

Original Research Article

An investigation into the frequency of negative appendectomies and contributing factors in patients with suspected acute appendicitis

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ABSTRACT

Background: Acute appendicitis is a common cause of acute abdominal pain in young adults, with varying diagnosis accuracy leading to a significant rate of negative appendectomies, particularly in females and younger patients. This study aimed to evaluate the prevalence of negative appendectomy in patients with suspected acute appendicitis.

Methods: A cross-sectional study was conducted at Dhaka medical college hospital from January 2022 to June 2024, involving 220 patients diagnosed with suspected acute appendicitis. Clinical history, examination, and relevant pre-operative investigations were performed. All patients underwent surgery, and histopathological examination of the excised appendices was conducted.

Results: Acute appendicitis was confirmed in 175 patients (79.55%), with the highest incidence in individuals aged 10-19 years (54.1%). The negative appendectomy rate was 20.45%, with significantly higher rates in females (77.8%) compared to males (22.2%) ($p=0.004$). Younger patients (age <20 years) also showed a higher rate of negative appendectomy (33.3%) ($p=0.012$). Common presenting symptoms included anorexia (66.7%), elevated temperature ($>99.4^{\circ}\text{F}$) (60%), and localized tenderness in the right iliac fossa (77.8%). Of the 64 patients who underwent pre-operative ultrasound, 63% experienced negative appendectomy. Histopathological examination revealed that 45 patients (20%) were diagnosed as not having appendicitis, with alternative conditions identified in several cases.

Conclusions: The study highlights a significant rate of negative appendectomies, particularly in younger females. While clinical judgment plays a crucial role in diagnosis, the findings suggest a need for enhanced diagnostic imaging techniques to reduce unnecessary surgical interventions.

Keyword: Negative appendectomy, Acute appendicitis, Laparotomy

INTRODUCTION

Acute appendicitis is the most common cause of an acute abdomen in young adults.¹ Historically, the pre-operative diagnosis has relied heavily on clinical history and physical examination findings, often without imaging studies.² However, due to overlapping symptoms with gynecological and gastro-urinary conditions, the potential

for misdiagnosis and subsequent negative appendectomy remains a clinical challenge.^{3,4}

This study aims to assess the incidence of negative appendectomy in patients diagnosed with suspected acute appendicitis and to identify key clinical and laboratory parameters associated with this occurrence.

METHODS

A prospective cross-sectional study was conducted from January 2022 to December 2023 in the department of surgery, Dhaka medical college hospital. The study included 220 patients selected according to predefined inclusion and exclusion criteria. Patients with abscess, lump, free gas were excluded. All age and sex group were included. All patients underwent appendectomy, followed by histopathological examination of the resected appendix to confirm the diagnosis.⁵

Clinical and laboratory parameters, along with ultrasonographic and operative findings, were recorded. Binary logistic regression analysis was performed by SPSS to evaluate the association between clinical symptoms and the occurrence of negative appendectomy.⁶

RESULTS

Out of 220 patients, 175 (79.55%) were diagnosed with acute appendicitis, while 45 (20.45%) were confirmed as negative appendectomy. The highest incidence of negative appendectomy was noted in females (77.8%) and in patients under the age of 20 years (33.3%). Significant independent predictors of negative appendectomy included female sex (OR: 3.3, 95% CI: 1.17-11.40), absence of Rovsing's sign (OR: 5.56, 95% CI: 1.24-25.62), rebound tenderness (OR: 11.12, 95% CI: 2.27-54.52), WBC count $<10,000/\text{ml}^3$ (OR: 13), and polymorph $<70\%$ (OR: 18).⁷

The regression model which included 9 predictor variables (Table 2) was first subjected to model-fit test. Hosmer and Lemeshow goodness-of-fit test demonstrated that the model was a good fit model which could predict 73.5% of negative appendectomy correctly ($p=0.837$).

Table 1: Demographic data.

Category	Subcategory	Frequency	Percentage (%)	
Age (in years)	<20	26	11.8	Mean age $\pm$ SD, 27.6 $\pm$ 7.5 years Age range: 14-62 years
	20-30	119	54.1	
	30-40	60	27.3	
	40-50	12	5.5	
	≥ 50	3	1.4	
Sex	Female	~132	~60.0	Female-to-male ratio: ~3:2
	Male	~88	~40.0	

Table 2: Association between clinical variables and negative appendectomy.

Clinical variables	Groups		P value
	Appendicitis, (n=175)	Negative appendicectomy, (n=45)	
Anorexia			
Present	122 (69.7)	30 (66.7)	0.693
Absent	53 (30.3)	15 (33.3)	
Pain around umbilicus#			
Present	146 (83.4)	30 (66.7)	0.012
Absent	29 (16.6)	15 (33.3)	
Pain migrated to RLQ			
Yes	86 (49.1)	19 (42.2)	0.407
No	89 (50.9)	26 (47.8)	
Tenderness in RLQ#			
Yes	161 (92.0)	35 (77.8)	0.014
No	14 (8.0)	10 (21.2)	
Rovsing's sign			
Present	143 (81.7)	20 (44.0)	<0.001
Absent	32 (18.3)	25 (54.0)	
Rebound tenderness#			
Present	142 (81.2)	4 (31.0)	<0.001
Absent	33 (18.8)	31 (69.0)	
Temperature#			
<99.14° F	27 (15.4)	18 (40.0)	<0.001
≥990° F	148 (84.6)	27 (60.0)	
WBC count#			
<10000/ml³	14 (30.4)	31 (69.0)	<0.001
≥10000/ml³	102 (96.2)	14 (31.0)	

Continued.

