

A Prospective Comparison of Gastric and Jejunoileal Bypass Procedures for Morbid Obesity

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A randomized prospective evaluation of the gastric and jejunoileal bypass procedures for morbid obesity was performed. The gastric bypass was performed predominantly as a 90% gastric exclusion with a Roux-en-Y reconstitution. The jejunoileal bypass was an end-to-end anastomosis between 30 cm of jejunum and 25 cm of terminal ileum, the bypassed segment of small bowel being decompressed by an end-to-side ileocolostomy. There were 32 patients in the gastric group and 27 in the jejunoileal group. The two groups were comparable in age, preoperative weight and height. There were no postoperative deaths, but the gastric bypass operation was associated with a slightly higher early complication rate indicating it is a more technically demanding procedure. Late sequelae were more prominent in the jejunoileal bypass group and included significant diarrhea in 56% and need for medication in 74%. Kidney stones and cholelithiasis also complicated the jejunoileal group and were not seen after gastric bypass. All patients showed fatty metamorphosis on the original liver biopsy. This had worsened in 75% of the jejunoileal group at one year whereas it had improved or was stable in all of the patients in the gastric group.

ALTHOUGH THERE IS LITTLE EVIDENCE that morbid obesity *per se* is detrimental to health,³ actuarial studies and other information have indicated obesity as a significant factor in the increased morbidity and mortality associated with a variety of conditions including heart disease, hypertension, diabetes, pulmonary insufficiency, and postoperative recuperation. While proper dieting and an exercise program is the best therapeutic modality for the morbidly obese, many patients are unable to lose weight or maintain ideal weight despite diets, drugs or psychotherapy. Thus surgical means of controlling weight have become popular over the past decade.

Jejunocolostomy was first advocated as the surgical procedure for morbid obesity. Although all patients showed dramatic weight losses, the postoperative mortality and morbidity seemed too high to warrant its

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Dedicated to the many other residents who participated in the care of these patients.

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continued use.^{1,5,9} In 1969, Payne and DeWind published their results on the small bowel bypass procedure where the jejunum was transected 35 cm (14 inches) distal to the ligament of Treitz and the proximal end anastomosed to the ileum ten centimeters (four inches) proximal to the ileocecal valve in an end-to-side fashion.⁶ Weight loss in some patients was spectacular, but there were some disappointing failures which were felt to be due to reflux of nutrients into the bypassed segment of bowel. In order to obviate this reflux, Scott et al., in 1971, conceived of transecting the jejunum 30 cm (12 inches) distal to the ligament of Treitz and the ileum 15 cm (six inches) proximal to the ileocecal valve. He then performed an end-to-end anastomosis between the proximal end of the jejunum and the distal end of the ileum.⁸ The distal end of the jejunum was oversewn and the proximal end of the ileum was anastomosed to the colon to provide drainage for the bypassed segment. With various modifications, usually in the amount of ileum preserved, this has become a more or less standard jejunoileal bypass procedure.

Meanwhile in 1969 Mason, having been discouraged by some of the untoward results seen with the small bowel bypass, devised the gastric bypass procedure.⁴ In this operation the proximal portion of the stomach is transected completely. The distal end is oversewn and the proximal pouch representing 10% of the stomach or less is anastomosed to a loop of jejunum. The diameter of the anastomosis is no more than 1.2 cm in order to discourage gastric emptying. At first this operation was greeted with concern about marginal ulceration and its technical difficulty in the morbidly obese patients, but the former problem has not materialized. Mason and others have devised modifications to the basic procedure and have tried some other techniques to simplify the operation which have not been very successful.⁷

While there are other procedures available for the

TABLE 1. *Criteria for Patients Undergoing Bypass Procedures for Obesity*

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1. >50 kg. over ideal weight.
 2. No evidence other causes for obesity.
 3. Concomitant diseases preferred.
 4. Psychiatric clearance.
 5. Willingness to participate in protocol.
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management of the morbidly obese including the wiring of teeth to avoid the ingestion of large quantities of food, the fact remains that the jejunoileal and gastric bypass procedures, both of which are surgically reversible, have become the accepted procedures in the management of the morbidly obese.

The time had arrived for a comparative study of the jejunoileal and gastric bypass procedures. In January 1974, utilizing hospital numbers as the randomizing determinant, a comparative study of the jejunoileal and gastric bypass procedure for morbid obesity was begun. This report is the result of that study in the first 59 patients.

