

# Remedial Surgery Following Failed Gastroplasty for Morbid Obesity

FREDERIC E. ECKHAUSER, M.D., JAMES A. KNOL, M.D., WILLIAM E. STRODEL, M.D.

Gastroplasty (GP) or gastric bypass with exclusion of 90% of the distal stomach (GBP) have largely replaced small bowel bypass in the surgical management of morbid obesity. Despite the theoretical advantages of GP over GBP, revision rates of up to 20% are reported with GP because of unsatisfactory weight loss resulting from staple line disruption, pouch dilatation, and/or stomal enlargement. This report describes four alternative surgical approaches to failed GP. "Complete" partitioning of the stomach accompanied by gastrogastrostomy or conversion to Roux-en-Y GBP is recommended. Because of intangible advantages associated with exclusion of the stomach and duodenum, conversion to GBP is favored over GP revision in such cases.

**I**NCOMPLETE GASTRIC PARTITIONING (gastroplasty) or gastric bypass with exclusion of 90–95% of the stomach have largely replaced intestinal bypass in the treatment of refractory morbid obesity, largely due to serious late complications associated with the latter procedure.<sup>1,2</sup> Despite the low incidence of late complications after gastric bypass, perioperative complications requiring reoperation occur in up to 10% of patients and mortality rates of 2–3% are common.<sup>1–5</sup> Early reoperation is necessitated by complications such as perforation of the proximal gastric pouch or the development of stomal stenosis and obstruction. The majority of late operations are made necessary because of inadequate or unsustainable weight loss due to technical problems, including separation of the staple line partition, dilatation of the proximal gastric pouch, or enlargement of the gastrojejunal or gastrogastric stomas.

Gastroplasty (GP) was introduced in 1971 as a simplified alternative to gastric bypass.<sup>5</sup> Early hopes that eliminating the need for a gastrointestinal anastomosis would decrease the frequency of early postoperative complications proved to be unfounded.<sup>4,6–8</sup> It also became apparent that incomplete gastric partitioning procedures without reinforcement of the channel between the upper and gastric lower pouches resulted in late failure rates of 25–40%.<sup>5,9</sup> Modifications of gastroplasty were developed

*From the Departments of Surgery, University of Michigan Hospital and Veterans Administration Medical Center, Ann Arbor, Michigan*

to decrease complications associated with staple line disruption, pouch dilatation, and stomal enlargement.<sup>10–13</sup> However, the many and often widely dissimilar variations which resulted have created technical problems that may vex even the most experienced bariatric surgeon, should revision become necessary. Despite such difficulties, remedial techniques for failed gastroplasty have received little emphasis in the surgical literature. This report describes four alternative approaches to the failed gastroplasty and addresses the question of gastroplasty revision vs. conversion to gastric bypass in such cases.

**Case 1.** M.H., a 44-year-old white woman, presented with a long-standing history of obesity. Her preoperative weight of 101 kg was calculated to be 200% of her ideal body weight. Previous attempts at weight reduction, including supervised diets, behavior modification, and hypnotherapy had been unsuccessful. Mandibular fixation 5 years earlier had resulted in a weight loss of 31 kg, but removal of the wires resulted in immediate weight regain. Endocrine causes of obesity were ruled out by appropriate laboratory testing. In June 1980, the patient underwent greater curvature gastroplasty, according to the method described by Gomez.<sup>10</sup> A 9 mm gastric channel or pseudopylorus was fashioned along the greater curvature of the stomach reinforced with a continuous seromuscular 2-0 polypropylene suture over a 28 F dilator. The continuous suture was reinforced with a second inverting layer of nonabsorbable sutures. Figure 1 is a postoperative barium swallow obtained in this patient following Gomez gastroplasty. Over the next 8 months, the patient lost 23 kg or 45% of her calculated excess body weight. However, subsequent weight regain of 14 kg was associated with the disappearance of early postprandial satiety and with tolerance of increasing quantities of food. A barium contrast study demonstrated stomal dilatation, probable disruption of the staple line partition, and unimpaired, rapid emptying of the proximal gastric pouch (Fig. 2). Fiberoptic endoscopy showed stomal enlargement and transmural migration of the polypropylene suture into the gastric lumen. The patient underwent revision to a Gomez gastroplasty with a smaller pouch and stoma 16 months after her original procedure. The new pseudopylorus was constructed over a 24 F dilator and measured 8 mm in diameter. Recovery was unremarkable. Over the next 3 months, the patient lost an additional 25 kg resulting in a total weight loss of 50 kg, or approximately 90% of her calculated excess body weight. She began complaining of intermittent postprandial emesis of partially undigested food which progressively became more frequent.

