

Title : Role of laparoscopy in Complicated Appendicitis in Children: A Five Year Single-Centre Experience.

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Background: Appendicitis is one of the most common surgical emergency among children .Nearly 30% of children present to hospital with complicated appendicitis, which is associated with higher morbidity than simple appendicitis. Controversy exists in the treatment of complicated appendicitis in pediatric age group.The goal of this study was to review the results of laparoscopic surgery in complicated appendicitis in terms of safety, efficacy and complications

Methodology- A Retrospective observational study was conducted in a Tertiary care hospital in Bangalore from 2015 to 2020 over a period of 5 years . All children who underwent laparoscopic surgery for complicated appendicitis (perforated, gangrenous and mass) were included in the study. Thorough history with respect to symptoms and their duration were recorded followed by general and abdominal examination. Routine blood investigation and imaging were done before surgery. Intra operative data regarding the type of complication, presence or absence of Fecolith, position of appendix were documented. Post operatively duration of stay and complications were analyzed.

Results- 60 cases were included in the study. Mean age of presentation was 10.11 ±0.855 years. Out of 60 children 53 were males and 7 were females. The mean operative time was 55.8333 ±4.806 min. The rate of conversion from the laparoscopy to open surgery was 11.5%. Mean time of duration of intravenous antibiotics was 4.2778 ±0.446 days. Mean time for starting of oral feeding was 2.8333 ±0.307 days. Mean duration of hospital stay was 5.11 ±0.545days . Wound infection in immediate post operative period was seen in 6.6% of the children. No long term complications were noted.

Conclusion- Laparoscopic appendectomy (LA) for complicated appendicitis is safe and effective. Therefore, it should be the first choice for cases of complicated appendicitis in children.

Keywords: Appendicitis, laproscopic appendectomy, children, complicated appendicitis

Introduction

Acute appendicitis in children is one of the most common surgical emergency. Its incidence peaks between the ages of 11 and 12 years, and it has a lifetime risk of 7–9% Children experience the greatest risk of disease, and incidence among children is 4 times greater than the overall population^[1]. Appendicitis is often categorized as uncomplicated (early, inflamed, simple) or complicated (gangrenous, perforated appendicitis with abscess/phlegmon or perforated appendicitis without abscess/phlegmon). Complicated appendicitis is found in up to 30% of patients treated operatively and represents a particularly resource-intensive condition.²

Children with complicated appendicitis have a longer length of stay (LOS), greater hospital cost, and higher risk of subsequent hospital visits compared with those with uncomplicated disease. Despite significant advancements in the diagnostic evaluation of children with suspected appendicitis during the past few decades, the rates of complicated appendicitis have remained unchanged.³

Since the first laparoscopic surgery for appendicitis in 1983, it has been established as the gold standard surgery for simple appendicitis. There are several hypothetical advantages for laparoscopic approach in complicated appendicitis. It facilitates evaluation of the entire abdominal space, diminishes the operative trauma and meticulous peritoneal lavage. The role of laparoscopic surgery in the treatment of complicated appendicitis has been more controversial.⁴ Compared with Open Appendectomy (OA), Laparoscopic Appendectomy(LA)needs higher technical skills, longer operative time and is associated with a higher incidence of intra abdominal collections. More recent studies have reported the safety and feasibility of this procedure in complicated appendicitis, with low incidence of infectious complications.⁵

The goal of this study was to review the results of laparoscopic surgery in complicated appendicitis in terms of safety, efficacy and complications.

Methodology- This was a retrospective observational study conducted in a tertiary hospital ,Bangalore over a period of 60 months from 2015 to 2020. All children diagnosed with complicated appendicitis (perforated, gangrenous and mass) were included in the study. Children with simple appendicitis were excluded from the study.

The data of children with respect to age, sex, symptoms and their duration were tabulated. The clinical, biochemical and imaging findings were documented. In all the children blood counts and renal function test were done. Initially all children had an ultrasonography (USG) of the abdomen and pelvis. In children where ultrasonography was inconclusive Computed Tomography of the abdomen was done.

