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The Laparoscopic Approach in Abdominal Emergencies: A Single-Center 10-Year Experience

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ABSTRACT

Introduction: Laparoscopy has rapidly emerged as the preferred surgical approach to a number of different diseases because it allows for a correct diagnosis and proper treatment. In abdominal emergencies, both components of treatment—exploration and surgery—can be accomplished via laparoscopy. The aim of the present work is to illustrate retrospectively the results of a case-control experience with laparoscopic versus open surgery for abdominal emergencies performed at our institution.

Methods: From January 1992 to January 2002, 935 patients (mean age, 42.3±17.2 years) underwent emergent or urgent surgery, or both. Of these, 602 (64.3%) were operated on laparoscopically (small bowel obstruction, 28; gastroduodenal ulcer disease, 25; biliary disease, 165; pelvic disease, 370 cases; colonic perforations, 14) based on the availability of a surgical team trained in laparoscopy. Patients with a history of malignancy, more than 2 previous major abdominal surgeries, or massive bowel distension were not treated laparoscopically. Peritonitis was not deemed a contraindication to laparoscopy.

Results: The conversion rate was 5.8% and was mainly due to the presence of dense intraabdominal adhesions. Major complications ranged as high as 2.1% with a postoperative mortality of 0.6%. A definitive diagnosis was accomplished in 96.3% of cases, and 94.1% of these patients were treated successfully with laparoscopy.

Conclusions: Even if limited by its retrospective nature, the present experience shows that the laparoscopic approach to abdominal emergencies is as safe and effective as conventional surgery, has a higher diagnostic yield, and results in less trauma and a more rapid postoperative recovery. Such features make laparoscopy an attractive alternative to open surgery in the management algorithm for abdominal emergencies.

Key Words: Laparoscopy, Abdominal emergencies, Appendicitis, Diagnosis, Surgery.

INTRODUCTION

Laparoscopy (LAP) has emerged as the standard surgical approach to a wide host of diseases, because it allows for correct diagnosis and treatment. Its role in the management algorithm of abdominal emergencies (where both critical components of operative treatment—exploration and surgery—can be accomplished laparoscopically) awaits definite clarification.[1] We report herein the results of a retrospective analysis of a case-control series of laparoscopic versus open emergency procedures (OP) performed in our department.

METHODS

From January 1992 to January 2002, 935 patients (M:F = 407:528; mean age, 42.3±17.2 years) underwent emergent (between the first 12 hours of hospital admission) or urgent (between the first 12 to 24 hours of hospital admission, or both) abdominal surgical procedures. Of these, 602 (64.3%) were operated on laparoscopically. Because minimally invasive surgery was not performed by all of the surgeons on our staff, patients admitted for acute abdomen were treated by laparoscopy or open surgery according to the presence of a well-trained surgical team and not randomly allocated to either treatment. Furthermore, at the beginning of our experience, we decided not to use laparoscopy in patients with a history of previous abdominal malignancies, more than 2 major abdominal surgeries, massive bowel distension, and in those too ill to withstand pneumoperitoneum. The presence of diffuse peritonitis was not considered a formal contraindication to the use of a laparoscopic approach. Therefore, our series reflects a selection bias in favor of laparoscopy as regards morbidity and mortality. Irrespective of the chosen approach, all patients underwent the same preoperative workup (chest x-rays, Electrocardiograph [ECG], and routine blood tests). The

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outcome measures were the incidence of intraoperative complications, operative mortality, postoperative morbidity and mortality rates, the incidence of concurrent diseases, and histology of resected specimens. The statistical analysis was performed with the *t* test for independent samples for continuous variables and the chi-square test or Fisher's exact test for categorical values. The level of significance was set at 5%.

RESULTS

Gastroduodenal Perforated Ulcers

Of 51 patients admitted for a perforated gastroduodenal ulcer, 25 (49%; 3 gastric and the remaining duodenal; mean age, 59.2±14.5 years; range, 28–79) were treated via LAP. The surgical treatments are listed in **Table 1**. The conversion rate was 12% and mainly due to inadequate ulcer localization. The mean operating time was 90.2±16.1 minutes (range, 60–130 min) (OP, 63.4±12.8 min; range, 30–100 min) (*P*=ns) with a mean postoperative hospital stay of 11.3±8.4 days (range, 7–28 days) (OP, 11.5±6.7 days; range, 7–17) (*P*=ns). Morbidity was 18.1% (4 cases) (OP, 13.7%) (*P*=ns). We had 1 postoperative death in a patient with a history of ictus cerebri, with a postoperative fistula, who died of recurrent stroke.

