Early Surgical Management of Appendicular Mass in Pediatric Patients

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ABSTRACT

Objective: To find out the feasibility and safety of early surgery in pediatric patients who presented with appendicular mass.

Study Design: Analytical observational study.

Place and Duration of Study: Department of Paediatric Surgery, National Institute of Child Health, Jinnah Sindh Medical University, Karachi, from September 2019 to April 2020.

Methodology: This study was conducted on 60 children, who were diagnosed with appendicular mass. Patients were operated after initial stabilisation and investigations. Variables analysed included demographic characteristics, clinical presentation, intra-operative surgical difficulties and postoperative complications. Data were entered into SPSS version 22. Chi-square test and Fisher Exact test were used for finding statistical significance among variables. A p-value of <0.05 was considered as significant.

Results: There were 41 (68.4%) male and 19 (31.6%) female patients with the mean age of 8.3 $\pm$ 2.9 year. Mean duration of pain was 3.8 $\pm$ 1.8 days. In 41 (68.4%) patients, mass was composed of appendix with adherent ileal loops and omentum, while in 19 (31.6%) patients frank pus was also found within the mass. Thirty-four (56.6%) patients had suppurative appendix without gross perforation, while in 26 (43.4%) patients partially sloughed / gangrenous perforated appendix found. Intraoperative difficulties were more in patients with complex mass (p=0.004). Postoperative complications were observed in 14 (23.3%) patients. These were more frequent in female patients (p=0.001), with sloughed, gangrenous perforated appendix (p=0.034) and complex mass (p=0.008). Superficial wound infection was the most common complication noted in 9 (15%) patients. In 5 (8.3%) children, deep seated intra-abdominal collections were found. The mean hospital stay was 3.4 $\pm$ 1.5 days.

Conclusion: Early surgery in pediatric patients with appendicular mass was found feasible with minimal complications. This obviated the need of prolonged follow-up and interval appendectomy with its inherent risks.

Key Words: *Appendicular mass, Appendicular lump, Appendectomy, Child.*

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INTRODUCTION

Acute appendicitis is one of the commonest surgical conditions in pediatric patients.[1] The lifetime risk for male and female children is 8.6% and 6.7%, respectively.[2] The management of simple acute appendicitis cases revolves around non-operative treatment with antibiotics and early laparoscopic appendectomy with fairly comparable results in terms of hospital stay, and complications.[3,4] In a systematic review, the initial success rate of non-operative management of uncomplicated acute appendicitis was from 58% - 100%, with recurrence rate of 0.1% to 31.8% at 1-year.[5] The management of appendicular mass remains controversial in the pediatric age group.

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In adult patients, a non-operative management of appendicular mass as proposed by Ochsner and Sherren about a century ago, is still practised.[6] However, literature on the subject of surgical *versus* non-operative approach in children with appendicular mass is still debatable. With improved understanding of surgical pathology, provision of critical care facilities, availability of safe anesthetic drugs and surgical techniques including minimally invasive approaches, a proactive approach is taken by many surgeons to intervene early in pediatric patients with appendicular mass with good outcome.[7] In a non-blinded randomised trial in children comparing early appendectomy in perforated appendix with interval appendectomy, adverse events rate of 30% was found in early intervention group and 55% in interval appendectomy group.[8] There are conflicting results reported in literature with variable approaches in pediatric patients with appendicular mass. This study was conducted to find out the results of early intervention in pediatric patients, who presented with appendicular mass so as to document feasibility and safety of this approach.

Table I: Stratification of clinical and operative data according to the gender.

		Total (n=60)	Male (n=41)	Female (n=19)	p-value
Age	1-4 years 5-8 years 9-12 years	05 25 30	04 18 19	01 07 11	0.658
Condition of appendix	Sloughed / gangrenous perforated Suppurative without gross perforation	26 34	17 24	09 10	0.881
Type of mass	Lump with adherent omentum and bowel loops Complex lump containing pus	41 19	29 12	12 7	0.773
Intraoperative difficulties	No Yes	23 37	14 27	9 10	0.487
Postoperative complications	No Yes	46 14	37 04	09 10	0.001*

**Significant*

Table II: Stratification of results according to intraoperative difficulties and postoperative complications.

