Hypothesis: Laparoscopic ileocolectomy can reduce the length of hospital stay and hospital charges compared with conventional surgery in the treatment of primary Crohn disease.

Design: Nonrandomized, comparative, retrospective analysis of a prospective database.

Setting: University hospital tertiary care center for inflammatory bowel disease.

Patients: Forty patients, 20 in the laparoscopic group (group A) and 20 in the conventional group (group B).

Intervention: From July 1, 1996, to June 30, 2001, we collected data on the following demographic clinical endpoints: age, sex, duration of disease, preoperative medical treatment, previous abdominal surgery, procedure performed, conversions to open surgery, operating time, number of trocars used, size of incision, blood loss, time to resolution of ileus, time to starting solid food diet, duration of hospital stay, hospital charges, morbidity, and mortality.

Main Outcome Measures: Surgical results, length of hospital stay, hospital charges, and recurrences.

Results: The mean age of the patients was 34.7 years (range, 20-68 years) in group A vs 40.0 years (range, 18-75 years) in group B. The male-female ratio was 1:2 in group A vs 1:1 in group B. The morbidity was 5% in group B. There was no mortality. Operating time was longer in group A (mean, 145.0 minutes; range, 45-270 minutes) compared with group B (mean, 133.5 minutes; range, 98-177 minutes) \((P = .36)\). Blood loss was significantly higher in group B (mean, 265.5 mL; range, 100-400 mL) compared with group A (77.2 mL; range, 25-350 mL) \((P < .001)\). Also, the size of the incision was significantly longer in group B (mean, 13.5 cm; range, 8-18 cm) compared with group A (mean, 5.5 cm; range, 3-12 cm) \((P < .001)\). Bowel function returned more quickly in the laparoscopic group vs the conventional group in terms of return of bowel movements (1.70 vs 2.63 days) \((P < .001)\) and resumption of a regular diet (1.35 vs 2.73 days) \((P < .001)\). The mean length of stay was significantly shorter in the laparoscopic group (4.25 days) vs the conventional group (8.25 days) \((P < .001)\). The mean hospital charges were US $9614 in group A vs US $17,079 in group B \((P < .05)\). The mean follow-up was 17.2 months in group A (range, 2.3-59.9 months) vs 18.7 months in group B (range, 1.0-37.5 months).

Conclusions: Laparoscopic-assisted ileocolicectomy for primary Crohn disease of the terminal ileum and/or cecum is safe and successful in most cases. Laparoscopic surgery for Crohn disease should be considered as the preferred operative approach for primary resections.

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entry, and the presence of dense adhesions, which may have been responsible for higher conversion rates in earlier series. However, several advantages are proposed, such as improved cosmesis, less pain, faster recovery, and shorter hospital stay, which make the laparoscopic approach an attractive and safe alternative to conventional surgery.\(^3\, ^4\) The purpose of this study was to compare retrospectively the safety, outcomes, length of stay, and cost for patients with Crohn disease treated via laparoscopic vs conventional surgery during a 5-year period at an academic medical center.

**METHODS**

From a prospective database between July 1, 1996, through June 30, 2001, we identified in a retrospective fashion a total of 40 patients undergoing an elective resection for ileocolic Crohn disease. Group A consisted of 20 laparoscopic-assisted procedures and group B consisted of 20 conventional operations. Patients who had undergone previous surgery for Crohn disease were excluded. The choice of a laparoscopic approach vs a conventional operation was based on the surgeon's preference and/or absolute contraindications for a laparoscopic approach. The presence of a fistula, phlegmon, or abscess was not an absolute contraindication to laparoscopy. Medical records and the collected data sheet designed for this study were reviewed for specific data, including age, sex, duration of disease, preoperative medical treatment, prior abdominal surgery, indications for surgery, type of procedure performed, conversions to open surgery, operating time, time to resolution of ileus, time to tolerating a regular diet, morbidity, mortality, duration of hospital stay, and hospital charges.