Reprint requests: Frederic E. Eckhauser, M.D., Chief, Surgery Service, Department of Surgery, Room 440A, Veterans Administration Medical Center, 2215 Fuller Road, Ann Arbor, Michigan 48105.

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FIG. 1. Postoperative barium swallow obtained in patient M.H. following greater curvature (Gomez) gastroplasty. Continuity between the small upper gastric pouch and the rest of the stomach is maintained via a 9 mm channel (small arrow) reinforced with a circumferential polypropylene suture.

She was readmitted in August 1982 after having lost an additional 10 kg in weight. A contrast examination showed a small stoma of 3–4 mm with markedly delayed emptying of the upper pouch. Fiberoptic endoscopy was used to place a guidewire through the gastric channel. The stoma was then successfully dilated to 10 mm using Puestow bougies. Following dilatation, the patient was better able to tolerate solid foods. She required one additional endoscopic dilatation to 12 mm, but has remained largely symptom-free since that time.

#### Comments

Pernicious vomiting continued to be a problem with this patient despite efforts at psychotherapy and behavior modification. Although the proximal pouch had been calibrated at operation to hold 50–60 ml, persistent overeating by the patient resulted in progressive enlargement of the pouch to greater than four times its original volume. Endoscopic dilatation of the gastric channel was necessary to improve pouch emptying and eliminate stasis. Continued noncompliance and failure to arrest weight loss

may necessitate restoration of gastric continuity in this patient.

**Case 2.** C.B., a 35-year-old white man, underwent jejunioileal bypass in 1977. His preoperative weight of 155 kg was 211% of his calculated ideal body weight. Following operation, he lost 32 kg in 24 months but developed chronic pancreatitis necessitating reversal of the bypass, as well as splenectomy and distal pancreatectomy. Over the next 18 months, his weight increased to 189 kg. In October 1981, he underwent Gomez gastroplasty over a 28 F dilator. The 2-polypropylene suture used to transfix and reinforce the lateral few staples in the gastric staple line partition was secured over small Teflon pledgets to prevent the suture from cutting through the stomach wall. Following operation, he developed a wound infection and a fascial dehiscence which resulted in a large abdominal wall hernia. Despite an initial weight loss of 30 kg, early weight stabilization prompted re-evaluation which showed dilatation of the stoma to 35 mm. He underwent revision using a modification of the vertical banded gastroplasty described by Mason (Fig. 3C).<sup>14</sup> The greater curvature gastric channel was reinforced with a prestretched 5.5 cm length of polypropylene (Marlex) mesh and was covered with omentum to prevent adherence to the liver and angulation of kinking. The partition between the upper and lower gastric pouches was completed with a single application of the TA-stapler. The patient lost an additional 20 kg, but developed increasingly frequent postprandial vomiting of solids progressing to include liquids. Barium swallow showed high-grade obstruction of the gastric channel with delayed emptying of barium into the distal gastric compartment. A trial of nasogastric tube decompression and intravenous hyperalimentation was unsuccessful. Endoscopic dilatation was attempted but unsuccessful because we were unable to

