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# RISK FACTORS FOR PERFORATION IN ACUTE APPENDICITIS

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## ABSTRACT

**Objective:** To determine the rate and risk factors for perforation in acute appendicitis.

**Materials and Methods:** This retrospective study was conducted at Surgical C Unit, Department of Surgery, Khyber Teaching Hospital, Peshawar from January 2008 to April 2009. A total of 150 patients were included in the study. Data regarding age, gender, time interval between development of symptoms and hospital admission, time in terval between hospital admission and appendicectomy, operative findings, and histopathology report were retrieved from the patients' hospital record and analyzed. Percentages were calculated for categorical data while numerical data were represented as mean ± SD with Chi square test and t test being used as tests of significance. Probability less than 0.05 ($P < 0.05$) was considered significant.

**Results:** Out of 150 patients, there were 87 (58%) males and 63 (42%) females. The mean age of the patients was 23 years with a range of 10 to 60 years. The rates of negative appendicectomy and perforation were 6.7% and 10% respectively. Mean interval between development of symptoms and hospital admission (patient interval) in the perforated group was 71.33 ± 44.69 hours which was statistically significant ($P < 0.001$) while mean interval between hospital admission and appendicectomy (hospital interval) was 10.93 ± 19.23 hours in patients with perforated appendicitis which was statistically insignificant ($P = 0.25$).

**Conclusion:** Age, male gender and patient interval are significant factors for perforation in acute appendicitis.

**Key Words:** Appendicitis, perforation, patient interval, hospital interval.

## INTRODUCTION

Appendicitis is the most common cause of surgical abdomen in all age groups[1,2]. Almost 10% of the general population develops acute appendicitis with maximal incidence in the second and third decades of life[3]. Late diagnosis and surgical intervention is regarded as an important cause of morbidity in acute appendicitis[2]. Acute appendicitis can proceed to gangrene and perforation if not readily diagnosed and attended to[4]. Different factors are responsible for perforation in acute appendicitis at different age groups and this can be explained by the difference in immune status and aetiologies of appendicitis[5,6].

Perforation in acute appendicitis is responsible for increased morbidity (6% to 17%), mortality, prolonged hospital stay and financial burden on the patient[4]. Therefore, many surgeons advocate an early appendicectomy at the cost of diagnostic accuracy to prevent perforation in acute appendicitis[7]. Recently, however, reports of successful conservative management of acute appendicitis in children with intravenous antibiotics and fluids negate this popular notion of early appendicectomy[6].

Early appendicectomy precludes perforation but certainly increases the morbidity, hospital stay and cost of treatment of the patients. The majority patients in our setup belong to the lower socioeconomic group. This study will help determine if time factor plays a role in disease progression in acute appendicitis and the appropriate steps to be taken, in light of results of this study, to decrease the morbidity, mortality and financial cost of treatment in patients with acute appendicitis.

## MATERIALS AND METHODS

This retrospective study was performed, after approval from Medical Ethics Committee of the hospital, at Surgical C Unit, Department of Surgery, Khyber Teaching Hospital, Peshawar from January 2008 to April 2009. The aims of the study were to determine the rate and risk factors for perforation in acute appendicitis. A total of 150 consecutive patients who underwent emergency appendicectomy for acute appendicitis were included in the study. Patients' data regarding age, gender, duration between symptoms development and admission to hospital, duration between hospital admission and appendicectomy, operative findings and histopathology report was retrieved from patients' hospital record and recorded

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on a proforma. Patients without documented onset of symptoms or deficient record and incidental appendicectomy were excluded from the study. Duration between development of first symptoms and admission to hospital was regarded as patient interval and expressed in hours. Similarly duration between hospital admission and appendicetomy was denoted as hospital interval which was also expressed in hours. Appendicetomies were carried out through Grid iron and Lanz incisions. Peroperatively appendicitis was grouped into five types, normal appendix (negative appendicetomy), catarrhal appendicitis, gangrenous appendicitis, phlegmonous, and perforated appendicitis. The peroperative criteria for different grades of inflammation were hyperaemia, edema, dilated blood vessels, and gangrenous patches in the wall of the appendix with or without perforation. Pre and peroperative diagnosis of acute appendicitis and the grade of inflammation were confirmed by histopathology report. Data analysis was carried out using Graphpad Instat version 3. Frequency and percentages were computed for categorical data like gender, operative finding and continuous data like age, patient interval, and hospital interval were presented as mean ± SD. Chi square test was used to compare frequencies of categorical variables and Students *t* test was used to compare the means for continuous variables. Probability $< 0.05$ ($P < 0.05$) was considered as significant.