Material and Methods

All patients were interviewed in the out-patient department before being admitted to the hospital. It was first determined that they met the primary criteria of being morbidly obese, namely 50 kg over their ideal weight. In addition, a careful history was taken regarding their weight problems as well as their attempts to deal with it. No patient was admitted to the program unless they had attended and lost weight in a diet program. In addition it was also determined that they did not have any endocrine abnormality to account for their excessive weight and that their general physical condition would permit them to be a satisfactory operative risk. Although not mandatory it was preferred that they gave a history or showed some sign or symptom of another significant condition, e.g. hypertension, diabetes, or pulmonary insufficiency (Table 1).

The entire protocol was explained to the patient including the randomization procedure where they were assigned to the gastric bypass group if the hospital number were odd, the jejunoileal bypass group if their hospital number were even. If they agreed to the protocol and the explanation of the procedure and risks, they were admitted to the hospital. As an inpatient they went through a standard series of examinations and tests of cardiorespiratory, renal, gastrointestinal, and endocrine systems (Tables 2 and 3). They were also visited by a psychiatrist who attempted to determine their suitability for the proposed operation. All of this preoperative evaluation took eight to ten days. The patients then underwent the operative procedure to which they had been assigned. The first seven gastric bypass

TABLE 2. *Preoperative Evaluation*

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- Endocrine*
1. T₃ and T₄
 2. Serum cortisol A.M. and P.M.
 3. GTT
 4. Urinary 17 hydroxy and 17 ketosteroids
- Lipid*
1. Lipid profile by lipoprotein electrophoresis
- Cardiorespiratory*
1. Pulmonary function tests
 2. Arterial blood gases
 3. Chest x-ray
 4. Electrocardiogram
-

procedures were done according to the method of Mason, et al. by transecting the stomach at a high level and making a retrocolic end-to-side gastrojejunostomy. The remainder of the gastric bypass group underwent the same transection of the stomach, but rather than using a loop of jejunum for the anastomosis, the jejunum was transected and the distal limb brought retrocolic for the anastomosis to the stomach. The proximal limb of the jejunum was then anastomosed to the jejunum 30 cm distal to the gastrojejunostomy in an end-to-side fashion (Fig. 1). This change was made because the greatest technical difficulty was bringing the stomach into a position so the gastrojejunostomy resided below the opening in the transverse mesocolon and because the first few patients seemed to have a great deal of difficulty with bilious vomiting.

The jejunoileal bypass procedure was done in an end-to-end fashion as advocated by Scott, et al. The length of the jejunum distal to the ligament of Treitz and the ileum proximal to the ileocecal valve were 30 and 25 cm respectively. The jejunal end of the bypassed segment of bowel was oversewn and tacked to the mesentery while the ileal end was anastomosed to the sigmoid colon in an end-to-side fashion. Stapling devices were used routinely in these procedures although all staple lines were oversewn where appropriate or excised when a standard two layer anastomosis was performed utilizing non-absorbable suture for the seromuscular stitches and chromic catgut for the mucosal layer. The appendix was routinely removed during

TABLE 3. *Preoperative Evaluation (cont'd)*

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- Renal*
1. BUN, Serum creatinine
 2. IVP
- Gastrointestinal*
1. UGI series, Barium enema, oral cholecystogram
 2. Basal and maximal gastric acids
 3. Absorptive tests for Vitamin B₁₂
 4. Fecal fat
 5. Liver function tests
- Hematologic*
1. Coagulogram
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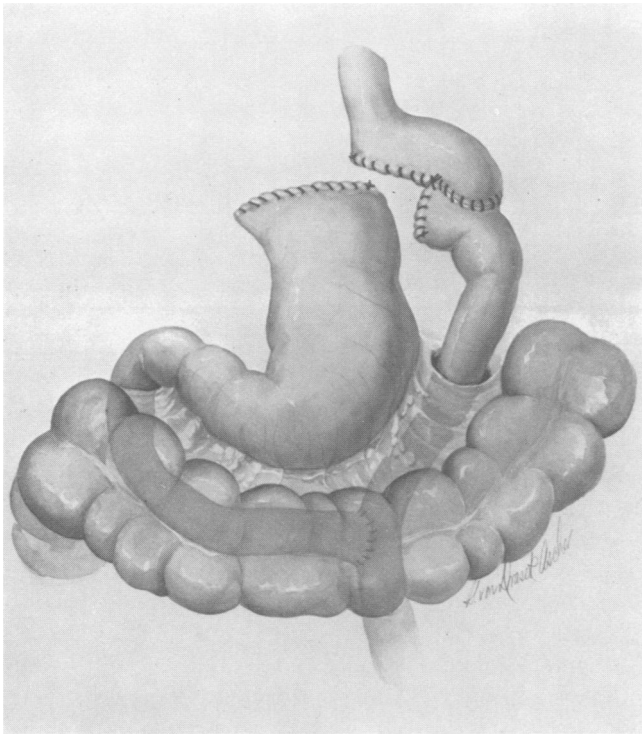


FIG. 1. Technique of retrocolic Roux-en-Y anastomosis used in last 25 patients undergoing gastric bypass.

jejunoileal bypass, but never removed during the gastric bypass procedure. Other simultaneous procedures were performed as indicated including cholecystectomy, Meckel's diverticulectomy, repair of previous incisional hernias and inferior vena caval clipping.