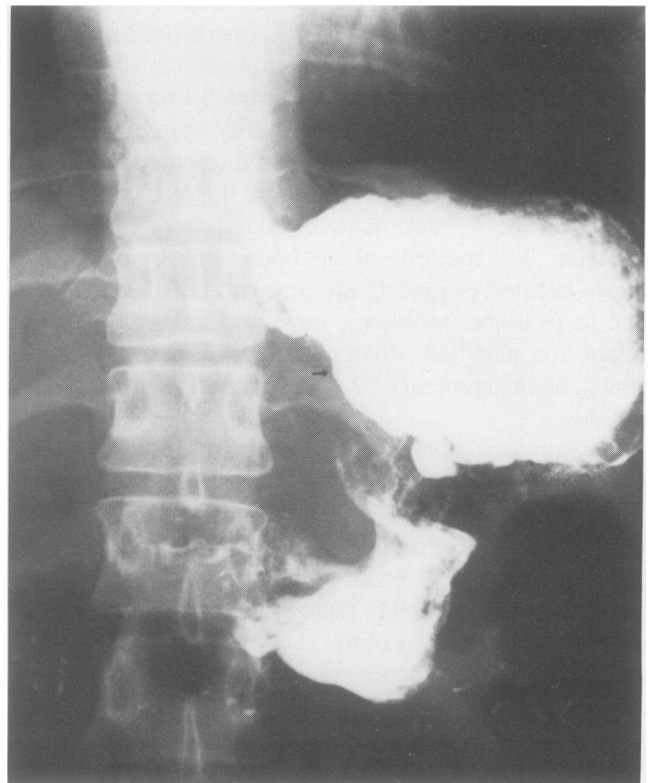
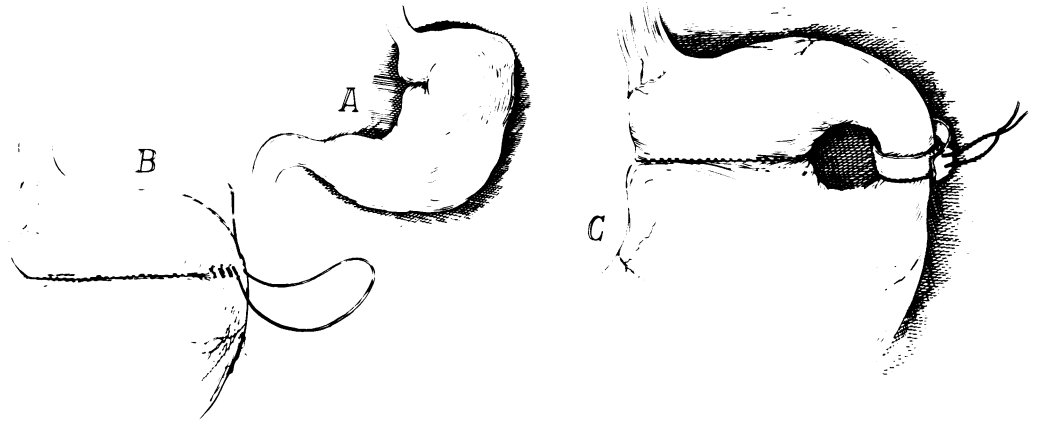


FIG. 2. Free flow of barium into stomach, suggesting disruption of staple line partition and/or stomal enlargement in patient M.H. Remnant of horizontal staple line can be seen just above the small arrow.

FIG. 3. Revision technique in patient C.B. following failed Gomez gastroplasty (A, B). The EEA stapler was used to create a 28 mm defect in the stomach wall along the greater curvature (C). A prestretched 5.5 cm segment of Marlex mesh was used to encircle the gastric channel to prevent premature enlargement.



visualize the stoma for intubation with a guidewire. The patient eventually underwent revision to a Roux-en-Y gastric bypass according to the technique of Griffen and others.<sup>15</sup> An 8 mm gastrojejunostomy was created using two layers of nonabsorbable suture. Recovery was unremarkable and he left the hospital 2 weeks later on a semi-solid diet.

#### Comments

Erosion of the pledget and seromuscular polypropylene suture through the stomach wall led to formation of a bezoar in the stomal lumen. To prevent obstruction of the new gastric stoma, the pledget and suture, along with a circular segment of stomach wall, were excised with the EEA stapler. A collar of Marlex mesh was applied to prevent subsequent dilatation of the newly created gastric channel. Ischemia of this segment of stomach wall or pressure necrosis caused by an overly tight collar led to the formation of a localized area of staple disruption and occult leak with migration of the Marlex into the stomal lumen.

