Video Available Online

SURGERY FOR OBESITY AND RELATED DISEASES

Surgery for Obesity and Related Diseases 5 (2009) 357–361

Video original article

Size really does matter—role of gastrojejunostomy in postoperative weight loss

Milton L. Owens, M.D., F.A.C.S., John P. Sczepaniak, B.S.

Coastal Center for Obesity, San Pedro, California

Received April 24, 2008; revised July 25, 2008; accepted August 26, 2008

Abstract

Background: Although the published data have clearly related the size of the gastrojejunostomy anastomosis to the subsequent likelihood of a stricture, a correlation between the anastomosis size and postoperative weight loss has not previously been described.

Methods: A retrospective comparison was made of 124 anastomoses accomplished with the 21-mm circular stapler followed by 100 anastomoses created with the 45-mm linear stapler technique at 6 community hospitals in Southern California. Age, gender, and preoperative weights were not significantly different between the 2 groups. The precise size of the anastomosis created using the linear stapler technique could not be determined, but it was calculated to be slightly larger than a 25-mm circular stapled anastomosis. Both weight loss trends were fit with a 1-phase exponential nonlinear regression analysis. The resulting curves were compared using an F test. A 1-tailed t test was also used to compare the weight loss at 12 months.

Results: An F test comparison of the exponential weight loss curves generated by the 2 anastomosis groups showed a significantly different trend in weight loss ($P < .001$). A 1-tailed t test comparison of the 2 groups at 12 months revealed significantly different results ($p < .0025$).

Conclusion: The results of this study show that the size of the anastomosis has a clear correlation with postoperative weight loss. A smaller opening results in significantly more weight loss. (Surg Obes Relat Dis 2009;5:357–361.)

Keywords: Weight loss; Linear anastomosis; Circular anastomosis; Gastric bypass; Gastrojejunostomy; Surgical technique

After gastric banding, the size of the pouch opening is universally accepted as a major determinant of postoperative weight loss. In contrast, after gastric bypass, the size of the pouch opening or gastrojejunostomy has consistently been found to have no affect on postoperative weight loss [1–5]. This has been true even when the gastrojejunostomy opening was as large as the jejunal lumen [1]; we, therefore, expected no effect on weight loss when, because of an unacceptably high stricture rate, we switched from a circular to a linear stapled anastomosis. However, as the following report demonstrates, weight loss was significantly different with the 2 techniques.

Methods

A retrospective review of the medical records was performed for 224 patients who had undergone laparoscopic gastric bypass from 2004 to September 2007 (Table 1). The circular stapler anastomosis (CSA) patients underwent surgery first, and, as a result, more were available for long-term follow-up (Table 2). The patient follow-up visits were approximately once a month for the first 3 months and once every 2 months for the first year postoperatively and approximately twice each year thereafter. A sufficient number of patients were available over time for statistically meaningful comparisons to be made.

The operations were done at 1 of 6 different community hospitals (Table 3). All the procedures were performed by 1 surgeon, and all were done laparoscopically. No revisions

Reprints not available from the authors.

1550-7289/09/$ – see front matter
doi:10.1016/j.soard.2008.08.020

Table 1
Patient characteristics

Characteristic	CSA	LSA
Age (y)		
Mean	40.7 ± 2.1	40.4 ± 2.3
Range	18–71	20–69
Gender (n)		
Male	19	14
Female	105	86
Weight (kg)	127 ± 2	128 ± 2
Height (m)	1.660 ± .009	1.666 ± .009
BMI (kg/m^2)	46.4 ± 1.2	45.6 ± 1.3
Operative time* (min)	110.6 ± 9.3 (n = 31)	92.5 ± 8.7 (n = 29)
LOS (d)	2.24 ± .07	2.3 ± 0.1

CSA = circular stapler anastomosis; LSA = linear stapler anastomosis; BMI = body mass index; LOS = length of stay.

Both groups compared using Student's *t* test to ensure comparability.