A number of paraoperative maneuvers were performed during the hospitalization of these patients. All patients received subcutaneous heparin, 5,000 units subcutaneously every eight hours upon admission to the hospital and until they were fully ambulatory in the postoperative period. Although the gastric bypass procedure patients did not receive any systemic antibiotics at first, the early incidence of wound infection was sufficiently high that they were given the same systemic antibiotics that the jejunoileal bypass group received after the first eight patients in the gastric group had been done. In general the endotracheal tube was removed within the first 24 hours after the operation. Early ambulation was the rule for the jejunoileal bypass group, but ambulation of the gastric bypass group was delayed for 48 hours so as not to put too much strain on the gastrojejunoostomy.

Once adequate peristaltic activity had begun, the nasogastric tube was removed and oral intake started. After clear liquids were tolerated, patients in the gastric bypass group received frequent small feedings while the patients in the jejunoileal group were given

a standard diet. Diarrhea inevitably ensued in the patients with the small bowel bypass, and the most effective anti-diarrheal method was found to be a combination of oral codeine and calcium which was usually begun before the patient left the hospital. All patients were placed on a therapeutic multiple vitamin oral supplement.

The patients were seen regularly every month as out-patients during the first six months postoperatively. They were seen more frequently as dictated by their condition or if the patient felt it necessary. Adjustments in medication and diet were made at the time of those visits, and specific blood tests were performed. Usually at six months postoperatively the patients had adjusted satisfactorily so they could be seen every two or three months. X-rays were performed as dictated by the patient's complaint, e.g. upper gastrointestinal series for patients with excessive vomiting or a reinforced oral cholecystogram for complaints suggesting gallbladder disease. Patients were rehospitalized for major problems which could not be handled on an out-patient basis, and all were admitted overnight at one year for a needle biopsy of the liver.

Results

The two groups were comparable in age. The sex difference was weighted toward females in the gastric group which probably is responsible for the lower preoperative weight and height in the patients undergoing the gastric bypass procedure. Nevertheless there is no statistical difference in the weights or heights in the two groups (Table 4). Concomitant conditions existed in 78% of the patients in the gastric group and 67% of those undergoing jejunoileal bypass. These included hypertension and cholelithiasis. The patients were classified as having diabetes if they showed glycosuria or an abnormal glucose tolerance curve in the absence of glycosuria (Table 5).

The overall complications show some similarities as well as interesting differences (Table 6). There were no immediate postoperative deaths in either group and one patient in each group has required a takedown of the bypass procedure. The patient in the gastric group who had a reanastomosis was one of two patients in that group who had an anastomotic leak. In this patient the

TABLE 4. Group Vital Statistics

	Gastric (32)	Jejunoileal (27)
Age	32.8 (19-52)	33 (23-49)
Sex	23 F, 9 M	13 F, 14 M
Preoperative		
Weight (kg.)	148.2 (110-209)	157.5 (122-238)
Height (cm)	162.9 (150-180)	168.4 (155-190)

TABLE 5. Concomitant Conditions

	Gastric (32)	Jejunioleal (27)
Total	25	18
Hypertension	9	5
Respiratory	3	4
Cardiac	3	2
Diabetes	9	8
Hyperlipidemia	2	3
Cholelithiasis	11 (6)*	7 (4)*

* Numbers in parentheses indicate cholecystectomy prior to bypass procedure; the other patients underwent cholecystectomy at the time of the bypass.

leak was small and responded to non-operative therapy. However, during the first postoperative year the gastrojejunostomy became stenotic to the point of almost complete obstruction, and the patient requested reanastomosis. The patient in the jejunioleal group who required reanastomosis lost 116 kg in one year and developed jaundice, ascites and peripheral edema. He finally consented to a reanastomosis when he weighed 66 kg.