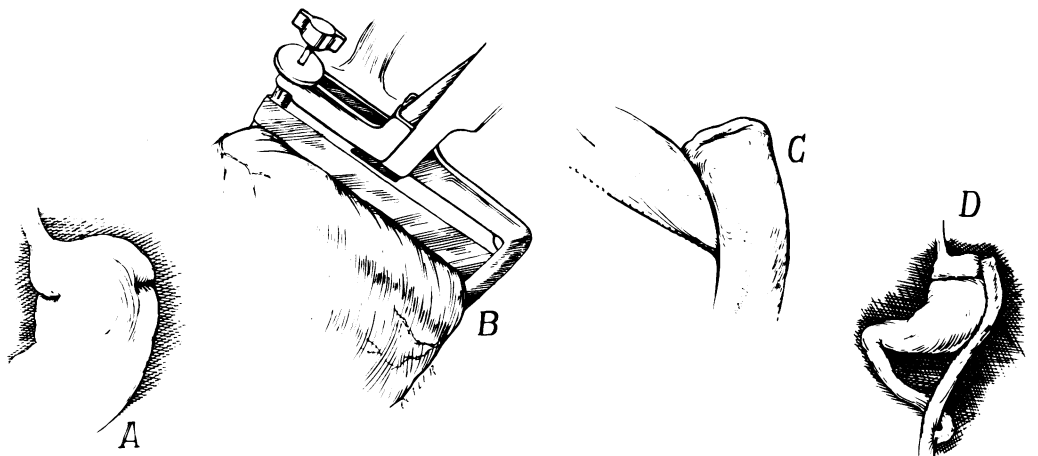
**Case 3.** M.K., a 36-year-old white woman, presented with childhood onset obesity. Her preoperative weight of 136 kg was 267% of her calculated ideal body weight. She underwent incomplete gastric partitioning

elsewhere in 1979, according to the technique described by Pace and Carey.<sup>9</sup> Despite an early loss of 21 kg, by 1 year her weight had stabilized. A barium upper GI series was interpreted as normal and a solid phase radionuclide gastric emptying study using <sup>99m</sup>Tc-DPTA mixed with oatmeal showed normal gastric emptying T of 59 minutes, compared to norms in our institution of 46 to 25 minutes. In July 1982, she underwent conversion to a Roux-en-Y gastric bypass using a 45 cm segment of jejunum (Fig. 4). A complete gastric partition was established using a single application of 4.8 mm staples. The gastrojejunostomy was performed over a 24 F dilator using a two layer technique. By the eighth postoperative week, the patient had lost an additional 14 kg. Although she describes symptoms of mild dumping after ingestion of foods with high carbohydrate content, she continues to lose weight and remains free of obstructive symptoms.

#### Comments

The partitioning technique described by Carey and Pace consists of removing three central staples from the TA-50 or 90 stapler. Application of the stapler to the upper stomach creates a centrally located gastric channel approximately 9 mm in diameter. Dilatation of the channel, which we now know is inevitable without reinforcement, occurred in this patient and resulted in a large defect

FIG. 4. Following a failed Pace-Carey gastroplasty with stomal enlargement (A) and weight gain, patient M.K. underwent complete staple line partition of the stomach (B) followed by conversion to a Roux-en-Y gastric bypass (C, D).



