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## RESEARCH ARTICLE

### RISK FACTORS ASSOCIATED WITH COMPLICATED ACUTE APPENDICITIS

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#### ABSTRACT

**Objective:** To determine the risk factors associated with complicated acute appendicitis. **Methodology:** An observational, cross-sectional, retrospective, and analytical study was conducted on patients with acute appendicitis to identify risk factors, including duration of symptoms, self-medication, and leukocytosis. Other variables considered included gender, age, comorbidities, body mass index (BMI), and types of complications. A probabilistic sample was used to create two comparison groups with and without complications. The data were analyzed using descriptive and inferential statistics with Chi-square tests performed using SPSS v26.0 software, with a significance level set at  $p < 0.05$ . **Results:** A total of 70 patients were evaluated, with 47 (67%) presenting complicated acute appendicitis and 23 (33%) having uncomplicated cases. The mean age was  $35 \pm 14$  in complicated cases, with 30 (64%) being female, while in uncomplicated cases, the mean age was  $33 \pm 14$ , with 12 (52%) being female. Complications included abscess and perforation in 11 (15.7%) and perforation alone in 9 (12.9%). Risk factors included leukocytosis in complicated appendicitis (32%) compared to non-complicated cases (9%), with an odds ratio (OR) of 5 (95% CI 1-23),  $p < 0.033$ . Symptom duration exceeding 24 hours was observed in 40% of complicated cases and 9% of uncomplicated cases, with an OR of 7 (95% CI 1.4-34),  $p < 0.007$ . **Conclusion:** Risk factors associated with complicated acute appendicitis were leukocytosis and symptom duration exceeding 24 hours.

#### INTRODUCTION

Acute appendicitis (AA) is one of the most common pathologies requiring emergency surgery, with a lifetime risk of acute appendicitis ranging from 7% to 8%, categorized into complicated and uncomplicated types. It most frequently occurs between the second and third decades of life, with a risk of 16.33% in males and 16.34% in females. The annual incidence is 139.54 per 100,000 inhabitants, associated with overweight in 18.5% and obesity in 81.5%. Complicated appendicitis is defined as perforated appendicitis, peri-appendiceal abscess, or peritonitis, resulting from acute inflammation of the peritoneum secondary to appendix infection. Abdominal pain is the central symptom of acute appendicitis, initially diffuse in the epigastrium or umbilical area, moderately intense, and constant. Other symptoms include fever, anorexia, localized pain at McBurney's point, or pain in the right leg when extended, known as the Psoas sign, crucial for the definitive diagnosis.

In cases of simple appendicitis, the complication rate is 10%, increasing to 65% in cases of acute appendicitis with perforation. Understanding the risk factors that may negatively impact acute appendicitis can improve treatment quality through individualized care and special postoperative measures for at-risk patients. Ander A et al. note a statistically significant relationship between complicated appendicitis and the time interval until surgery. Cruz Díaz mentions that the duration of illness or time before hospital care is statistically significant, especially with a symptomatic period exceeding 24 hours, posing a higher risk of progressing to complicated acute appendicitis. Some consider obesity, especially when subcutaneous fat exceeds 3.5 cm, as the main risk factor for surgical site infection development. Regarding age, Moreira LF suggests that patients over 40 years old have a higher proportion of complicated acute appendicitis. In cases of older adults, there is a delay in acute appendicitis diagnosis, with a cutoff age of 65, as only a quarter present typical symptoms, and more than a third are diagnosed after a significant delay. Self-medication can sometimes mask the classical clinical picture, leading to the presentation of complicated stages of acute appendicitis due to delayed surgical treatment.

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AgramonteBurón and colleagues mention that leukocytosis exceeding 16,000 leukocytes/ml is considered a factor associated with perforation in patients with acute appendicitis. The purpose of this study is to identify whether age over 65, the presence of obesity, patient care delay, or leukocytosis are associated risks for complicated acute appendicitis.

**MATERIALS AND METHODS**

A cross-sectional and comparative study was conducted on patients with acute appendicitis to identify risk factors for complicated acute appendicitis. Patients over 18 years old were included, while those with a history of hemolytic disease, liver disease, or incomplete records in their variables were excluded. Convenience sampling was used, and the sample size was probabilistic and comparative. Once approved by the ethics and research committees, the search for variables such as age, sex, BMI, comorbidities, leukocytosis above 20,000, obesity, duration of appendicitis in days, self-medication, and advanced age began. Two comparison groups were formed: one with complications defined as perforated appendicitis, periappendicular abscess, or peritonitis (defined as acute inflammation of the peritoneum secondary to an appendix infection), and the other without complications, showing none of these events, to determine the risks. The data obtained were entered into an Excel table for analysis using measures of central tendency (mean, median, mode) for quantitative variables, absolute and relative frequencies for qualitative variables, and inferential analysis with odds ratio calculation and a 95% confidence interval. Chi-square tests were performed with a significance level of  $p < 0.05$ , supported by the statistical package SPSSv26.0.

