at our institution from May 1, 2006 to March 31, 2008. All procedures were performed by one of two fellowship-trained laparoscopic surgeons. Our technique included transgastric placement of a 25-mm circular anvil and creation of a stapled gastrojejunostomy with an antecolic Roux limb. Two lateral 3-0 Vicryl sutures were placed between the gastric pouch and jejunum at the anastomosis. All biliopancreatic limbs were 50 cm in length, and the Roux limbs varied from 75 to 150 cm, depending on the patient's body mass index. Both antecolic and jejunojejunostomy mesenteric defects were closed with running suture. From May 2006 to May 2007, 180 patients underwent LRYGB using the 4.8-mm height circular stapling device (catalog no. EEA25, Covidien Health Care, Mansfield, MA) to create the gastrojejunostomy. From May 2007 to March 2008, another 180 consecutive patients underwent LRYGB using the 3.5-mm staple height circular stapler (catalog no. EEA2535, Covidien Health Care). All other aspects of the surgery remained constant during the study period.

Postoperatively, all patients were admitted to the regular surgical floor with telemetry monitoring, patient-controlled analgesia, and nothing by mouth for the first 24 hours. If the patient was progressing well, a clear liquid diet and oral pain medications were initiated on postoperative day 1. Contrast studies were ordered sparingly at the discretion of the operating surgeon. If the patients tolerated their diet and their pain was well-controlled, they were discharged home as early as postoperative day 1.

The National Surgical Quality Improvement Project and Michigan Bariatric Surgery Collaborative databases were used to collect patient demographics and track complications of the LRYGB performed at our institution. The following data points were collected: age, gender, weight, body mass index, hypertension (requiring medication), hyperlipidemia (requiring medication), diabetes mellitus (requiring medication), surgery duration, sleep apnea, 30-day wound infection (superficial incisional, deep incisional) characterized by erythema, cellulites, and purulent drainage, 30-day anastomotic leak, hemorrhage (requiring transfusion of packed red blood cells in the first 72 h), and gastrojejunostomy stenosis. Anastomotic stenosis was defined as the signs and symptoms of gastric outlet obstruction combined with the inability to allow passage of a 10-mm gastroscope. The indications for endoscopy included prolonged vomiting, dysphagia, or new onset epigastric pain >4 weeks postoperatively. All stenotic gastrojejunostomies were treated with serial endoscopic balloon dilation. Dilations were continued ≤15 mm, unless mucosal injury occurred, at the discretion of the endoscopist.

The patient demographics and complications were then compared according to the staple height using the Pearson chi-square test, as appropriate (expected frequency >5), otherwise Fisher's exact test was used. Continuous variables were tested for normality. None were normally distributed; thus, all were examined using a Wilcoxon rank test. Continuous variables are given as the mean ± standard deviation, followed by the median and 25th and 75th percentiles, as needed. All analyses were performed using the SAS system for Windows, version 9.2 (SAS Institute, Cary, NC).

Results

With the exception of age and hyperlipidemia, the demographics did not vary between the patients with 3.5-mm staples and those with 4.8-mm staples (Table 1). Anastomotic stricture developed in 27 (15%) of 180 patients with 4.8-mm staples and 11 (6.1%) of 180 patients with 3.5-mm staples ($P = .01$, Table 2). The median point for the occurrence of gastrojejunostomy stricture for the 4.8-mm and 3.5-mm stapler group occurred at postoperative day 26 and 21 days, respectively (Table 2). A second dilation for gastrojejunostomy stenosis was required in 8 of 27 patients with 4.8-mm staples and 2 of 11 patients with 3.5-mm staples within 90 days of their operation ($P = .69$). No patients in either group required revision of LRYGB because of anastomotic stenosis. No anastomotic leaks developed in either group, and no difference was found between the 2 groups with respect to hemorrhage or wound infection. All wound infections occurred at the EEA stapler incision

