

# *Jejunioileal Bypass for Massive Obesity:*

## *Results and Complications in Fifty-Two Patients*

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**O**BESITY IS A SERIOUS HEALTH HAZARD predisposing to heart disease and other conditions with increased morbidity and mortality. Medical and psychiatric therapy in massively obese patients has been only temporarily successful with rapid regain of weight after intensive therapy is discontinued.<sup>5</sup> Surgical bypass of a major part of the small bowel has been proposed and carried out in various centers. This procedure is still in the experimental stage and has been associated with significant morbidity. Bypassed patients may develop severe, sometimes fatal, electrolyte imbalance and have to be watched closely, especially during the first year. The long-range effects of this procedure are unknown, although initial results show the procedure to have definite value in these patients.

We are presenting a review of 52 patients who underwent jejunioileal bypass for morbid obesity in our institution during the last five years to evaluate results and complications. The unusual findings were: 1) the development of megacolon in 3 patients, a condition not reported before in jejunioileal bypassed patients, and 2) recurrent urinary tract calculi in 5 bypassed patients.

### **Materials and Methods**

Fifty-two patients underwent jejunioileal bypass in our institution between February 1967 and July 1972. There were 47 females and 5 males. Ages ranged from 22 to 49 years, with the average age being 30 years. Table 1 shows the weights above ideal before bypass. The majority of the patients were 140 to 240 pounds above ideal weight. Only 9 patients were between 110 and 139 pounds above ideal weight. Many presented one or more of the complications related to obesity; namely,

fatigue, back pain, exertional dyspnea, peripheral edema, hypertension, cardiovascular disease, diabetes, arthritis, liver disease and stasis dermatitis.

The criteria for selection of patients for jejunioileal bypass were slight modifications of those used by Payne and DeWind:<sup>6</sup> 1) weight more than 100 pounds above ideal for longer than five years, 2) failure of medical and psychiatric therapy, 3) absence of correctable endocrinopathy, and 4) assurance of patient's cooperation for prolonged follow-up visits.

The operative procedure included a regular bowel preparation. Generally a transverse elliptical skin incision was made, with excision of the redundant fatty apron. In all 52 patients 14 inches of jejunum measured from the ligament of Treitz was anastomosed end-to-end to 4 inches of terminal ileum (Fig. 1). The proximal end of the bypassed small bowel was closed in two layers and fixed to the root of the transverse megacolon to prevent intussusception. The distal end of the bypassed small bowel was anastomosed to the caecum. All measurements were made along the mesenteric border. The peritoneum was closed with No. 1 running chromic catgut, and the fascia with 00 interrupted silk. No. 4 silk retention sutures were used. The subcutaneous tissue was drained with hemovac drains.

### **Results**

The average duration of hospitalization was 14 days. Seventy per cent of the patients had less than two weeks of hospitalization, and 14% stayed in the hospital for more than three weeks.

There was a minimum of 30% and a maximum of

TABLE 1. *Weights above Ideal before Jejunioleal Bypass (52 patients)*

No. Patients Above Ideal Weight (lbs)	
10	200-240
11	180-199
13	160-179
9	140-159
9	110-139

48% loss of the preoperative body weight after bypass. The average was 39%. Table 2 shows the cumulative weight loss after jejunioleal bypass. There was an average of 45 pounds weight loss in the first three months, 70 pounds in the first six months, and 95 pounds in the first twelve months after bypass. The body weight stabilized after 18 to 30 months post surgery. Three patients showed 15 to 30 pounds weight gain one to three years after their weight had stabilized.

Table 3 shows the operative complications. There were 12 minor and 6 major wound infections. Causative organisms were mainly *E. coli*, *Enterobacter* and *Klebsiella*. There were 5 cases of atelectasis, 1 of pneumonia and 3 of pulmonary embolism. One patient had pancreatitis with paralytic ileus. Another patient developed high-output enterocutaneous fistula nine days after bypass, for which he was reoperated. Five days later he developed a massive fatal pulmonary embolism. This was the only operative death.