Table 1.
Perforated Gastroduodenal Ulcer Patients by Treatment Option

Treatment	n
Peritoneal lavage + drainage (perforation already covered by omentum)	7 (31%)
Peritoneal lavage + omentoplasty	1 (4.5%)
Suture closure	10 (45.4%)
Suture closure + omentoplasty	4 (18.1%)

Suspected Appendicitis and Pelvic Disease

Data refer to 370 of 612 patients (mean age, 23.2±22.1 years; range, 9–65) who underwent LAP for right lower quadrant abdominal pain. The mortality rates in LAP and OP groups are 0.2% and 0.4%, respectively (*P*=ns). Major intraoperative complications were observed in the LAP group (0.2%) and consisted of 1 inadvertent lesion to the sigmoid colon requiring conversion. Reinterventions were as high as 0.8% in the LAP group versus nil in the OA group (*P*=ns). The conversion rate was 2.7% and due to dense adhesions in 8 cases, an extrauterine pregnancy in 1 patient, and an iatrogenic lesion to the sigmoid

Table 2.
Incidence of Concurrent Diseases in Patients With Histology-Proven Appendicitis by Treatment Option

Disease	Laparoscopy n=282	Open Emergency Procedures n=208	*P*
Adhesions	22 (7.8%)	0	ns
Graaf follicle	4 (1.4%)	1 (0.4%)	ns
Omental cyst	4 (1.4%)	0	ns
Ovarian cyst	3 (1%)	0	ns
Salpingitis	2 (0.7%)	0	ns
Umbilical hernia	2 (0.7%)	0	ns
Tubal cyst	1 (0.3%)	0	ns
Polycystic ovaries	1 (0.3%)	0	ns
Cholecystitis	1 (0.4%)	0	ns
Omental necrosis	0	1 (0.4%)	ns
Meckelís diverticulum	0	1 (0.4%)	ns
Total	**40 (14.1%)**	**3 (1.4%)**	**<0.01**

colon in another. Postoperative complication rates were similar in LAP and OP groups (1.6% vs 0.8%; *P*=ns). A superior diagnostic yield of laparoscopy was observed in our series. The incidence of concurrent diseases in patients with proven appendicitis was significantly higher in the LAP (14.1%) vs the OP group (1.4%; *P*<0.01). The most frequent conditions diagnosed at laparoscopy were adhesions (7.8%) and pelvic diseases (3.9%) **(Table 2)**. The diagnostic yield of laparoscopy in patients without histology-proven appendicitis was even higher. In such cases, laparoscopy allowed for identification of concurrent diseases in 62.5% vs 8.8% of patients **(Table 3)**.

As regards the postoperative course, LAP patients recovered more rapidly with a significantly shorter stay than that of OP patients (4.4±1.2 vs 5±3.40 days; *P*=0.01) and flatus passed more quickly (1.6±0.7 vs 2.2±1.2 days; *P*<0.01;). Furthermore, LAP patients experienced far fewer wound infections (nil vs 6.1%; *P*<0.01).

Small Bowel Obstruction

Of 82 patients admitted to our institution with acute small bowel obstruction (SBO), 28 (34.1%) were treated with LAP (mean age, 56.4±17.2 years, range. 22–79). The average operating time was 45.1±11.3 minutes (range, 20–65). **Table 4** illustrates the mechanisms of SBO in our series and its surgical management. Conversion to open surgery was required in 12 patients because of a trocar-borne visceral injury in 1 patient; a required intestinal resection in 5 (due to severe ischemia); and impossibility to locate the disease in the remaining patients. Overall, 57.1% (16 cases) of patients were treated successfully with LAP, with mortality and morbidity rates of 6.2% (OP, 12.1) (*P*=ns).

