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Perforated Appendicitis: Is Laparoscopy Safe?

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ABSTRACT

Objective: The purpose of this study was to demonstrate the safety and efficacy of laparoscopy in children with perforated appendicitis.

Methods: This is a retrospective review of consecutive patients under the age of 18, operated on for perforated appendicitis between September 1997 and December 1999.

Results: Sixty-nine patients were operated on for perforated appendicitis. Eleven appendectomies were performed laparoscopically. Fifty-four patients underwent an open appendectomy. Four laparoscopic appendectomies were converted to an open procedure. The mean operative time was 79 minutes for the laparoscopic group, and 87 minutes for the open group. The mean length of hospital stay was 5.4 days versus 7.6 days for the laparoscopic and open groups, respectively. Neither of these differences was statistically significant.

Conclusions: The above data support the use of laparoscopy in the management of perforated appendicitis in children. In conclusion, laparoscopy is as safe as open appendectomy. Laparoscopy is an effective alternative with a shorter length of hospital stay compared with that for an open appendectomy for perforated appendicitis in children.

Key Words: Laparoscopic appendectomy, Perforated appendicitis, Complicated appendicitis.

INTRODUCTION

With the advancement of laparoscopy in children, controversy has emerged with regards to the management of perforated appendicitis. Laparoscopy has the potential to decrease hospital stay and expedite return to normal activities. This has been demonstrated in the pediatric population with simple appendicitis.[1,2] The goal of this study was to demonstrate the safety, efficacy, and potential benefits of laparoscopy in the management of perforated appendicitis in children.

METHODS

After internal review board approval was obtained, a retrospective chart review was performed of all patients less than 18 years of age operated on for perforated appendicitis. Charts were reviewed for a 28-month period when laparoscopic appendectomy was introduced into the care of pediatrics at our institution. The study began in September 1997 and ended in December 1999. All patients were treated at a children's hospital within a tertiary care hospital and operated on by 4 pediatric surgeons. All diagnoses were made clinically. The clinical diagnosis was assisted by suspicious ultrasound findings in 17.4% (12) of patients (open appendectomy group, 14.8%; laparoscopic appendectomy group, 36.4%). Postoperatively, all patients received intravenous broad-spectrum antibiotics while in the hospital (Ampicillin, Gentamycin, and either Flagyl or Clindamycin) and broad-spectrum oral antibiotics when discharged (Bactrim and Flagyl).

Data concerning gender, age, weight, mean operative time, length of hospital stay, and complications were recorded. Unpaired Student t test analysis was performed to compare age, weight, mean operative time, and length of stay data. Pearson chi-squared analysis was used to compare the frequency of complications between the laparoscopic and open groups.

RESULTS

Sixty-nine charts were reviewed. Fifty-four appendectomies were performed using an open technique (OA), 11 appendectomies were performed laparoscopically

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(LA), and 4 cases were begun laparoscopically but had to be converted to open (CA) because of the difficulty of dissection and surgeon comfort level. These 4 patients were included in their own group. The open group was 57% male and 43% female. The laparoscopic group was 45% male and 55% female. The converted group was 75% female and 25% male. The mean age and weight of the OA group was 10.3 years and 42.5 kg, respectively. The mean age and weight of the LA group was 11.8 years and 42.4 kg, respectively. No statistically significant difference was found between these 2 groups based on an unpaired Student t test **(Table 1)**. The mean age and weight of the CA group was 13.1 years and 58.2 kg. When compared with both the OA and LA groups, the CA group was significantly older than the OA group by 2.8 years (P=0.01).

Mean operative time, length of hospital stay, and postoperative complications were compared between the 2 groups. For the OA group, the mean operative time was 87.7 minutes, the average length of hospital stay was 7.6 days, and complications were seen in 18.5% of patients. For the LA group, the mean operative time was 79 minutes, the average length of hospital stay was 5.4 days, and complications were seen in 27.3% of patients. No statistically significant differences were noted between the 2 groups when comparing operative times, length of hospital stay, or complications **(Table 2)**. For the CA group, the mean operative time was 132.5 minutes, and the average length of hospital stay was 4.25 days. When compared with both the OA and LA groups, the CA had a significantly shorter length of stay (3.4 days) than did the OA group (P=0.047).

