

# Retrospective cohort study of elderly patients with acute appendicitis

Ilker Murat Arer<sup>1</sup>, Murat Kus<sup>1</sup>, Nezh Akkapulu<sup>1</sup>, Aydinca Akdur<sup>2</sup>, Tevfik Avci<sup>2</sup>, Abdirahman Sakulen Hargura<sup>1</sup>, Hakan Yabanoglu<sup>1</sup>

<sup>1</sup>Baskent University Adana Teaching and Research Center, Department of General Surgery, Adana Turkey

<sup>2</sup>Baskent University School of Medicine, Department of General Surgery, Ankara, Turkey

## Abstract

**Aim:** Appendicitis is the most common surgical cause of abdominal pain among the patients being admitted to Emergency department. Although it affects younger patients, its incidence increases in elderly as the population gets older. Higher perforation and complication rates have been reported in elderly patients. The aim of this study is to investigate appendicitis in patients older than 65 years.

**Material and Methods:** A total of 61 patients with performed appendectomy older than 65 years age were included in this study. Laparoscopic and open appendectomies were included. Data were collected retrospectively. Patients were analyzed according to demographic data, operative findings, complications and mortality.

**Results:** Of 61 patients, 34 (55.7%) were male and 27 (44.3%) were female. The mean age was found to be 71.59 years. The average duration of symptoms were 3.2 days. Laparoscopic appendectomy was performed in only 4 (6.6%) patients. The mean hospital stay was found to be 3.89 days. Complications were found in 13 (21.3%) patients. Mortality was found to be 3.3%. Perforated appendicitis was found to be associated with physical findings, CRP level and hospital stay ( $p < 0.05$ ). Abdominal ultrasound has a sensitivity of 45.2% and specificity of 66.7% and computerized tomography has higher sensitivity (82.1%) and specificity (100%).

**Conclusion:** Prompt diagnosis and treatment should be performed in the elderly patients with suspected appendicitis in order to prevent complications and mortality. Radiological modalities should be used to ensure accurate diagnosis of appendicitis in elderly patients.

**Keywords:** Appendicitis; Appendectomy; Elderly.

## INTRODUCTION

Appendectomy is the most commonly performed surgical procedure for patients admitted to emergency department (1). However this situation is uncommon in the elderly. According to WHO data, global life expectancy at birth in 2015 was found to be 71.4 years which was 66 years in 2000 (2). As the elderly population increase the emergency surgery performed for them also increase (3). Appendectomy is performed nearly 5% of all elderly patients with acute abdomen (4). However appendicitis in the elderly is associated with complications. Perforated appendicitis accounts for 20% of patients with appendicitis however this rate can be as high as 70% in the elderly (5). This elevation with the age can be explained by physiological changes such as decreased immune response, bowel function and pain perception in the elderly (6-8). Morbidity rate of perforated appendicitis in the elderly was reported to be 48% (9). In the superaged

patients (age  $\geq 80$  years) perforation of the appendix and postoperative mortality was higher compared to younger patients (10).

Although there are detailed radiological modalities and urgent evaluation of the patients, appendicitis in the elderly still has higher complication and mortality rates. The aim of this study is to evaluate the postoperative complications and mortality rates of appendectomy performed for the elderly patients in our center.

## MATERIAL and METHODS

2616 patients underwent laparoscopic or open appendectomy between 2000 and 2016 in our Institution. Patients older than 64 years of age were accepted as elderly. 171 (6.5%) patients were with age 65 years and older. Among 171 patients with diagnosis of acute appendicitis, 61 patients underwent laparoscopic or open appendectomy between 2000 and 2016 were enrolled in this

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**Corresponding Author:** Ilker Murat Arer, Baskent University Adana Teaching and Research Center, Department of General Surgery, Adana, Turkey, E-mail: igy1981@yahoo.com

study. Patients with age 65 years and older with diagnosis of acute appendicitis were included. Exclusion criteria were patients underwent appendectomy additionally for other surgical procedures, patients with diagnosis of appendix tumors. 15 patients with missing data and 95 patients underwent appendectomy additionally for other surgical procedures (Colorectal surgery, appendix tumors, etc.) were excluded. Data were collected retrospectively from hospital records. Patients were compared according to age, sex, comorbidity, complaint, physical findings, ultrasound or computed tomography (CT) findings, American Society of Anesthesiologists (ASA) score, surgical technique, perforation, operation time, complication and mortality.

