

# LAPAROSCOPIC APPENDECTOMY IN PEDIATRIC POPULATION: A SINGLE CENTER EXPERIENCE

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## ABSTRACT

**Objective:** To share our institutional experience and outcome of appendectomy in the pediatric population early in our transition from open approach to laparoscopic.

**Methodology:** This retrospective study was conducted in the Pediatric Surgery Unit of Khyber Teaching Hospital, Peshawar, from January 2015 to July 2017. We reviewed records of 233 patients, who underwent appendectomy. All cases were classified into early stage (ES) and complicated appendicitis (CA) on operative findings. Outcome variable includes operative time, length of hospital stay (LOHS), analgesia requirement, parent/care-giver satisfaction and postoperative complications. Clinical and demographic data were collected and analyzed with SPSS 20.

**Results:** A total of 98 patients were operated by laparoscopic appendectomy (LA) and 135 by open appendectomy (OA). The operative time for LA was higher than OA both for early stage (LA 35.5 ± 1.78 min, OA 33.5 ± 1.68 min, p = 0.53) and complicated appendicitis (LA 55 ± 1.32 min, OA 40.6 ± 2.05 min, p = 0.005). Hospital stay in cases of early stage appendicitis was shorter for LA (1.9 ± 0.31 days) as compared to OA (2.8 ± 0.57 days), p value = 0.000; while in complicated cases it was same in both groups (04 days, p = 0.28). Analgesia requirement was low for LA, both for ES (p = 0.05) and CA (p = 0.01). Parents' satisfaction score was significantly higher for LA than OA.

**Conclusion:** Laparoscopic appendectomy is a safe method and a substitute for open appendectomy among children. It should be preferred over open appendectomy even in cases of complicated appendicitis.

**Key Words:** Laparoscopic appendectomy, Open appendectomy, Early stage appendicitis, complicated appendicitis

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## INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies in children<sup>1</sup>. Open appendectomy was the treatment of choice for long time before introduction of laparoscopic approach in its treatment in 1992 in pediatric population<sup>2</sup> and since then research started on its outcome in pediatric population<sup>3</sup>. Currently some authors have even reported laparoscopic appendectomy in outpatient to further enhance its superiority over open approach<sup>4</sup>. Studies show that LA is superior in outcome to OA in early stage appendicitis but LA role in complicated appendicitis is yet to be identified<sup>5</sup>. The popularity of laparoscopy is not uniform that's why LA preference varies between different centers. Role of laparoscopic appendectomy is still debatable and for the most

part pediatric surgeons are indisposed to recognize its routine use<sup>6</sup>. Variability of reports on the dominance of laparoscopic appendectomy for ES and CA, warrant further research on this topic. In an attempt to clarify this dominance of laparoscopic appendectomy both for ES and CA, this study was conducted. Outcome of open appendectomy was compared with Laparoscopic appendectomy in a single institution

## METHODOLOGY

This retrospective observational study was carried out in the Pediatric Surgery Unit of Khyber Teaching Hospital, Peshawar, from January 2015 to July 2017. A total of 233 patients were included in the study with LA (n=98) and OA (n=135). Children having age 5 to 16 years who underwent appendectomy during the

study period were included in the study. Patients below 5 years and previous operated cases of laparotomy were excluded from the study. Appendicitis was classified as early stage (ES) and complicated appendicitis (CA) by the operating surgeon on operative findings. Suppurative and perforated appendicitis were considered as CA. All appendix specimens were submitted for histopathology, in order to know the frequency of negative appendectomy. The choice of procedure was, according to preference of parents/care-giver, opting for the open or laparoscopic procedure. All surgeries were performed by the same group of surgeons. Urinary catheterization and NG tube were passed in all patients who underwent LA.

Outcome variables include operative time, LOHS, analgesia requirements and postoperative complications. Operative time starts from incision to last stitch. Postoperative complications include wound infection and adhesive obstruction. We used intravenous Acetaminophen as 1st line analgesia for both procedures and number of doses required were recorded. For increased intensity of pain intravenous ketorolac acid was advised as 2nd line drug. Both were given according to weight (acetaminophen 1ml/kg and ketorolac acid 0.5mg/kg diluted). Intravenous narcotics were avoided as their safety profile are not established in children.