**RESULTS**

In this study, 70 patients were selected into two groups to identify risks for complicated acute appendicitis, with 47 (67%) being complicated and 23 (33%) uncomplicated.

**Table 1. Characteristics of patients with acute appendicitis**

N= 70		
Characteristics	Complicated n= 47 (%)	Uncomplicated n= 23 (%)
Age	35 ± 14	33 ± 14
<b>Gender</b>		
Male	17 (36)	11 (48)
Female	30 (64)	12 (52)
<b>Comorbidity</b>		
None	37 (78.7)	20 (87)
Hypertension	4 (8.5)	0
Diabetes Mellitus 2	2 (4.3)	1 (4.3)
Diabetes Mellitus, Obesity	3 (6.4)	0
Diabetes Mellitus, Hypertension	1 (2.1)	1 (4.3)
UrinaryTractInfection	0	1 (4.3)

source: have

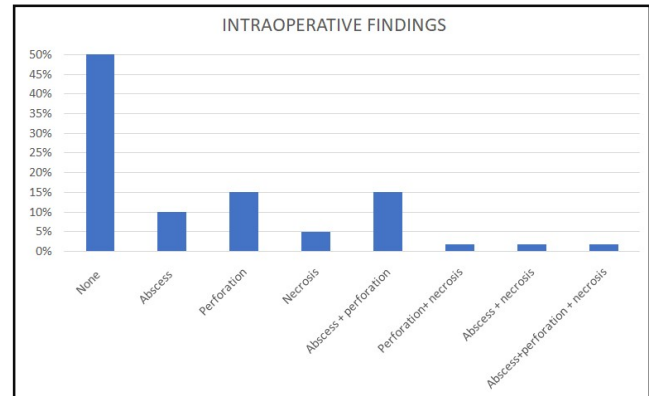
The complicated appendicitis group had a mean age of 35 ± 14, with 30 (64%) being female and 37 (78.7%) having no comorbidities. In the uncomplicated group, the mean age was 33 ± 14, with 12 (52%) being female and 20 (87%) having no comorbidities.

**Table 2. Risk factors for patients with complicated acute appendicitis**

RiskFactors	Complicated (%)	Uncomplicated (%)	OR (IC 95%)	P Value
Self- Medication	14 (30)	3 (13)	2.8 (0.7-11)	<0.125
Age over 40 years	15 (32)	6 (26)	1.3 (0.4-4)	<0.617
Leukocytosis	15 (32)	2 (9)	5 (1-23)	<0.033
Obesity	13 (28)	6 (26)	1 (0.3-3.3)	<0.899
Duration of symptoms over 24 hours	19 (40%)	2 (9)	7 (1.4-34)	<0.007

Source: Haev

9 (12.9%), as shown in Figure 1. Among the risk factors, leukocytosis greater than 20 was found in complicated appendicitis in 15 (32%) and uncomplicated in 2 (9%), with an odds ratio (OR) of 5 (95% CI 1-23);  $p < 0.033$ . Symptom duration longer than 24 hours was observed in complicated appendicitis in 19 (40%) and uncomplicated in 2 (9%), with an OR of 7 (95% CI 1.4-34);  $p < 0.007$ . As shown in Table 2.



SOURCE: HAEV

**Figure 1. Intraoperative findings in acute appendicitis**

**DISCUSSION**

In this study, the risk factors associated with complicated acute appendicitis were identified by selecting 70 patients with an average age of 33-35 years, and the majority were women, similar to what Mohammad Naderan mentioned in a population in Turkey, although the average age there was 30 years. It was observed that there was a lower presence of comorbidities in the complicated appendicitis group. It is noteworthy that, although obesity is considered a risk for pulmonary atelectasis during surgical procedures or the presence of infections, it was not associated with complicated appendicitis in our population. Since associated diseases typically manifest more in the elderly, they did not pose a risk in our study subjects who were over 40 years old.

The predominant complications were abscess and perforation. The presence of post-surgical infection, a factor that prolongs hospital stay as mentioned by Rodríguez Fernández, was not observed in our study. However, an association was found between the time elapsed from the onset of acute appendicitis symptoms and surgery after 24 hours, with an odds ratio (OR) of 7 (95% CI 1.4-34). According to Cruz Díaz and colleagues, this was observed in a population of 234 patients, with 69.2% experiencing a time of extrahospital disease exceeding 24 hours and presenting complications (OR=5.72, 95% CI 3.16-10.37,  $p < 0.001$ ). Leukocytosis was also associated with complicated appendicitis, as reported by Pineda Villeda RH in 100 patients, where it existed in the majority of cases (66%). Moderate leukocytosis (46%) and severe leukocytosis (39%) were associated with the severity of acute appendicitis.

## CONCLUSION

The risk factors associated with complicated acute appendicitis in this study group were leukocytosis greater than 20,000 and the progression of symptoms exceeding 24 hours.

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