* Smaller sample size from Alvarado hospital used to compare operative times; operations that included hiatal hernia repair were also excluded; demographics of this smaller patient subset were not significantly different from whole group.

were included in the data, and no patients required conversion from the laparoscopic to an open approach. All patients underwent a comprehensive evaluation before surgery, including nutritional counseling, a medical evaluation by the surgeon, and a psychiatric evaluation. The usual criteria for surgery of a body mass index (BMI) of ≥40 kg/m^2 without co-morbidities or a BMI of ≥35 kg/m^2 with co-morbidities were applied. We introduced the use of a 2-week preoperative high-protein liquid diet in January 2007. Patient weight was recorded before and after the diet was initiated, and the greater weight was used in the calculations.

Gastric bypass was accomplished using an antecolic antegastric approach. With occasional exceptions for patients with difficult anatomy, the procedure was accomplished using 5 ports. When the CSA technique was used, the lateral left upper quadrant port was a 15-mm port to make possible the routine removal of a small segment of jejunum and a piece of stomach after the circular stapler had been introduced for the gastrojejunostomy. When the linear stapler anastomosis (LSA) technique was used, the lateral port was routinely 12 mm, and no tissue was removed.

Table 2
Duration of follow-up

Month	CSA (n)	LSA (n)
0	124	100
1	111	83
3	101	67
5	93	60
7	87	54
9	85	49
12	75	35
15	53	24
18	40	6

Abbreviations as in Table 1.

Table 3
Hospitals included in our study

Location	LSA group (n = 100)	CSA group (n = 124)
Alvarado	48 (48)	103 (83.06)
Chapman	21 (21)	6 (4.84)
Torrance	11 (11)	11 (8.87)
Tri-City	6 (6)	
Rancho	5 (5)	
South Bay	6 (6)	
Other	3 (3)	4 (3.23)

Abbreviations as in Table 1.

All hospitals from across Southern California.

The jejunum was divided using a linear stapler at a distance from the ligament of Treitz that permitted tensionless elevation of the Roux limb to the gastroesophageal junction. The jejunal mesentery was similarly divided. The jejunal limb was measured to a length of approximately 1 m. When it appeared that the Roux limb might be under some tension, it was tunneled through the omentum, which was later split. Otherwise, the omentum was allowed to drape around the Roux limb. The jejunal anastomosis was accomplished using the linear stapler.

The proximal gastric pouch was created by complete division of the stomach with a linear cutting stapler. The line of gastric division was started 3–4-cm distal to the gastroesophageal junction perpendicular to the lesser curve and then continued vertically to the left gastroesophageal junction. When using the CSA technique, the horizontal portion of the gastric division was made somewhat longer to accommodate the intra-abdominal introduction of the anvil and subsequent amputation and closure of the pouch. When using the LSA technique, the pouch was constructed loosely around a 32F bougie. In both cases, the intent was to have a pouch with an approximate 30-cm^3 volume. The pouch size was not otherwise calibrated.

When the circular stapler was used, the anvil with a sharp detachable arrow in the stem was introduced into the abdominal cavity. Then, using the anvil grasper, it was introduced through an opening in the left edge of the pouch, and, at the same time, the arrow was used to pierce the pouch wall just below the medial aspect of the horizontal staple line (Fig. 1). Next, the pouch opening was closed, and a portion of the pouch was amputated using the linear stapler. This left the anvil in the pouch with the stem protruding from just below the horizontal staple line. The detachable arrow was next removed, thereby preparing the anvil for connection with the circular staple handle. An opening was made in the end of the Roux limb, and the circular staple handle was introduced through the left lateral port site and into the Roux limb. The arrow to connect the handle to the anvil was deployed through the side of the Roux limb (Fig. 2). Once the connection was made, the stapler was fired and removed, and the opening in the Roux limb was closed, and the excess bowel was amputated and removed through the