Ethical approval was not taken because of the retrospective design of the study. This study was conducted according to Helsinki declaration principles.

Statistical analysis was performed using SPSS software (Version 17.0, SPSS Inc., Chicago, IL, USA). If continuous variables were normal, they were describe as the mean ± standard deviation ( $p > 0.05$  in Kolmogorov-Smirnov test or Shapira-Wilk ( $n < 30$ )), and if the continuous variables were not normal, they were described as the median. The continuous variables were compared by the use of Student t test or Mann-Whitney U test depending on parametric or non-parametric values; respectively. The categorical variables between the groups were analyzed by using the Chi square test or Fisher's Exact Test. Receiver operating characteristic curves (ROC curves) were constructed and the areas undercurve (AUC) as well as the sensitivity (sen), and the specificity (spe.) were calculated. The level for statistical significance was predetermined at  $p < 0.05$ .

## RESULTS

34 (55.7%) patients were male and 27 (44.3%) were female. The mean age was found to be 71.59 (min 65 – max 89) years. Comorbidity was not found in 26.2% of patients. Demographic data of the patients were listed on Table 1.

The most common complaint was abdominal pain (83.6%). The average duration of symptoms were 3.2 days (min 1–max 14). Physical findings with acute abdomen were found in 64% of patients. The average body temperature was  $36.98 \pm 0.4$  °C. The mean leukocyte count was  $12.19 \pm 4.66 \times 10^3/\mu\text{L}$  and C-reactive protein (CRP) was  $124.62 \pm 88.28$  mg/L. Patients with ASA-2 and 3 score were 23% and 77% respectively. Abdominal ultrasound findings consistent with appendicitis was found in only 14 (23%) patients. Abdominal CT was done in 28 patients and it was not diagnostic in 5 patients. Open appendectomy via Mc Burney incision was performed in 44 (72.1%), midline incision in 11 (18%), laparoscopic in 4 (6.6%) and paramedian incision in 2 (3.3%) patients. Perforation was found in 22 (36.1%) patients. The average operation time was 57.98 minutes (min 30 – max 120). The mean hospital stay was found to be 3.89 days (min 1–max 13). Negative appendectomy rate was 4.9%. Complications were found in 13 (21.3%) patients and were listed on Table 2.

**Table 1. Demographic data of the patients**

	Patients ≥ 65 years age (n=61)
Age (Years)*	71.59 ± 5.38
Gender (F/M)	34/27
Comorbidity (%)	
None	16 (26.2)
HT	20 (32.8)
CAD + HT	8 (13.1)
CAD	6 (9.8)
DM	3 (4.9)
HT + DM	2 (3.4)
Others	6 (9.8)
Duration of symptoms (Days)*	3.2 ± 2.64
Body temperature (°C)*	36.98 ± 0.4
Leukocyte count ( $\times 10^3/\mu\text{L}$ )*	12.19 ± 4.66
CRP (mg/L)*	124.62 ± 88.28
Operation time (minutes)*	57.98 ± 15.56
Hospital stay (Days)*	3.89 ± 3.15
Mortality (%)	2 (3.3)

\*: Values are mean ± standard deviation.

Abbreviations: CAD: Coronary artery disease, CRP: C-reactive protein, DM: Diabetes mellitus, HT: Hypertension

**Table 2. Postoperative complications**

	Patients ≥ 65 years age (n=61)
None (%)	48 (78.7)
Wound infection	10 (16.4)
Seroma	2 (3.3)
Incisional hernia	1 (1.6)

Permanent pathology report was appendicitis (73.8%), perforated appendicitis (19.7%), appendix vermiformis (4.9%) and mucinous tumor (1.6%). Mortality was found to be 3.3%. In univariate analysis perforation of the appendix was found to be associated with physical findings, CRP level and hospital stay (Table 3).