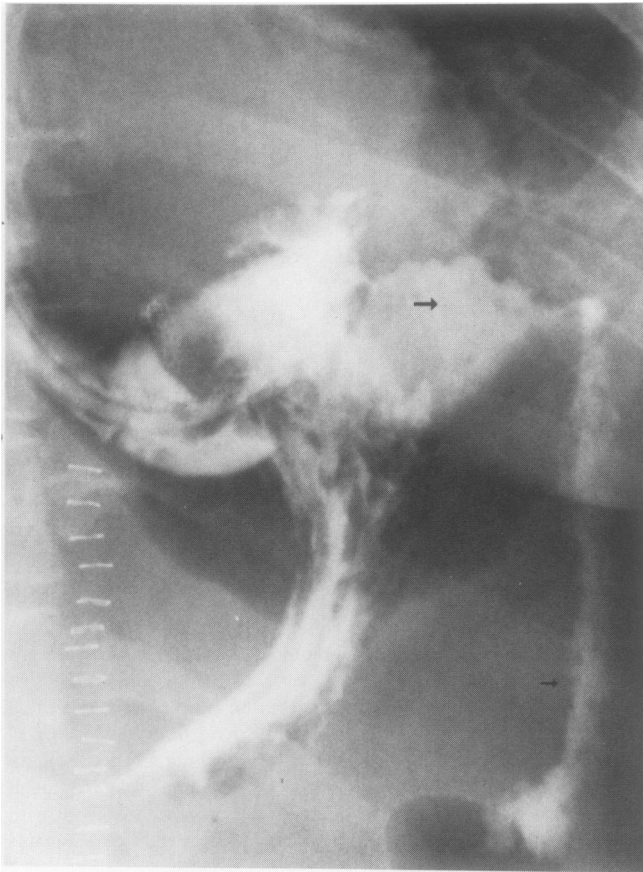


FIG. 5. Postoperative Hypaque swallow in patient S.H. who developed a gastric leak 6 days after Gomez gastroplasty. The swallowed contrast material can be seen extravasating into the free peritoneal space. Some dye passes into the distal stomach segment.

bordered on both sides by thickened stomach consisting of apposed anterior and posterior walls. To minimize future risks of stomal enlargement, a complete staple line partition separating the upper and lower gastric pouches was established and a Roux-en-Y gastric bypass was performed.

**Case 4. S.H.**, a 33-year-old white woman, presented with longstanding obesity and a preoperative weight of 122 kg which was 230% above her calculated ideal body weight. The possibility of an endocrinopathy was excluded with appropriate laboratory tests. The patient had been refractory to all nonsurgical forms of weight reduction. In November 1981, she underwent uncomplicated Gomez gastroplasty similar to that performed in Cases 1 and 2. Six days after surgery, the patient experienced a paroxysm of gagging and dry heaves followed by left upper quadrant and left shoulder pain. Four hours later she appeared anxious, was mildly tachypneic, and febrile to 101 F. A Hypaque swallow demonstrated extravasation of contrast material near the esophagogastric junction and a question of projection of the nasogastric tube outside the stomach (Fig. 5). She underwent emergency reoperation, at which time total dehiscence of the pseudopylorus was noted. The stomach wall was debrided and closed carefully in layers. A 9 mm gastrogastrostomy, similar to that described by Buchwalter and others<sup>13</sup> was constructed to re-establish gastric continuity (Fig. 6). Following operation, her pulse rate and temperature rapidly returned to normal. Four days later, tachycardia and respiratory distress recurred. A second Hypaque swallow showed extravasation of dye from the posterior fundic portion of the stomach. At reoperation, severe inflammation in the upper abdomen precluded visualization of the leak site for primary repair, and multiple soft drains were placed for drainage. Her postoperative course was complicated by wound sepsis and the development of an enterocutaneous fistula. After 2 months of intravenous hyperalimentation, she underwent repair of the enterocutaneous fistula and closure of an abdominal wall hernia defect. She recovered uneventfully and was discharged nearly 5 months after her initial admission to the hospital. Her weight at the time of discharge was 99 kg or 81% of initial body weight.