There have been two late deaths, one in each group. The death in the jejunioleal group occurred ten months postoperatively after the patient had lost 114 kg. He steadfastly refused reanastomosis despite severe liver disease and died in hepatorenal syndrome. The patient in the gastric group who died was readmitted three months after the bypass procedure for observation. Two days after admission she collapsed and could not be resuscitated. The clinical impression was pulmonary embolus, but none was found at autopsy. Ten other patients in the jejunioleal group required rehospitalization, mostly for severe electrolyte imbalance although some have been rehospitalized for further surgical procedures, e.g. four for cholecystectomy and an additional one for incisional hernia repair. Only four gastric bypass patients required rehospitalization, one for a fistula after an anastomotic leak, the other three for incisional hernia repair.

The incidence of early surgical complications was greater in the gastric bypass group (Table 7). The wound complication rate and urinary tract infections were similar in both groups. However, there were two anastomotic leaks in the gastric bypass groups whereas none were seen following jejunioleal bypass. There were no pulmonary emboli in either group, but the gastric bypass procedure led to three incidental splenectomies. If splenic injury is eliminated from consideration, the early complication rate is almost identical in the two groups. Nevertheless the overall greater number of intraoperative and early postoperative complications after gastric bypass probably reflects the somewhat higher degree of difficulty posed by that operation in the morbidly obese patient.

TABLE 6. Overall Complications

	Gastric (32)	Jejunioleal (27)
Operative deaths	0	0
Late deaths	1	1
Rehospitalization	4	10
Reanastomosis	1	1

The late complications and sequelae are of considerable interest (Table 8). Nausea and vomiting is a prominent symptom in the patients with a gastric bypass. Some vomiting is experienced by all until they learn to adjust to the small stomach, but bilious vomiting was particularly annoying and persistent in the first seven patients and resulted in a change of technique to the Roux-en-Y reconstruction. Even then significant nausea and vomiting was the most troublesome sequella following gastric bypass. In contrast the jejunioleal bypass carries a high incidence of diarrhea requiring specific anti-diarrheal medication. They are also associated with excess potassium loss requiring supplemental oral potassium.

Specific late complications require some emphasis. Kidney stones occurred in four patients undergoing jejunioleal bypass; none were seen in the gastric group. Since almost all of the patients showed an increased serum uric acid and oxaluria postoperatively, there must be another explanation for this difference. Likewise cholelithiasis occurs quite frequently in the patients undergoing jejunioleal bypass and is infrequent after gastric bypass. Since 11 of the patients in the jejunioleal group already had had a cholecystectomy or had that done at the time of the bypass procedure, only 16 patients were at risk for the development of cholelithiasis and six are known to have done so. In the gastric group where 15 patients are at risk only one is known to have developed gallstones.

The incidence of liver disease is also quite strikingly different in the two groups. Liver function tests, specifically serum bilirubin, alkaline phosphatase, SGOT SGPT are of no value in predicting *developing* liver disease. No patient undergoing gastric bypass demonstrated significant liver disease while two patients in