Clinical variables	Groups		P value
	Appendicitis, (n=175)	Negative appendicectomy, (n=45)	
Neutrophil#			
<70%	77 (44.0)	38 (84.5)	<0.001
≥70%	98 (56.0)	7 (15.5)	

Table 3: Independent predictors of acute appendicitis, (n=220).

Variables of interest	Univariate analysis (p value)	Multivariate analysis	
		Odds ratio (95% CI of OR)	P value
Age (≤20 years)	0.012	0.99 (0.911-0.8)	0.882
Sex (female)	0.004	3.33 (1.17-11.40)	0.013 ^s
Pain around umbilicus	0.012	3.52 (0.75-16.50)	0.110
Tenderness in RLQ	0.014	3.41(0.62-15.08)	0.172
Rovsing's sign	<0.001	5.62 (1.24-25.62)	0.026 ^s
Rebound tenderness	<0.001	11.12 (2.27-54.52)	0.003 ^s
Elevated temperature (> 99.14° F)	<0.001	2.30 (0.52 10.20)	0.273
WBC <10000/ml ³	<0.001	13.46 (1.57-69.40)	0.018 ^s
Polymorph <70%	<0.001	18.51 (3.90-87.85)	<0.001 ^s

Table 2 demonstrates the binary logistic regression analysis of odds ratios for clinical symptoms and signs of the patients likely to be associated with negative appendicectomy. The variables revealed to be significantly associated with acute appendicitis ($p<0.05$) by univariate analyses were all entered into the model directly. Of the 9 variables, female sex, absence of Rovsing's sign, rebound tenderness, WBC<10000/ml³ and polymorph <70% were found to be the independent predictors of negative appendicectomy ($p=0.013$, $p=0.026$, $p=0.003$, $p=0.018$ and $p<0.001$ respectively).

The possibility of negative appendicectomy is 3.3 times (95% confidence interval=1.17-11.40) higher in female than that in male. Similarly, the likelihood of negative appendicectomy is 5.56 (95% CI=1.24-25.62) times and 11.12 times (95% CI=2.27-54.52) higher in patients having absence of Rovsing's sign and rebound tenderness respectively compared to those patients who have had these signs.

Patients with WBC count <10000/cm³ of blood and polymorphs<70% also carries 13 and 18 fold risk of being negative appendicectomy compared to those who had WBC >10000/cm³ of blood and polymorphs ≥70% respectively. The odds ratios and their 95% CI are given in Table 2.

The total diagnostic accuracy of acute appendicitis was 79.55%, with significant clinical findings such as localized tenderness in the right iliac fossa (92.0%), elevated temperature (>99.4°F) in 84.6%, and leukocytosis (WBC count ≥1000/Cu-mm of blood) observed in 96.2% of confirmed appendicitis cases.^{8,9} Pre-operative ultrasonography showed a low diagnostic yield, with only 14% of cases suggesting acute appendicitis.

DISCUSSION

The findings of this study align with previous literature indicating a higher rate of negative appendicectomy in females and younger age groups.^{10,11} The high incidence of gynecological disorders in young women likely contributes to this trend, leading to misdiagnosis.¹² The study also reaffirms the significance of thorough clinical evaluation in the diagnosis of acute appendicitis.¹³

In comparison to historical data, this study reveals a negative appendicectomy rate of 20.45%, which is higher than the rate reported by other studies.¹⁴ Notably, there were considerable differences in clinical symptoms between those diagnosed with acute appendicitis and those with normal histology. For example, nausea, vomiting, and migratory pain were prevalent in the appendicitis group, while fewer signs were present in the negative appendicectomy group.

The use of imaging techniques, particularly ultrasonography, showed limited efficacy in this study. Only a minority of cases with suspected appendicitis were accurately diagnosed through imaging.¹⁵ The need for improved diagnostic tools is essential, particularly in female patients to differentiate appendicitis from gynecological conditions.¹⁶

Limitation

The study was conducted in a surgical department of a tertiary level hospital (DMCH) and included limited number of patients and selected by purposive sampling methods may not represent the actual rate negative appendicectomy patients undergoing operation for suspected appendicitis of the whole country.

CONCLUSION

The judgment of an experienced clinician remains crucial in the diagnosis of acute appendicitis. The study highlights the need for careful clinical assessment and the potential benefits of using structured scoring systems to improve diagnostic accuracy. Negative appendectomy is more prevalent in women and younger patients, indicating a need for targeted diagnostic approaches in these demographics. We should ensure thorough exploration of potential alternative diagnoses during surgery, especially in cases of right iliac fossa pain. We also advocate for pre-operative assessment by senior surgeons to minimize the incidence of negative appendectomy.

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