## RESULTS

A total of 150 patients who underwent appendicectomy for acute appendicitis justifying the selection criteria were included in the study. The mean age of male patients was 21.89 years ± 8.71 SD compared to 24.31 years ± 10.17 SD for females. There were 87(58%) males and 63(42%) females with a male to female ratio of 1.3:1. The mean age of the patients was 23 years ± 9.4 SD with a range of 10 to 60 years. In males 66(44%) of patients had catarrhal, 4(2.7%) had phlegmonous, 1(0.7%) had gangrenous, 13(8.6%) had perforated, and 3(2%) had negative appendicectomy. The corresponding figures in females were 53(35.3%), 1(0.7%), 0(0%), 2(1.3%) and 7(4.7%) respectively. An accurate histopathology proved diagnosis of acute appendicitis was made in 140 (93.3%) of the patients with 10 (6.7%) being the negative appendicetomy rate. Frequency of perforation in males and females in different age groups is shown in Table 1. In more than 94.5% the duration of time interval and grade of inflamation in appendicitis was less than 24 hours, 17(12%) waited more than 48 hours before arriving at hospital. Mean hospital interval was 7.64 hours ± 9.28 SD in patients without perforation compared with 10.93 hours ± 19.23 SD for patients with perforated appendicitis,

**Table 1: Age and gender stratification in perforated appendicitis**

| Age group years | Perforated appendicitis (%) | | |
|---|---|---|---|
| | Male (n) | Female (n) | Total (n) |
| 11-20 | 4 (80%) | 1 (20%) | 5 (33.33%) |
| 21-30 | 5 (100%) | 0 (0%) | 5 (33.33%) |
| 31-40 | 1 (100%) | 0 (0%) | 1 (6.66%) |
| 41-50 | 2 (66.66%) | 1 (33.33%) | 3 (20%) |
| Above 50 | 1 (100%) | 0 (0%) | 1 (6.67%) |

**Table 2: Patient interval in different grades of inflammation of appendicitis***

| Duration of Time before admission | Catarrhal n(%) | Phlegmonous n (%) | Gangrenous n (%) | Perforated n (%) | Total |
|---|---|---|---|---|---|
| Less than 24 hrs | 103 (94.5%) | 3 (2.8%) | 0 | 3 (2.8%) | 109 (77.8%) |
| 24-48 hrs | 7 (50%) | 2 (14.3%) | 1 (7.14%) | 4 (28.6%) | 14 (10%) |
| 48-72 hrs | 4 (50%) | 0 | 0 | 4 (50%) | 8 (5.7%) |
| More than 72 hrs | 5 (55.6%) | 0 | 0 | 4 (44.4%) | 9 (6.4%) |
| Total patients | 119 (100%) | 5 (100%) | 1 (100%) | 15 (100%) | 140 (100%) |

*Negative appendictomy excluded

**Table 3: Hospital interval in different grades of inflammation***

| Duration b/w admission and appendicectomy | Catarrhal n (%) | Phlegmonous n (%) | Gangrenous n (%) | Perforated n (%) | Total |
|---|---|---|---|---|---|
| Less than 6 hrs | 37 (80.4%) | 1 (2.2%) | 0 | 8 (17.4%) | 46 (32.9%) |
| 6-12 hrs | 79 (88.8%) | 4 (4.5%) | 1 (1.1%) | 5 (5.6%) | 89 (63.6%) |
| 12-24 hrs | 3 (75%) | 0 | 0 | 1 (25%) | 4 (2.9%) |
| More than 24 hrs | 0 | 0 | 0 | 1 (100%) | 1 (0.7%) |
| Total | 119 (100%) | 5 (100%) | 1 (100%) | 15 (100%) | 140 (100%) |

*Negative appendictomy excluded

statistically insignificant (P = 0.25) as shown in Table 3, depicting hospital interval, more than 96% patients were operated within 12 hours of admission.