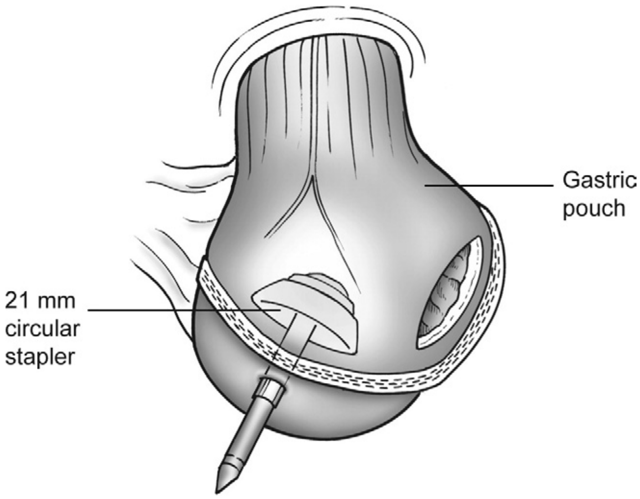

Fig. 1. Anvil placement into the proximal gastric pouch.

lateral port site along with the previously amputated piece of stomach. A total of 2 or 3 tacking sutures were placed to take tension off the anastomosis; the mesenteric defects were closed; and a round 19F drain was routinely placed and brought out through the lateral port.

When using the linear stapler to create the gastrojejunostomy, the end of the Roux limb was brought up and tacked

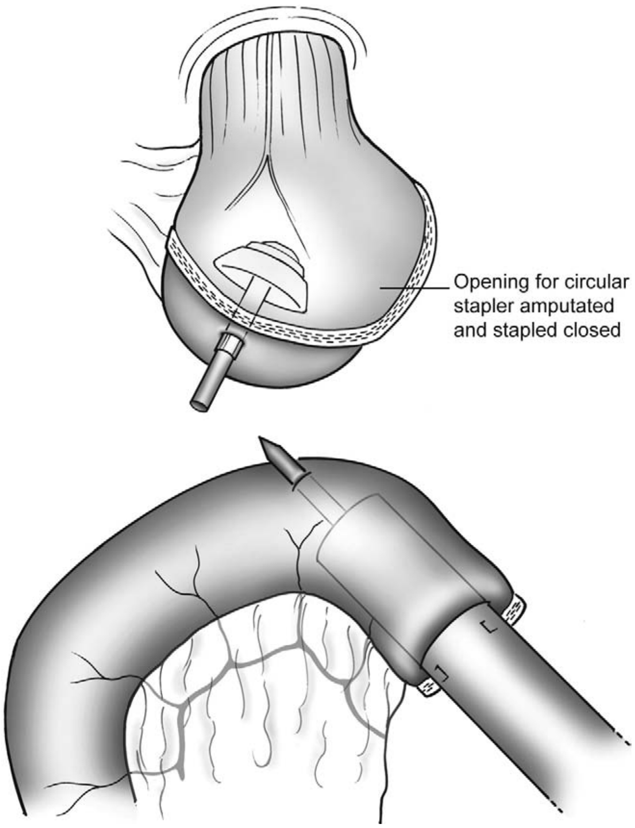

Fig. 2. Handle introduction into the end of the Roux limb.

