

Post-operative Complications of Complicated Paediatric Appendicitis in a Tertiary Teaching Hospital

Aravind C S¹, Sam Varkey¹, Binu M K², Shinaz Sadiq², Maneesha U R²

¹Associate Professor, Department of Paediatric Surgery, Government Medical College Trivandrum, Kerala, India.

²Assistant Professor, Department of Paediatric Surgery, Government Medical College Trivandrum, Kerala, India

Corresponding Author: Aravind C S

DOI: <https://doi.org/10.52403/ijrr.20220102>

ABSTRACT

Background: Acute appendicitis is a common surgical problem, with complicated appendicitis having significant post operative complications, which contribute significantly to cost of medical care.

Methodology: A hospital based retrospective study was conducted in department of paediatric surgery, Thiruvananthapuram. Study population consisted of children treated with complicated appendicitis from January 2016 to June 2021.

Results: The study had 30.4% surgical site soft tissue infection (SSI). There was 13.48% incidence of major complication, with laparoscopic and open appendicectomies having similar incidence even though not statistically significant. SSI was more common with appendicular abscess and post ileal appendix. Post operative intra-abdominal abscess is more common with open appendicectomy, generalised peritonitis, post ileal appendix and base/proximal perforation of appendix. Post operative adhesive intestinal obstruction was more common with laparoscopic appendicectomy, appendicular abscess and base/proximal perforation of appendix. Total hospital stay correlates significantly with duration of symptoms on presentation with mean hospital stay of 7.72 days.

Conclusion: Complicated appendicitis have high incidence of post operative complications, 30.4% SSI and 13.48% serious complications like intra-abdominal collection and adhesive intestinal obstruction.

Key Words: Appendicitis, Complication, Surgical site infection, Children

INTRODUCTION

Acute appendicitis is a common surgical emergency in children. Those presenting late can have complicated appendicitis. Complicated appendicitis means appendicitis complicated by perforation or gangrenous appendix, and include appendicular mass, abscess and peritonitis. Unlike uncomplicated appendicitis, children with complicated appendicitis will be having significant complications like intra-abdominal collection, wound infection and adhesive intestinal obstruction in post-operative period. These contribute for significant morbidity in these children and increase medical expenditure. [1-4]

Studies have identified that those presenting after 24 hr duration have more than 60% chance of complicated appendicitis which increase with time. [1] All children with appendicitis are managed with appendicectomy either open or laparoscopically as it is found to have a better outcome compared to conservative management in various studies [2,4] and is the policy followed in our institution.

These children with complicated appendicitis have a significantly higher post-operative complication rates compared

to simple appendicitis with overall complication rate of 35 to 40%. Studies have described wound infection rate of 12.5% to 40%, which is higher in open appendicectomy. Similarly, the incidence of post-operative intraabdominal collection is 20 to 38.5%. Post-operative adhesive intestinal obstruction is also described to occur in 5% of these children. These children require prolonged hospital stay and antibiotic therapy. Up to 30% of children require readmission also due to post-operative complication especially intra-abdominal collection with in first 30 days of discharge [5,6].

In the present study an attempt is made to find the proportion of complications in children undergoing appendicectomy in a tertiary care teaching hospital in South India.

MATERIALS AND METHODS

This is a retrospective observational study conducted in department of paediatric surgery, SAT Hospital, medical college, Thiruvananthapuram. Records of children who underwent treatment for appendicitis from January 2016 to June 2021 were retrieved and data collected. Operative notes were analysed and those children with uncomplicated appendicitis were excluded from the study. Those who were partially treated outside and improving clinically on conservative treatment were also excluded from study. Children with appendicitis underwent open or laparoscopic appendicectomy.