Table 1
Patient demographics and co-morbidities

Variable	3.5-mm Stapler (n = 180)	4.8-mm Stapler (n = 180)	*P* value
Age (y)	48 ± 12	46 ± 10	.024*
Men	45 (25)	47 (26)	.81
Weight (kg)	134 ± 26	139 ± 29	.19
Body mass index (kg/m^2)	47.7 ± 7.7	48.6 ± 8.2	.57
Hypertension	112 (63)	117 (65)	.63
Hyperlipidemia	131 (73)	95 (53)	< .0001*
Diabetes mellitus	95 (53)	84 (47)	.22
Surgery duration (min)	127 ± 35	129 ± 42	.94
Sleep apnea	101 (56)	90 (50)	.22

Data presented as numbers, with percentages in parentheses, or mean ± standard deviation.

* Statistically significant.

Table 2
Complications

Variable	3.5-mm stapler (n = 180)	4.8-mm Stapler (n = 180)	*P* value
Anastomotic stenosis	11 (6.1)	27 (15)	.01*
Stricture			
Median	21.0	26	
90th percentile	30	30	
Range	16–30	21–30	
Hemorrhage	7 (3.9)	10 (5.6)	.46
Anastomotic leak	0	0	NA
Wound occurrence	4 (2.2)	3 (1.7)	.72

NA = not available.

Data presented as numbers, with percentages in parentheses, or mean ± standard deviation.

* Statistically significant.

site and were treated with open packing and antibiotics. The 4.8-mm group had a greater number of patients with hemorrhage requiring transfusion than the 3.5-mm group; however, statistical significance was not achieved. In our study group, 17 patients required transfusion, 10 in the 4.8-mm stapler group and 7 in the 3.5-mm stapler group. The mean number of blood transfusions in the 4.8- and 3.5-mm stapler group was 5.3 and 4.6, respectively. Of those in the 4.8-mm stapler group, 7 patients required a blood transfusion secondary to intraluminal bleeding and 3 required transfusion for an unknown etiology. In the 3.5-mm staple group, 5 patients required a blood transfusion because of intraluminal bleeding and 2 required transfusion for an unknown etiology. No patient in either group required reoperation for bleeding.

Discussion

Narrowing of the gastrojejunostomy is known to occur after gastric bypass, regardless of whether a hand-sewn, linear-stapled, or circular-stapled technique is used. The use of a circular stapling device stemmed from our desire to produce a consistent outlet size with a low rate of anastomotic leakage [7,11] and personal preference. Initially, all LRYGB procedures were performed using a 21-mm circular stapler; however, this resulted in an unacceptably high rate of symptomatic stenosis, prompting us to adopt the 25-mm diameter stapler.

However, the cause of anastomotic stenosis after LRYGB could be multifactorial. Chronic fibrosis secondary to marginal ulceration can lead to narrowing of the anastomotic orifice [12]. Ischemia of the stomach or jejunum has also been suggested as a cause of stenosis [13]. Tension at the anastomosis and subclinical leakage at the gastrojejunostomy have also been suggested as factors in stricture formation [14].

No occurrence of anastomotic leak was noted in either group. The rate of wound infection did not differ between the two groups. A trend was seen toward a reduction in hemorrhage, but this did not achieve statistical significance. We were not able to determine whether a tendency toward less intraluminal bleeding was present between the two groups because of the unknown etiology of bleeding in 2 patients in the 3.5-mm stapler group. We found that the 4.8-mm stapler creates an internal diameter of 15 mm, and the 3.5-mm stapler creates an internal diameter of 16.5 mm. This difference could account for the decreased incidence of stenosis with the 3.5-mm stapler.

Our study had potential limitations. First, the mean age of the patients was different between the two groups. Although statistically significant, we believe a difference of 2 years was unlikely to be clinically significant in patients undergoing LRYGB. Second, it is possible that a "learning curve" contributed to the reduction in the stricture rate over time. However, several hundred LRYGB procedures were performed before our change in the staple height. In addition, the temporal distribution of anastomotic stenosis was evenly distributed within the individual groups. Finally, given the retrospective nature of our study and the relatively short surgical follow-up period, it is possible that some patients might have received treatment at outside facilities without our knowledge.

