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Outcomes of early surgical management of complicated appendicitis in children

Pramod S.1*, B. Revanth Kumar²

¹Department of Paediatric Surgery, ²Department of Surgery, Kempegowda Institute of Medical Sciences and Research Institute, Bangalore, Karnataka, India

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*Correspondence:

Dr. Pramod S.,

E-mail: pramodbmc76@gmail.com

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ABSTRACT

Background: Appendicitis is the most common surgical emergency in children. Nearly 30% of children present with complicated appendicitis. Controversy exists between early or delayed surgery in complicated appendicitis. Present study was done to evaluate the outcome of early surgical management of complicated appendicitis in children and also to analyze risk factors for complicated appendicitis.

Methods: A retrospective observational study conducted by the department of Paediatric Surgery, KIMS, hospital Bangalore. All children with complicated appendicitis (perforated, gangrenous and mass) from October 2014 to October 2017 were included in the study. Clinical, biochemical and imaging findings of these children were tabulated. Children underwent either open or laparoscopic appendectomy. Intra operative data regarding the type of complication, presence or absence of Fecolith, position of appendix was documented. Post operatively duration of stay and complications were analyzed.

Results: 47 children were included in the study. Mean age of presentation was 10.38 ± 2.84 years. Most common presentation was pain abdomen. 65% of the patient had pain abdomen for duration of three days or more. Total leucocyte count of more than 15000 was seen in about 50% of the children. 68% of children underwent laparotomy, 23.5% underwent laparoscopic appendectomy. Intra operatively, perforation of the appendix with generalized peritonitis was the commonest finding. Fecolith was present in 32% of the cases. Mean duration of stay was 7.46 days. Wound infection was seen in 15% of the children. Late complication in the form of adhesive obstruction was seen in 5 patients.

Conclusions: Complicated appendicitis is associated with high morbidity. High leucocyte count, delayed presentation and Fecolith are possible indicators of complicated appendicitis. Early surgery in complicated appendicitis is safe, feasible. The complication rate is acceptable and most of them can be managed conservatively. Hence early surgery in complicated appendicitis is an option to be considered.

Keywords: Appendectomy, Complicated appendicitis, Fecolith

INTRODUCTION

Appendicitis is the most common surgical emergency in children.¹ The lifetime risk of developing appendicitis is approximately 9% in males and 7% in females. Nearly about 30% of children present with complicated

appendicitis.² Appendicitis is most commonly seen in second decade of life.³

Acute appendicitis is divided into two subgroups. They are simple appendicitis (early, inflamed, uncomplicated) and complicated appendicitis (gangrenous, perforated

appendicitis with abscess/phlegmon or perforated appendicitis without abscess/phlegmon). 4,5 Common type of appendicitis is simple or uncomplicated appendicitis. In case of perforation of appendix, it presents as generalized peritonitis, or the appendicle perforation gets walled off. Walled of appendicle perforation presents either as simple inflammatory mass consisting of inflamed appendix, adjacent viscera and greater omentum or present as pus containing mass (appendicular abscess).

In pediatric population it is challenging to diagnose appendicitis, due to atypical presentation, non-specific symptoms and wide range of differential diagnosis. The initial misdiagnosis rate of appendicitis in older children vary from 28%-57%. Delay in diagnosis lead to complicated appendicitis with increased morbidity, prolonged hospitalization and morbidity.

Complicated appendicitis has got good overall prognosis. Overall mortality rate of complicated appendicitis is less than 1%.^{7,8} However it is associated with higher morbidity than simple appendicitis.

Appendectomy is the most common surgical procedure done worldwide. The management of simple appendicitis is straight forward. Its appendectomy, either open or through laparoscopy. Complicated appendicitis was traditionally managed with immediate surgery. But in 1980 conservative management was described. As per this approach, patients with complicated appendicitis were initially treated with intravenous antibiotics followed by interval appendectomy after a period of 4 to 16 weeks. Over the years this approach gained popularity. But in recent years this practice has been questioned with new data. The objective of the present study was to evaluate the outcomes of early surgical management of complicated appendicitis and also to analyse risk factors for complicated appendicitis.