Table 4 shows the delayed complications after jejunioleal bypass. Sixteen patients developed incisional hernias. Twenty-two patients developed hepatocellular insufficiency as demonstrated by elevated liver enzymes, increased BSP retention and hepatomegaly. However,

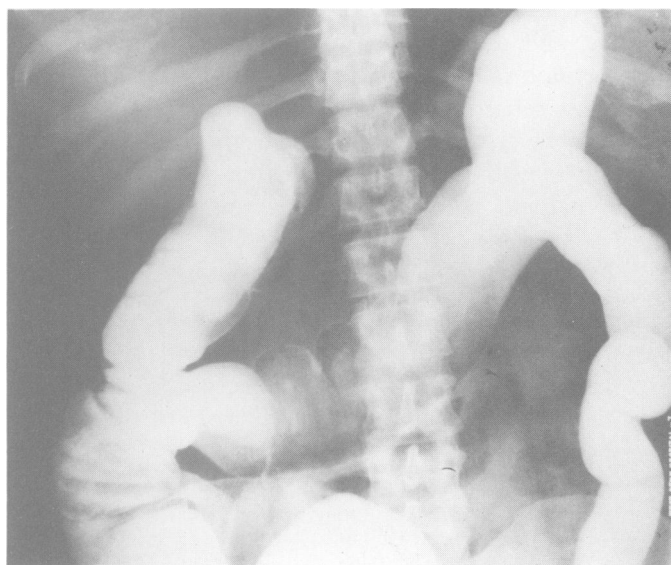


FIG. 1. Pre-operative barium enema of one of the patients who developed megacolon after the bypass.

TABLE 2. *Cumulative Weight Loss after Jejunioleal Bypass (52 Patients)*

Time Post Surgery	Cumulative Weight Loss (lbs)	Average (lbs)
3 months	30-80	45
6 months	40-120	70
12 months	60-170	95
2 years	100-190	130
3 years	100-190	135
5 years	90-170	125

these tests returned to normal 12 to 16 months after bypass. Liver biopsy performed three months after bypass on 9 patients showed increased fatty metamorphosis, as compared to the biopsy taken at the time of bypass. A repeat liver biopsy taken on 4 patients 9 to 15 months after bypass showed marked improvement in liver architecture.

The majority of the patients had between 5 to 14 liquid bowel movements a day, for two to four months after bypass. This was adequately managed with antidiarrheal agents. After this period, antidiarrheal agents were not required in most patients. By avoiding fatty meals and fluids during meals, the patients had 2 to 5 semiformal bowel movements a day. However, 4 patients had intractable weight loss and diarrhea with severe electrolyte imbalance and had to be partially refunctionalized.

Two patients had intussusception and underwent corrective surgery.

Three patients had huge dilatation of the colon about two years after bypass with distention, bloating, and considerable abdominal discomfort. Figs. 2 and 3 show the barium enema of one of these patients before and five years after bypass, respectively. The large dilated colon, an anatomic megacolon, is obvious. Fig. 4 shows the dilated colon photographed during repair of the patient's incisional hernia. The development of megacolon is an unusual finding and to our knowledge has not been reported before on bypassed patients.

Sixteen patients developed electrolyte imbalance in the form of hypocalcemia, hypokalemia and hypomagnesemia. These were adequately managed by electrolyte supplements in all except five patients. Four had intrac-

TABLE 3. *Operative Complications after Jejunioleal Bypass (52 Patients)*

Minor wound infection	12
Major wound infection	6
Atelectasis	5
Pneumonia	1
Pulmonary embolism	3
Urinary tract infection	3
Pancreatitis	1
Ileus	1
Entero-cutaneous fistula	1
Death	1

TABLE 4. *Delayed Complications after Jejunioleal Bypass (52 Patients)*

Incisional hernia	15
Hepatocellular insufficiency	22
Intractable diarrhea	4
Intussusception	2
Megacolon	3
Nephrolithiasis	5
Anal soreness	6
Electrolyte imbalance	16

table diarrhea, as mentioned earlier, and were partially refunctionalized. The fifth died of cardiac arrest, secondary to severe hypokalemia of 1.4 mg %.

