

# Laparoscopic Appendectomy in Children Can Be Done as a Fast-Track or Same-Day Surgery

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## ABSTRACT

**Background:** Laparoscopic surgery has reduced the length of hospital stay for common operations like cholecystectomy, gastric fundoplication, and appendectomy. We have noticed a reduction in length of hospital stay for children undergoing laparoscopic appendectomy. We, therefore, looked at our data to assess whether laparoscopic appendectomy in children could be performed as fast-track or same-day surgery ( $\leq 24$ -hour postoperative stay).

**Methods:** We performed a retrospective review of the records of all children who underwent laparoscopic appendectomy for suspected appendicitis during a 3-year period (7/97 to 7/00).

**Results:** Laparoscopic appendectomy was performed in 79 children (44 boys and 35 girls), between 2 to 17 years of age (mean, 11 years). In 4 (5%) children with perforated appendicitis, the laparoscopic appendectomy was converted to an open appendectomy. At operation, 51 (64.5%) had acute appendicitis, 22 (27.8%) had perforated appendicitis, 4 (5%) had ruptured ovarian cysts, and 2 (2.5%) had no pathology. The median operative time was 54 minutes. Total length of stay for all 79 patients was a median of 58 hours, and median postoperative LOS was 35 hours. Complications included wound infection (2), abdominal abscess (4), drug rash (2), and epididymo-orchitis (1). In 57 (72%) children without perforated appendicitis, the total length of hospital stay was a median of 42 hours, while median postoperative length of stay was only 28 hours. Thirty-two (56%) children went home in  $\leq 24$  hours following laparoscopic appendectomy. No significant morbidity was noted in the non-perforated group (drug rash, 1; fever  $> 24$  hrs, 3); and no

readmissions or reoperations were necessary on follow-up.

**Conclusion:** Laparoscopic appendectomy is safe and effective for treating children with appendicitis. Laparoscopic appendectomy may be safely performed as fast-track or same-day surgery, in select children without perforated appendicitis, with a postoperative stay of  $\leq 24$  hours.

**Key Words:** Laparoscopic appendectomy, Pediatric laparoscopy, Same-day surgery.

## INTRODUCTION

Laparoscopic surgery has gained widespread acceptance in a variety of procedures, ranging from gastric fundoplication to cholecystectomy.<sup>1,2</sup> Gans<sup>3</sup> first introduced laparoscopic surgery in the pediatric population in 1973.<sup>3</sup> Semm<sup>4</sup> first described laparoscopic appendectomy in 1983. Although laparoscopic appendectomy (LA) is more expensive than is open appendectomy (OA) due to the costs of the disposable equipment, and can be more technically challenging in children, the overall cost of the operation has been shown to be similar to that of open appendectomy.<sup>5</sup> The real cost savings of LA are due to the shorter postoperative length of hospital stay (LOS) and the infrequent postoperative complications.<sup>5,6</sup>

The ultimate reduction in postoperative hospital costs to make LA most cost-effective would be to perform the procedure as same-day surgery or so-called fast-track surgery. Because it has been our observation that many children can be discharged within 24 hours after a laparoscopic appendectomy, we reviewed our records to determine its feasibility.

## METHODS

A retrospective chart review was performed on 79 children who underwent a laparoscopic operation for the suspected diagnosis of acute appendicitis over a 3-year period between July 1997 and July 2000. Prior to the operation, if the diagnosis of acute appendicitis was unclear, the patients were evaluated with further labora-

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tory and diagnostic testing, which included an abdominal computed tomography scan or ultrasound evaluation, or both of these, in select patients. Laboratory information included white blood count and urinalysis, and depending on the circumstances, might also include a beta human chorionic gonadotropin and rapid streptococcal screen, as well as other tests as indicated.