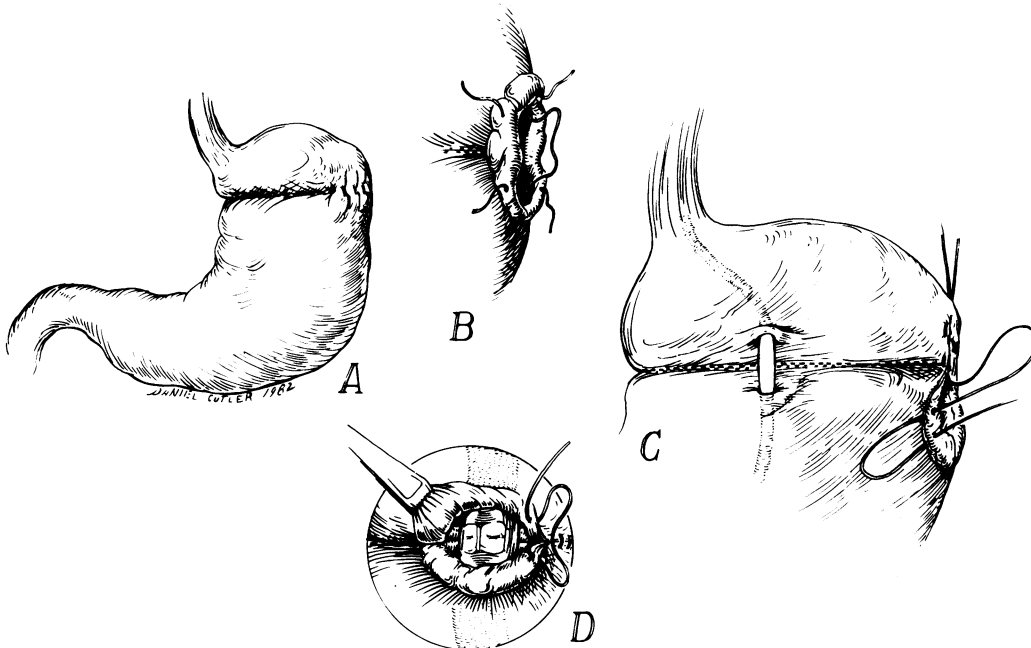


FIG. 6. Patient S.H. underwent emergency reoperation for acute disruption of the greater curvature stoma following Gomez gastroplasty. The gastric defect was carefully closed in layers (B, C) and continuity between the upper and lower stomach segments was re-established primarily with a 9 mm gastrogastrostomy (C, D).

## Comments

This presentation was similar to postemetic rupture of the esophagus seen with Boerhaave's syndrome. Violent retching presumably caused a marked increase in intra-abdominal and intra-gastric pressure, which could not be vented because the narrow gastric channel was obstructed by the nasogastric tube. This type of perforation is distinct from the so-called "pistol-shot" perforation which results from impingement of the tip of the nasogastric tube against the gastric wall with subsequent pressure necrosis and perforation.

## Discussion

Gastroplasty operations were developed to simplify "gastric reduction" and obviate many of the complications associated with gastric exclusion or bypass.<sup>16,17</sup> It was initially hoped that eliminating the need to open the bowel and construct a gastrointestinal anastomosis by performing gastroplasty would reduce the likelihood of peritoneal contamination and wound sepsis. However, the incidence of infectious complications observed with both procedures has been shown to be similar.<sup>6,8</sup> Unlike gastric bypass, gastroplasty does not alter gastrointestinal continuity and theoretically maintains the normal sequence of digestion and absorption. The lack of a complete staple line partition across the stomach facilitates endoscopic or roentgenographic evaluation of the distal stomach, should this become necessary.

Leaks are equally common after gastroplasty or gastric bypass and although the mechanisms are similar, the sites of perforation differ.<sup>18</sup> Leaks following gastric bypass occur most commonly from the gastrojejunostomy site, but also occur frequently from the stapled or sutured ends of the stomach when gastric transection is employed. The causes of leakage include ischemia due to devascularization of the upper stomach pouch, distal obstruction of the retrocolic bowel segment and closed loop obstruction of the excluded stomach. Mason et al., in 1979, reported 45 leaks among 40 of 620 patients who underwent a variety of gastric operations for morbid obesity.<sup>19</sup> In 35 patients undergoing gastric bypass with or without transection, nine leaks resulted from so-called "pistol-shot" perforations. Similarly, in five patients undergoing gastroplasty, two leaks were attributed to this mechanism. Perforation at the site of the greater curvature gastric channel was observed in one additional gastroplasty patient.

There are no absolute findings in morbidly obese patients that reliably indicate a leak following gastric reduction surgery. These patients appear to have an unusual level of pain tolerance and seldom complain following gastroplasty or gastric bypass. Physical findings are often absent but subjective complaints of abdominal, back, or

left shoulder pain should heighten one's index of suspicion. A sudden increase in pulse rate, an unexplained leukocytosis, or left-sided pulmonic findings on physical examination or x-ray should prompt an x-ray examination using water soluble contrast material. Mason and co-authors showed that survival rates among patients with leaks vary, depending on the patient's age and the experience of the surgeon.<sup>19</sup> Prior to 1975, they observed a 32% survival rate among patients with leaks. In contrast, survival of patients treated after 1975 increased to nearly 90%, primarily because of increasing awareness of the problem, earlier diagnosis, and more effective treatment. Case 4 illustrates that major disruptions of the pseudopylorus in patients undergoing greater curvature gastroplasty can be managed effectively with debridement/closure and immediate as opposed to delayed reconstruction of gastro-gastric continuity.