## DISCUSSION

During the past 25 years there has been a slight change in the epidemiology of acute appendicitis with the disease becoming almost equally prevalent in males and females with a recent male to female ratio of 1.2:1. The present study also shows that there was not a substantial difference in the prevalence of appendicitis in the two genders with the male to female ratio being 1.3:1. A study from Rawalpindi General Hospital has reported a higher male to female ratio of 1.94:1 in 150 patients presenting with acute appendicits[8]. In a retrospective review of 140 patients of appendicitis, 52 were females with a male to female ratio of 1.7:1[4]. Higher male to female ratio of appendicitis is encountered in teens and the results of this study are fairly in accordance with the generally accepted figure.

The mean age of the patients presenting with acute appendicitis in this study was 23 years. This observation is consistent with findings in other national studies[3,8]. The mean age of patients having appendicitis is reported to be 33 and 31 years in studies from Hong Kong and Sweden respectively, which is quite high compared to this study[4,9]. Acute appendicitis occurs sparsely in infants. The highest incidence is in the second and third decades of life[10].

Although it is simple and straight forward to treat appendicitis, the main difficulty lies in diagnosing it. Clinical presentation of acute appendicitis may mimic other abdominal and chest inflammatory conditions and the classical symptoms of migrating right lower quadrant pain, fever, anorexia, nausea and vomiting may be evident in only 50 to 60% of the patients making it difficult to diagnose correctly and in time[4]. In this study total 10 (6.7%) patients were misdiagnosed as confirmed on histopathology. Women of reproductive age group (due to gynaecological pelvic diseases), elderly and children (atypical presentation) are most likely to be misdiagnosed. Ali N et al reported a very high rate of 24% of negative appendicectomy compared to results of present study[11]. A study from Hyderabad[12] showed lower rate of 3.78% while, in contrast to our results, studies from Iran and Sweden reported almost two times the rates of negative appendecectomy, 14%[13] and 13.6%[7], respectively. In patients with atypical clinical features diagnostic laparoscopy should be the first line option instead of CT, US or observation in view of the excellent diagnostic results of laparoscopy and low yield of US and CT in equivocal cases[14].

Luminal obstruction of the appendix by external or internal factors causes an increased mucus production and stasis with increased wall tension, above perfusion pressure, leading to necrosis and perforation[6]. Delay in diagnosis and treatment is an important factor leading to perforation as it explains well the time dependent above mechanism. The principal finding in this study was that patients with perforated appendicitis had a significant pre hospital interval (2.67 times longer) in contrast to patients having appendicitis without perforation. This finding has previously been reported in several other studies which show that pre admission delay is highly associated with the risk of perforation in acute appendicitis[2,4,6,7,9]. Fahim F et al found that patient interval did not severely affect the outcome in acute appendicitis contrary to our findings[3]. Hospital interval has little influence on perforation in acute appendicits[15] and a similar finding is determined in this study. Our finding is supported by previous data[7,9], although others believe that prolonged hospital interval due to repeated observations is responsible for perforation[3,16].

In the present study, perforation occurred more frequently in males compared to females, which is in accordance with previous reports[9,17]. The difference in immune response between males and females may be responsible for this difference in the rate of perforation. The mean age of patients with perforated appendicitis was 30.20 years with 26.67% patients > 40 years and 33.33% patients < 20 years of age. One shortcoming in this study was that children below 10 years were not included as they are managed in the paediatric surgery unit. This study does not show an increased rate of perforation at extremes of age being uniformly distributed throughout different age groups. Previous studies reported a perforation rate of 37%[9] and 48%[17] for patients above 50 years of age. There are also articles which suggest that increased rates of perforation occur in younger children which can be attributed to the atypical presentation of appendicitis in this age group[15].

## CONCLUSION

Old age, male gender and delayed presentation to hospital are significant factors which lead to perforation in acute appendicitis.

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