



## **The Frequency of Different Clinical Presentation of Appendicitis, Complications and Prognosis in Elderly**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author MH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AT and GS managed the analyses of the study. Authors AA and HAO managed the literature searches. All authors read and approved the final manuscript.*

**Original Research Article**

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### **ABSTRACT**

**Background:** The classic symptoms of acute appendicitis are seldom seen in the elderly patient and the diagnosis is particularly easy to miss in this group. Therefore complications are more common as a result of delayed diagnosis. The aim of this study was to identify prognosis, complications and factors associated with perforation in elderly patients with acute appendicitis.

**Materials and Methods:** This is a retrospective (descriptive-analytic) study which was conducted from August 2011 until October 2013 in Tehran. A sample of 76 available patients with suspected acute appendicitis –who had been admitted to Rasoul-e-Akram and firoozgar hospital were recruited to participate in this study. Patients' demographic data, symptoms, complications and their blood samples for CRP and Leukocyte count were collected and sent to the laboratory for analysis. Statistical analysis was carried out

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by chi2 and independent sample t-tests.

**Results:** A number of 76 patients were investigated. Nearly 47.2% were male and 81% of the patients had leukocytosis. 15% of patients had normal appendix. Sensitivity and specificity value of WBC was higher than other markers. 14.4% of patients were died. Age, gender, pain duration, fever, leukocytosis and anorexia were 6 factors which affected prognosis of patients.

**Conclusion:** The results of this study showed that in addition to physical examination, some basic laboratory findings such as CRP and leukocytosis can be helpful also it seems some factors such as duration of pain could affected outcomes of patients.

*Keywords: Acute appendicitis; perforation; complication; elderly people.*

## 1. INTRODUCTION

Acute appendicitis still remains the most common intra-abdominal surgical emergency. The definitive treatment of acute appendicitis is appendectomy. [1] The highest incidence of primary positive appendectomy (appendicitis) was found in the second and third decades of life, however it can strike at any age [2]. Although the majority of patients diagnosed with uncomplicated acute appendicitis, but complicated appendicitis with perforation, gangrene, or abscess is relatively common in some age groups [2]. Lifetime probability of appendicitis is 7% and perforation occurs in 17 % to 20% of patients [3]. The diagnosis is usually not difficult for young people and is an excellent surgical results of treatment [4]. The usual signs and symptoms of appendicitis may be diminished, atypical or absent in the elderly, which leads to a higher rate of perforation, approximately 70 percent of patients [3]. Appendicitis is the most common causes of severe abdominal pain in the elderly, after intestinal obstruction and biliary tract diseases. More frequent perforation rate (often due to delay in diagnosis) in the elderly combined with a higher incidence of other medical problems and less reserve to fight infection contribute to a mortality rate of up to 5 percent or more [5,6]. In the elderly, acute appendicitis is misdiagnosed in about half of patients, and diagnosis in about one fourth of cases take more than 24 hours [7]. The prognosis of uncomplicated appendicitis is just as good in the old as in the young patient, but perforation and concomitant diseases worsen the situation [8].

In recent years, a few studies specifically examined the clinical aspects, diagnostic and prognostic problems of acute appendicitis in the elderly population.

## 2. MATERIALS AND METHODS

The present study was a retrospective study of 95 patients over 60 years with acute appendicitis were admitted to Rasoul-e-Akram and Firoozgar hospital from the 1st of August 2011 to the 31st of October 2013. The variables studied in this research include demographic characteristics such as age, sex, and acute appendicitis clinical presentation, including fever, nausea, vomiting, anorexia, rebound tenderness, guarding, laboratory findings include leukocytosis, The presence of immature neutrophils in blood is (left shift), neutrophil to lymphocyte ratio (NLR), C-reactive protein level and also complications of appendicitis, including perforation, mortality in patients. Inclusion criteria included patients aged over 60 years, diagnosed with acute appendicitis without severe disease requiring simultaneous surgery. Incompletely recorded files that had less than 80% of the required information were excluded. The diagnosis of appendicitis was made on a clinical basis and confirmation was made after surgical appendix process excision and careful histological examination. Then, we assessed the prevalence of C-reactive protein elevation and

Leukocytosis between these clinically diagnosed and histologically confirmed groups. At the end of data collection, the data were analyzed using the Univariate analysis technique and Statistical Package for Social Sciences version 18 and Statistical analysis was carried out by  $\chi^2$  and independent sample t-tests. We also used the *kappa* (k) statistic, which measures agreement beyond chance ( $K = 1$ )

### 3. RESULTS

At the end of the study period between 1st of march 2009 to the 31st of February 2012, 76 elderly patients enrolled (40 women and 36 men). The mean age of the study population was  $72.1 \pm 5.4$  years. Table 1 presents the clinical symptoms and physical findings frequency in patients.

