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Original article

Results of gastrojejunal anastomotic technique designed to reduce stricture

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Abstract

Background: The incidence of strictures developing after gastrojejunostomy has been reported to range from 3% to 31%. We found an unacceptably high stricture rate (13%) using a 21-mm circular stapler. Attempts to use the 25-mm circular stapler were frustrated by disparities between the size of the instrument and the patient's anatomy. We, therefore, modified the technique to accomplish the anastomosis with the linear stapler and hand sewing (LSA) at community hospitals in Southern California.

Methods: A total of 124 anastomoses were accomplished with the circular stapler (CSA) followed by 100 anastomoses using the LSA technique. Drains were used routinely with the CSA technique but were used only selectively with the LSA technique. Stricture was defined as that requiring endoscopic dilation for symptoms. Leaks were confirmed radiologically or surgically, and bleeding was defined as the need for transfusion. Our analysis used the Student *t* test and Fisher's exact test, with $P < .05$ considered statistically significant.

Results: No patient died. The LSA technique was faster and resulted in significantly fewer postoperative strictures and complications compared with the CSA technique.

Conclusion: The results of our study have shown that the LSA technique, as described, is preferable to the CSA technique. (Surg Obes Relat Dis 2009;5:77–80.)

Keywords: Linear anastomosis; Circular anastomosis; Stricture; Stenosis; Gastric bypass; Port site infection; Laparoscopic technique

The incidence of strictures occurring after gastrojejunostomy has been reported to range from 1.6% to 31% [1–6]. Our own technique, using a 21-mm Ethicon circular stapler, resulted in an unacceptably high (13%) stricture rate. Initial attempts to use the 25-mm Ethicon circular stapler were frustrated by disparities between the size of the instrument and the port site in the body wall, the size of the small bowel lumen, and the size of the pouch relative to the anvil. We, therefore, modified the technique to accomplish the anastomosis with the linear stapler and hand sewing (LSA).

Methods

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

The operations were done at 1 of 6 different community hospitals (Table 2). All the procedures were performed by 1 surgeon, and all were done laparoscopically. No revisions were included in the data, and no patients required conversion from the laparoscopic to the open approach. All pa-

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Table 1
Patient demographics, operation time, and length of stay*

Variable	Technique	
	CSA (n = 31)	LSA (n = 29)
Age (yr)		
Mean	40.7 ± 2.1	40.4 ± 2.3
Range	18–71	20–69
Gender		
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	92.5 ± 8.7
LOS (d)	2.24 ± .07	2.3 ± .1

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

* Only operative time showed significant difference, at $P = .005$; operative time comparison only included patients from Alvarado, with those requiring hernia repair excluded.

tients underwent a comprehensive evaluation before surgery, including nutritional counseling, a medical evaluation by the surgeon, and a psychiatric evaluation. The usual criterion for surgery of a body mass index ≥40 kg/m^2 without co-morbidities or a body mass index of ≥35 kg/m^2 with co-morbidities was applied. We introduced the use of a 2-week preoperative high-protein liquid diet in January 2007 in response to data showing a reduction in liver size preoperatively with such a diet [7]. The 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 with 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 the stomach after the circular stapler had been introduced for the gastrojejunostomy. When the LSA technique was used, the lateral port was routinely 12 mm, and no tissue was removed.

Table 2
List of 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.

Data presented as number of patients, with percentages in parentheses.

* From across southern California.

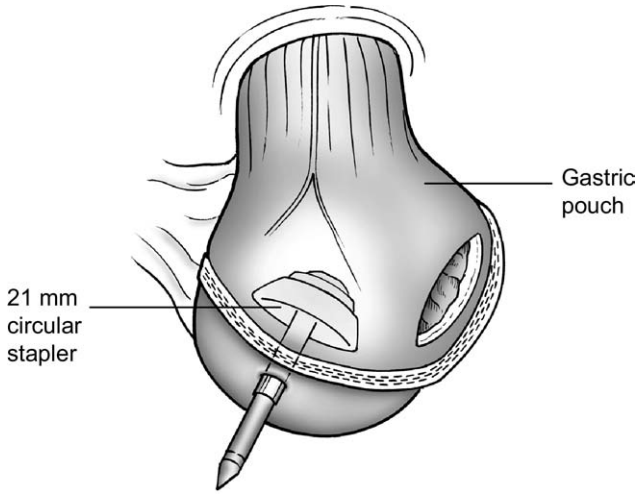

Fig. 1. Inserting the anvil transabdominally.

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 done using the linear stapler.

The proximal gastric pouch was created by complete division of the stomach with a linear cutting stapler. The line of the 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, and then, using the anvil grasper, it was both 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 lateral port site, along with the previously amputated piece of stomach. Two or three 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. The drain was placed not only as protection against a leak but to prophylactically drain the subcutaneous tissue, which was presumably contaminated from removal of the portion of small bowel and stomach.

When using the linear stapler to create the gastrojejunostomy, the end of the Roux limb was brought up and tacked 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 a 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. A drain was used selectively and infrequently.