Problems with maintenance of the staple line partition and prevention of stomal dilatation have plagued gastric reduction surgery.<sup>20</sup> Early gastroplasties by Mason, et al.<sup>5</sup> and Pace and collaborators<sup>9</sup> without external support of the channel resulted in failure rates of 29% and 51%, respectively. Animal studies by Ellison, et al.<sup>21</sup> and Brolin and Ravitch<sup>22</sup> showed that the staple line was weakest at 2 to 4 weeks following operation and that the strength increased to levels comparable with the unstapled stomach by 8 weeks. They further demonstrated that stomal dilatation was not related to stretching of the lumen alone, but involved partial disruption of the staple line beginning at the stoma and progressing laterally.

Attempts to prevent premature stomal enlargement have included restriction of solid foods for 6 to 8 weeks after operation, reinforcement of the partition with a second row of staples or with prosthetic material such as Marlex or Teflon, and external reinforcement of the channel itself.

Ellison, et al. in 1980 reported 21 failures among 111 patients undergoing Pace-Carey gastroplasty where postoperative intake was limited to liquids alone.<sup>15</sup> The observed failure rate of 19% was significantly less compared to 50% for those patients permitted solid foods. In that report, two applications of the TA-stapler (four rows of staples) in 15 patients further decreased the incidence of early disruption.

Brolin and Ravitch evaluated modifications of the Pace-Carey gastroplasty in dogs using various types of staple line reinforcement.<sup>22</sup> Reinforcement of the partition with a second application of the TA-stapler decreased the incidence of early disruption. Among animals in whom the staple line partition was reinforced with either Marlex mesh or Teflon, the disruption rate was similar to that seen following two applications of the TA-stapler without reinforcement. However, the incidence of leak and death due to peritonitis with Marlex or Teflon reinforced par-

titions was five times higher than that observed without these materials.

Gomez introduced the horizontal gastroplasty in 1977. To obviate problems of obstruction or enlargement of the channel, Gomez constructed a pseudopylorus along the greater curvature using a circumferential, seromuscular suture of polypropylene to imbricate the stoma.<sup>10</sup> Despite Gomez's initial enthusiasm, Linner<sup>8</sup> and Lechner et al.<sup>6</sup> reported reoperation rates of 8% and 12%, respectively, after Gomez gastroplasty for late weight gain associated with stomal enlargement. Mason has speculated that the polypropylene suture, which transfixes the last few staples and penetrates the stomach, causes low grade inflammation and eventually migrates into the gastric lumen resulting in enlargement of the stoma.<sup>17</sup> Obstructive problems requiring revision also occur in a small percentage of these patients, presumably because of the "gathering" effect of the reinforcing polypropylene suture.<sup>8,13</sup>

Stomal dilatation and late weight gain occurred in patients M.H. and C.B. (Cases 1 and 2) in our series. In both instances, fiberoptic endoscopy demonstrated transmural migration of the polypropylene suture into the gastric lumen and dilatation of the stoma. Patient M.H. underwent a second greater curvature gastroplasty over a 24 F (8 mm) dilator but developed stomal stenosis, which required endoscopic dilatation. C.B. also underwent revision of a failed Gomez gastroplasty for late weight gain. The technique used in this case was a modification of the vertical banded gastroplasty described by Mason in which the greater curvature gastric channel was reinforced with a prestretched 5.5 cm segment of Marlex mesh.<sup>14</sup> This patient also developed stomal obstruction that did not respond to intravenous fluids, nasogastric suction and/or attempted dilatation using an angiographic technique similar to Gruntzig balloon dilatation. Fiberoptic endoscopy demonstrated migration of the Marlex collar into the stomach lumen. This patient was ultimately revised to a Roux-en-Y gastric bypass and with the exception of a mild episode of acute pancreatitis that resolved spontaneously, has done well since.