All patients underwent the operation while under general anesthesia, and all received a single dose of a broad-spectrum antibiotic preoperatively for wound infection prophylaxis. The standard laparoscopic operative technique was used, with either a 5-mm or 12-mm port introduced at the umbilicus after inducing pneumoperitoneum with carbon dioxide. A 0- or 30-degree laparoscopic telescope was then introduced through this port, and the abdominal and pelvic cavities were directly visualized with the laparoscope to inspect for other possible pathologies. Next, two 5-mm ports were introduced under direct vision, one in the suprapubic region or the left lower quadrant and another in the right iliac fossa or in the right upper quadrant. The appendix was identified and grasped by its distal end to fully expose the entire organ and its attached structures. The appendiceal artery was isolated, ligated, and divided or cauterized. At that point, a staple line was fired across the base of the appendix by using an endoscopic stapler, or endoscopic loops were used to isolate the base of the appendix, and it was divided. If the appendix was particularly enlarged or friable, it was removed from the abdomen through the umbilical incision with the use of an endoscopic bag. All ports were removed under direct visualization, and the fascia was reapproximated to prevent future incisional hernia occurrences. All skin incisions were closed and no drains were placed.

If any evidence of localized or generalized peritonitis was visualized during the operation, patients were sent home on oral antibiotics, usually a 5-day course of amoxicillin plus clavulanate. If the appendix was perforated prior to removal, patients were placed on triple antibiotic coverage intravenously, which included ampicillin, gentamicin, and clindamycin for 5 days while in the hospital. They were then discharged home on oral antibiotics. If any evidence of abscess formation or peritoneal soilage was noted, the abdominal cavity was vigorously lavaged with normal saline. Postoperative analgesia was obtained usually with ketorolac tromethamine and acetaminophen.

To be discharged home, patients had to be tolerating oral

liquids, be afebrile, and free of nausea and vomiting. Patients were seen in follow-up 7 to 14 days after hospital discharge.

## RESULTS

Seventy-nine children (44 boys and 35 girls) between 2 to 17 years of age (mean, 11 years) underwent LA. In 4 (5%) children, all with perforated appendicitis, the LA was converted to an open appendectomy, secondary to technical difficulties in completing the operation laparoscopically. At operation, 51 (64.5%) had acute appendicitis, 22 (27.8%) had perforated appendicitis, 4 (5%) had ruptured ovarian cysts, and 2 (2.5%) had no obvious pathology. The median operative time was 54 minutes. Total LOS for all 79 patients was a median of 58 hours, and median postoperative LOS was 35 hours. Complications included wound infection, 2 (2.5%); abdominal abscess, 4 (5%); drug rash, 2; and epididymo-orchitis, 1. All but one complication (drug rash, 1) occurred in the perforated group. In the 57 (72%) children without perforated appendicitis, the total LOS was a median of 42 hours, while median postoperative LOS was only 28 hours. Thirty-two (56%) of the children without perforated appendicitis went home in  $\leq 24$  hours following LA. No significant morbidity occurred in the non-perforated group (drug rash, 1; fever  $>24$  hrs, 3); and no readmissions or reoperations were necessary on follow-up.

## DISCUSSION

Although most appendectomies, especially in children, are not done laparoscopically, many studies have shown that laparoscopic appendectomy (LA) is at least as good as open appendectomy (OA), with several benefits, including less postoperative pain and shorter lengths of stay (LOS).<sup>5,7-13</sup> The disadvantages of LA, which include increased operative time and increased cost of equipment, are easily offset by the decreased postoperative recovery time and the apparent decreased incidence of postoperative complications.<sup>5,6,14,15</sup> Additionally, it has been suggested that with increasing operative experience the operative time required for LA will decrease significantly.<sup>15</sup> The use of nondisposable laparoscopic equipment significantly decreases the cost of LA.<sup>5-6,12,14,15</sup> Lastly, it has been suggested that even if patients are not discharged from the hospital soon enough after LA to make a significant difference between the cost of LA ver-

sus OA, LA has a much shorter recovery time and returns patients to a productive lifestyle sooner, thus justifying LA.<sup>14</sup> Although most children are not working, the caregivers or parents can return to work sooner, when their child goes back to school.