Children underwent surgery within 24 hours of admission after all the routine investigation. Informed consent about the procedure was taken(Parents/Guardians). All the children received pre-operative antibiotics, combination of 1st generation cephalosporin, amikacin and metronidazole.

Laparoscopic appendectomy was done by standard three port technique. Port sites were infraumbilical, left and right iliac fossa. Similar to open technique, pus was drained followed by appendectomy and lavage. In all the children a drain was placed which was subsequently removed in post operative period.

Intraoperative findings in terms of type of complicated appendicitis, position of appendix, presence of appendicolith, were documented. Primary outcome with respect to complication was assessed. Secondary outcomes were duration of intravenous antibiotics, resumption of oral diet and the length

of stay. The follow up period ranged from 6months to 5 years. Immediate and late complications in each group were evaluated (With follow ups and telephonic contacts). All the data collected were entered into Microsoft Excel sheet and suitable analysis was carried out.

Results- During the study period 200 children underwent laparoscopic appendectomy for appendicitis. Out of 200 children 60 children underwent laparoscopic procedure for complicated appendicitis.. Mean duration of pain at the time of presentation was 2.88 ± 0.342 days and the mean total leucocyte count was $14,125.22 \pm 1,234.47$

Operative findings

The cases were further divided into four groups according to the operative findings: group 1 – perforation with localised abscess, group 2 - Perforation with generalised abscess, group 3 – appendicular mass and group 4-gangrenous appendix. The distribution of operative findings is presented in table 3. The data with respect to position of appendix is tabulated in table 4. 12 children had fecolith.

Operative time

The mean operative time was 55.83 ± 4.80 min.

Rate of conversion

The rate of conversion from the laparoscopic approach to open approach was 11.5% (seven cases). In five cases conversion was due to dense adhesions of small bowel loops forming a mass. In two cases the appendix was retrocaecal and plastered to the lateral abdominal wall and the caecum. In view of chances of injuring the caecum decision to convert to open was taken.

Duration of intravenous antibiotics, oral feeding, hospital stay:

The mean time of duration of intravenous antibiotics was 4.27 ± 0.4 days. Mean time for starting of oral feeding was 2.83 ± 0.31 days. Mean duration of hospital stay was 5.1 ± 0.5 days (range 3-10 days).

Early and late complications:

The incidence of early and late complications is shown in Table 6. Four patients (6.6%) had early postoperative complications in the form of wound infection. All these patients were treated conservatively with regular dressing. No patient presented with features of adhesive obstruction on long term follow up.

Tables & Figures:

Table 1. Demographic variable

		LA
Age (years)		10.11 ± 0.85
Sex	Male	53
	Female	07

Table 2. Duration of pain, TLC

	LA
Duration of Pain(days)	2.88 ± 0.34
Total leucocyte count	$14,125.23 \pm 1,234.47$

Table 3. Operative findings

Operative Finding	LA
Perforation with localised abscess	26(43.33%)
Perforation with generalised abscess	18(30%)
Appendicular Mass	06 (10%)
Gangrenous appendix	10(16%)

Table 4. Position of appendix

Position of appendix	LA
Retrocaecal	24(40%)
Pelvic	13(21.6%)
Paracaecal	14(23.3%)
Preileal	09(15%)

Table 5: Duration of operation and Post op recovery in Hospital

Variables	LA
Operative time(min)	55.83 ±4.8
Duration of I.V. Antibiotics (days)	4.27 ±0.4
Resumption of oral feed (days)	2.83 ±0.3
Length of stay (days)	5.11 ±0.5

Table 6: Complications with Laparoscopic Apendectomy

	No complication	Complication*	Total
LA	56	04	60

*Immediate complication only(wound infection)

DISCUSSION

A lot of controversies do exist in the management of children with complicated appendicitis. These include type of antibiotics, conservative management, only drainage of abscess and later appendectomy, skin closure. Added to these controversies is the role of laparoscopy in complicated appendicitis in children.

