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Research Article

### STUDY TO DETERMINE THE CAUSES OF LATE REFERRALS AND OUTCOME OF APPENDICITIS IN CHILDREN

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**Abstract:**

**Objectives:** The incidence of appendicitis is increasing in developing countries. Our goal was to determine the impact of late referrals and inappropriate treatment on the outcome of appendicitis among children.

**Place and Duration:** This Retrospective Study was held in the Pediatric Surgery department of Nishtar Hospital Multan for one-year duration from April 2019 to April 2020

**Methodology:** Retrospective analysis of all children treated for appendicitis were selected. Pre- and post-operative diseases, length of hospitalization, treatment costs and mortality were compared among children who presented early, within 24 hours of the first episode of symptoms and those onwards.

**Results:** A total of 481 children aged 2 to 16 years (mean  $9.7 \pm 2.8$ ), including 265 men and 216 women with a male to female ratio of 1.2: 1, had appendectomy, which was 5.7 % of all pediatric operations and 47.5% of all abdominal operations in children. Only 206 (42.8%) children reported in the first episode of symptoms and in a clinically stable condition, and 275 (57.2%) were referred after poor diagnosis and treatment by family doctors, which resulted in various complications from appendicitis 60 (12.5%), appendix weight 54 (11.2%), perforated appendix 47 (9.8%), gangrene of the appendix 41 (8.5%), and peritonitis 34 (7.0%). These influenced the postoperative outcome with wound infection reported in 91 (18.9%), wound fracture 35 (7.3%), sepsis 31 (6.4%), pelvic abscess 13 (2.7%) and death 1 (0.2%). They were not reported among those who reported early, who also had significantly shorter hospitalization and treatment costs ( $P < 0.0001$ ).

**Conclusion:** Late referrals due to a low rate of suspicion were common, which significantly increased associated diseases and mortality among children treated with appendicitis.

**Keywords:** appendicitis, children, incidence, outcome, developing country.

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**INTRODUCTION:**

Appendicitis, an inflammation of the appendix that can be acute, subacute, or recurrent, is associated with high morbidity that can be prevented by having the appendix removed over time. The incidence has been reported to be high in developed cities where diets are high in fat and low in fiber. Although the exact incidence in Pakistan is unknown due to a weak database, it has been reported to be lower than in developed countries. This lower prevalence in Pakistan has been attributed to a diet rich in roughage to protect against inflammatory bowel lesions. This leads in endemic to infectious intestinal diseases such as typhoid fever, amoebic dysentery, gastroenteritis, and helminthic invasion, which appear as appendicitis-mimicking abdominal pain. As a consequence, many doctors rank appendicitis lower on the list of differential diagnosis of abdominal pain in children in Pakistan. Moreover, ignorance and poverty lead to delays in the admission of children with appendicitis, which may lead to complications, compounding diagnostic difficulties. While appendectomy performed in clinically stable children with mild appendicitis has favorable results, the opposite is true for appendicitis or gangrene in children with clinical disorders who may experience life-threatening complications after surgery. The literature studied on appendicitis in children in this sub-region showed a gradual increase in incidence since the early 1960s, but this had minimal effect on the rise in awareness. As a result, it increases and becomes alarmingly severe morbidity resulting from delayed or mismanaged cases suspected of other causes of abdominal pain. Moreover, the African diet has become western and intestinal infections / infestations have decreased due to improved living standards. The need to reassess the differential diagnosis of abdominal pain in children from this sub-region cannot be overstated. The aim of this ten-year retrospective study was to review the cases of children treated for appendicitis to determine the incidence and comparison of pre / post-operative disease, length of hospitalization, treatment costs, and mortality between those reporting early, within 24 hours of the first symptom episode and those who came later. This is to determine the impact of

late referral on appendicitis outcome so as to reduce avoidable morbidity and mortality in developing countries.

**METHODOLOGY:**

This Study was held in the Pediatric Surgery department of Nishtar Hospital Multan for one-year duration from April 2019 to April 2020. Data collected included age, gender, presentation pattern, clinical condition at arrival, diagnosis, preoperative morbidity, surgery, intraoperative outcomes, postoperative morbidity, treatment / length of hospitalization, and outcome. The socio-economic status of parents, their level of education, place of residence and a stable diet were also noted. Two children with insufficient data were excluded from the study because their files could not be recovered. Statistical analysis: The obtained data was analyzed by SPSS and presented as number, frequency and percentage. Continuous data was expressed as mean / standard deviation, while categorical data were analyzed using the Chi-square test and, if necessary, p values less than 0.05 and greater than 0.05 were considered significant and not significant, respectively.