METHODS

This was a retrospective observational study conducted by the Department of Pediatric Surgery, Kempegowda Institute of Medical Sciences, Hospital, Bangalore from October 2014 to October 2017. All children 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 sex, age, address, 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. The children underwent either open or laparoscopic appendectomy. In few children laparoscopy had to be converted to open in view of adhesions. Open appendectomy was done by infraumbilical transverse incision. In case of abscess/perforation the pus was drained, appendectomy done followed by a thorough lavage. 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, site of perforation was documented. Postoperative the duration of intravenous antibiotics and the length of stay was tabulated. The follow up period ranged from 6 months to 3 years. Immediate and late complications were evaluated.

RESULTS

Out of the 180 children with appendicitis in the study period, 47 children with complicated appendicitis were included in the study. Mean age of presentation was 10.38 ± 2.84 years. Age distribution of the children is shown in table 1. Out of 47 children 31 were males and 16 females. Equal numbers of patients were seen from both rural and urban background (Table 1).

Table 1: Sex, age and background characteristics of children.

Characteristics		Number	Percentage
Sex	Male	31	65.9
	Female	16	34.1
Age	5-10 years	23	48.9
	>10 years	24	51.1
Background	Rural	21	44.7
	Urban	26	55.3

Table 2: Distribution of study subjects according to the presenting complaints (multiple response).

Symptom		Number	Percentage
Pain abdomen		47	100
Pain duration	<3days	17	36.17
	3-5 days	18	38.3
	>5 days	12	25.53
Nausea and vomiting		42	89.3
Fever		25	53.2
Others*		12	25.5

*Loose stools, constipation, abdominal distension, loss of appetite, shock

The symptoms and their duration are depicted (Table 2). Most common presentation was pain abdomen followed

by vomiting and fever. 65% of the patient had pain abdomen for duration of three days (72 hours) or more.

Table 3: Distribution of subjects according to the nutritional status and general examination findings.

Characteristics	Finding	No.	Percentage
	Normal	42	89.4
Nutritional status	Mild/moderate malnutrition	02	4.2
	obesity	03	6.4
pallor	present	04	8.5
	absent	43	91.5
Right iliac fossa tenderness	Present	47	100

The data about general physical and abdominal examination of the included children is shown in Table 3.

Table 4: Distribution of subjects based on blood investigations.

Blood Investigation	Finding	No.	Percentage
Total leucocyte	Normal	04	8.5
count (n =47)	abnormal	43	91.5
TLC	<10000	04	8.5
	10000-15000	21	44.7
	>15000	22	46.8
Hemoglobin (>10g/dl)	Normal	47	100

Total leucocyte count of more than 15000 was seen in about 50% of the children (Table 4). Ultrasonography showed abnormality in 91% of the children. Four children required CT scan has USG was inconclusive.

Table 5: Distribution of appendicitis patients based on surgery and intra operative finding.

Characteristics	Surgery/findings	No.	Percentage
Operative procedure	Laparoscopy	11	23.5
	Open	32	68
	Laparoscopy converted to open	04	8.5
Intra operative finding	Perforation with local abscess	16	34
	Perforation with generalized abscess	18	38.3
	Mass	06	12.7
	Gangrene	07	15
Fecolith	Present	15	32
	Absent	32	68
Position of appendix	Retrocaecal	23	48.9
	Pelvic	15	31.9
	Para caecal	07	15
	Pre ileal	02	4.2

Of the 47 children 32 (68%) of children underwent laparotomy, 11 (23.5%) underwent laparoscopic appendectomy. In 4 cases laparoscopy had to be converted to open for completion of surgery. Intra operatively, perforation of appendix with generalized abscess was the most common finding seen in 38% of the children followed by perforation with localized abscess seen in 34% (Table 5). Fecolith was present in 32% of the cases (Table 5). Most common position of appendix was retrocaecal (Table 5). Post operatively children required intravenous antibiotics for a mean duration of 7 days.

Table 6: Distribution of study subjects based on duration of post op stay and complication.

