

Laparoscopic Gastric Bypass in a Porcine Model

CONSTANTINE T. FRANTZIDES, M.D., Ph.D. F.A.C.S., MARK A. CARLSON, M.D.,
and WILLIAM J. SCHULTE, M.D., F.A.C.S.

ABSTRACT

Gastric bypass and vertical banded gastroplasty are the two procedures used most frequently in the treatment of morbid obesity. In a pilot study, we used a porcine model in which laparoscopic gastric stapling and Roux-en-Y gastrojejunostomy were accomplished.

INTRODUCTION

IN THE UNITED STATES, 5 million people are considered morbidly obese (body mass index greater than or equal to 35 kg/m²). The morbidly obese patient has a much higher incidence of ischemic heart disease, hypertension, adult onset diabetes, restrictive respiratory disease, degenerative arthropathies, certain forms of cancer, and psychiatric illness compared with the general population.¹ Attempts at dietary management fail in 90% of morbidly obese patients.²

Several surgical procedures have been introduced in the last 50 years, some of which have been effective in the treatment of morbid obesity. Gastric bypass and vertical banded gastroplasty are the two operations most frequently used today.³⁻⁸ A comparison between these two procedures demonstrated the superiority of gastric bypass.^{9,10} The success of this operation is the result of creating a small reservoir (30 mL) and restrictive outlet (8-10 mm), which prolong the feeling of satiety.

We have undertaken a pilot study in a porcine model in which laparoscopic Roux-en-Y gastrojejunostomy was accomplished. Emphasis is placed on the technical aspects and instrumentation needed.

MATERIALS AND METHODS

Six 35-40 kg pigs were used. Under general endotracheal anesthesia, pneumoperitoneum is established and maintained at 13 mm Hg. Four 10-11-mm and one 12-mm trocars are used. The laparoscopic Roux-en-Y gastrojejunostomy duplicates the open procedure. In 4 animals, the circular stapler (Endopath ILS 21 mm, Ethicon, Cincinnati, OH) was used to produce an end-to-side anastomosis. In two animals, the linear stapler (Endopath 35 mm) was used to form a side-to-side anastomosis.

The lesser sac is entered 5 cm distal to the gastroesophageal junction along the lesser curve of the stomach, preserving all vessels. A gastrotomy on the anterior wall is made distal to this point. The anvil of the endoscopic circular stapler is introduced into the abdomen through a 3-cm incision on the abdominal wall. The anvil is then guided through the gastrotomy to the chosen site of the anastomosis with a prolene suture on a straight needle (Fig. 1). The stomach is stapled transversely with a thick tissue linear cutter-stapler (Endopath 35 mm) to create a 30-40 mL pouch (Fig. 2).

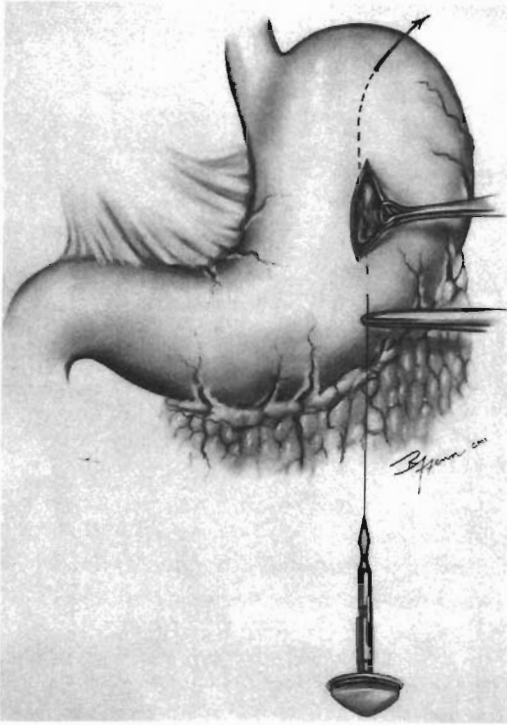


FIG. 1. Insertion of the anvil of the circular stapler (Endopath ILS 21 mm) through a gastrotomy into the proximal stomach. A straight needle is used to guide the anvil to the anastomotic site.