Cholecystitis

We treated 165 patients admitted for acute cholecystitis (mean age, 56.4±12.7 years). Patients with suspected common bile duct stones underwent Endoscopic Retrograde Cholangiopancreatography (ERCP) first. An intraoperative cholangiogram (IOC) was performed only in case of suspected intraoperative choledocholithiasis or difficult anatomy. Eighty-five percent of the procedures were undertaken within 48 hours of admission. The conversion rate was 4.8% (8 cases), and it was due to choledocholithiasis in 1 patient, bleeding in 2, dense adhe-

Table 3.
Incidence of Concurrent Diseases in Patients With Histologically Normal Appendicitis by Treatment Option

Disease	Laparoscopy n=282	Open Emergency Procedures n=208	*P*
Adhesions	20 (22.7%)	0	0.01
Graaf follicle	20 (22.7%)	0	0.03
Mesenteric lymphadenitis	4 (4.5%)	2 (5.8%)	ns
Bleeding luteal cyst	2 (2.2%)	0	ns
Endometriosis	1 (1.1%)	1 (2.9%)	ns
Ectopic pregnancy	1 (1.1%)	0	ns
Retroperitoneal leiomyosarcoma	1 (1.1%)	0	ns
Perforated diverticulitis	1 (1.1%)	0	ns
Perforated duodenal ulcer	1 (1.1%)	0	ns
Ileitis	1 (1.1%)	0	ns
Omental necrosis	1 (1.1%)	0	ns
Cholecystitis	1 (1.1%)	0	ns
Bleeding ovarian cyst	1 (1.1%)	0	-
Total	**55 (62.5%)**	**3 (8.8)**	**<0.01**

Table 4.
Small Bowel Occlusion: Causes and Surgical Treatment

Causes	n	Surgery
Adhesions	10 (62.5)	Lysis
Volvulus (due to adhesions)	1 (6.2)	Lysis
Internal hernias (due to adhesions)	1 (6.2)	Lysis
Endometriosis	2 (12.5)	Cauterization
Peritoneal carcinosis	1 (6.2)	Biopsy
Gallstone ileus	1 (6.2)	Enterolithotomy

sions and unclear anatomy in 4, and perforated gangrenous cholecystitis in 1. Morbidity was 1.2%, mortality 0.6% (1 case due to a massive postoperative pulmonary embolism), and the mean hospital stay was 5.7±2.3 days.

Colonic Perforations

Fourteen of 21 patients (mean age, 67.4±18.3 years) underwent emergency laparoscopic surgery for diffuse peritonitis secondary to perforated diverticular disease or iatrogenic perforation on colonoscopy (3 cases). The conversion rate was 14.2% (in these patients, an ostomy was performed also). All patients underwent an extensive peritoneal lavage and drainage, and 6 of them underwent suture closure of the perforation. No ostomy was necessary. Neither major nor minor intraoperative adverse events were observed. The hospital stay lasted 7.2±4.1 days on average (OP, 9.4±5.6 days) (*P*=ns). No morbidity and mortality occurred (OP morbidity=22.2%) (*P*=ns). One patient underwent elective laparoscopic sigmoid resection after 3.5 months.

DISCUSSION

Laparoscopy has gained widespread acceptance in common surgical practice as a diagnostic and therapeutic tool. Abdominal emergencies often pose a diagnostic challenge to the general surgeon.[1-3] A correct diagnosis is crucial because of the various diseases that may be responsible for the same symptoms, in order to plan the appropriate procedure or to avoid unnecessary laparotomies. Noninvasive diagnostic procedures are expensive, and not always conclusive and available in all settings.[4,5] Laparoscopy is the only minimally invasive technique to simultaneously allow for an appropriate diagnosis and proper treatment, or the correct abdominal approach, or both.

In 1992, we decided to treat abdominal emergencies with LAP, if a well-trained LAP surgeon was present. Ever since that time, 602 patients admitted with acute abdomen have been treated laparoscopically. The overall conversion rate was 5.8%; morbidity 2.1%, and mortality 0.6%. A definitive diagnosis was reached in 96.3% of patients, and 94.1% of these received proper treatment. Herein, we wish to analyze the advantages of laparoscopy in the management algorithm for acute abdomen as regards its indications, morbidity, mortality, and its socioeconomic impact.

Indications

The absolute and relative contraindications to laparoscopy in the treatment of abdominal emergencies are the same as those for elective procedures.[6] As for peritonitis, a theoretical concern exists that the CO_2 pneumoperitoneum may enhance bacteremia and endotoxemia due to the increased intraperitoneal pressure.[7] Only a few controversial data exist regarding this issue. In animal models of peritonitis, endotoxemia and the development of intraabdominal abscesses do not seem to be increased by CO_2 laparoscopy when compared with that in control groups. Over the past few years, an increasing number of patients treated laparoscopically for peritonitis have had favorable results.[8-13] In our experience, we observed only 1 case of postoperative pelvic collection in a girl operated on for perforated appendicitis. At the time of laparoscopy, the surgeon did not deem it useful to place a drain, which could have been one of the causes to the observed complication.