Data retrieved from records include age, sex, duration of symptoms, intra operative findings (presence of abscess/peritonitis/ mass formation, position of appendix, perforation), post operative complications (abscess, adhesive obstruction) and duration of hospital stay. Appendicular abscess was defined as contained pus collection without peritoneal contamination, Local peritonitis was defined as pus limited to right iliac fossa and/or pelvis, appendicular mass was defined as inflammatory bowel mass secondary to

appendicitis with pus collection and gangrenous appendicitis was defined as inflamed appendix with gangrenous changes. Complications were grouped into two, (i) Surgical site infection (SSI), (ii) severe complications (intra-abdominal collection/ abscess, adhesive intestinal obstruction, stump leak and enterocutaneous fistula). Intra-abdominal collections were confirmed by USS abdomen. The data was entered in Microsoft excel sheet. Analysis was done using open-source statistical software 'jamovi 2' [7,8].

RESULTS

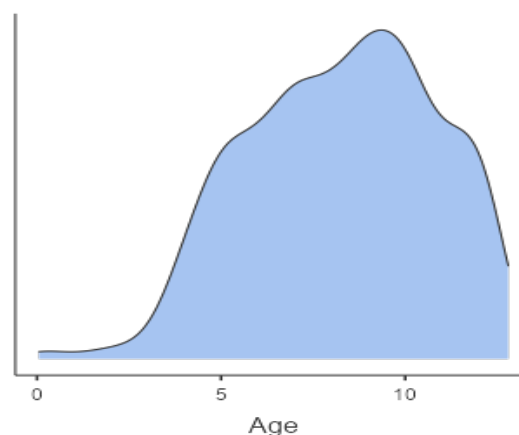


Fig. 1 Age distribution of complicated appendicitis

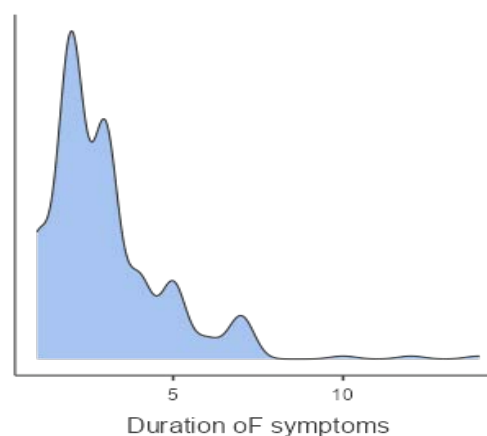


Fig 2. Pattern of duration of symptoms

During the study period from January 2016 to June 2021, 1123 children were treated for appendicitis. 4 children underwent conservative treatment. Of 1119 children who underwent appendicectomy, 601 had complicated appendicitis and were included in the study.

The age ranged from 17 days to 12.8yr with a mean age of 8.26 yr, Fig 1 shows the age distribution pattern of the

study There were 244 females (40.6%) and 357 males (59.4%) in study group, Male: Female ratio- 3:2.

Table 1. Distribution of type of complicated appendicitis

	Number	Total	Proportion	p
Abscess	177	601	0.295	< .001
Gangrenous	14	601	0.023	< .001
Generalised Peritonitis	30	601	0.050	< .001
Mass	56	601	0.093	< .001
Local Peritonitis	324	601	0.539	0.061

The duration of symptoms at presentation varied from 1 day to 14 days with a mean of 2.98 days (SD 1.77)

Complicated appendicitis was distributed as given in table 1.

136 children (22.63%) underwent laparoscopic appendicectomy and 465 (77.37%) children underwent open appendicectomy. The position of appendix was found to be as shown in table 2.

Table 2. Distribution of position of appendix

Binomial Test				
Position of appendix	Number	Total	Proportion	p
Paracaecal	9	600	0.015	< .001
Pelvic	184	600	0.307	< .001
Postileal	26	600	0.043	< .001
Preileal	55	600	0.092	< .001
Retrocaecal	326	600	0.543	0.037

Post operative Complications

Most common complication encountered was Surgical site infection (SSI). 183 children (30.4%) developed surgical site soft tissue infections. 178 of 465 open appendicectomies (38.28%) developed SSI, while 5 out of 136 (3.6%) laparoscopic appendicectomies had SSI and it was found to be statistically significant (p < 0.001).