Variables		Intraoperative difficulties		p-value
		No	Yes	
Condition of appendix	Sloughed / gangrenous perforated	6 (23.1%)	20 (76.9%)	0.060
	Suppurative without gross perforation	17 (50.0%)	17 (50.0%)	
Type of mass	Mass with adherent omentum and bowel loops	21 (51.2%)	20 (48.8%)	0.004*
	Complex mass with pus	2 (10.5%)	17 (89.5%)	
		Postoperative complications		p-value
		No	Yes	
Condition of appendix	Sloughed / gangrenous perforated	16 (61.6%)	10 (38.4%)	0.034*
	Suppurative / without gross perforation	30 (88.2%)	4 (11.8%)	
Type of mass	Mass with adherent omentum and bowel loops	36 (87.8%)	5 (12.2%)	0.008*
	Complex mass with pus	10 (52.6%)	9 (47.4%)	

**Significant*

METHODOLOGY

This was an analytic observational study conducted at the Department of Paediatric surgery, National Institute of Child Health, Jinnah Sindh Medical University Karachi, from September 2019 to April 2020. Study was approved by the Institutional Review Board (IERB # 46/2019). All children up to the age of 12 years of either gender with appendicular mass, diagnosed on clinical examination and ultrasound, were included in the study. An appendicular mass was defined as complex, if abscess was noted within it. Patients who presented with generalised peritonitis were excluded from the study. A sample size of 60 was calculated at 95% confidence level and 7% precision (margin of error) on the basis of reported complication rate of 7.69% and taking into consideration the dropouts. Informed consent was taken from the parents after explaining the procedure and associated complications.

All patients were admitted to high dependency unit and kept nil by mouth. They were monitored for respiratory rate, heart rate, body temperature, and urine output. All patients received intravenous fluids, and broad spectrum antibiotics. Laboratory investigations included CBC, blood urea, serum creatinine, C-reactive proteins, and serum electrolytes. Patients underwent surgery after initial stabilisation.

All procedures were done under general anesthesia. Postoperatively patients were managed in high dependency unit. Pain and fever were managed with rectal diclofenac suppositories and intravenous paracetamol. Complications occurring during ward stay like wound infection, deep seated collections, and prolonged ileus, were documented. Patients were discharged when oral diet was tolerated. They were followed up in outpatient clinic for any complications, especially those related to surgical wound.

Operative findings, intraoperative difficulties, and postoperative complications were noted on a pre-designed form. Data were entered into SPSS version 22.0 and analysed. Descriptive and analytic statistics were used for reporting the results. Mean and standard deviations were calculated for quantitative data. Frequency and percentages were computed for intraoperative finding and postoperative complications. Stratification of results was done according to the gender, intraoperative findings and postoperative complications. Chi-square test and Fisher Exact tests were applied for comparison, where applicable. A p-value <0.05 was considered as statistically significant.

RESULTS

Sixty children were enrolled in this study. Mean age of the patients was 8.3 $\pm$ 2.9 years (range=10, from 2 years - 12 years) and median age of 8.0 year. There were 41 (68.4%) male and 19 (31.6%) female patients. The mean duration of abdominal pain was 3.8 $\pm$ 1.8 days. In 33 (55%) patients, pain was more marked in hypogastrium and in 27 (45%) in right iliac region. Fifty-six (93.3%) patients presented with high grade fever, 53 (88.3%) had nausea and vomiting, while 10 (16.6%) patients experienced loose motions.

Forty-eight (80%) patients underwent open appendectomy through Lanz incision as laparoscopy equipment was not available in emergency operation theater because of limited resources in the public sector hospitals; and in 12 (20%) laparoscopy was performed. Three of these were converted to open surgery due to difficult dissection. In 41 (68.4%) patients, mass was composed of adherent omentum and ileal loops with inflamed appendix. In 19 (31.6%) patients, abscess was noted within the mass. In 26 (43.4%) patients partially sloughed, gangrenous perforated appendix was found. In 34 (56.6%) cases, suppurative, non-perforated inflamed appendix was encountered. Difficulty in localising appendix was noted in 14 (23.3%) patients. Few serosal tears of ileum resulted in 9 (15%) patients during dissection. None of the patients had bowel perforation, need of stoma formation or hemicolectomy. Drain was placed in 11 (18.3%) patients, where mild ooze was noted. Postoperative complications were observed in 14 (23.3%) patients. Superficial wound infection was noted in 9 (15%) patients. In 5 (8.3%) patients, inter-loop collections was noted on ultrasound. They responded to conservative measures. The duration of hospital stay was from 2 days to 8 days (mean 3.4 $\pm$1.5 days).

Stratification of results, according to gender, is given in Table I. Age groups, condition of appendix, type of mass, and intraoperative difficulties were not statistically different among the genders. Postoperative complications, however, occurred more frequently in female patients which was statistically significant (P=0.001). The results were further analysed based upon the condition of appendix, characteristics of mass and their impact on intraoperative surgical difficulties and postoperative complications. More difficulties were encountered in patients where mass was complex (p=0.004). Postoperative complications found more frequently in patients with sloughed gangrenous appendix (p=0.034), and where mass was complex (p=0.008) and both were statistically significant (Table II).