**Table 1. Shows the frequency of the clinical data of the patients**

| Signs and symptoms | Frequency        |
|--------------------|------------------|
| Abdominal pain     | 76 cases (100%)  |
| Vomiting           | 60 cases (78.9%) |
| Anorexia           | 69 cases (90.1%) |
| Dysuria            | 4 cases (5.2%)   |
| Diarrhea           | 15 cases (19.7%) |
| Constipation       | 18 cases (23.6%) |
| Local tenderness   | 71 cases (93.4%) |
| Rebound tenderness | 58 cases (76.3%) |
| Fever              | 67 cases (88.1%) |

*"Table 1 - clinical symptoms and physical findings frequency in patients"*

Histological evaluation of patient appendix specimens, shown normal appendix (normal appendectomy) in 12 cases (15.7%). On the other hand in patients operative reports, 18 cases (23.6 %) had normal appendix during surgery. Table 2 compares intra operative macroscopic findings with histological diagnosis. Kappa agreement coefficient is equal to 0.69 ( $p < 0.001$ ), which show significant coordination between the surgical and pathological results.

**Table 2. Comparison of the intra operative macroscopic findings with histological diagnosis**

|                             | Surgically appendicitis | Surgically normal |
|-----------------------------|-------------------------|-------------------|
| Pathologically appendicitis | 57 cases (75%)          | 7 cases (9.2%)    |
| Pathologically normal       | 1 case (1.3%)           | 11 cases (14.4%)  |

**Table 3. Demonstrates the sensitivity, specificity, positive and negative predictive values of diagnostic tests in appendicitis**

| Diagnostic tests                      | NPV  | PPV  | Specificity | Sensitivity |
|---------------------------------------|------|------|-------------|-------------|
| Leukocytosis                          | 49.1 | 81.5 | 39.4        | 86.8        |
| Positive CRP                          | 43.1 | 82.9 | 53.7        | 76          |
| Neutrophil to lymphocyte ratio $>3.5$ | 36.8 | 81.6 | 47.3        | 70.3        |

*Table 3 – Efficiency evaluation of diagnostic tests used in the study*

Considering the threshold of 10,000cells/mcl WBC count, sensitivity of leukocytosis in the diagnosis of appendicitis increased to 86% and its specificity is about 40%. Table 3 presents the efficiency evaluation of diagnostic tests used in the study.

In view of the above or below this threshold level (10,000cells/mcl WBC count) does not increase the diagnostic accuracy of the test. For example, in Considering the leukocytosis threshold over 8,000, sensitivity is increased to 93.2%, But the specificity decreased to 18%. The problem for the other tests used in this study is also true. By taking the higher diagnostic thresholds for example over 12,000cells/mcl, sensitivity is reduced to 76% while the specificity only increase to 50%. This issue is also true for the other diagnostic tests used in this study.

Table 4 shows sensitivity, specificity, negative predictive value and positive predictive value of the combined use of these tests for the detection of histologically confirmed simple appendicitis. A combination of the tests increases sensitivity and negative predictive value, but decreases specificity.

**Table 4. Performance of blood tests to diagnost histologically confirmed appendicitis**

| Diagnostic test                                      | NPV  | PPV  | Specificity | Sensitivity |
|--|------|------|-------------|-------------|
| Leukocytosis and neutrophil to lymphocyte ratio      | 56.1 | 80.8 | 67.6        | 91.8        |
| Positive CRP (>1.0mg/L) and leukocytosis             | 61.9 | 80.2 | 21          | 96.1        |
| Leukocytosis, CRP and neutrophil to lymphocyte ratio | 66.7 | 78.4 | 18.8        | 97.2        |

The present study shows that, WBC count ( $P=0.046$ ), CRP ( $P=0.019$ ) and clinical symptoms was significantly higher in patients with perforated appendicitis than patients with non-perforated appendicitis.

From all 76 enrolled patients, 11 patients (14.4%) had died, and the remaining patients survived. All of patients who had died were over 70 years of age, and perforated appendicitis was seen in 8 patients out of 11 patients.

Third factors that affect prognosis of the patients were; Age, perforated appendicitis and symptoms severity.

The mean interval between onset of symptoms and hospital arrival was  $1.9 \pm 2.4$  days. In patients with perforation, the mean interval was  $2.1 \pm 2.8$  days, which was significantly higher in the group of perforations. From 76 examined patients, 34 patients (44.3%) had appendix perforation. Statistical analysis shows the six variables involved in appendix perforation: age ( $ci = 1.02-1.07$ ,  $or = 1.05$ ), male sex ( $1.96 = or$ ,  $ci = 1.35-2.06$ ), the duration of abdominal pain ( $ci = 1.11-1.36$ ,  $or = 1.23$ ), fever ( $ci = 1.78-3.77$ ,  $or = 2.59$ ), leukocytosis ( $ci = 1.27-4.32$ ,  $or = 2.34$ ) and anorexia ( $ci = 1.38$  to  $2.99$ ,  $or = 2.03$ ).