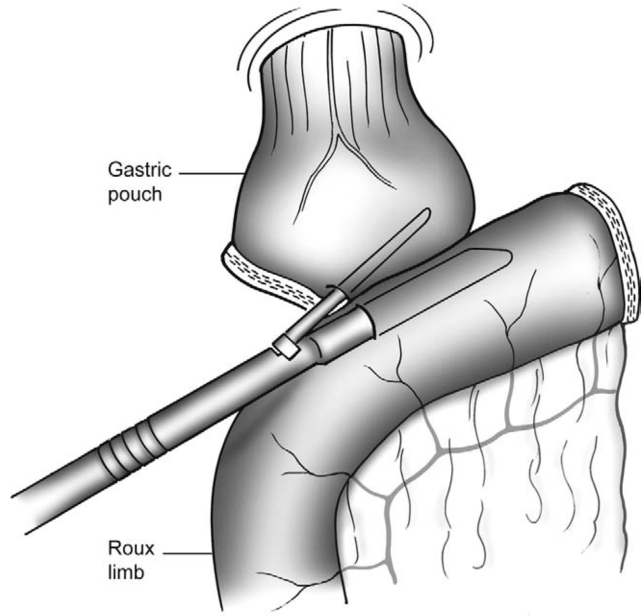

Fig. 3. Introduction of the linear stapler to 1/2 the staple line.

to the staple line near the gastroesophageal junction. Next, an opening was made in the gastric pouch against the end of the 32F lavage tube. A similar small perforation was made in the antimesenteric side of the Roux limb, and the ends of 45-mm linear stapler were introduced into both the pouch and the Roux limb for about one half the length of the staple line (Fig. 3). The stapler was fired, and then the opening for the stapler was closed in 2 layers with absorbable suture (Videos 1–7). A drain was used selectively and infrequently.

With both techniques, the mesenteric defects were closed.

Patients' absolute weights were converted to the BMI before fitting to the exponential decay curves. The data suggested use of a 1-phase exponential decay. The exponential equation also makes physical sense in its natural tendency to change more rapidly when distant from equilibrium. Both the CSA and LSA groups were fit using GraphPad Prism software to the equation $y = (y0 - c)\exp(-kx) + c$, where c is the plateau value and k is the rate constant. The equations were then compared using the f test. This test is a formal method to verify as statistically signficantly the visible difference in both curves. The recorded BMIs were found to best fit different exponential decay curves. The BMI values were also compared using a 1-tailed t test for the 3-month intervals around the 1-year postoperative mark. The average excess weight loss at 18 months was calculated for both groups using the Metropolitan Life Insurance tables for 1983.

Results

Using the F test, the 2 curves were shown to be different, with $P < .001$ (Fig. 4). Using the 1-tailed t test, the BMIs were significantly different at 1 year (P <.0025). The difference was calculated to be 1.8 ± 0.6 kg/m^2, which equates to a 7.8% difference in the percentage of excess weight loss and a difference of 10.5 lb.

The BMI at 3 points on the curves is provided in Table 4. The difference in the mean BMI at 18 months was 2.0 kg/m^2 between the 2 groups. This meant for a patient of average height (5 ft., 5.5 in.), a 12-lb difference in weight between the CSA and LSA groups or an average patient weight of 162 lb versus 174 lb. The percentage of excess weight loss was 86% versus 77%.

Table 4
Interpolated trend values under 95% confidence interval

Interval (mo)	BMI (kg/m^2)	
	CSA	LSA
6	30.6 ± .5	31.2 ± .6
12	27.3 ± .6	28.9 ± 1.0
18	26.6 ± .9	28.5 ± 1.2

Abbreviations as in Table 1.

Discussion

To compare the size of the anastomoses using the 2 techniques, it was necessary to do some rough calculations. The internal diameter of a 21-mm external diameter circular stapler is approximately 12 mm; thus, the circumference of the anastomosis will be about 37 mm. With the linear stapler, most of the anastomosis circumference will be comprised of 2 one-half lengths of the linear stapler, equal to about 45 mm, with an additional 10-15 mm from the hand-closed opening created for the insertion of the stapler. The resulting circumference will be approximately 55–60 mm. As a result, the LSA technique will result in a substantially larger anastomosis than will the CSA technique. The calculations were confirmed by our intraoperative impressions, such that the 32F tube, used to test the anastomosis for leaks, always passed more easily through the LSA anastomosis. Others have not found that the size of the anastomosis had an effect on weight loss. That our results differ might have been because of our larger numbers of patients and a longer follow-up. Nguyen et al. [3] compared the 21-mm and 25-mm CSA and found no difference at 1 year; however, only 29 patients began the study. Stahl et al. [4] had similar findings comparing the 21-mm and 25-mm circular stapler; however, relatively few patients appeared to have been followed up for >9 months. In our series, the group differences did not become apparent until about 8 months postoperatively (Fig. 4).