The incidence of SSI in relation type of complicated appendicitis is shown in table 3.

Table 3. Proportion SSI in relation type of complicated appendicitis

	SSI		Total
	Absent	Present	
Abscess	110	67	177
Gangrenous	10	4	14
Genarilised Peritonitis	22	8	30
Mass	50	6	56
Local Peritonitis	226	98	324
Total	418	183	601

Table 4. Incidence of SSI in relation to position of appendix

Contingency Tables			
Position of appendix	SSI		Total
	Absent	Present	
Paracaecal	6	3	9
Pelvic	145	39	184
Postileal	15	11	26
Preileal	45	10	55
Retrocaecal	207	120	327
Total	418	183	601

As seen in table 3 those with appendicular abscess has highest SSI, while appendicular mass has the least (p - 0.004)

Incidence of SSI in relation to position of appendix is shown in table 4

Postileal position of appendix was associated with highest SSI rates (42.31%), followed by Retrocaecal position of appendix and least with preileal position (18.8%), p value- 0.001.

The more significant/ serious post operative complications (intra-abdominal/intestinal) in the study occurred in 81 children (13.48%). They are distributed as shown in table 5.

Table 5. proportion of significant post-operative complications

Level	Number	Total	Proportion	p
Abscess	177	601	0.295	< .001
Gangrenous	14	601	0.023	< .001
Gen Peritonitis	30	601	0.050	< .001
Mass	56	601	0.093	< .001
Peritonitis	324	601	0.539	0.061

The proportion of intra-abdominal complications in relation to type of surgery is shown in table 6. The complication rate in open group is slightly higher (13.76% vs 12.5%) but statistically not significant (p- 0.31)

Table 6 The proportion of intra-abdominal complications in relation to type of surgery

Type of surgery	Complication				Total
	Abscess	Adhesions	Enterocutaneous fistula	Stump leak	
Laparoscopy	10	6	1	0	136
Open	45	17	0	2	465
Total	55	23	1	2	601

The incidence of intra-abdominal/intestinal complication in relation position of appendix is as shown in table 7. From the above table pelvic position of appendix is associated with more post operative intra-abdominal abscess. Adhesive obstruction is more with paracaecal position

of appendix followed by retrocaecal position, but the total appendix in paracaecal position is only 9. The relation of position of appendix to post operative intra-abdominal/ intestinal complications were also not statistically significant (p- 0.51).

Table 7. Incidence of intra-abdominal complication in relation Position of appendix

Position of appendix	Complication				Total
	Abscess	Adhesion	Enterocutaneous fistula	Stump leak	
Paracaecal	1	2	0	0	9
Pelvic	21	5	1	1	184
Postileal	3	1	0	0	26
Preileal	3	1	0	0	55
Retrocaecal	27	14	0	1	327
Total	55	23	1	2	601

The incidence of intra-abdominal/intestinal in relation type of complicated appendicitis is as shown in table 8. Incidence of intra-abdominal abscess and adhesive obstructions were more in those

children with generalised peritonitis while appendicular mass had least post operative intra-abdominal abscess formation, but the results were not statistically significant (p- 0.144)

Table 8. Incidence of intra-abdominal complications in relation type of complicated appendicitis

	Complication				Total
	Abscess	Adhesion	Enterocutaneous fistula	Stump leak	
Abscess	20	7	1	0	177
Gangrenous	2	0	0	0	14
Gen Peritonitis	5	3	0	1	30
Mass	2	2	0	0	56
Peritonitis	26	11	0	1	324
Total	55	23	1	2	601

The proportion of intra-abdominal/intestinal in relation to site of perforation is as given in table 9. 374 appendix was found to have perforation, of which 30 had perforation at proximal third/ base, middle third perforated in 70 and 274 had perforation in distal third/tip of appendix.