**Table 3. Univariate analysis of factors associated with perforated appendicitis**

	Patients with PA	Patients without PA	P value
Physical findings (%)	20 (90.1)	19 (48.7)	0.002
CRP level*	166.54 ± 85.72	89.15 ± 76.42	0.018
Hospital stay*	5.09 ± 3.61	3.21 ± 2.68	0.010

\*: Values are mean ± standard deviation.

Abbreviations: CRP: C-reactive protein, PA: Perforated appendicitis

According to the pathology report that has been accepted as gold standard, abdominal ultrasound has a sensitivity of 45.2% and specificity of 66.7% for acute appendicitis. These values for CT were found to be higher (sensitivity 82.1% and specificity 100%) and listed on Table 4. Further

analysis was performed according to age groups (65-70, 71-75, 76-79, >80 years) and no statistical difference was observed between groups regarding physical findings (P= 0.163), surgery type (P= 0.898), ultrasound findings (P= 0.282), abdomen CT findings (P= 0.821), perforation (P= 0.194), complication (P= 0.217), mortality (P= 0.753).

ASA score (P= 0.001) and complaint of the patients (P= 0.031) were found to be statistically different between age groups (Table-5). As the patient gets older they admit to the hospital with complaint of abdominal pain, nausea and vomiting.

**Table 4. Radiological modalities for diagnosis of appendicitis**

	Sensitivity	Specificity	PPV	NPV
CT scan (CI 95%)	82.1 (68/96.3)	100 (100/100)	100 (100/100)	16.7 (-13.2/46.5)
Ultrasound (CI 95%)	45.2 (27.6/62.7)	66.7 (13.3/120)	93.3 (80.7/106)	10.5 (-3.3/24.3)

Abbreviations: NPV: Negative predictive value, PPV: Positive predictive value

**Table 5. Data of the patients according to age stratification**

	65-70 years	71-75 years	76-80 years	>80 years	P value
Physical findings (%)					
Tend	13 (41.9)	3 (20)	6 (42.9)	0 (0)	0.163
Tend + Reb	13 (41.9)	10 (66.7)	7 (50)	0 (0)	
Tend + Reb + Def	5 (16.2)	2 (13.3)	1 (7.1)	1 (100)	
Surgery type (%)					
Mc Burney	23 (74.2)	12 (80)	8 (57.2)	1 (100)	0.898
Laparoscopic	1 (3.2)	1 (6.7)	2 (14.3)	0 (0)	
Midline	6 (19.4)	2 (13.3)	3 (21.4)	0 (0)	
Paramedian	1 (3.2)	0 (0)	1 (7.1)	0 (0)	
Ultrasound findings with appendicitis (%)	7 (22.6)	5 (33.3)	1 (7.1)	1 (100)	0.282
Abdomen CT findings with appendicitis (%)	12 (38.7)	4 (26.7)	6 (42.9)	1 (100)	0.821
Perforation (%)	9 (29)	8 (53.3)	4 (28.6)	1 (100)	0.194
Complication (%)	5 (16.1)	4 (26.7)	3 (21.4)	1 (100)	0.217
Mortality (%)	1 (3.2)	0 (0)	1 (7.1)	0 (0)	0.753
ASA score (%)					
ASA-2	14 (45.2)	0 (0)	0 (0)	0 (0)	0.001
ASA-3	17 (54.8)	15 (100)	14 (100)	0 (100)	
Complaint (%)					
AbP	29 (93.5)	13 (86.6)	9 (64.3)	0 (0)	0.031
AbP + N	0 (0)	1 (6.7)	1 (7.1)	0 (0)	
AbP + N + V	2 (6.5)	1 (6.7)	4 (28.6)	1 (100)	

Abbreviations: AbP: Abdominal pain, Def: Defence, N: Nausea, Reb: Rebound, Tend: Tenderness, V: Vomiting.

