Ileal Bypass for Hyperlipidemia

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Partial ileal bypass (PIB) is a safe, effective, and lasting therapy for the reduction of lipids and lipoproteins in patients with hyperlipidemia. Following PIB, circulating plasma and low-density lipoprotein (LDL) cholesterol fall markedly, while high-density lipoprotein (HDL) cholesterol rises. The average plasma cholesterol lowering is 25% after diet, with a 40% reduction in the LDL-cholesterol fraction; concurrently, the HDL-cholesterol rises about 8%. These effects have been demonstrated to be maintained for up to 20 years. Currently, PIB is being used in the Program on the Surgical Control of the Hyperlipidemias (POSCH), a randomized controlled clinical trial designed to assess the effects of lipid reduction on mortality and morbidity in a postmyocardial infarction population with arteriographically demonstrated coronary atherosclerosis.

We performed the first human partial ileal bypass operation specifically for cholesterol reduction on May 29, 1963. At present, we have performed over 350 partial ileal bypass operations at the University of Minnesota. Many other institutions in the United States and in Europe have now initiated programs testing this method of cholesterol lowering [1–14].

Operative Technique

In essence, the technique for partial ileal bypass has remained unchanged since 1963. Intestinal preparation is carried out at least overnight by means of a clear liquid diet, nonabsorbable oral antibiotics, and cathartics; enemas are not used. The skin is washed with povidone-iodine (Betadine®) but not shaved until the patient is in the operating room. Intravenous administration of antibiotics is begun on the morning of the operation, is intensified in the operating room (2 g of a cephalosporin every 2 hours), and maintained for 48 hours (every 6 hours) after the operation. General anesthesia is preferred to a regional block because general anesthesia provides better cardiovascular control, an advantage in these patients who often have threatening arterial disease.

Unless a concomitant procedure is planned, entrance is gained into the abdominal cavity by a right lower quadrant transverse incision some 2 cm below the umbilicus. As a rule, only the right rectus muscle, the linea alba, and a few centimeters of the oblique muscles are divided. The cecum is delivered into the operative field and the appendix, if still present, is removed. The small intestine is next elevated from the peritoneal cavity and measured with a marked umbilical tape knotted every 25 cm. The tape is placed along the mesenteric border of the intestine, since this surface is less variable in its dimensions than is the antimesenteric length. Marking sutures for division of the bowel are placed at 200 cm from the ileocecal valve if the entire small bowel length (counting 25 cm for the duodenum) is 600 cm or less; if the bowel is longer than 600 cm, we bypass 250 cm.

The ileum is divided at the designated area. We prefer to use clamps and not a stapling instrument. The distal end of this division, or what is to become the proximal end of the bypassed segment, is closed in 2 layers. We prefer an inner row of 4-0 absorbable Vicryl®, taken in a Parker-Kerr manner, and an outer reinverting row of interrupted 5-0 Tevdek® sutures. Anastomosis is then accomplished between the proximal small intestine and the cecum in
an end-to-side manner on the anterior tenia, approximately 6 cm above the inverted appendical stump. Again, as a rule, a 2 layer open anastomosis is preferred. The cecum is retained to maximize water-absorbing surface, and anastomosis is made distal to the ileocecal valve to minimize ileal retention of cholesterol and bile acids and their resorption.

The procedure is completed by tacking the proximal end of the bypassed segment to an area between the anastomosis and the appendiceal stump to prevent future intussusception. The small divisional and the large rotational mesenteric defects are carefully closed to prevent internal herniation.

It has been our custom for the surgeons and scrub nurse to change gloves and gowns and to use a separate set of instruments for the closure. Postoperatively the patient is, as a rule, extubated in the operating room and maintained overnight in the intensive care unit for cardiac monitoring. Early ambulation is instituted. The nasogastric tube is removed after demonstrable intestinal activity is present, and dietary progression is usually rapid. On the average, the patient is discharged on the sixth or seventh postoperative day.

The operative technique is schematically shown in Fig. 1. A more complete and detailed discussion of this operation has previously been published [15].

**Results**

**Operative Complications**

We believe that the partial ileal bypass procedure can be performed with an in-hospital, or operative, mortality close to 0%, the presence of coexisting coronary artery disease in many of these patients notwithstanding. Wound infections, pulmonary emboli, or other serious postoperative complications resulting in prolonging hospitalization beyond 1 week have occurred in only 2% of these patients [16, 17].

To date, in the Minnesota series, no instance of intussusception of the proximal end of the bypassed segment or obstruction secondary to an internal hernia created by inadequate closure of the rotational mesenteric defect has occurred. These complications seem to be avoidable.

We have seen the expected 2–3% incidence of small bowel obstruction, due to adhesions, following partial ileal bypass. Treatment is common to that of any other bowel obstruction except for those rare instances in which the bypassed loop itself becomes obstructed. Unless suspected, this complication can pose a diagnostic problem: the patient has characteristic crampy abdominal pain and lower abdominal tenderness; yet, there is no evidence of air-fluid levels on x-ray, and bowel movements continue since the non-bypassed intestine is not obstructed. If allowed to progress, a mass will form representing fluid-filled obstructed bypassed intestine. It is probably advisable when operating for this form of obstruction to resect the intestine from the closed margin to a point beyond the obstruction, or even to the ileocecal valve, and not to attempt an anastomosis in, or lysis of adhesions to, a piece of bowel that will subsequently continue to remain nonfunctioning.

**Side Effects and Unique Complications**

Diarrhea is the one annoying side effect experienced by the majority of individuals after partial ileal bypass. Commonly, it is not persistent. Within a year or so, approximately 90% of patients have fewer than 5 bowel movements daily, while taking no bowel-controlling medications. Patients generally also report an increase in the firmness and