Perforation of appendix in proximal third is found to be associated with more incidence of intra-abdominal collection and adhesive intestinal obstruction followed by perforation in middle third, but results were not statistically significant (p- 0.401)

Table 9. Proportion of intra-abdominal/ intestinal in relation to site of perforation

Site of perforation	Complication				Total
	Abscess	Adhesion	Enterocutaneous fistula	Stump leak	
Base/ proximal third	5	2	0	0	30
Distal third	25	8	1	0	274
Middle third	10	3	0	1	70
No perforation	15	10	0	1	227
Total	55	23	1	2	601

Post operative hospital stay

Duration of post operative hospital stay varied from 2 days to 40 days with a mean of 7.72 days. It correlates with duration

of symptoms on presentation as shown in figure 2 (p <0.001)

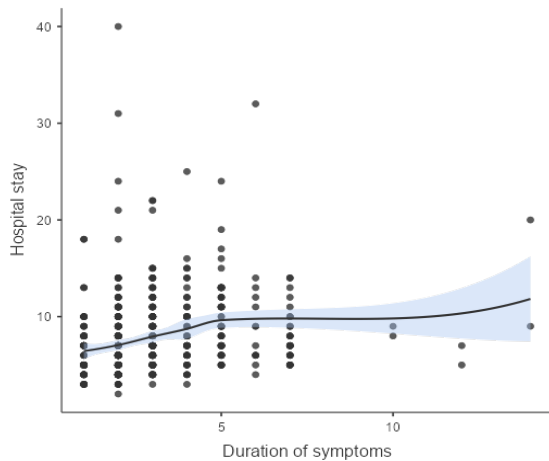


Fig 2. Relation between duration of symptom at presentation and hospital stay

DISCUSSION

Acute appendicitis is a common surgical emergency in children. Uncomplicated appendicitis has low morbidity when treated promptly. While those presenting late tend to have significantly high complications in post operative period. [5,6] In this study we try to analyse the complications in children undergoing appendicectomy for complicated appendicitis.

There was total of 601 children with complicated appendicitis, of which 40.6% were females and 59.4% were males. Francesco M. Labricciosa et al [9] Martin L. Blakely et al [10] and Max Knaapen et al [11] report similar male predominance of 3:2. The mean age in our study was 8.26 yrs which is less than that reported by Martin L. Blakely et al [10] (10.4yrs) and Max Knaapen et al [11] (10.5yrs).

In our study local peritonitis accounted for 53.9%, generalised peritonitis 5%, gangrenous appendix 2.3 %, appendicular mass 9.3 % and appendicular abscess 29.5%. Pramod Sreekanta Murthy et al [12] reports 38.3% generalised peritonitis in their series. They also report local abscess rate of 33.3% and gangrenous appendicitis of 3%. But total number of complicated appendicitis is 60 only and of these 60% presented within 2 days of symptoms. The difference may be due to geographical reasons and delayed presentation to hospital

in our study. In our study the mean time of presentation was 2.98 days.

In our study the commonest position of appendix is retrocaecal (54.3%) followed by pelvic (30.7%), pre-ileal (9.2%), post-ileal (4.3%) and least common Para-caecal (1.5%). Pramod Sreekanta Murthy et al [12] also reports retrocaecal position (46.66%) as the commonest followed by pelvic position (30%) of appendix, but they have 16.66% incidence of paracaecal appendix.

The most common complication in our study was surgical site infection (SSI), soft tissue infection at surgical site. The incidence was 30.4%, open surgery having significantly higher wound infection of 38.28% while laparoscopic appendicectomy had only 3.6%. This was statistically significant too. Nazir A et al [13] also reports increase wound infection rates for open appendicectomy (27.69%) when compared to laparoscopic appendicectomy (10.77%). In our study SSI incidence is higher than reported by Nazir A et al [13] but the SSI in laparoscopic group is much less.