## DISCUSSION

Acute appendicitis can be seen in all age groups whereas it commonly affects younger population in the second and third decades of life (11, 12). As the global life expectancy increases and the population gets older, some disease may shift to elderly. Acute appendicitis in the elderly has been evaluated by some authors (13,14). Most of them are single center experience like our study but Harbrecht et al. conducted a study from all hospitals of Kentucky (15). They also concluded on similar findings; higher mortality

rates, length of hospital stay and increased hospital charges associated with increased age (15). Among elderly patients admitted to emergency department and received urgent surgical intervention, the incidence of acute appendicitis was found to be 6.52% with half of them presented with perforation (16). Thus most of the elderly patients are evaluated for other differential diagnosis which may cause delay in the diagnosis of acute appendicitis. They also have decreased pain perception and therefore physical examination may cause misdiagnosis. But in our study we found perforation to be strongly associated

with physical examination ( $p < 0.05$ ). In a retrospective review of 65 patients, right lower quadrant pain was found to be highly associated with acute appendicitis (17). Storm-Dickerson et al. found that 55% of nonperforated appendicitis were diagnosed correctly at the time of initial assessment versus 38% of perforated group which means the differential diagnosis of appendicitis gets difficult when perforated during initial assessment of the elderly patients in the Emergency Department (13). Therefore physical examination seems to be a significant indicator for accurate diagnosis of appendicitis in the elderly and appendicitis should be suspected when evaluating an elderly patient with abdominal pain in the Emergency Department. Some authors evaluated scoring systems for appendicitis in the elderly and found both Alvarado and Lintula scores to have a high sensitivity and specificity (18). Lacking scoring systems for appendicitis is one of the limitation of our study. Retrospective design of our study is another limitation.

Duration of symptoms until admission to the hospital varies between 1.6-2.08 days (19-21). Our findings were higher than literature with 3.2 days. This can be explained by our hospital characteristics. Our center is not the first hospital admitted. Our patient population comprise patients that reject treatment of other hospitals and finally admit to our hospital. This can lead to delay and longer duration of symptoms observed. Sirikurnpiboon et al. investigated factors associated with perforated appendicitis in 206 elderly patients and found duration of pain in admission period, duration from pain to operation and duration from arrival to imaging to be significantly higher in perforated group (22). They also found duration of pain in preadmission period to be a significant factor associated with perforated appendicitis ( $p < 0.001$ ). All these data suggest as the duration of symptoms get longer the risk of perforated appendicitis gets higher.

The radiological modalities aid in differential diagnosis of elderly patients with abdominal pain admitted to emergency department. The sensitivity and specificity of ultrasound on diagnosis of appendicitis ranges between 56-77.3% and 37.5-80% respectively (23,24). However these studies were conducted on general population. Our findings on sensitivity of ultrasound were lower than literature report (45.2%). This can be explained by anatomical changes with age that makes appendix difficult to be visualized. The sensitivity and specificity rates with CT as high as 100% and 97.6-100% respectively has been reported (25). We also found higher rates for CT than ultrasound similar to literature findings.

Our operation time (57.98 minutes) was found to be shorter than most of the literature findings (78.3-88 minutes) (20,21,26). This was a result of lower laparoscopic appendectomy rates (6.6% only) of our study. The mean length of hospital stay was found only 3.89 days that is also shorter than recent studies (20,21,26). We found that perforation of the appendix increases mortality rates and complications. The complications after appendectomy

was reported to be 3.1-32% (27,28). These can be minor complications such as wound infection and urinary tract infection and major complications such as intraabdominal abscess. Our complication rate was found to be 21.3% because of higher perforated appendicitis rates (36.1%) and open appendectomy rates (93.4%). Both of these can be risk factors for complications.

The mortality rate of appendicitis in the elderly was reported between 0.01-4% (13,29). Moazzez et al. found higher mortality rates associated with increased age ( $p < 0.001$ ) (30). As the patients' age was older than 80 years this rate was found to be as high as 4.1%. Our mortality rates after appendectomy (3.3%) was consisted with literature findings.

## CONCLUSIONS

Acute appendicitis should be suspected in any elderly patients admitted to the hospital with abdominal pain. Differential diagnosis of appendicitis can be ruled out with radiological modalities. If appendix was perforated it may cause serious complications and higher mortality rates. Therefore urgent diagnosis and treatment should be performed in the elderly patients suspected appendicitis.

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