Table 5 lists the patients with recurrent urinary tract calculi. The first patient developed urolithiasis four times and had three ureterolithotomies. The second patient had urolithiasis three times and required surgery once—a left pyelolithotomy. This patient on her last admission passed 15 stones of 2 to 5 mm in size within one week. The third patient had urolithiasis three times and had two ureterolithotomies. The fourth patient developed a bladder calculus and right ureteral calculus, for which he underwent cystotomy and right ureterolithotomy. The fifth patient developed right ureteral calculus thirteen months after bypass. All stones were of the calcium oxalate type.

Routine laboratory studies in these five patients were



FIG. 3. Picture of the colon of the same patient as in Figs. 1 and 2, taken during an incisional hernia repair, three years after the bypass.



FIG. 2. Barium enema of the same patient as in Fig. 1, five years after the bypass, showing the large dilated colon.

normal. The serum protein electrophoresis, calcium, phosphorous, and uric acid were also normal. The 24-hour urine volume ranged from 1100 to 2300 cc. The 24-hour urinary excretion of calcium was normal in all five patients. However, the 24-hour urine oxalic acid levels were markedly elevated in all, ranging from 54 mg. to 121 mg.

Four patients had refunctionalization of variable seg-

TABLE 5. *Urolithiasis after Jejunioleal Bypass (5 patients)*

38 y. o. W. M.—Urolithiasis x 4—Lt., Rt., Lt. ureters 10, 17, 22 and 29 months after bypass.
29 y. o. W. F.—Urolithiasis x 3—Lt., Lt., Rt. ureters 5, 7 and 22 months after bypass. The third time she passed 15 stones of 2–5 mm. in size in one week.
33 y. o. W. F.—Urolithiasis x 3—Rt., Lt., Rt. ureters 6, 10 and 26 months after bypass.
45 y. o. W. F.—Urolithiasis x 2—bladder and Rt. ureter 11 and 25 months after bypass.
44 y. o. W. F.—Urolithiasis once, Rt. upper ureter, 13 months after bypass.

All stones were of the calcium oxalate type.

ments of upper jejunum because of intractable diarrhea, excessive weight loss, severe electrolyte imbalance, hypoproteinemia, and profound weakness (Table 6). The refunctionalized segments were 24 inches, 20 inches, 12 inches, and 9 inches respectively. These patients gained 30 to 60 pounds, stabilized in weight, and lost all signs and symptoms after refunctionalization.

There were 3 deaths in this series. One was an operative death of a 41-year-old male who died of pulmonary embolism six days after his second operation, necessitated for closure of an enterocutaneous fistula that developed nine days after bypass. The second patient died of cardiac arrest secondary to severe hypokalemia of 1.4 mg%, 12 months after bypass. This patient had not been cooperative and had not come for follow-up visits. The third patient died of liver failure secondary to hepatitis three months after bypass. The gastroenterology consultant felt that this was due to serum hepatitis.

Twenty patients had hypertension before bypass. After bypass, 11 patients became normotensive and 8 showed improvement in their elevated blood pressure.

Five patients had been diabetic. After bypass, 2 no longer required antidiabetic medication, and the dose of insulin was reduced in the other 3.

Forty-five patients formerly had hypercholesterolemia. The serum cholesterol levels dropped to a range of 90 to 150 mg% after bypass.