#### 4. DISCUSSION

The present study examined the frequency of various clinical presentation and prognosis of acute appendicitis in the elderly above 60 years were admitted to Rasoul-e-Akram and Firouzgar hospitals.

The present study showed that, there was no statistically significant difference in appendicitis occurrence between male or female, as was shown in previous studies [9-11].

In Lunca and colleagues in a study in 2004, 63 patients with a definitive pathological diagnosis of Acute Appendicitis were retrospectively analyzed. The primary admission diagnosis was established correctly in 44 patients (69.8%). Nineteen patients (30.1%) required further diagnostic investigations and the mean time to final diagnosis was 26 hours. For 3 patients (4.8%), the final diagnosis was established intra-operatively. The perforation rate was 31.8% (20 patients). Thirty-eight patients (63.3%) had associated co-morbidities. The overall mean duration of pre-hospitalization symptoms was 2.7 days, 2.3 days for non-perforated cases and 3.8 days for perforated Acute Appendicitis. The complication rate was 34.9% (23 patients), complications occurred in 75% of perforated appendicitis. Overall mortality rate was 6.3%, The majority of patients mortality was also in perforated case group [9].

In this study, overall, nearly 40% of patients had perforated appendicitis and overall mortality rate was 14 % these rates were close to the similar previous studies.

In another study conducted by Lee and colleagues (2000), did assess acute appendicitis in patients older than 60 years. In this study, the 64.6% of patients were correctly diagnosed on admission. In other patients, the average duration until diagnosis and treatment was 9.4 hours there was a delay in diagnosis and treatment. Patients who had a perforation, had longer pain duration at the time of admission. Using a midline incision associated with an increased risk of wound infection and increased length of hospital stay and increased morbidity and mortality [10].

Yang and colleagues' study in 2005, the role of leukocyte count, neutrophil percentage and C - reactive protein (CRP) in the diagnosis of acute appendicitis in the elderly were studied. Based on the results, the diagnosis of acute appendicitis in the elderly based on the laboratory test is not definitive and should be evaluated with extra caution [11-14].

In a study conducted in 2011 by Siddique and colleagues found that; duration of symptoms, temperature, length of admission, number of leukocytes and CRP were significantly higher in patients with perforated appendicitis. [15].

In another study by Broker and his colleague's in 2011, 498 patients were studied with acute appendicitis to Discriminating between simple and perforated appendicitis. The results of this study showed that Perforation of appendicitis can be predicted from the CRP level and the duration of abdominal pain. These findings might influence the choice between conservative or surgical treatment of appendicitis, and could provide guidance in the early start of antibiotics [16].

Sulberg and colleagues in a study on acute appendicitis, determined the cutoff point of 101mg/l for CRP, with a sensitivity of 72% and specificity of 81% for the diagnosis of perforated appendicitis in patients older than 60 years. According to the result, CRP correlated strongly with the degree of inflammation and perforation in acute appendicitis [17].

Some studies have evaluated the role of CRP and white blood cell counts in diagnosis of appendicitis [10-20]. Escalona et al. in a study showed higher sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive and negative likelihood ratio (LR) of leukocyte count compared to CRP in diagnosis of appendicitis. CRP and leukocyte

count combination had a higher specificity, PPV and LR (+). Leukocyte count had more accuracy compared to CRP in diagnosis of appendicitis [18-20]. In another study Rothrock et al. [21], white cell count in patients with appendicitis has been considered unreliable. But CRP was a more sensitive measure to differentiate simple appendicitis, from perforated appendicitis in their study.

Among the factors that could affect the results of the above tests, is time elapsed between onset of symptoms and diagnosis of appendicitis. For example Beltran et al [22,23] showed higher differential diagnostic values of CRP in first 13 to 24 hours of onset of symptoms.

In some studies neutrophils to lymphocytes ratio (NLR)>3.5 has had a good sensitivity and specificity. [24] But in our study this ratio hasn't have acceptable sensitivity and specificity.

Combination of two or more of above biomarkers, increase the sensitivity and specificity of these biomarkers in the diagnosis of acute appendicitis. For example stefanutti and colleagues [25] found that, the sensitivity of the 2 combined tests is extremely high and normal values of both WBC Count and CRP are very unlikely in pathologically confirmed appendicitis.

Sheu and colleagues in a 2007 study, were evaluate risk factors associated with perforated appendicitis in the elderly. 9 risk factors were identified, which include age, male gender, duration of pain before admission, interval between admission and surgery, leukocyte left shift >76%, anorexia, fever above 38 degrees and retroseal location of the appendix.

## **5. CONCLUSION**

In present study, like other previous studies [25] we found that combined use of WBC count and CRP appears to be more sensitive in diagnosing acute appendicitis. The most common clinical symptom in our patients was abdominal pain.abdominal tenderness and anorexia were occur after the onset of pain. Base on The results of the present study, 6 risk factors were identified in perforating appendicitis included: age, male sex, duration of abdominal pain, fever, leukocytosis and anorexia.

## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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