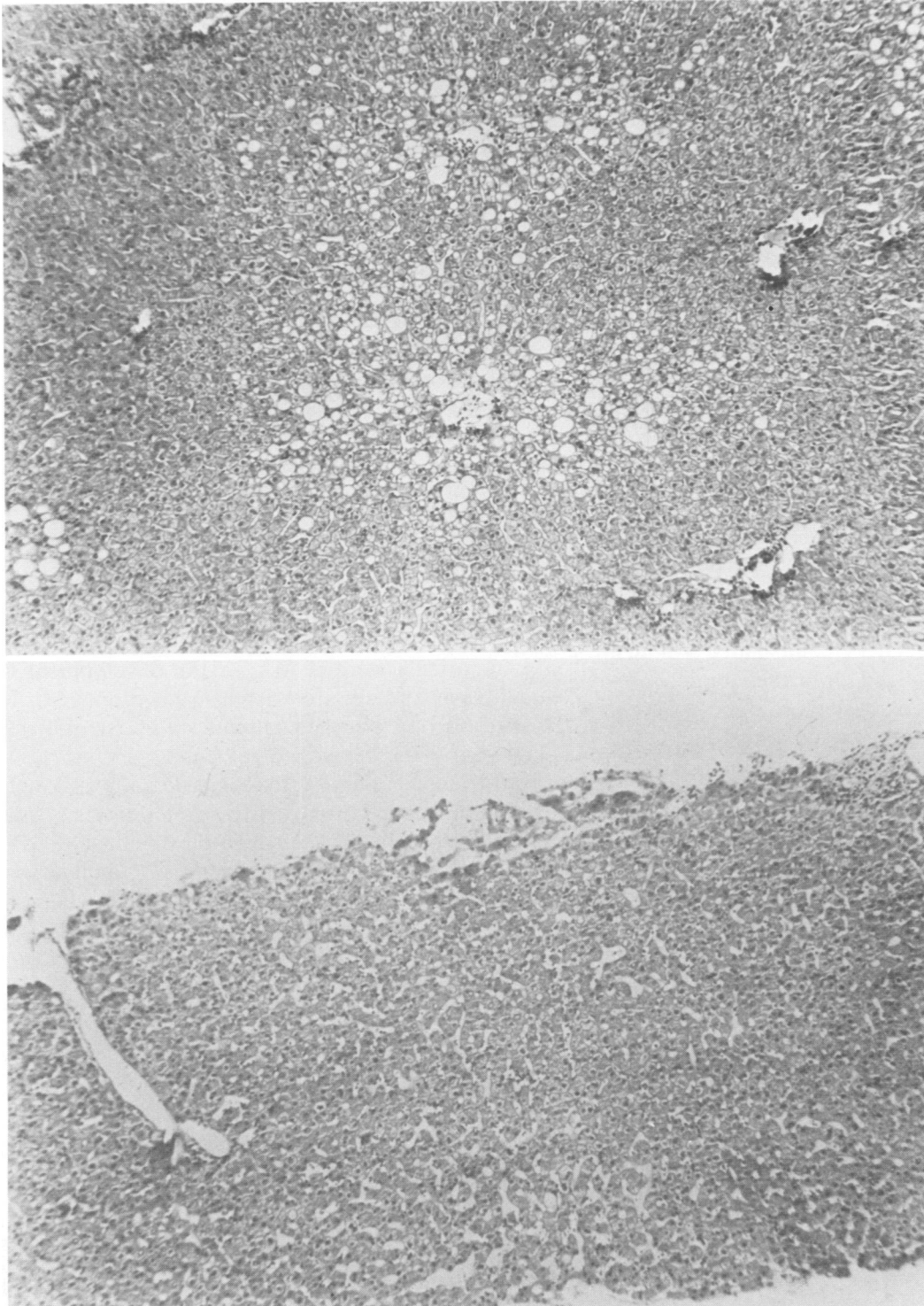
TABLE 7. Early Surgical Complications

	Gastric (32)	Jejunioleal (27)
Wound infection	8	6
Dehiscence	1	1
Anastomotic leak	2	0
Other sepsis	2	1
Urinary tract infection	4	4
Pulmonary embolus	0	0
Other	3	1
	20 (62.5%)	13 (48%)