Surgical timing is another relevant issue: the earlier the better. As evidenced in acute cholecystitis, the degree of inflammation is strictly related to the time from the onset of symptoms.[12] We operated on 85% of our patients within 48 hours of admission with a consequent success rate of 95%. A similar success rate was observed in the group of perforated gastroduodenal ulcers, where time to surgery was no longer than 24 hours.

Diagnostic Accuracy

The diagnostic accuracy of LAP was very high, which matches favorably with the 89% to 100% rate reported in the international literature.[2,3] The high diagnostic yield of LAP is even greater if concomitant diseases found in patients without histology-proven appendicitis are to be taken into account (62.5% vs 8.8%, LAP vs OP, respectively). In agreement with others,[14] we always remove the appendix, even when it appears normal. Histology revealed inflammation within the appendix wall in 24.6% of our patients with an apparently normal appendix on gross inspection. Furthermore, LAP allows for a thorough exploration of the abdominal cavity and identification of concomitant diseases, such as Meckel's diverticulum. In our experience with diagnostic LAP, we operated on 3 cases of Meckel's diverticulum in patients who underwent prior open surgery for acute appendicitis. A laparoscopic approach at the time of the appendectomy might have spared them a second surgical procedure.

Treatment Options

LAP allows the use of the same surgical procedures as those in open surgery, or even to schedule the appropriate medical therapy in the presence of concomitant diseases. The length of surgery is almost equal to that of open surgery, due to improvements in both equipment and the surgeon's learning curve. The time spent for treatment of diseases incidentally found at laparoscopy should be weighted against the economic impact of a missed diagnosis.[8]

Conversion

The most frequent causes of conversion were the presence of dense adhesions and unclear anatomy. Iatrogenic lesions were second in frequency. Conversion should never be regarded as a defeat: even when forced to convert the procedure, a surgeon may choose the most appropriate incision for treating the patient.[10-12]

Morbidity and Mortality

Our experience shows the feasibility of LAP in the treatment of abdominal emergencies with acceptable morbidity and mortality rates, comparable to those reported for OP, but these favorable results might be a consequence of patient selection.[9] The complications we observed occurred mainly at the beginning of our experience: undoubtedly a surgeon with sound experience would lower the morbidity and mortality rates.

Hospital Stay

Hospital stay after LAP was shorter than that in open controls, and patients experienced a faster recovery. The shorter hospital stay is particularly evident in patients operated on for pelvic disease, SBO, and cholecystitis.[8,9,12]

Cost

The advantage of LAP does not only consist of cosmesis but also of a decrease in operative trauma.[15] This results in a reduced incidence of wound infections and incisional hernias. Consequently, although the exact economic impact of LAP is difficult to assess, namely if direct costs are taken into account, the earlier patient recovery and return to work does benefit all of society.[16] In computing the indirect costs of LAP, its diagnostic accuracy, therapeutic potentials, and the reduced long-term morbidity rate should also be evaluated. It has been reported in the literature that women who undergo open appendectomy have an 80% risk of infertility and chronic abdominal problems compared with 10% for those treated laparoscopically.[17]

Patient Perception

Patients have an unquestionably positive perception of LAP thanks to its advantages (reduced postoperative pain, prompt recovery of gastrointestinal functions, shorter hospitalization, and improved cosmesis). Therefore, ever-growing requests for it are being made by the lay public.

The Surgeon

The Surgeon remains a crucial issue. A well-trained and

experienced surgeon together with a well-trained team is a necessity for LAP. In order to offer patients the same chance of cure, at our institution LAP is performed only when a well-trained laparoscopic surgeon is on call.

CONCLUSION

Based on our experience, LAP in the treatment of abdominal emergencies is feasible and effective in experienced hands. LAP provides superior diagnostic accuracy as well as wider therapeutic potentials than does OP. Sparing patients unnecessary laparotomies reduces postoperative pain, increases prompt recovery of gastrointestinal functions, shortens hospitalization, helps contain health-care costs, and increases cosmesis. This approach appears to play a crucial role in the diagnostic and therapeutic algorithm for fertile women, obese patients, and in almost every abdominal emergency. On these grounds, we advocate a wider adoption of laparoscopy and are confident it will become more important in common surgical practice.

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