Introduction

Although the small intestine comprises approximately 70 to 80% of the length of the gastrointestinal tract and 90% of the mucosal surface area, only about 3 to 6% of tumors involving the intestines arise in the small bowel. Non-malignant disorders of the small bowel are equally uncommon. Therefore, resective surgery of the small intestine is uncommon and the operative procedure most commonly performed on the small bowel is perhaps that for the placement of enteral feeding appliances. Although the small intestine is often used as a conduit during other major surgery, this chapter will be devoted to the laparoscopic surgery on the small intestine itself.

Since the small bowel is endowed with a longer mesentery, greater mobility, and smaller diameter than the large intestine, it is better suited to laparoscopic intervention. To date, most of the small-bowel laparoscopic procedures reported in the literature have been for the placement of feeding tubes, though there have been isolated reports of resections for Meckel's diverticulum. It seems reasonable that this approach could also be considered for creation of jejunal interposition limbs for esophageal replacement or for gastric bypass in the morbidly obese. In addition, one can imagine that in the rare cases where small-bowel free grafts are needed, harvest of these grafts might be done laparoscopically.

Small-Bowel Resection and Anastomosis

If one is presented with a localized area of small-bowel pathology (as happens in Crohn's disease), certainly a minimally invasive approach that would allow the patient more-rapid recovery should be considered. In addition to resections, there may be opportunities to perform controlled enterotomies or bypass procedures.

The appropriate placement of equipment in the operating room cannot be emphasized enough. An otherwise uneventful operation can become an ordeal if the surgeon has to strain to see a monitor or simply must rearrange things in the process of trying to get an operation started.

After establishing pneumoperitoneum, the cannula placement is based on the most logical arrangement for the anticipated operation, thus, there is no standard.

With the technology of stapling anastomoses already well established, the development of staplers exclusively for laparoscopic use was inevitable. First to appear were the 30-mm Endo GIA (Auto Suture Company, a division of the US Surgical Corporation, Norwalk, CT) and the 60-mm Endo Linear Cutter (Ethicon Endo-Surgery, Cincinnati, OH). These instruments simplified the techniques used in laparoscopic appendectomy and small-bowel resection. They were designed exclusively for intestinal use and were used to perform partial or wedge resections of bowel, such as in the elective management of a Meckel's diverticulum (Figure 16.1). Most recent de-
velopments in the area of staple size and configuration have increased the versatility of the staplers and allowed surgeons to perform more-extensive intestinal surgery. The mesentery of the intestine can now be rapidly divided with the same instrument loaded with staple cartridges designed expressly for hemostasis. This technique does not require skeletonization of the mesenteric vessels and allows a wide *en bloc* resection, which is important in the case of malignant diseases (such as carcinoid tumors).

Specimen extraction does not generally pose a problem since the large (33 mm) cannulae now available (Ethicon Endo-Surgery, Cincinnati, OH) can be used to remove less-bulky small-bowel specimens (Figure 16.2). If for some reason the specimen cannot be removed by this route, a small muscle-splitting incision can be used instead, maintaining the advantages of minimally invasive techniques. To avoid spillage or possible seeding of a tumor, an impermeable sack may be used to remove the specimen.3,4

Anastomoses may be accomplished intracorporeally with the newer laparoscopic stapling devices or may be constructed extracorporeally using suturing or stapling techniques (Figure 16.3). The critical principles of bowel anastomosis must always be observed to prevent leakage or stricture. Most conditions needing small-bowel resection require that a specimen be removed. Most authorities prefer a small muscle-splitting incision, which allows one to remove the specimen and perform the anastomosis in one step. The proper name for this approach would then be laparoscopic-assisted small-bowel resection.

**Enteral Access for Nutritional Support**

Jejunostomy is a well-established procedure for feeding malnourished patients.6,7 Laparoscopic techniques are useful for gaining access to the gastrointestinal tract when endoscopic placement of tubes is not possible due to proximal obstruction, severe gastroesophageal reflux, contraindications for percutaneous endoscopic gastrostomy (PEG), or previous upper-abdominal surgery. Laparoscopic jejunal access, either for a placement of a jejunostomy tube or the creation of a Roux-en-Y enteroenteric jejunostomy, requires three or four abdominopelvic punctures and atraumatic bowel-grasping forceps. The left midabdominal site is generally located in the midediaphragmatic line, approximately midway between the umbilicus and xiphoid, providing adequate egress for the tube or allowing placement of the stoma, if the more permanent method is employed (Figure 16.4).

The proximal jejunum is identified by retraction of the transverse colon superiorly, demonstrating the ligament of Treitz, and the bowel is "run" for a distance of 60 to 100 cm (Figure 16.5). Once the preferred segment of small bowel has been identified, it can be eviscerated through a dilated umbilical cannula site after the laparoscope is moved to the left-sided cannula (Figure 16.6). After the bowel is brought to the surface of the skin, the surgeon, maintaining an appreciation for proximal and distal ends, can perform the enterotomy and tube placement, and create a Witzel tunnel (Figure 16.7). If this method is utilized, sutures must be kept short and the proximal and distal suture needles left attached so that the bowel can be secured to the anterior abdominal wall after it is returned to the abdominal cavity and the tube is brought out through the left midabdominal cannula. The umbilical fascial defect is then reapposed to allow re-insufflation of the abdomen. Intracorporeal suturing techniques are used to attach the bowel to the abdominal wall, using the sutures previously placed along the Witzel tunnel.8,9 The Stamm technique of jejunostomy placement can also be followed if so desired. Various laparoscopic stapling devices may eventually be used to secure the bowel to the abdominal wall, but at this time there are no manufacturer recommending this use for the products.

In another technique, the bowel is tacked to the anterior abdominal wall in the appropriate location with T-fasteners (Ross Laboratories, Columbus, OH) introduced percutaneously through a needle and an 8F catheter is inserted through a peel-away introducer with a J-wire (Figure 16.8).10 One of the advantages of this technique is that it does not require laparoscopic suturing and knot-tying skills.

An alternative method of accessing the gastrointestinal tract for long-term alimentation is to create a cutaneous...