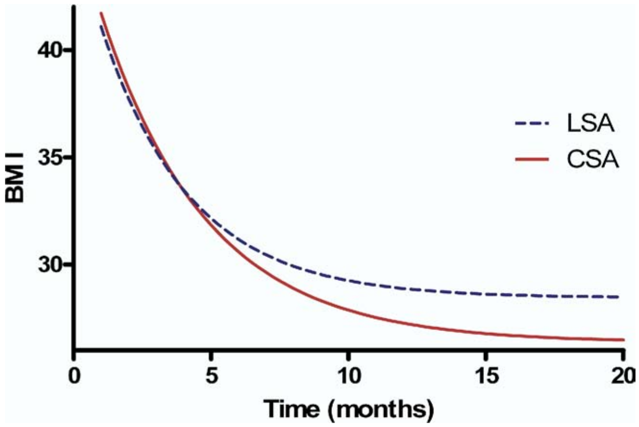

Fig. 4. Resulting exponential curves from the LSA and CSA BMI scatter plots.

Shope et al. [2] studied 61 patients but only followed up the group for 6–8 months. Also, the comparison of 25-mm CSA to LSA might have been a comparison of similar-size anastomoses [2]. The circumference created with the 25-mm circular stapler calculates to be approximately 47 mm. Supporting this concept, Haughn et al. [5] compared the LSA and 25-mm CSA and followed up 78 patients for 1 year and found no difference in weight loss.

Although no mortalities resulted, and the morbidities were otherwise similar in our 2 groups, we did have significantly more strictures in the CSA group. Compounding factors, such as tension on the anastomosis or a liquid protein diet given postoperatively (instead of a solid and dilating diet) might have contributed to the incidence of strictures, as well as some of the difference in weight loss. Because the smaller CSA anastomosis can result in both more strictures and greater weight loss, we have not taken a position on which is the better technique. Instead, we are pointing out that the best explanation for the differences in weight loss are the differences in the size of the anastomoses and that this has not previously been shown.

Acknowledgments

The authors would like to thank Bill Anderson, Ph.D., for his expert statistical advice, S. E. Wilson, M.D., for review and comments, and Julie Raines, B.S., for help in formatting and literature searches. We are also grateful for many hours of help from Sheryl Lang, R.N., at Alvarado Hospital.

Disclosures

The authors claim no commercial associations that might be a conflict of interest in relation to this article.

Appendix

Supplementary data

The videos associated with this article can be found, in the online version, at www.SOARD.org under "Multimedia Library."

References

[1] Kirkpatrick JR, Siegle T. Critical determinants of a successful gastric bypass: reservoir versus stoma. Am J Gastroenterol 1982; 77:464–6.

[2] Shope TR, Cooney RN, McLeod J, Miller CA, Haluck RS. Early results after laparoscopic gastric bypass: EEA vs GIA stapled gastrojejunal anastomosis. Obes Surg 2003;13:355–9.

[3] Nguyen NT, Sevens CM, Wolfe BM. Incidence and outcome of anastomotic stricture after laparoscopic gastric bypass. Gastrointest Surg 2003;7:997–1003.

[4] Stahl RD, Sherer RA, Seevers CE, Johnston D. Comparison of 21 vs. 25 mm gastrojejunostomy in the gastric bypass procedure—early results. Obes Surg 2000;10:540–2.

[5] Haughn C, Calic S, Carrodeguas L, Szomstein S, Rosenthal R, Bergamaschi R. Stricture rates after circular stapled vs. linear stapled gastrojejunostomy for laparoscopic gastric bypass. Eur Surg 2006;38:6:405–10.