The 3 most common postoperative complications were wound infection, abscess, and bowel obstruction. For the OA group, 18.5% of patients had complications, which included 8 wound infections, 3 intraabdominal abscesses, and 2 bowel obstructions. For the LA group, 27.3% of patients had complications, which included 2 postoperative abscesses, 1 wound infection, and 1 bowel obstruction. One patient in the CA group had a wound infection. Based on chi-square analysis, no statistically significant difference was found between these 3 groups when considering the total number of patients with complications in each group (χ^2=2.31, $P \leq 1$). All wound infections were treated with continued broad-spectrum antibiotics. All patients who presented with postoperative obstruction were given a trial of conservative management (nasal gastric tube decompression and broad-spectrum antibiotics) and then taken back to the operating room for reexploration if this was not successful. All patients who presented with only a pelvic abscess and no signs of obstruction were treated successfully with computed tomography-guided percutaneous drainage and broad-spectrum antibiotics **(Table 3)**.

DISCUSSION

An increasing number of pediatric surgeons are using laparoscopy in the management of acute appendicitis. Although many feel comfortable removing a simple acute appendix laparoscopically, many surgeons would hesitate to remove a grossly perforated appendix laparoscopically. While laparoscopy is believed to decrease complications and hospital stay, in the case of complex appendicitis, it is feared that laparoscopy will unneces-

Table 1.
Patient Demographics

	No. of Patients	M:F Ratio	Mean Age	Mean Weight
Open	54	31:23	9.85 years	49.57 kg
Laparoscopic	11	5:6	11.8 years	42.4 kg
t test			P=0.246	P=0.988

Table 2.
Laparoscopic vs Open Appendectomy

	Mean Operative Time	Mean Length of Stay
Open	87.25 min	7.57 days
Laparoscopic	79 min	5.4 days
t test	P=0.394	P=0.130

Table 3.
Postperative Complications

	Wound Infection	Abscess	Bowel Obstruction
Open (n=54)	14.8% (8)	5.6% (3)	3.7% (2)
Laparoscopic (n=11)	9% (1)	18.2% (2)	9% (1)

sarily prolong the operative time and increase the rate of postoperative intraabdominal abscesses.

Some authors[3-7] have noted that patients with perforated appendicitis may have an increased incidence of infectious complications when treated laparoscopically. Horwitz et al[3] reviewed 2 years of their experience using laparoscopy for complicated appendicitis. They found a statistically significant increase in the occurrence of postoperative intraabdominal abscesses when laparoscopy was used. Others have shown small increases in the number of intraabdominal abscesses seen in both adult and mixed (pediatric and adult) populations, but they failed to demonstrate statistical significance.[4-7]

In our study population, 11 ruptured appendices were successfully removed laparoscopically over the 28-month period. No significant increase occurred in the total number of patients with postoperative complications or operating room time when the laparoscopic group was compared with the open group.

With the use of laparoscopy, the average length of hospital stay was decreased, although this was not statistically significant. We expect that a study encompassing a greater number of patients will show a statistically significant decrease in the average length of hospital stay. We conclude that laparoscopy is a safe and effective approach to perforated appendicitis.

References:

1. Gilchrist BF, Lobe TE, Schropp KP, et al. Is there a role for laparoscopic appendectomy in pediatric surgery? *J Pediatr Surg*. 1992;27(2):209-214.

2. el Ghoneimi A, Valla JS, Limonne B, et al. Laparoscopic appendectomy in children: report of 1,379 cases. *J Pediatr Surg*. 1994;29(6):786-789.

3. Horwitz JR, Custer MD, May BH, Mehall JR, Lally KP. Should laparoscopic appendectomy be avoided for complicated appendicitis in children? *J Pediatr Surg*. 1997;32(11):1601-1603.

4. Paik PS, Towson JA, Anthone GJ, Ortega AE, Simons AJ, Beart RW Jr. Intra-abdominal abscesses following laparoscopic and open appendectomies. *J Gastrointest Surg*. 1997;1(2):188-193.

5. Golub R, Siddiqui F, Pohl D. Laparoscopic versus open appendectomy: a metaanalysis. *J Am Coll Surg*. 1998;186(5):545-553.

6. Kluiber RM, Hartsman B. Laparoscopic appendectomy. A comparison with open appendectomy. *Dis Colon Rectum*. 1996;39(9):1008-1011.

7. Bonanni F, Reed J III, Hartzell G, et al. Laparoscopic versus conventional appendectomy. *J Am Coll Surg*. 1994;179(3):273-278.

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