DISCUSSION

This study showed encouraging results with surgical intervention in pediatric patients, who presented with appendicular mass. The age of the patients varied from 2 to 12 years with the mean and median age about 8 years. This is almost similar to that reported in other studies where mean age was about 9.4 year and 10.5 year, respectively.[9,10] Male predominance was noted in this series. However, in literature no gender predilection was reported. Late presentation to tertiary care hospital was observed, as mean duration of symptoms was around four days. Pham *et al*. also noted in their study that patients with complicated disease had longer duration of symptoms.[11] In this study, nearly all the patients had high grade fever at the time of presentation, indicating advanced stage of disease. Diagnosis can be made easily at clinical examination if mass is palpable. Ultrasound abdomen can provide more information, especially the presence of fluid in the vicinity and its characteristics. Inter-loop abscess formation can also be picked up.[12] CT scan abdomen is not needed in all cases; though it can provide more anatomical details, especially of pelvic organs in females and presence of intra-abdominal of pus pockets.[13] This may be advised in selective cases, when there is doubt in making a diagnosis or complications are expected.

Most of the patients in this study were referred late with high grade fever and vomiting. Supportive treatment was, therefore, needed to stabilise these children before surgery. Supplemental oxygen, intravenous fluid hydration, and broad spectrum antibiotics were required. Multimodal analgesia is recommended to address pain in acute appendicitis. Preoperative opioids may be avoided as they increase their postoperative use.[14] In this study, intravenous paracetamol was used for fever. Surgery is technically demanding in patients with appendicular mass. In this study, difficulty in dissection was encountered in 31.6% patients. Tissues were friable and few serosal tears occurred in ileum in 15% patients. Localisation of appendix in these patients was also difficult as it required lysis of adhesions specially in patients with advanced suppurative, perforated, and gangrenous appendix. Intraoperative difficulties were encountered in patients, where complex mass was present, which was statistically significant. In a multivariable logistic regression data analysis from dedicated children hospitals on laparoscopic appendectomy, it was shown that in children with peritonitis and abscess formation, conversion rate to open appendectomy was significantly higher.[15]

Postoperative complications in this study were observed in 23.3% patients. Superficial wound infection was the most frequent complication. This was managed conservatively. In 8.3% patients, inter-loop collections were noted on ultrasound. These were small pockets of collection and did not require drainage. None of the patients developed prolonged ileus, large intra-abdominal collections or fecal fistula. Postoperative complications were found more frequently in female patients with perforated gangrenous appendix, which was statistically significant. The mean hospital stay was 3.4 $\pm$1.5 days. This is short in comparison with a study from Singapore, in which median stay was 6 days in a series of 32 patients with appendicular mass.[16]

This study reported intraoperative difficulties in patients with appendicular mass that were handled with meticulous dissection. Postoperative complications, in this study, were safely managed without any significant impact on patients' health. There is a risk of generalised peritonitis with conservative approach in patients with appendicular mass.[17] Other issues related to non-operative treatment like recurrent appendicitis at follow-up, which in a study is reported as 14% and postoperative complications of interval appendectomy if undertaken, are circumvented by early surgery.[18,19] This study found that operation in same hospital admission helped in early recovery and discharge of patients from hospital within short span of time.

The strength of this study included a good sample size and defined protocol in managing pediatric patients, who present with appendicular mass. Limitation of this study was being from a single center.

Main outcomes of this study were manifold. The fate of appendicular mass in pediatric patients is variable. It can lead to formation of appendicular abscess and generalised peritonitis. Non-operative approach fails in number of children, and delayed surgery can lead to more complications. Surgery at primary admission in children with appedicular mass obviates the need of delayed appendectomy and chances of recurrent appendicitis. Early surgical intervention is found safe and feasible in pediatric patients with minimal complications that are dealt with easily. It is suggested that other pediatric centres may follow this approach for patients who present with appendicular mass, and document the results, so that a large database is established with strong evidence-based recommendations related to the protocol.

CONCLUSION

In children, early surgical intervention for appendicular mass is feasible and safe. Procedure-related complications were few and managed easily. This approach is thus recommended in pediatric age group.

ETHICAL APPROVAL:
Study was approved by the Institutional Review Board (IRB # 46/2019).

PATIENTS' CONSENTS:
Informed consents were taken from all the parents after explaining the procedure and associated complications.

CONFLICT OF INTEREST:
The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:
SI, JA, SMHT, NZ: Concept and design, data collection, analysis and interpretation, literature search, writing and critical review, and final approval.

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