	Findings		No.	%
Post op discharge	<5 days		07	15
	5-10 days		31	65.9
	>10 days		09	19.1
outcome	Uneventful recovery		35	74.4
	Complications	Immediate*	07	15
		Late*	05	10.6
	Mortality		00	

Mean duration of stay was 7.46 days. Wound infection in immediate post-operative period was seen in 15% of the children (Table 6). Wound infection was managed conservatively with daily dressings. Late complication in the form of adhesive obstruction was seen in 5 patients. Adhesive obstruction was seen between 6 weeks to 6 months post-surgery. 2 children required re-surgery for adhesive obstruction. In 3 children, adhesive obstruction was managed conservatively with intravenous fluids, antibiotics and nil per oral. So overall the re-surgery rate in children undergoing early surgery for complicated appendicitis was 4.25%. No mortality was recorded in the present study.

DISCUSSION

Appendicitis is most common surgical condition. In the present study the incidence of complicated appendicitis was 26%. In literature the perforation rates vary from 5 and 62% respectively. 6.10 Various risk factors have been studied for the increased risk of perforation. These include extremes of age, male sex, rural locality, delayed presentation, delay in diagnosis, presence of appendicolith, elevated blood parameters namely neutrophils. 11-15 If the above-mentioned risk factors are correlated to our study we find the following results. 66% of children with complicated appendicitis were male. Equal numbers of children were from both rural and urban locality. Hence no difference was found with respect to the area of living. None of the children were below 5 years. But in literature, perforation rates were as high as 82% in children less than 5 years and 100% in children less than 1 year. 1,16 Pain abdomen of more than 3 days (72 hours) duration was seen in 65% of children presenting with complicated appendicitis.

conducted in America found that perforation risk is less than 2% if the presentation is less than 36 hours and beyond 36 hours risk of perforation rose by 5% every 12 hours. 14 On the contrary, study by Augustine et al found that there is an early risk of perforation even in first 36 hours. 17 About 50% of the children with complicated appendicitis had a leucocyte count of more than 15,000 cells/mm.

Appendicolith is well established risk factor for complication. Appendicolith obstructs the lumen of appendix causing appendicitis. Appendicitis caused by appendicolith is commonly associated with perforation and abscess. 18,19 In this study appendicolith was present in 32% of children with complicated appendicitis.

With respect to timing of surgery for complicated appendicitis controversy exists between early or delayed surgery. In delayed group, children with complicated appendicitis were initially treated conservatively with intravenous antibiotics/percutaneous drainage of abscess followed by interval appendectomy after a period of 4 to 16 weeks. It's been noticed that 10-20% of patients treated conservatively fail to respond and require delayed appendectomy which is difficult with possibility of bowel resection. Following discharge from hospital nearly 50% of patients suffer recurrence of appendicitis.²⁰

There is also a chance of misdiagnosis and condition like intussusceptions, cancer of colon being treated conservatively.²¹

Early surgery reduces the time away from normal activity. In our study mean duration of stay was about 7.4 days. In a study done at America the overall length of stay was 10 days. Children planned for interval appendectomy have longer duration of hospital stay, unplanned admission and financial burden. Various studies with respect to early surgery in appendicular mass have concluded that early surgery reduces duration of hospital stay, no difference with respect to wound infection, reduced financial burden on patients.^{22,23} In children it must be noted that, if child is away normal activities it limits the parent's ability to work also.

Other concern about early surgery is higher complication rate i.e. wound and other infection. The complication rate ranges from 3-30% in various studies.²⁴⁻²⁸ In the present study wound infection rate was 15% and these cases were managed conservatively with dressings. Zero percent mortality was seen in the present study.

Yet another concern with early surgery is the difficulty of surgery in the acute phase. In the present study no such difficult was encountered. Study conducted by Samuel et al concluded that oedema and friability did not affect the outcome in patients treated with early surgery. On the contrary in patients undergoing interval appendectomy had significant adhesions.²⁴

CONCLUSION

Appendicitis is the most common surgical condition. Complicated appendicitis is associated with high morbidity. High leucocyte count, delayed presentation and appendicolith are possible markers of complicated appendicitis. Controversy exists about the ideal time for surgery in complicated appendicitis. Early surgery in complicated appendicitis is safe, feasible. The complication rate is acceptable and most of them can be managed conservatively. Early surgery makes the child to get back to normal activities sooner and also reduces financial burden on family. Hence early surgery in complicated appendicitis is an option to be considered.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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