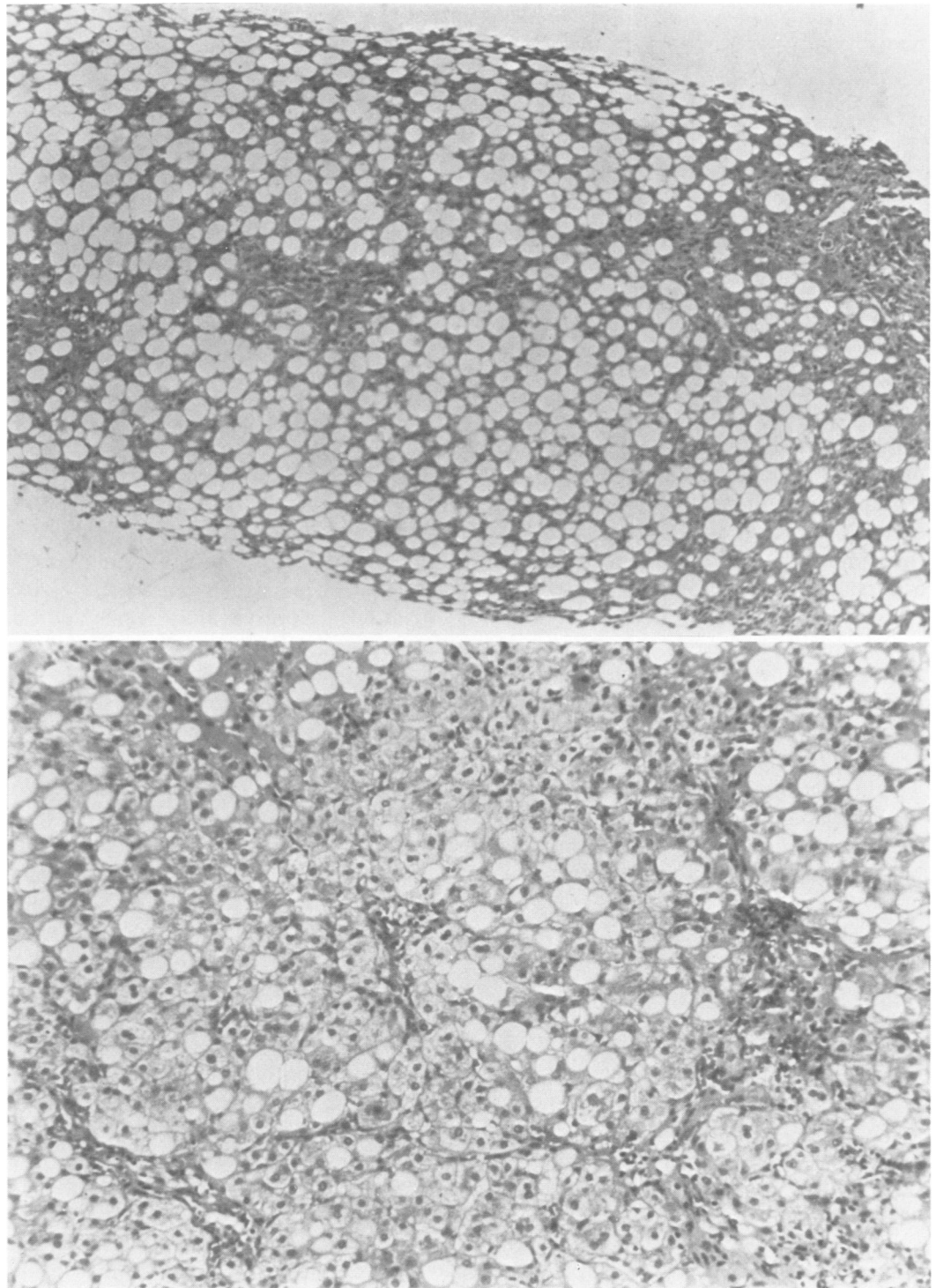
TABLE 8. Late Surgical Complications

	Gastric (32)	Jejunioleal (27)
Nausea and vomiting	11	2
Diarrhea	2	15
Kidney stones	0	4
Pulmonary embolus	2	1
Reoperations (excl. takedowns)	3	10
On medication	3	20

the jejunioleal group showed severe liver disease postoperatively. One of these patients died of this complication; the other required takedown of the bypass to prevent further hepatic deterioration. Moreover, the liver biopsies done at one year postoperatively in the two groups show entirely different pictures. Twelve patients in the gastric bypass group and 15 in the jejunioleal group have consented to percutaneous liver



FIGS. 2a and b (a, top) Liver biopsy during gastric bypass. Note fatty and mononuclear infiltration, 10×10 magnification. (b, bottom) Liver biopsy one year after gastric bypass. Essentially normal pattern 2.5×10 magnification.



FIGS. 3a and b (a, top) Liver biopsy during jejunoileal bypass. Note marked fatty infiltration 2.5×10 magnification. **(b, bottom)** Liver biopsy one year after jejunoileal bypass. Note persistent fatty infiltration and destruction of hepatocytes 10×10 magnification.

biopsies one year following the bypass operation. All 12 of the patients in the gastric group show no change (2) or improvement (10) in the biopsy (Figs. 2a and b). In the jejunoileal group, 12 of the 15 show worsening of the liver pattern histologically, and the other three show no change (Figs. 3a and b).

Finally the weight loss pattern and statistics show essentially no difference (Table 9). Patients in both

groups generally show a weight loss of 20 to 30 kg. in the first two or three months. They then stabilize to a weight loss of four to six kilograms per month. If any of the patients show a weight loss of greater than ten kilograms per month after three months postoperatively, they must be evaluated with regard to actual nutritional balance. At one year postoperatively, the mean weight loss is 51.0 kg. in the gastric group and

TABLE 9. Postoperative Weight Loss Statistics (kg)

	Gastric (32)	Jejunioleal (27)
3 Months	20.1 (10–31.9)	21.0 (10.9–34.1)
6 Months	33.4 (13.0–64.1)	37.2 (16.1–72.1)
1 Year*	51.0 (13.0–100.0)	57.9 (15.2–116.3)

* Includes 18 gastric and 22 jejunioleal patients.
At one year no significant difference by Student's *t* Test.

57.9 kg in the jejunioleal groups. These figures are not significantly different by the Student's *t* test.

Discussion

The usual history of a patient who is morbidly obese is one of repeated successes and failures at weight loss using a variety of methods which include various diets, diet pills, psychological maneuvers such as hypnotherapy or rational behavior training, or a combination of these approaches. Despite all of these techniques the trend is an ever-increasing weight. Although actuarial statistics and scientific evidence is lacking that obesity *per se* leads to decreased longevity, most of these patients inevitably develop complicating conditions such as diabetes, hypertension, and others which then make obesity a definite factor in their life expectancy. Therefore, the sine qua non of any operation designed to deal with morbid obesity must be effective weight loss which is permanent. Additional factors in the ideal operation are that it be technically feasible in these large individuals, safe in terms of immediate morbidity and mortality, does not produce excessive morbidity in the long term followup and enables an individual to function properly while continuing to lose weight. It should also be reversible.