Adult series have documented a decreased incidence of postoperative complications and a decreased incidence of wound infection after LA.<sup>7,14-16</sup> In our series, 2 patients had wound infection and 4 patients developed abscesses, which is a similar complication rate to that in other series.<sup>15,16</sup> In all instances, these complications arose in the perforated group. Although perforation was at first considered a contraindication for LA, it has now been utilized successfully in the management of acute appendicitis as well as perforated appendicitis.<sup>17-20</sup> It has been suggested that thorough lavage of the abdominal cavity after appendectomy can help to decrease the incidence of abscess formation, and this is a practice that we utilize and is facilitated by the use of laparoscopy. Certainly, the laparoscopic approach facilitates the complete irrigation of the abdominal cavity and identification of all loculated collections.

An additional benefit of laparoscopic surgery is that it leads to greater accuracy of diagnosis, especially in teenage female patients with suspected appendicitis. In cases such as obesity and mental retardation, the diagnosis of appendicitis can be hampered. Laparoscopy can be used to delineate the source of abdominal pain when the diagnosis of appendicitis is suspected but not certain. In 4 of our patients with the presumed diagnosis of appendicitis, intraoperative visualization revealed normal appendices, and ruptured ovarian cysts were identified as the source of their pain. Obviously, all four patients were female. Others have also found an increased preponderance of unclear diagnoses in the female population.<sup>9,10,15</sup>

In our patients, the appendix was always removed at the time of operation, despite the fact that occasionally (in 4 patients) the gross appearance of the appendix was normal. In the past, it has been unclear whether it would be of any benefit to the patient to remove a healthy organ, but it has been argued that with advances in laparoscopy and its proven benefit, there is no justification for leaving a visually normal appendix in place.<sup>9,10,21</sup> Additionally, microscopic evidence of early appendicitis is occasionally seen. In our study, it was noted that 2 visually normal appendices were found to have micro-

scopic evidence of appendicitis.

Outpatient surgery has been widely accepted in a variety of procedures, and many are done laparoscopically.<sup>22</sup> The idea that an appendectomy can be done in the pediatric patient as outpatient surgery is not a new one. In 1993, Ramesh and Gallard<sup>23</sup> suggested early discharge after open appendectomy, even within 24 hours. In another study, Velhote et al<sup>24</sup> also found that most children could be sent home within 24 hours after appendectomy. In that study, the appendectomy was performed through a standard gridiron incision of 2 cm or less. Brosseuk and Bathe<sup>21</sup> suggested laparoscopic appendectomy as outpatient surgery in 1999, and they advocated early discharge in both perforated and simple appendicitis. However, no children underwent LA in this study.

The fact that all major complications in our study occurred in perforated cases would argue against these cases being performed as same-day surgery,<sup>23</sup> although others have disputed this approach.<sup>2,24</sup> In our treatment protocol, perforated appendicitis would not be placed on a fast-track surgery list because these patients usually receive inpatient intravenous antibiotic therapy for 72 hours.

We suggest that laparoscopic appendectomy is a safe and effective treatment in the pediatric population, and that in cases of nonperforated appendicitis this may be performed as a fast-track or short-stay procedure. We believe that this not only is more convenient for patients and their families, but it also adds to the overall cost-effectiveness of laparoscopic appendectomy. Our findings are based on a retrospective review of our charts over the past 3 years, and this is an obvious criticism of the study. In no instance was it prospectively decided that the child would be discharged within 24 hours. In fact, a small number of children met exclusion criteria due to delays in discharge not related to their medical condition. We made our best attempt to identify when the order was given for the child to be released rather than the actual time that the child left the hospital. However, the documentation was occasionally unclear, and these children were excluded if it could not be ascertained exactly when the order was given or when they left the hospital.

We believe that in cases of simple appendicitis, there is no reason not to dismiss a child within 24 hours if the

above-mentioned discharge criteria are met. We anticipate that in the future, a greater percentage of our pediatric patients will be discharged within 24 hours, and we feel that in cases of simple appendicitis, laparoscopic appendectomy can be done as fast-track or short-stay surgery.

## CONCLUSION

Laparoscopic appendectomy is safe and effective in treating children with suspected appendicitis. It may be safely performed as fast-track or same-day surgery, in select children without perforated appendicitis, with a postoperative stay of  $\leq 24$  hours in the majority of such patients.

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