Standard three port technique was used to perform LA. Two ports were 3mm and one port was 5mm. Pneumoperitoneum was produced with a closed Varese needle technique. End loop was used for ligation of the base of the appendix and retrieved through the 5mm suprapubic port without direct contact with wound. In case of suppurative/gangrenous appendicitis sample was retrieved on glove technique. OA was performed through Lanz's muscle splitting incision in a conventional way.

All patients were mobilized and orally allowed 06 hours after surgery. All patients were discharged on criteria of being clinically stable (afebrile, pain free, normal pulse & TLC in normal range). Parent/care-giver satisfaction

was calculated through a pre-designed proforma having 7 questions with three different options (0 =not satisfied, 1 =satisfied and 2 =very satisfied). Parents/care-givers had filled this proforma on 1st follow up visit. The collected data were revised, tabulated, coded and fed in PC having statistical analysis program SPSS-20. Mean, SD and range were calculated for numerical data while frequency and percentages were calculated for categorical data. Groups were compared using chi-square test for categorical data and student t-test was used for numerical data. Statistical significance was accepted at a p value <0.05.

## RESULTS

Laparoscopic group had 81% ES and 19% CA while the open group had 77.7% ES and 22.2% CA (p =0.6). For both procedures, patient ages range from 5-16 years, with a mean age for LA 11.3 ±2.23 years and OA 9.3 ±2.27 years (p =0.922). LA had 42.1% males, while OA had 57.9% males and LA had 42% females, while OA had 58% females (p=0.98).

Operative time for ES appendicitis was higher for LA, with no statistical significance (t =7.54, p =0.53). Operative time for CA was significantly higher for LA (t =27.16, p =0.005) as shown in Table 1. LOHS was shorter for LA as compare to OA in ES appendicitis while in CA there was no significant difference in length of stay (Table 2). Regarding analgesia, LA patients had significantly low analgesia requirement for both early stage and complicated appendicitis when compared with OA (Table 3).

Postoperative complication rate was very low in LA group. The incidence of wound infection in LA group was zero versus 10.3% in OA group. LA group had a high incidence of negative histopathology report (LA 10.2% Versus OA 9.6%). There was a high incidence of adhesive obstruction in the OA group because of increase bowel handling in open surgery (LA 0% Vs. OA 3.7%). LA has a high parents/care-giver satisfaction than OA (LA 13.3 ±0.67 and OA 10.7 ±1.27) with t =17.72, p <0.001 (Table 4).

**Table 1: Comparison of operative time for laparoscopic and open appendectomy**

Appendicitis	Laparoscopic Appendectomy	Open Appendectomy	P value
Early stage appendicitis	35.4 ± 1.78 min	33.5 ± 1.68 min	0.53
Complicated appendicitis	55min ± 1.32	40.6 ± 2.05 min	0.005

**Table 2: Length of Hospital stay for laparoscopic and open appendectomy**

Appendicitis	Laparoscopic Appendectomy	Open Appendectomy	P value
Early stage appendicitis	1.9 ± 0.311 days	2.8 ± 0.57 days	<0.001
Complicated appendicitis	4 ± 0.94 days	4 ± 1.38 days	0.28

**Table 3: Analgesia requirement for laparoscopic and open appendectomy**

Appendicitis	Laparoscopic Appendectomy	Open Appendectomy	P value
Early Stage appendicitis	03 doses of acetaminophen/ day	03 doses of acetaminophen/day + 01 dose of ketorolic acid/day	0.05
Complicated appendicitis	03 doses of acetaminophen + 01 dose of ketorolic acid/day	3 doses of Acetaminophen + 2 doses of ketorolic acid/day	0.01

**Table 4: Complications and histopathology for laparoscopic and open appendectomy**

Variables	Laparoscopic Appendectomy n (%)	Open Appendectomy n (%)	P Value
Wound infection	0	14 (10.3%)	0.001
Adhesive obstruction	0	5 (3.7%)	0.04
Negative Histopathology	10 (10.2%)	13 (9.6%)	1.00

## DISCUSSION

Laparoscopic appendectomy has gained popularity and researchers have pointed out the many advantages of LA including shorter hospital stays, low incidence of postoperative complications and rapid return to normal activity<sup>7-9</sup>. Advantages of LA for complicated appendicitis are not yet clear and consensus need to be established. Recent research shows that LA is superior to OA even for complicated appendicitis<sup>3,10</sup>. Our study has clarified all these issues through a transition from open to the laparoscopic approach.