Preoperatively, all patients were evaluated with computed tomographic scans, small bowel series, barium enema, or endoscopy as deemed necessary. If the patient had a documented presence of an abscess or phlegmon, a 3-day course of broad spectrum intravenous antibiotics and/or percutaneous drainage was used before surgery to sterilize the operative field. All patients underwent an attempt at preoperative bowel preparation (at least 24 hours before surgery) consisting of a clear liquid diet, 2 doses of oral metronidazole (500 mg) and neomycin (1000 mg), and 2 doses of 45 mL of Fleet Phosphosoda oral laxative (C.B. Fleet Co., Lynchburg, Va), which was successful in all patients. Postoperatively, a clear liquid diet was offered the next morning following surgery to all patients, and their amount of oral intake was carefully recorded; if they tolerated more than 500 mL by midday, they were advanced to full liquids for the rest of the day and then to a regular diet on postoperative day 2, irrespective of the presence or absence of flatus or bowel movements per rectum.

We defined laparoscopic-assisted ileocolectomy as a complete intracorporeal mobilization of the terminal ileum and cecum and the division of the mesenteric vessels as performed via a laparoscopic technique. The ileocolic vascular pedicle was always transected with an endoscopic vascular stapler. The anastomoses were created extracorporeally through a 3-cm midline infraumbilical incision, except in the rare case on which they were created through a preexisting right lower-quadrant appendectomy scar when present. All anastomoses (laparoscopic or conventional) were constructed in a side-to-side fashion. Conversion to a conventional operation was defined as any unplanned termination of the laparoscopic-assisted procedure after we initially determined it was feasible.

Complications during the surgery and in the postoperative period were recorded. Postoperative pain was controlled with either an intravenous patient-controlled analgesia or epidural analgesia. Operative mortality was defined as death within 30 days after surgery. The following conditions had to be fulfilled before a patient was discharged from the hospital: good general status, tolerating sufficient oral intake, afebrile, ambulating without the need of assistance, and adequate control of pain while taking oral analgesics. All patients were followed up 1 week after discharge and then at the 3- and 6-month intervals. The total hospital charges were compared in both groups.

**LAPAROSCOPIC-ASSISTED TECHNIQUE**

Under general anesthesia, the patient was placed in a supine position lying on a beanbag with arms tucked at the sides when possible. A nasogastric tube and Foley catheter were inserted. Pneumoperitoneum was established at 15 mm Hg, following an open Hasson 11-mm trocar placement through a 1.5-cm, longitudinal infraumbilical incision. Under laparoscopic vision, 2 further trocars were placed, a 5- to 12-mm trocar in the left flank of the patient lateral to the rectus sheath and a 5-mm trocar in the left upper quadrant lateral to the rectus sheath in line with the umbilicus. Both the operating surgeon and camera holder stood on the patient's left side. The affected segment was identified with the patient in some mild Trendelenburg positioning and tilted to the left. The ileocolic vascular pedicle was transected first, after creating a window on either side of it and making sure the duodenum was pushed posterolateral. One firing of an endoscopic, 30-mm, vascular stapler was used in all cases. Mobilization of the right colon was performed mainly with a blunt dissection from a medial to lateral direction, and, where necessary, either electrocautery or a harmonic scalpel was used for hemostasis of small bleeding vessels or vascular peritoneal attachments. The hepatic flexure was mobilized in most cases. Once the mobilized segment of bowel became a midline structure, it was extracted through a slight caudal extension of the infraumbilical trocar site or through a prior right lower-quadrant scar from a previous appendectomy. Transection of the bowel and formation of the anastomosis were performed extracorporeally.

**CONVENTIONAL TECHNIQUE**

For this operation, the approach was through a middle line incision in all cases, extending 5 to 6 cm below and above the umbilicus (10-12 cm long), and a Ballour retractor was used for improved exposure. Hemostasis and dissection were achieved with monopolar electrocautery. The ileocolic vascular pedicle was ligated between clamps with absorbable 0-polyglactin 910 (Vicryl) ties. The anastomosis was fashioned with the same technique used for the laparoscopic-assisted procedure. In 1 patient with mass and abscess in the conventional group, a 10-mm closed suction drain was used. Closure of the fascia was performed with absorbable running sutures. No patient required a protective ileostomy.

**STATISTICAL ANALYSIS**

The data are presented as means and ranges for each variable within each group. The \( t \) test (2-tailed) and \( \chi^2 \) test were used to determine significant differences between the 2 groups for normally distributed data, as appropriate. \( P<.05 \) was accepted as statistically significant.