Some operations while seemingly effective at first have not successfully met all of the criteria. Jejunocolostomy generally showed a spectacular weight loss, but the patients were so incapacitated that they required frequent hospitalizations and were unable to perform their jobs properly. Eventually most, but not all, of the patients required a takedown of the original operation. Wiring the teeth together, while effective in producing weight loss invariably failed as a long-term solution since the patients regained their weight as soon as the teeth were unwired. Other procedures have come and gone, but the jejunioleal and gastric bypass procedures have stood the test of time and are currently the two operations most used for the management of this condition.

The jejunioleal bypass procedure has been the most popular operation, probably because of its technical simplicity. Dissatisfaction with the operation has come from 1) the excessive diarrhea which usually requires some sort of medication, often leads to electrolyte im-

balance, particularly hypokalemia, and which may require hospitalization, and 2) the severe liver disease which has been fatal in several instances.² If the dehydration from diarrhea is sufficiently prolonged, kidney stones will occur. To be added to the list of reasons for dissatisfaction is the fact that the jejunioleal bypass operation is a lithogenic one. Almost invariably the jejunioleal bypass will create imbalance among cholesterol, phospholipids and bile acids in the bile and these patients will develop cholelithiasis in the long-term postoperative period.

On the other hand, the gastric bypass procedure has not achieved great popularity because at first thought it appears to be a technically demanding operation which may even have to be abandoned in the very obese and which was thought to carry a great risk of intractable dumping and marginal ulceration when first presented by Mason. Gradually as dissatisfaction with the jejunioleal bypass procedure in the hands of several investigators has increased, the gastric bypass procedure has gained in popularity. Thus need for comparative study seems appropriate.

The results reported herein record the first three years experience with this study. The small number of patients entered so far may reflect the population base served by the University of Kentucky Medical Center, but as anyone who has worked in this field knows, once a surgeon begins to do operations for the morbidly obese, fat people appear in a steady stream. The small number in this series rather represents adherence to strict criteria for admittance into the study as well as an effort on the part of the surgeons to encourage the morbidly obese person to seek other means of weight loss than an operative procedure.

However, from the results of this study several conclusions are apparent. Both the jejunioleal and gastric bypass operations can be performed quite safely in the morbidly obese. Anastomotic breakdown is a rarity, and other complications such as wound infection, pulmonary embolus and urinary or upper respiratory infection are acceptable. The gastric bypass procedure is somewhat more demanding technically and strict attention to the details of the operation, particularly size of the gastric pouch and diameter of the gastrojejunostomy are crucial to success for weight loss in the gastric bypass procedure.

All patients undergoing a bypass operation for morbid obesity must be followed closely. This is particularly true during the first six months postoperatively when changes in medication may be needed. Monitoring weight is crucial to detect failure of the procedure either because of lack of or excess weight loss. General psychological support is also necessary during these early postoperative days.

Liver disease is a definite threat in the jejunoileal bypass patient, but the trend to excessive weight loss while pleasing to the patient is the harbinger of significant liver disease. Weight loss of more than 6 kg per month in these patients generally means that they are not ingesting adequate calories or they are losing excess calories because of severe diarrhea and, therefore, they have exogenous malnutrition superimposed upon the surgically created malabsorption. This will then lead to the same type of liver disease that is seen in Kwashiorkor. Obviously it can be combated by checking the excess diarrhea, making specific detailed recording of the diet or if necessary, hospitalization for hyperalimentation to reverse the trend.

All patients show a trend to attain a plateau of weight loss between one and two years following the bypass. They rarely reach their ideal weight. Once sufficient weight has been lost, they should be encouraged to embark on a regular exercise program.

The gastric bypass procedure definitely has a finite learning curve both to obtain the correct size in the gastric pouch and the diameter of the gastrojejunostomy opening and to eliminate technical errors. Once the technique of gastric bypass is learned, it would

appear to be superior to jejunoileal bypass in that it has the same weight loss capability, fewer long-term sequelae and no evidence of the development of significant liver disease.

