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Original Research Article

FREQUENCY OF APPENDIX PERFORATION IN PATIENTS PRESENTING WITH ACUTE APPENDICITIS

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ABSTRACT

Background: *Acute appendicitis is one of the most common surgical emergencies worldwide, with appendix perforation being a major complication that increases morbidity and mortality. Identifying the frequency and risk factors associated with perforation is essential for early intervention and improved patient outcomes.* ***Objective:*** *To determine the frequency of appendix perforation in patients presenting with acute appendicitis.* ***Study Design:*** *Cross-sectional study.* ***Setting:*** *The Department of Surgery, Saidu Group of Teaching Hospital in Swat, Pakistan.* ***Duration of Study:*** *09-March-2024 to 09-September-2024.* ***Methods:*** *A total of 169 patients aged 18–60 years with ultrasound-confirmed acute appendicitis were included. Diagnosis was based on ultrasonographic findings, including wall thickening (>3 mm), hyperechoic appendicolith, echogenic periappendiceal fat, and appendix diameter >6 mm. Appendix perforation was diagnosed using predefined ultrasonographic criteria, including appendix diameter >6 mm, wall thickness ≥3 mm, and evidence of peritoneal spillage. Clinical data, including age, hypertension status, and diabetes status, were also recorded. Statistical analysis was performed to assess the frequency and associated risk factors.* ***Results:*** *The mean age of patients was 33.20 ± 11.72 years. Among them, 99 (58.6%) were males and 70 (41.4%) were females. The frequency of appendix perforation was 16.6%. Higher age, hypertension, and diabetes showed a significant association with appendix perforation.* ***Conclusion:*** *Appendix perforation occurred in 16.6% of patients with acute appendicitis in our study, with older age and comorbidities such as hypertension and diabetes emerging as key associated factors. Early diagnosis and timely surgical intervention are critical to reducing complications.*

Keywords: Acute Appendicitis, Appendix Perforation, Risk Factors, Diabetes, Hypertension, Ultrasonography

INTRODUCTION

Acute appendicitis (AA) represents an often-observed surgical emergency (1). Appendectomy ranks as one of the most frequently carried out surgical procedures, with over 108,000 operations executed annually (2). AA takes place at an incidence of 100 instances per 100,000 individuals every year and is the most prevalent reason for acute abdominal pain (3, 4). The lifetime probability of AA is marginally greater in men than in women (8.6% and 6.7%); however, women demonstrate a higher lifelong risk for undergoing an appendectomy (5). AA is a prevalent cause of lower abdominal pain that prompts patients to visit the emergency department, and it is the most frequently diagnosed condition among young cases hospitalized with an acute abdomen (6).

Appendiceal perforation corresponds with heightened mortality and morbidity relative to non-perforating appendicitis. The mortality risk related to AA, excluding gangrenous instances, is below 0.1%. However, this risk increases to 0.6% in instances of gangrenous appendicitis. Conversely, perforated appendicitis has been linked with a mortality rate of roughly 5%. Recent evidence shows that perforation is not a foregone conclusion of appendiceal obstruction. In addition, it indicates that not all individuals who have AA are susceptible to perforation. In contrast, resolution may occur frequently (7-10). Patients with a perforated appendix who have had prolonged symptoms typically receive antibiotics before surgery. Necrosis of the appendix is a possible consequence of untreated appendicitis. Complications caused by fecal peritonitis can be fatal in instances of perforation (11, 12). A study indicated that 15.8% of patients with AA presented with appendix perforation (13).

Appendix perforation is one of the serious complications of appendicitis that is linked with increased morbidity and mortality, regarded as a surgical emergency, due to the lack of data available on this subject. Therefore, the purpose of this research is to determine the frequency of appendix perforation in patients presenting with acute appendicitis. The outcome of this study will highlight the importance of early diagnosis in preventing complications.

METHODOLOGY

This study was conducted as a cross-sectional investigation at the Surgery Department of Saidu Group of Teaching Hospital in Swat from 09-March-2024 to 09-September-2024 following ethical approval from our hospital. We selected 169 participants for the study, with the sample size calculated using the WHO calculator. This calculation was based on a reported appendix perforation proportion of 15.8% (13) from previous literature, with a 95% confidence level and a 5.5% margin of error. Consecutive non-probability sampling was employed.

Patients between 18 and 60 years of age diagnosed with acute appendicitis through ultrasonography were included in the study regardless of gender. Demographic information, including age, gender, and residential address, was recorded for each participant. The diagnostic criteria for acute appendicitis included specific ultrasound findings, such as wall thickening greater than 3 mm, a hyperechoic appendicolith, evident echogenic periappendiceal fat, and an expanded appendix diameter exceeding 6 mm. Appendix perforation was confirmed via ultrasound when spillage of stool in the peritoneal cavity was observed alongside an appendix diameter greater than 6 mm and a wall thickness of 3 mm or more. Exclusion standards were applied to pregnant women and patients with chronic kidney or liver disease. The entire process was supervised by a consultant with five years of experience following their fellowship. Patient data was recorded on standardized proformas designed specifically for the study.

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Data analysis was done with SPSS 23. Age, height, weight, and body mass index were expressed as mean ± standard deviation. Gender, presence of appendix perforation, diabetes, residential area, and hypertension were expressed as frequencies and percentages. The Chi-Square test was used to assess the association between appendix perforation and demographics, as well as comorbidities. Statistical significance was set at a p-value of ≤ 0.05.