### Discussion

Surgical shunting of a major part of the small bowel as a treatment of morbid obesity is a relatively new procedure. It has been generally condemned in the medical literature and found promising in the surgical literature. The major benefit of the surgical treatment of obesity is that it offers a permanent and significant reduction in body weight.<sup>2,6</sup>

The average weight loss after bypass in our series was 39% of the preoperative body weight. Body weight generally stabilizes 18 to 30 months after bypass. Subsequent to weight stabilization, some patients may show weight gain, as demonstrated by 3 of our patients in Table 2, due to mucosal hyperplasia and elongation of the anastomosed segments.<sup>7,8</sup>

Wound infection and incisional hernia are encountered more frequently in these patients because of the large dead space in the subcutaneous tissue, and the weakened fascia from fatty infiltration. Hepatocellular insufficiency in the form of deranged liver enzymes, increased BSP retention, and hepatomegaly are common after jejunoileal bypass.<sup>1,3,6</sup> Fatty infiltration of the liver, usually present in obese people, is increased after bypass. However, liver function usually returns to normal within one to two years,<sup>1</sup> as seen in our patients.

Diarrhea and electrolyte imbalance during the first

TABLE 6. *Reconstructive Surgery after Jejunoileal Bypass (4 patients)*

26 y. o. W. F.—Refunctionalized segment 24"	Wt. gain 60 lbs. stabilized at 190 lbs.
31 y. o. W. F.—Refunctionalized segment 20"	Wt. gain 50 lbs. stabilized at 180 lbs.
40 y. o. W. F.—Refunctionalized segment 12"	Wt. gain 20 lbs. stabilized at 150 lbs.
29 y. o. W. F.—Refunctionalized segment 9"	Wt. gain 30 lbs. 3 months after refunction.

few months after bypass was adequately managed with electrolyte supplements and antidiarrheal agents. Generally, no antidiarrheal agents are required four months after bypass.<sup>7</sup> However, 4 of our patients had to be partially refunctionalized because of intractable weight loss and diarrhea. Reviewing the literature, no mention of the length of refunctionalized segment is made.<sup>5</sup> An attempt was made in our hospital to refunctionalize only small segments of bypassed bowel. The result was rewarding in that there was only modest weight gain (Table 6), with complete relief of the signs and symptoms present before refunctionalization.

An unusual and previously unreported finding has been the development of megacolon in 3 of our patients (Figs. 2 and 3). It is not clear why these patients developed megacolon since they had no constipation after bypass. Their blood chemistries and protein electrophoresis were normal.

Another unusual finding has been the development of recurrent urinary tract calculi in 5 patients (Table 5). These patients had normal 24-hour urine calcium levels, but the 24-hour urine oxalic acid levels were markedly elevated. Smith *et al.*<sup>9</sup> have recently described a syndrome of acquired hyperoxaluria and urinary tract calculi in patients with ileal resection. The 5 patients with recurrent urinary tract calculi present a similar syndrome. It is not clear why these patients develop hyperoxaluria, but it appears to be related to deranged bile acid-glycine metabolism. Administration of cholestyramine will convert the oxaluria to normal.<sup>9</sup>

Other beneficial sequelae of small bowel bypass have been the improvement in the diabetic state, and relief of hypertension in those patients with these conditions. The fall of serum cholesterol levels is marked and dramatic. One can only speculate on the significance of reduced cholesterol levels. Buchwald<sup>4</sup> indicates that atheromatosis of the greater blood vessels is a reversible process. Improvement of angina and cerebrovascular symptoms with regression of xanthomata and xanthelasma have been observed after reduction of hypercholesterolemia.

Despite the complications, the majority of our patients are happy with the results and enjoy better social, psychologic and economic adjustment.

### Summary

A review of 52 patients with jejunioileal bypass for morbid obesity has been presented. There was one operative death and two delayed deaths. Wound infection, hepatic insufficiency and incisional hernia were common complications. Diarrhea and electrolyte imbalance could be adequately managed in most patients.

Unusual findings were the development of megacolon in 3 and recurrent urolithiasis in 5 patients. There was an average weight loss of 39% of preoperative body weight after bypass. The majority of the patients were pleased with the operation and enjoyed improved social and emotional adjustment.

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