**RESULTS**

Demographics data are summarized in Table 1. We found no significant difference in the mean age, sex, duration of symptoms before operation, and previous abdominal surgery or medical treatments. Indications for surgery are...
given in Table 2. In both groups, the most common indication for surgery was the presence of a stricture that caused partial and symptomatic obstruction. Other indications, such as phlegmatous mass, abscess, or enteroenteric fistula, had similar distributions in both groups; bleeding was an indication in only 1 patient in group A.

The location of disease was limited to the terminal ileum in 14 patients in group A and 8 patients in group B (P = .08) and to the terminal ileum and right colon (cecum) in 6 patients in group A and 12 patients in group B (P = .09). Results after surgery are presented in Table 3. The mean surgical time was slightly longer in the laparoscopic group but without statistical significance (P = .36).

We found significant differences in favor of the laparoscopic approach in terms of intraoperative blood loss, size of the incision, resumption of regular diet, return of bowel movement, and length of hospital stay. Also, the hospital charges were significantly lower in the laparoscopic group (US $9614) compared with the conventional group (US $17079) (P = .05).

A mean of 3.1 trocars (range, 3-4) were used in the laparoscopic procedure, with only 1 conversion (5%), secondary to the presence of severe adhesions. There was mortality and no operative complications encountered in this series. The only morbidity observed was a patient in group B (conventional surgery), who during the surgery had a mass with abscess; this patient developed an anastomotic leak and intra-abdominal abscess, which required an urgent exploration for drainage of the abscess with temporary diversion. Mean follow-up was 17.2 months in group A and 18.7 months in group B without symptomatic clinical recurrence.

Advances in technology and surgeons’ improved laparoscopic skills have led to the application of the minimally invasive techniques to all aspects of colorectal surgery. This review demonstrates several benefits in patient care and costs that can be provided by laparoscopic surgery with the appropriate level of skill. In particular, these benefits were seen in patients who underwent a primary resection localized to the terminal ileum and/or the right colon. There were no anastomotic leaks or mortality in the laparoscopic group, thus indicating that it is a safe and reliable procedure when performed by surgeons with adequate experience.

The conversion rate of 5% (1 patient) was secondary to the presence of severe adhesions that obscured the normal anatomic landmarks, which made continuing with a laparoscopic operation too hazardous. Previous reports in the literature that have reported conversion rates of 14% or more support our findings that with adequate experience and improved technology the conversion rates are now low. A major criticism of laparoscopic colon procedures has always been the significant increased time of operation, but in this series the surgical time for the laparoscopic-assisted approach was not statistically significant, since this procedure took only an average of 12.5 minutes longer to perform (145 vs 133.5 minutes for the conventional group). Once again, this article confirms that the presence of abscess, fistula, or phlegmon does not represent an absolute contraindication for the laparoscopic approach.

Multiple publications have demonstrated the improved cosmetic results following a laparoscopic approach. Our group of patients with ileocolic Crohn disease realized the same benefit with a mean incision size of 5.5 cm (vs 13.5 cm in the conventional group) (P < .001). This finding raises an interesting point that is critical to one of the main potential benefits of laparoscopic surgery: if we believe that a significant component of patient morbidity and ability to return to full activities occurs from the...
incision size, then minimally invasive surgery has the potential to make a major impact in patient recovery time. We believe that this time should be shorter for patients undergoing a laparoscopic operation, which has further economic advantages in this younger patient population in terms of time lost from work. A prospective trial for an adequate evaluation of this area is needed. The total hospital charges were significantly less in favor of the laparoscopic group, despite the longer operative time and increased cost of surgical equipment, and can no longer be an argument for those who oppose a laparoscopic approach in this patient population. One aspect that is not rigorously evaluated in this article is the quantification of postoperative pain and analgesic requirement. However, other articles have reported less postoperative pain in patients who underwent a laparoscopic approach compared with open surgery, and we also believe that the amount of pain and pain medication in the laparoscopic group was noticeably less.

CONCLUSIONS

Laparoscopic colorectal surgery for benign conditions continues to evolve. When performed by surgeons with adequate experience, laparoscopic surgery seems to demonstrate advantages over conventional operations. We believe at this time that laparoscopic ileocolonectomy should be considered the first-line surgical option for most primary resections for Crohn disease localized to the ileocolic region.

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REFERENCES