Frazer and Bohannon were among the first to conclude that laparoscopic appendectomy is safe and beneficial for patients with complicated appendicitis⁶

Laparoscopy is now shown to be the optimal approach to treat complicated appendicitis, but in very young children this standardized operation is not always easy to perform. Pneumoperitoneum in infants should be of low pressure for possible haemodynamic effects and so the working space could be very limited. Also the use of endoscopic mechanical staplers could be limited by the abdominal cavity dimensions.⁷

Few studies suggested lack of concrete evidence supporting laparoscopic approach for complicated appendicitis.^{4,8,9,10} However, others concluded that LA for complicated appendicitis is better than OA(open appendectomy).¹¹⁻¹⁴ In complicated appendicitis, especially in obese children, LA benefits a patient compared with OA because it minimizes the tissues damage and allows better visualization of abdominal spaces and thorough peritoneal irrigation, avoids wound incision and extension, and is associated with less exposure of wound surface to contaminated fluids. There is also

reduced postoperative pain, early return to normal daily activity, and of course superior cosmetic results.

Taking in consideration the above-mentioned debate, the aim of our study was to evaluate the efficacy of LA in children with complicated appendicitis in our institution.

The mean age of study subjects in the present study was 10.11 ± 0.855 with a range of 4-15 years. Few studies showed similar age distribution, Saquib et al., in which age of subjects ranged from 3 to 12 years¹⁵, and Ikeda et al., which ranged from 2 to 15 years with median of 9 years¹⁶.

The ratio of male to female children were 7.5 males to 1 female which was more compared to other studies, Menezes et al., study¹⁷, Saquib et al., study¹⁵, Wang et al., study¹⁸ and Ikeda et al., study¹⁶. The mean leucocyte count in patients was $14,125.23 \pm 1,234.47$, similar finding was observed with study by Hackam et al. where the mean total leukocyte count was 18000 per mm³ in his cases¹⁹. The mean operative time in our study was 55.83 ± 4.8 min. This was very similar to studies by Mohammad G. Khirallah et al. and Liet al.,^{20,21} where the mean operative time were 56.41 minutes and 57.94 minutes respectively. Few other studies have reported longer duration of surgery, Ikeda et al., and Moraitis et al., which showed average time of 87.3 ± 9.1 minutes, and 129.5 ± 13.6 minutes respectively^{16,22}. This difference could be attributed to the difference in the level of laparoscopy skills.

Our patients, who underwent LA were able to start oral intake within 2.83 ± 0.3 days. This is in agreement with L. R. Padankatti et al., in which feeds were established in 2.5 days in the LA group and to Saquib et al., who reported the mean time until return to normal diet was 1.8 ± 0.6 days¹⁵.

Our study also showed that the mean duration of hospital stay in the LA group (5.11 ± 0.5), this was comparable with other studies like Meguerditchian et al., who reported postoperative hospital stay of 2.33 ± 1.23 day²³. Hackam et al., found that the mean length of post-operative hospital stay was 5.95 ± 1.56 days¹⁹, while Moraitis et al., found that the mean length of post-operative hospital stay was 3.58 ± 1.98 days in cases of complicated perforating appendicitis²², and Menezes et al., found the mean length of post-operative hospital stay was 7.36 ± 2.1 days¹⁷.

Many studies found that LA markedly reduced the postoperative wound infection rate when compared with Open appendectomy (1.3 vs. 12.5%)^{11,13,24}. No case in our study had post operative intra-abdominal abscess. Many studies like Hackam et al.¹⁹, Ikeda et al.¹⁶ and Meguerditchian²³ et al have had few cases of intra-abdominal abscess. Thorough intra-abdominal lavage post surgery and drain placement might be the reason for absent post operative abscess in our study. The overall incidence of postoperative complications in our study was 6.6%.

CONCLUSION

It can be concluded that laparoscopic approach could be used in cases of complicated appendicitis. Laparoscopic appendectomy for complicated appendicitis is safe and effective. It is associated with lesser mean operative time, early start of oral feeds, low incidence of infectious complications and short duration of hospital stay. Therefore, it can be considered as the first choice for cases of complicated appendicitis in children.

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