Conclusion

Our results suggest that the use of a 3.5-mm-height circular stapler to create the gastrojejunostomy during LRYGB is associated with a lower stricture rate than the 4.8-mm stapler. In addition, a trend was seen toward a reduction in hemorrhage, although this did not achieve statistical significance. These benefits were achieved without an increase in anastomotic leakage or wound infection. Currently, all LRYGB procedures at our institution are performed with a 25-mm circular stapler with 3.5-mm staples. The transition to a shorter staple height has not increased the cost of the procedure and might reduce the overall cost by preventing the need for secondary interventions.

Disclosures

K. Krause is a consultant for Covidien and receives consultant fees. The remaining authors have no commercial associations that might be a conflict of interest in relation to this article.

References

[1] Hedley AA, Ogden CL, Johnson CMD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents and adults, 1999–2002. JAMA 2004;291:2847–50.

[2] Shekelle PG, Hardy ML, Morton SC. Efficacy and safety of ephedra and ephedrine for weight loss and athletic performance. JAMA 2003; 289:1537–45.

[3] NIH Conference. Gastrointestinal surgery for severe obesity. Consensus Development Panel. Ann Int Med 1991;115:956–61.
[4] Gould JC, Garren M, Boll V, Starling J. The impact of circular stapler diameter on the incidence of gastrojejunostomy stenosis and weight loss following laparoscopic Roux-en-Y gastric bypass. Surg Endosc 2006;20:1017–20.
[5] Mechanick JI, Kuschner RF, Surgarman HJ, for the American Association of Clinical Endocrinologists, the Obesity Society, and ASMBS. Medical guidelines for clinical practice for perioperative nutritional, metabolic, and non-surgical support of the bariatric surgical patient. Endocr Pract 2008;14(Suppl 1):1–83.
[6] Wittgrove AC, Clark GW, Tremblay LJ. Laparoscopic gastric bypass, Roux-en-Y: preliminary report of five cases. Obes Surg 1994;4:353–7.
[7] DeMaria EJ, Sugerman HJ, Kellum JM, Meador JG, Wolfe LG. Results of 281 consecutive total laparoscopic Roux-en-Y gastric bypasses to treat morbid obesity. Ann Surg 2002;235:640–7.
[8] Higa KD, Ho T, Boone KB. Laparoscopic Roux-en-Y gastric bypass: Technique and 3-year follow-up. J Laparoendosc Adv Surg Tech A 2001;11:377–82.
[9] Wittgrove AC, Clark GW. Laparoscopic gastric bypass, Roux-en-Y in 500 patients: technique and results with 3 to 60-month follow-up. Obes Surg 2000;10:540–42.
[10] Kretzschamar CS, Hamilton JW, Wissler DM. Balloon dilatation for the treatment of stomal stenosis complicating gastric surgery for morbid obesity. Surgery 1987;102:443–6.
[11] Hutter MM, Randall S, Khuri SF, Henderson WG, Abott WM, Warshaw AL. Laparoscopic versus open gastric bypass for morbid obesity. Ann Surg 2006;243:657–62.
[12] Pope GD, Goodney PP, Burchard KW, et al. Peptic ulcer/stricture after gastric bypass: a comparison of technique and acid suppression variables. Obes Surg 2002;12:30–3.
[13] Spaulding L. The impact of small bowel resection on the incidence of stomal stenosis and marginal ulcer after gastric bypass. Obes Surg 1997;7:485–7.
[14] Sanyal AJ, Sugerman HJ, Kellum JM, Engle KM, Wolfe L. Stomal complications of gastric bypass: incidence and outcome of therapy. Am J Gastroenterol 1992;87:1165–9.