Stomal obstruction is second in frequency only to leakage as a morbid complication of gastric reduction surgery and occurs with an incidence of 3–19%.<sup>1–4,8–10,12,13</sup> This problem appears to be especially common with greater curvature gastroplasty.<sup>8,13</sup> Early stenosis of the channel is probably caused by postoperative edema and usually resolves with nasogastric decompression without requiring operative revision. On the other hand, late obstruction results either from stricturing due to ischemia of the stomach wall, or from imbrication or infolding of too much tissue with the circumferential suture. Transmural migration of the circumferential suture used to construct the pseudopylorus in greater curvature gastroplasty has also led to late weight gain resulting from enlargement

of the stoma. Recent modifications, including the use of silastic tubing as advocated by Laws, have been designed to provide external reinforcement of the stoma and eliminate the need for a seromuscular suture.<sup>11</sup> The tubing is held in place by nonabsorbable suture threaded through and transfixing the stomach wall at the end of the staple line. It is unknown, however, whether passage of the suture through the stomach may predispose to eventual migration into the lumen.

Case 2 illustrates an attractive but impractical remedial technique for failed gastroplasty. The vertical banded gastroplasty recently described by Mason may eliminate problems with stomal dilatation because it permits encirclement of the stoma with a collar of Marlex mesh to provide external reinforcement.<sup>14</sup> In retrospect, application of this gastroplasty technique was unwise. We hypothesize that the occult leak found at reoperation resulted from staple dehiscence due to ischemia. Based on the unsatisfactory result obtained in this case and the availability of alternative procedures with fewer theoretical disadvantages, we recommend that this revision technique not be used for failed gastroplasty.

Despite the frequency of failures requiring reoperation (leaks, stenosis, or late weight gain) after gastric reduction surgery, there is little data in the surgical literature addressing management of these often complex problems. In some hands, the revision rate for gastroplasty (11%) is nearly twice that of gastric bypass (4.3%).<sup>8</sup> More importantly the success rate after conversion of a failed gastroplasty to a gastric bypass appears to be much greater than that obtained by simple revision to a gastroplasty of smaller dimensions.<sup>8</sup> Although stomal enlargement may occur with either operation, the tendency to overeat after stomal dilatation and failed gastroplasty is offset in gastric bypass patients by the increased incidence of dumping syndrome.

Buchwalter et al. recommended gastrogastrostomy as the operation of choice in patients with stomal obstruction requiring operation after greater curvature gastroplasty or gastric bypass.<sup>13</sup> In contrast, he recommended conversion of failed gastrogastrostomy to Roux-en-Y gastric bypass presumably because of technical difficulties related to creating a second gastrogastrostomy. Pories, in a similar comparison of gastric bypass and gastroplasty (gastrogastrostomy with complete staple line partition) observed a high failure rate with the latter procedure and cited an overall revision rate of nearly 40%.<sup>7</sup>

Buchwald described conversion to jejunoileal bypass as an alternative approach to failed gastroplasty or gastric bypass.<sup>23</sup> Citing their experience in patients with successful and unsuccessful gastric bypasses, they concluded that failure to lose weight resulted primarily from poor eating habits rather than from technical problems related to the gastric bypass procedure. Although nonsurgical factors are important to the success of surgery for morbid obe-



sity,<sup>24</sup> there is little hard data to justify concluding that motivational rather than technical factors have been responsible for most late failures. Revision of one failed gastric reduction procedure to another configuration can result in resumption of satisfactory weight loss.<sup>10</sup> Since gastric reductions are equally effective compared to jejunoileal bypass in terms of weight loss, it is difficult to understand why someone would advocate the latter operation because of the high incidence of serious, late complications.

### Summary

Gastric reduction surgery is effective in selected patients with morbid obesity and can be performed with acceptably low morbidity and mortality. A number of studies have been published suggesting significant differences between the effectiveness of gastric bypass and gastroplasty.<sup>6,8</sup> The implied superiority of gastric bypass may be due to exclusion of the antrum and duodenum with interference of neurohumoral mechanisms involved in appetite regulation and satiety, or may be attributed to the untoward symptoms caused by dumping. Failure to maintain weight occurs with either procedure and often results in reoperation. The type of remedial operation that is undertaken for a failed gastroplasty should be determined by the type of initial operation and anatomical factors encountered at time of reoperation. Our current recommendation is that complete staple line partition of the stomach with gastrogastrostomy, or conversion to a Roux-en-Y gastrojejunostomy, should be considered for failed gastroplasty. Because of intangible advantages associated with exclusion of the stomach and duodenum, Roux-en-Y gastric bypass is favored in such cases. Gastrogastrostomy can be performed as an acceptable alternative if experiential or other factors contraindicate gastric bypass.

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