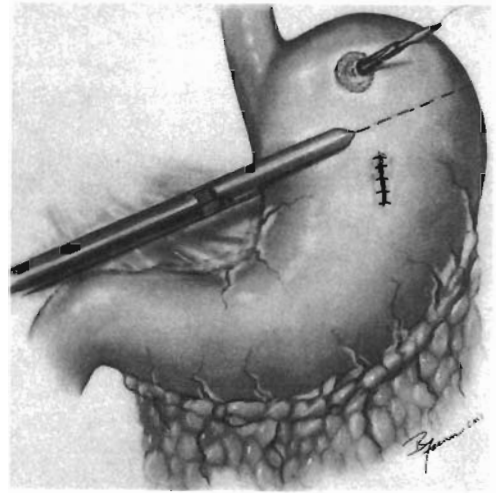


FIG. 2. Division of the stomach with the linear stapler-cutter to create the proximal gastric pouch.

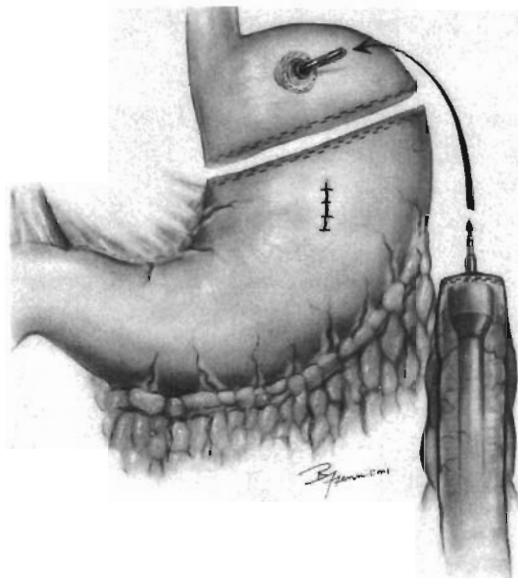


FIG. 3. Approximation of the circular stapler to the anvil for creation of the gastrojejunostomy.

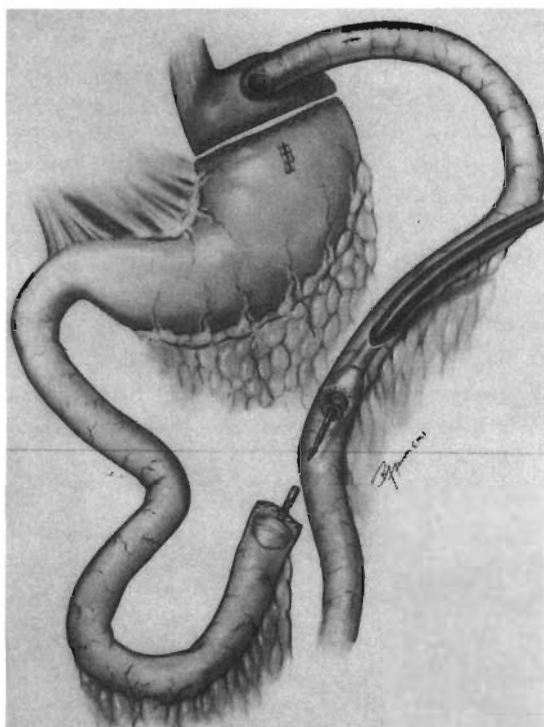


FIG. 4. Creation of a side-to-end jejunojejunostomy. Alternatively, a side-to-side anastomosis may be formed with a linear stapler.

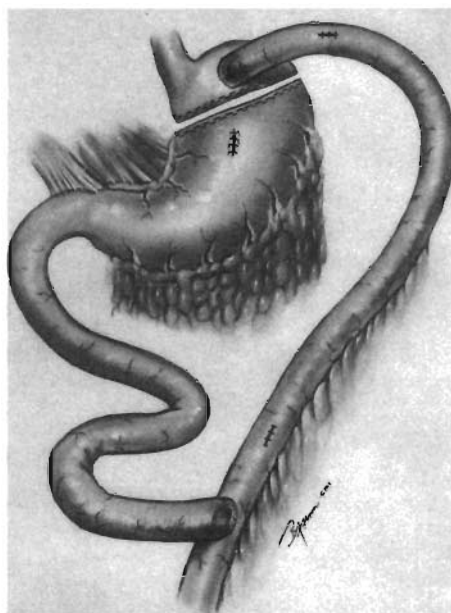


FIG. 5. The completed laparoscopic gastric bypass.

The jejunum is divided with a linear cutter-stapler (Endopath 35 mm) at a point 35 cm distal to the ligament of Treitz. An enterotomy is performed in the distal limb of jejunum to allow the introduction of the circular stapler. The anvil is launched into the circular stapler, and an 13-mm anastomosis is created (Fig. 3). The gastrotomy and enterotomy are closed laparoscopically with 3-0 running suture.