Relation of SSI to type of complicated appendicitis and position of appendix was analysed. Children with post ileal appendix had highest SSI (42.31%) followed by retrocaecal appendix (36.7%). Pre ileal appendix had the least SSI incidence (18.18%). Similarly, children with appendicular abscess had highest incidence of SSI (57.26%), followed by local peritonitis (30.25%) while appendicular mass had least SSI (10.71%). These findings were statistically significant but we couldn't find any literature by searching internet to compare these findings.

The incidence of significant/ serious post operative complications (intra-abdominal/intestinal) is 13.48%. Martin L. Blakely et al [10] reports 30% incidence of serious complications. Max Knaapen et al [11] reports 23% serious complications for complicated appendicitis. In our study commonest serious complication was intra-abdominal abscess (9.2%) followed by adhesive intestinal obstruction (3.8%). There were 2 cases (0.3%) of stump leak

and one case (0.2%) of enterocutaneous fistula. Martin L. Blakely et al ^[10] reports 19% intra-abdominal abscess for a/c appendicitis and 37% for interval appendicectomy. They had 10.4% incidence of adhesive intestinal obstruction in interval appendicectomy. Max Knaapen et al ^[11] reports 15% intra-abdominal collection, they also had one stump leakage (1.6%) and one fistula (1.6%) out of 60 patients.

On comparison of serious complication with type of surgery, intra-abdominal collection was slightly higher in open appendicectomy group than laparoscopic appendicectomy group (9.68% vs 7.35%) while adhesive obstruction was higher in laparoscopic group (4.41% vs 3.66%), but were not statistically significant. Total complications in both groups were similar (open vs laparoscopy-13.76% vs 12.5%) but was not statistically significant (p- 0.31). Pokala N ^[14] et al have published almost similar overall post operative complication rates in both open and laparoscopic appendicectomy groups but intra-abdominal abscess was significantly higher in laparoscopic appendicectomy (11.6% vs 4.9%) group. Yau KK ^[3] et al and Lim SG ^[15] et al also reports higher intra-abdominal abscess following laparoscopic appendicectomy.

When we analysed post operative complications in relation to type of complicated appendicitis, generalised peritonitis accounted for highest rate of complications followed by gangrenous appendicitis and appendicular abscess. Appendicular abscess follows the same pattern. But these findings were not statistically significant (p- 0.144) Lim SG et al ^[15] also studied the relation of type of complicated appendicitis to the incidence of complications they have found peri appendiceal abscess is associated with higher incidence of post operative intra-abdominal abscess.

The analysis of post operative complications in relation to position of appendix and site of perforation of abscess. Pelvic appendix had the highest incidence of

intraabdominal abscess. Para caecal appendix also having a high complication rate but the numbers are less. When considering the site of site of perforation of appendix, the complications (both intra-abdominal abscess and adhesive obstruction) a was highest for perforation at base/ proximal third. These findings were not statistically significant (p-0.401). We couldn't find any article to compare our results.

Our study showed relation of duration of symptoms at presentation and duration of hospital stay. Mean hospital stay was 7.72 days. It is higher than that reported by Max Knaapen et al ^[11] (5.5days) but less than reported by Martin L. Blakely et al ^[10] (11.2 days).

CONCLUSIONS

Complicated appendicitis has significant post operative complications, SSI of 30.4% and serious complication of 13.48% in our study. Our study shows that post operative intra-abdominal abscess is more with open appendicectomy and adhesive obstruction in laparoscopic appendicectomy even though not statistically significant. We have identified that type of complicated appendicitis, appendicular position and site of perforation of appendix influences postoperative complications, even though serious findings don't have statistical significance. These findings need further studies preferably prospective to confirm these findings.

Funding: Nil

Conflict of Interest: Nil

Disclosure: Institutional research committee clearance and Institutional Ethical committee clearance obtained for the study

Acknowledgement: None

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How to cite this article: Aravind C S, Sam Varkey, Binu M K, Shinaz Sadiq et.al. Post-operative complications of complicated paediatric appendicitis in a tertiary teaching hospital. *International Journal of Research and Review*. 2022; 9(1): 9-16. DOI: <https://doi.org/10.52403/ijrr.20220102>