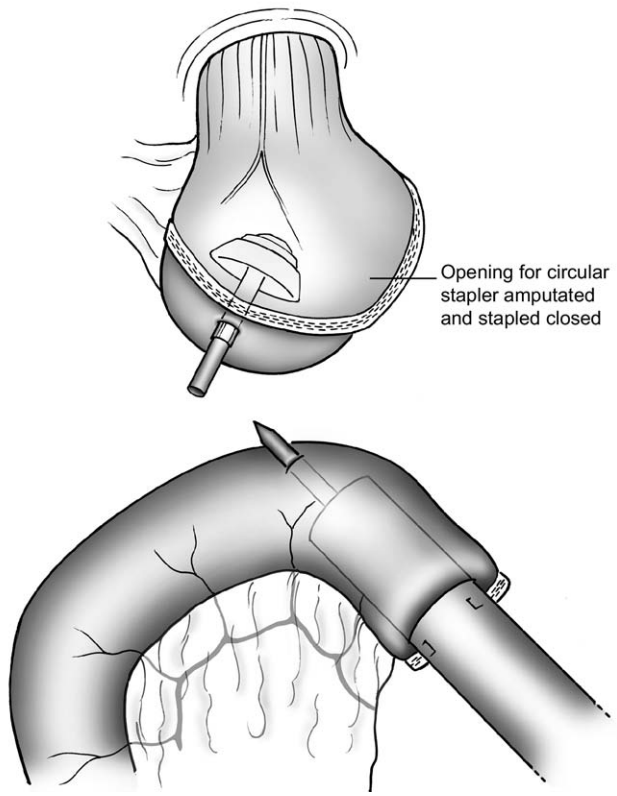

Fig. 2. Insertion of handle into the Roux limb.

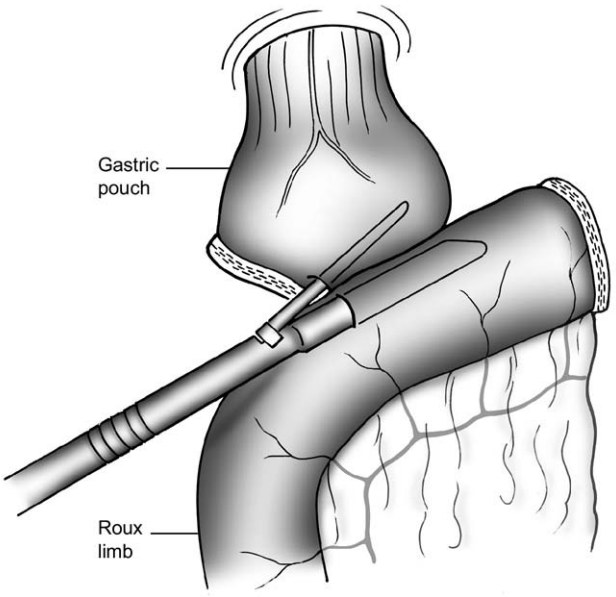

Fig. 3. Inserting the linear stapler into the gastric pouch and Roux limb.

With both techniques, the mesenteric defects were closed to prevent internal hernias.

Stenosis was defined as nausea and vomiting, with stenosis confirmed radiologically and requiring endoscopic dilation. Bleeding was defined as the need for transfusion. Infection was defined as a port site with redness and tenderness, requiring drainage.

Statistical analysis was done using Fisher's exact test for 95% confidence. A 2-tailed $P < .05$ was considered statistically significant.

Results

The operative time with the LSA technique was significantly less than with the CSA technique ($P < .005$; Table 2). The 60-day complication rate is presented in Table 3.

Table 3
Postoperative complications

Complication	CSA	LSA	*P* value
Stenosis	16	0	<.001
Leak	1	1	NS
Bleed	2	1	NS
Drain infection*	2	0	NS
Pneumonia	1	2	NS
UTI	1	0	NS
Nausea/vomiting	1	0	NS
Total	23	7	.0313
Readmissions	5	1	NS
Reoperation	3	2	NS

UTI = urinary tract infection; other abbreviations as in Table 1.

* Several patients in CSA group treated with antibiotics for oozing around stapler introduction site but did not meet criteria for infection.

The occurrence of stricture was the leading significant difference between the 2 groups. Sixteen patients required dilation, of whom, five required dilatation more than once.

Discussion

The LSA technique resulted in significantly fewer postoperative strictures, with a trend toward fewer port site infections and fewer readmissions.

Our results differed from those of 2 previous studies that were done with fewer patients but that showed the stricture rates of CSA and LSA to be indistinguishable [3,4], although Shope et al. [4] did not mention stricture directly.

In response to published studies indicating a smaller size liver preoperatively, we began the high-protein liquid diet as a routine shortly after beginning the LSA portion of the study. Arguably, the smaller liver might have contributed to the better outcomes in that arm of the study.

All our patients were instructed to consume a liquid protein diet for 2 weeks after surgery. We have done this to ensure adequate nutrition and weight loss and to avoid the risk of obstructing the anastomosis with solids and possibly causing vomiting and tearing. However, it could be that without the dilating effect of solids passing through the anastomosis, the development of a stricture is more likely.

We found a small increase in port site infections in the CSA group, which has been noted by others [2,4]. This is consistent with the increased trauma and contamination that occurs at the lateral port site, where the circular staple handle is inserted and the amputated bowel and stomach removed. That we did not see more infections was likely the result of also routinely bringing a drain out of that site.

According to Nguyen et al. [8] "the circular stapler technique is the most commonly reported technique in the literature for the creation of the gastrojejunostomy." Schauer et al. [9] described an evolution in technique similar to ours, and although they did not publish a comparison of the 2 approaches, they did finally decide to use LSA.

Conclusion

The LSA resulted in significantly fewer postoperative strictures and fewer complications and took less time. Also, with the LSA technique, port site trauma and port site infections might be reduced, as suggested by our results and those of others [2, 4].

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Disclosures

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

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