References

1. Barron, J., Frame, B. and Bozalis, J. R.: Shunt Operation for Obesity. *Dis. Colon Rectum*, 12:115, 1969.
2. Brown, R. G. Jr., O'Leary, J. P. and Woodward, E. R.: Hepatic Effects of Jejunoileal Bypass for Morbid Obesity. *Am. J. Surg.*, 127:53, 1974.
3. Mann, G. V.: The Influence of Obesity on Health. *N. Engl. J. Med.*, 291:178 and 226, 1974.
4. Mason, E. E. and Ito, C.: Gastric Bypass. *Ann. Surg.*, 170:329, 1969.
5. Payne, J. H., DeWind, L. T. and Commons, R. R.: Metabolic Observations in Patients with Jejunocolic Shunts. *Am. J. Surg.*, 106:273, 1963.
6. Payne, J. H. and DeWind, L. T.: Surgical Treatment of Obesity. *Am. J. Surg.*, 118:141, 1969.
7. Printen, K. J. and Mason, E. E.: Gastric Surgery for Relief of Morbid Obesity. *Arch. Surg.*, 106:428, 1973.
8. Scott, H. W. Jr., Sandstead, H. H., Brill, A. B., et al.: Experience with a New Technic of Intestinal Bypass on the Treatment of Morbid Obesity. *Ann. Surg.*, 174:560, 1971.
9. Shibata, H. R., MacKenzie, J. R. and Long, R. C.: Metabolic Effects of Controlled Jejunocolic Bypass. *Arch. Surg.*, 95:413, 1967.

DISCUSSION

DR. HENRY BUCHWALD (Minneapolis, Minnesota): I would like first of all to compliment Dr. Griffen, and his co-workers, for what I believe is the first randomized study to be reported in what is now a middle-aged field. We do both procedures at the University of Minnesota but we do not have a randomized trial.

I would criticize Dr. Griffen with respect to his technique in the jejuno-ileal bypass patients. I believe that he leaves too much functioning bowel. His retained small intestine, excluding the duodenum, measures 55 cm. We leave 40 to 45 cm, as does Dr. H. William Scott. This five to ten centimeter difference is critical and, I believe, may account for the jejuno-ileal bypass patients in Dr. Griffen's series losing no more weight than his gastric patients. In our experience, we have found a far more significant weight reduction after the intestinal bypass procedure.

We have not been able to document the marked postoperative cholelithiasis found by Dr. Griffen. Currently, we are determining the tripartite coordinants and the lithogenic index of ampullary bile aspirates before, and after, bypass. Possibly, we can provide some scientific data on this subject in the not too distant future.

We would agree with Dr. Griffen that 75% of jejuno-ileal bypass patients have a negative progression of the liver biopsy at one year. However, sequential biopsies up to five years, have often demonstrated a return to the original histology, or even an improvement. Far more critical, is the fact that only five per cent of jejuno-ileal bypass patients exhibit clinical liver failure.

I would like to invite Dr. Griffen to extend the number of his patients, and the years of follow-up to a minimum of three per individual, before drawing any final conclusions. It may well turn out that different operations should be done for different people, depending on their weight and on their personality. Will they tolerate diarrhea? Will they tolerate small meals, or vomiting? Will they work to outeat the bypass? Will the gastric pouch distend with time and negate the original satisfactory results? Experience

has shown that the gastric bypass can probably be outeaten; whereas, it is only rare that the jejuno-ileal bypass can be outeaten.

And, finally, both operations are compromises with reality. All this surgical activity should stimulate true students of this field not only to perfect the best operative intervention but to engage in basic research to elucidate the underlying mechanism of this problem.

DR. EDWARD E. MASON (Iowa City, Iowa): This is the first of three randomized prospective studies that I'm aware of, and the first one to be reported.

Dr. Griffen mentioned that one of the problems with the gastric operation is that it is somewhat more difficult; and I would like to mention a modification of the procedure that is being used in the Twin Cities by several different surgeons, but particularly by Dr. John Alden, who has loaned me some slides. (slide) This simplification consists of dissecting the greater curvature up to the cardia, a high anterior gastroenterostomy in the descending limb of the loop of the proximal jejunum, placement of the TA90 across the stomach just below the gastroenterostomy, pulling the stomach down through the TA90, so as to make this pouch less than 100 ml in volume and then setting the staples. There are a few sutures placed between the descending limb of jejunum and the stomach which completes the operation.

There is a little trick that someone told me about, of putting a Robinson catheter on the foot process of the TA90, so that you can guide it into place. This is a little bit like building a boat in a bottle, but it can be done very easily once you learn the manipulations. It's also like putting on your shoe.

The operation in Alden's hands has had no mortality in over 200 patients, and his average operating time is 67 minutes. This can be a simple operation, but it takes some learning. When we started doing the operation, it took us an average of five hours, which is an indication of the learning that can come about in the performance of the procedure.

The development of an operation for duodenal ulcer has gone