**RESULTS:**

During this period, the center treated a total of 481 children due to appendicitis. They were 2 to 16 years of age (mean  $9.7 \pm 2.8$ ), including 265 men and 216 women, with a male to female ratio of 1.2:1. Appendectomy accounted for 5.7% of all 8456 pediatric operations and 47.5% of 1,012 abdominal surgery in children over ten years. Most of the patients, 361 (75.1%), were children living in semi-urban and urban cities whose parents were of higher socioeconomic classes who could afford and eat a more Western diet, while 120 (24.9%) were children, parents from lower socio-economic classes. These children lived with their parents in rural areas and ate more roughage-rich foods. However, only 206 (42.8%) children reported directly to the ward within 24 hours of the first symptom episode and were clinically stable on arrival, and 275 (57.2%) were referred late after poor diagnosis and treatment for various complications.

**Table-I: Relative frequency of signs/symptoms**

<i>Signs/symptoms</i>	<i>Frequency (%)</i>
Right iliac fossa pain	462(96.0)
Generalized abdominal pain	409(85.0)
Fever	403(83.8)
Nausea/vomiting	322(67.0)
Anorexia	304(63.2)
Diarrhea	108(22.5)
Constipation	96(20.0)
Dysuria/urinary frequency	91(18.9)
Weight loss	72(15.0)
Impaired right leg movement	69(14.3)
Maximal right iliac fossa tenderness	475(98.8)
Right iliac fossa guarding	401(83.4)
Generalized abdominal tenderness	356(74.0)
Rebound tenderness	231(48.0)
Positive Rovsins sign	168(34.9)
Dehydration	160(33.5)
Pallor	72(15.0)
Anterior rectal tenderness/fullness	69(14.3)
Jaundice	63(13.1)

Table I shows the relative frequency of signs and symptoms over a ten-year period. Right iliac pain 462 (96.0%) was the most common symptom, and the rarest symptom was right leg movement disturbance and walking, reported in 69 (14.3%) children. The most common symptom was maximal tenderness of the right iliac fossa, noted in 475 (98.8%), and jaundice in 63 (13.1%) was the least common symptom. The signs and symptoms occurred in various combinations, especially in children with subacute and recurrent appendicitis. The classic signs and symptoms of appendicitis were changed by the medications taken before the presentation, while many of the children already had complications upon arrival. In many of them it caused diagnostic difficulties.

**Table-II: Preoperative Morbidity**

<i>Preoperative morbidity</i>	<i>No. of children</i>
Acute appendicitis	98(20.4)
Sub-acute appendicitis	75(15.6)
Recurrent appendicitis	72(15.0)
Appendix Abscess	60(12.5)
Appendix mass	54(11.2)
Perforated appendix	47(9.8)
Gangrenous appendix	41(8.5)
Peritonitis	34(7.0)
Total	481(100)

Late referrals and complications were more common for children living in rural areas who did not seek medical attention early, mainly because of ignorance and financial constraints. Of 275 children with late referrals, 72 (26.2%) were referred from the pharmacy after many years of treatment of recurrent episodes of abdominal pain, the rest came from private health care facilities after 78 (28.4%) were treated for worm infestation, 76 (27.6%) for typhoid fever and 49 (17.8%) for amoebic dysentery. They were referred when they had failed to respond to treatment with continued clinical deterioration. Due to late referrals to the department, 236 children with life-threatening preoperative diseases came: appendicitis 60 (12.5%), appendicitis 54 (11.2%), perforated appendix 47 (9.8%), gangrene appendix 41 (8.5%) and peritonitis 34 (7.0%), which were confirmed by exploratory laparotomy (Table II). Therefore, an extremely significant statistical difference was observed when the morbidity and postoperative mortality were compared between children who presented early without preoperative morbidity and those who returned late ( $p < 0.0001$ ). Imaging diagnostics (abdominal ultrasound, computed tomography and abdominal X-ray) and complete leukocytosis in complete morphology were useful in making the diagnosis, although appendicitis was correctly diagnosed during exploratory laparotomy in 85 (17.7%) cases. The Lanz incision centered at the McBurney point was the preferred access for those correctly diagnosed prior to surgery with no evidence of peritonitis. Postoperative morbidity mirrored the preoperative clinical condition; therefore, postoperative diseases were reported among 236 children who developed complicated appendicitis. Postoperative morbidity, management and results are presented in Table III.

Table-III: Postoperative morbidity and outcome

<i>Postoperative morbidity</i>	<i>No. of children</i>	<i>Percentage</i>	<i>Outcome</i>
Wound infection	91	38.6	Responded to wound dressing
Wound breakdown	35	14.8	Dressing/secondary suturing
Septicemia	31	13.1	Responded to adequate antibiotics
Protracted fever	23	9.7	Subsided after two weeks
Nausea and vomiting	14	5.9	Subsided without sequel
Pelvic abscess	13	5.5	Responded to antibiotics/drainage
Band and adhesion	10	4.2	Responded to adhesiolysis
Enterocutaneous fistulae	5	2.1	Spontaneous closure on treatment
Incisional hernias	5	2.1	Hernia repaired after two years
Burst abdomen	3	1.3	Antibiotics/closure, one died
Portal pyemia	3	1.3	All responded to adequate antibiotics
Pneumonia	2	0.9	Responded to two weeks antibiotics
Total	236	100	One mortality

Wound infection 91 (38.6%), wound rupture 35 (14.8%), sepsis 31 (13.1%), and abdominal tear 3 (1.3%) were the most common postoperative complications resulting in prolonged hospital stay. Other diseases responded to treatment, with the exception of one child, whose mortality was reported in 3 (1.3%) children with abdominal disruption. Overall, 236 (49.1%) children had postoperative illness, with 1 (0.2%) having died of the disease, and no morbidity or mortality was reported among children who came early and underwent appendectomy.