Jejunal continuity is reestablished by anastomosing the proximal jejunal limb to the side of the distal limb either extracorporally or with a laparoscopic surgical stapler (Figs. 4, 5). This anastomosis can also be done in a side-to-side fashion.

In the 2 animals in which the linear stapler was used for the creation of gastrojejunostomy, a gastrotomy and enterotomy were made, and the two arms of the linear stapler were introduced into these openings. The stapler arms were marked to designate a length that would result in a 1-cm anastomosis. The two openings remaining after the stapler application were closed with interrupted sutures.

All animals were killed after completion of the procedure so that the anastomoses could be evaluated for size and integrity.

RESULTS

All 4 pigs in which the circular stapler was used had an intact anastomosis that measured 13 mm. Both pigs with the linear stapler anastomosis had a 15-mm opening, and 1 of them had a leaking anastomosis.

DISCUSSION

The open gastric bypass is a major abdominal operation with a long painful postoperative recovery. Prolonged hospitalization puts the patient at risk for infectious and thromboembolic complications. If the

gastric bypass could be accomplished through the laparoscopic approach, a faster recovery could be expected that would minimize the potential postoperative complications. In addition, the minimally invasive aspects of laparoscopy would make the gastric bypass more appealing to the patient, so that he or she might decide to have the operation earlier, before the development of obesity-associated complications.

Based on our small number of observations, it appears that the use of the circular stapler results in a more secure and predictably sized gastrojejunostomy than the use of the linear stapler. Currently available instrumentation appears to be inadequate, as we have realized with our pilot study. It has been shown with the open technique that an 8-mm anastomosis provides optimal results. A circular stapler that would result in an 8-mm anastomosis is not available.

This article points out a few technical hints in the performance of laparoscopic gastric bypass. A crucial point in the procedure is the introduction of the anvil of the circular stapler into the proximal gastric pouch. Wesley et al.¹¹ have described transesophageal introduction of the circular stapler into the proximal pouch. We favor our technique because it is simpler, and the potential risk for esophageal perforation is avoided. Once a few technical issues have been resolved and appropriate instruments become available, the laparoscopic approach for gastric bypass may be a viable alternative to open surgery.

REFERENCES

1. National Institutes of Health Consensus Development Conference Statement. Health implications of obesity. Bethesda, MD: National Institutes of Health, February 11-13, 1985.
2. National Institutes of Health Consensus Development Conference Statement. Gastrointestinal surgery for severe obesity. Bethesda, MD: National Institutes of Health, March 25-27, 1991.
3. Pories WJ, Flickinger EG, Meelheim D, et al: The effectiveness of gastric bypass over gastric partitioning in morbid obesity. *Ann Surg* 1982;196:389.
4. Linner JH. Comparative effectiveness of gastric bypass and gastroplasty. *Arch Surg* 1982;117:695.
5. Naslund I, Wickbom G, Christoffersson E, et al: A prospective randomized comparison of gastric bypass and gastroplasty. *Acta Chir Scand* 1986;152:681.
6. Mason EE. Vertical banded gastroplasty for obesity. *Arch Surg* 1982;117:701.
7. Mason EE, Scott DH, Maher JW, et al: The first decade of vertical banded gastroplasty (VBG) for treatment of extreme obesity. *Obesity Surg* 1991;1:228.
8. MacLean LD, Rhode BM, Forse RA: Late results of vertical banded gastroplasty for morbid obesity. *Surgery* 1990;107:20.
9. Sugerman HJ, Starkey JV, Birkenhauer R: A randomized prospective trial of gastric bypass versus vertical banded gastroplasty for morbid obesity and their effects on sweets versus non-sweets eaters. *Ann Surg* 1987;205:613.
10. MacDonald KG, Pories WJ: Roux gastric bypass or vertical banded gastroplasty. Surgical treatment of morbid obesity. *Prob Gen Surg* 1992;9:321-331.
11. Wesley C, Whitgrove A: Laparoscopic gastric bypass, roux-en-Y. *Obesity Surg* 1994;4(4).

Address reprint requests to:
Constantine T. Frantzides, M.D., Ph.D., F.A.C.S.
Associate Professor, Department of Surgery
Medical College of Wisconsin
9200 West Wisconsin Avenue
Milwaukee, WI 53226