Many researchers have reported similar or longer operative time for LA as compare to OA<sup>11</sup>. However, operating time depends on operator experience and stage of appendicitis, early versus complicated appendicitis. Research shows longer operative time for LA in complicated and no significant difference was reported for LA in early stage appendicitis. Our study shows longer operative time for LA in both cases of early stage and complicated appendicitis. Reasons for increased operative time were transition from open to laparoscopic approach, initial learning curve and use of unipolar diathermy for cauterization of mesoappendix.

Wound infection is one of the postoperative complications that affect outcome. Infectious complication rate in LA is very low as compare to OA<sup>12,13</sup>. In our study there was no single patient with wound infection. This is because in LA the extraction site is protected. The appendix retrieval was in trocar sheath or in gloves finger, with no direct contact with the wound. Removal of appendix in complicated cases in glove finger is easy, safe and the least expensive method to avoid contact with the wound to minimize infection rate in LA<sup>12,14</sup>.

Effective and safe analgesia has key role in early recovery and return to normal activity<sup>15</sup>. Less post opera-

tive pain is one of the advantages of minimally invasive procedure. Research and literature review show that postoperative pain is very low in LA as compare to OA, therefore, analgesia requirement is low in LA<sup>16,17</sup>. This can be explained by low surgical trauma. The results in our study show less analgesia requirement in LA than OA.

Some authors report no significant difference in hospital stay between the two groups<sup>18</sup> while other shows shorter length of hospital stay for LA than OA<sup>17,19</sup> and this is endorsed by our results as well. Shorter hospital stay can be explained by less surgical stress, early mobilization, enteral feed and less post operative pain.

High conversion rate is reported in the literature. In this study there was only single case which was converted to open in the initial 10 cases. Some surgeons have low threshold for conversion to open. Conversion should be avoided as it carries a high morbidity rate<sup>3</sup>.

Laparoscopic appendectomy has best cosmetic result, low incidence of adhesions and low parents stress<sup>20,21</sup>. Due to high level of bowel handling in open appendectomy, adhesive obstruction and readmission is common. In current study, 3.7% cases were readmitted with diagnosis of adhesive obstruction after open appendectomy and this percentage was zero after laparoscopic appendectomy. Parents satisfaction is an important factor of outcome in pediatric surgery. Laparoscopic surgery has the beauty of high rate of parents satisfaction<sup>22</sup>. This study shows high parents/ care-giver satisfaction.

Despite advances in imaging modalities, appendectomy is generally performed on clinical ground of right iliac fossa pain. Such presenting complaint of pain can be due to other pathology and leads to negative appendectomy. Literature review showed that the negative histopathology of appendicitis is common in fe-

male patients and after laparoscopic appendectomy<sup>23</sup>. Laparoscopic criteria to agree on appendicitis is wanting and some authors have attempted to define a criteria<sup>24</sup>. On these footings, we subjected all specimens of appendices to histopathology, to know the frequency of negative appendectomy. Our results showed high rates of negative histopathology for laparoscopic appendectomy as compared to open appendectomy.

### LIMITATIONS

Our early experience of laparoscopic procedure, small sample size and retrospective data collection can affect the results of this study. Prospective randomized controlled trials are recommended to clarify the supremacy of LA over OA.

### CONCLUSION

Our results favoured laparoscopic appendectomy over open appendectomy in the pediatric population. It was found safe and effective even for complicated appendicitis. Less hospital stay and low analgesia doses were recorded in LA as compared to OA. Wound infection rate and adhesive obstruction were significantly less in LA as compare to OA.

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### CONTRIBUTORS

FUR conceived the idea, planned the study, and drafted the manuscript. ZUR and WA helped acquisition of data and statistical analysis. IUR helped acquisition of data and critical review of the manuscript. MI helped acquisition of data and final approval of the manuscript. All authors contributed significantly to the submitted manuscript.