### DISCUSSION:

Timely appendectomy, open or laparoscopic, is the gold standard in the treatment of appendicitis with excellent results in experienced hands. Neglected or untreated appendicitis, which allows for preoperative complications, is associated with life-threatening postoperative diseases, as shown in this study and others. Of 481 treated children, only 206 (42.8%) came early, while 275 (57.2%) came late, 236 (49.1%) of them had preoperative complications that influenced the postoperative

outcome. This resulted in an extremely significant statistical difference observed when comparing the results between children who presented early and those who presented late ( $P < 0.0001$ ), which is similar to the other results. The age / sex distribution of the affected children in this study is in line with previous reports, but the incidence was significantly higher than that observed by earlier authors, confirming the steady increase in the incidence of appendicitis in sub-Saharan Africa. In this study, appendectomy accounted for 5.7% of all

pediatric operations and 47.5% of abdominal operations in children, compared with 0.43% and 18.0% in similar studies conducted a decade earlier in western Nigeria. Also, appendicitis-related morbidity from delayed and inadequately treated cases was correspondingly higher in this report than in others, showing a discrepancy between the increasing incidence of appendicitis and referrals due to the low rate of suspicion from GPs. Consequently, 78 (28.4%) children in this series were treated for helminthiasis, 76 (27.6%) for typhoid fever and 49 (17.8%) for amoebic dysentery and were referred with complications when they have not responded to inappropriate treatment. Although the clinical diagnosis of appendicitis is straightforward in adults, it has been found to be more difficult in children due to the inability to provide an accurate history, multiple differences, non-compliance during the examination, and the absence of classic signs and symptoms that may be compounded by medications taken before the presentation that could have altered the clinical picture, as shown in this study. In addition, the rapid progression of appendicitis to complications in children and a greater risk of peritonitis due to an underdeveloped network, as well as previous literature in this sub-region where appendicitis was rare in children, led to presentation delays and diagnostic difficulties in many children in this series, which is similar to the experience of earlier authors. In addition, reported pre-operative diseases were more frequent and severe among children in rural areas who came very late. Among these children, the most frequent were preoperative life-threatening diseases, appendicitis 60 (12.5%), appendix weight 54 (11.2%), perforated appendix 47 (9.8%), appendicitis 41 (8, 5%) and peritonitis 34 (7.0%). frequent as previously reported. The importance of imaging diagnostics in such cases has been documented to prevent negative appendectomy in the event of diagnostic difficulties, but financial constraints in many developing countries mean that their use is limited. Therefore, in this and other series, exploratory laparotomy was used more often, which was diagnostic and therapeutic in nature to avoid further delays, especially in children with features of peritonitis. As a result of misdiagnosis and late referrals, postoperative wound infection was reported in 91 (38.6%) children, wound damage 35 (14.8%), sepsis 31 (13.1%) and pelvic abscess 13 (5.5%), which were very difficult to deal with the disease, and this resulted in prolonged hospitalization and, consequently, an increase in treatment bills, as also reported by the previous researcher. Pre-operative peritonitis has been reported to cause post-operative band formation and adhesions with consequent intestinal obstruction which may require re-examination and adhesions, but these

were rare in this series (Table II). Likewise, wound infections have produced post-operative hernias that are successfully repaired as seen in this and other studies. However, enterocutaneous fistula, portal abscess, and abdominal rupture were difficult to manage postoperative diseases in this study, and one child who had a ruptured abdomen died from overwhelming sepsis. This is in contrast to a previous report in this sub-region where no mortality was reported despite a similar spectrum of postoperative morbidity. The 0.2% mortality recorded in this study, however, was consistent with the literature, but the incidence reported in 236 (49.1%) children was exceptional.

### CONCLUSION:

Overall, the incidence of appendicitis in children is increasing in Pakistan, and the number of children treated in this review was higher than in previous reports, but at the time of diagnosis, there were worrying cases of inadequately treated patients and delayed referrals that allowed for life-threatening complications. This is a continuation of other causes of abdominal pain that are prioritized in the differential diagnosis as the incidence of appendicitis was thought to be very low in Pakistani children. However, the incidence of appendicitis, which led to increased hospitalization time, treatment costs, and mortality, was worrying, especially as no morbidity or mortality was reported in children who presented early and underwent appendicitis in a timely manner. Parents / guardians should suspect appendicitis and report children with abdominal pain to the hospital early. Doctors in this sub-region should give priority to appendicitis and refer children to a surgical consultation early, as the classic clinical picture of appendicitis may have been altered by self-medication prior to its onset.

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