RESULTS

The study included 169 patients with a mean age of 33.20 ± 11.72 years. The average BMI of the participants was 26.13 ± 1.59 kg/m². Among the study population, 99 (58.6%) were male, while 70 (41.4%) were female. Comorbidities were present in a notable proportion of the cohort. Diabetes was reported in 29 (17.2%) patients, whereas hypertension was observed in 36 (21.3%) (Table 1). The overall frequency of appendix perforation was 28 (16.6%) (Table 2).

The age distribution revealed that patients with perforated appendicitis, 15 (53.6%), fell within the 18- to 35-year age group, while only 6 (21.4%) were aged 36 to 50 years and 7 (25.0%) were between 51 and 60 years (p = 0.04). BMI also showed a trend toward association with perforation, although it did not reach statistical significance (p = 0.09). Among perforated cases, 24 (85.7%) had a BMI exceeding 24.9 kg/m². Gender (p = 0.50) and residence (p = 0.81) did not show notable associations with perforation. Comorbidities, however, were strongly linked to perforation. Diabetes was present in 35.7% of perforated cases (p=0.004). Similarly, hypertension was more prevalent in the perforated group, affecting 42.9% (p=0.002) (Table 3).

Table 1: Demographics and comorbidities

Demographics and comorbidities		n	%
Gender	Male	99	58.6%
	Female	70	41.4%
Residence	Rural	94	55.6%
	Urban	75	44.4%
Diabetes	Yes	29	17.2%
	No	140	82.8%
Hypertension	Yes	36	21.3%
	No	133	78.7%

Table 2: Appendix perforation

Appendix perforation	n	%
Yes	28	16.6%
No	141	83.4%

Table 3: Association of appendix perforation with demographics and comorbidities

Demographics and comorbidities		Appendix perforation				P value
		Yes		No		
		n	%	n	%	
Age distribution (Years)	18 to 35	15	53.6%	106	75.2%	0.04
	36 to 50	6	21.4%	21	14.9%	
	51 to 60	7	25.0%	14	9.9%	
BMI (Kg/m2)	18 to 24.9	4	14.3%	42	29.8%	0.09
	> 24.9	24	85.7%	99	70.2%	
Gender	Male	18	64.3%	81	57.4%	0.50
	Female	10	35.7%	60	42.6%	
Residence	Rural	15	53.6%	79	56.0%	0.81
	Urban	13	46.4%	62	44.0%	
Diabetes	Yes	10	35.7%	19	13.5%	0.004
	No	18	64.3%	122	86.5%	
Hypertension	Yes	12	42.9%	24	17.0%	0.002
	No	16	57.1%	117	83.0%	

DISCUSSION

The findings of this study reveal several important trends regarding perforated appendicitis, which align with and diverge from previous research in notable ways. The perforation rate observed in this study was 16.6% falling within the range reported by other studies. Riaz et al reported a 13.8% perforation rate (14). Potey et al. documented a 13.8% perforation rate in their cohort (15). Manan et al. reported an 8% rate, while Malik et al. documented a higher Figure of 40% (16, 17).

The variability in perforation rates across studies may be attributed to differences in study populations, healthcare access, and diagnostic protocols. For instance, the lower perforation rate reported by Manan et al. could reflect a younger cohort. In contrast, the higher rate of 40% in Malik et al. may indicate delayed presentations or a higher proportion of elderly patients.

Age emerged as a notable predictor of perforation in this study, as the rate of perforation was higher in patients over 35 years of age. This aligns with Khalid et al, who identified age greater than 30 years as a risk factor for perforation (18). The physiological decline in immune response and delayed pain perception in older adults may contribute to later hospital presentations, increasing the likelihood of complications. Our study revealed a more gradual increase with age, which may be attributed to variations in population demographics or healthcare-seeking behavior.

BMI demonstrated a trend toward association with perforation, although it did not reach statistical significance in our study. Patients with a BMI exceeding 24.9 kg/m² constituted 85.7% of perforated cases compared to 70.2% in the non-perforated group. This finding is consistent with Khalid et al, who reported a potential association between obesity (BMI >25 kg/m²) and perforation, with 36.4% of obese patients experiencing perforation versus only 6.9% in the non-obese group (18). The discrepancy in statistical significance between the two studies may stem from differences in sample size or BMI categorization. Obesity likely complicates diagnosis due to challenges in physical examination and imaging interpretation, leading to delays in surgical intervention.

Gender did not influence perforation rates in our study, with males representing 64.3% of perforated cases and 57.4% of non-perforated cases. Our results are in agreement with Khalid et al., who also found no noteworthy gender difference. The inconsistency across studies suggests that while males may historically present more frequently with appendicitis, gender may not be a decisive factor in perforation risk.

Residential status showed no association with perforation in our study, with rural and urban residents exhibiting similar perforation rates

(53.6% vs. 44.4%). This contradicts Khalid et al, who reported a notably higher perforation rate among urban residents (30.0% vs. 7.0%). The authors attributed this finding to delayed healthcare-seeking behavior in urban areas, possibly due to initial self-medication or misdiagnosis in private clinics. Our results, however, suggest that rural and urban populations in our cohort faced comparable barriers to timely care, possibly due to improved healthcare access or uniform diagnostic practices across regions.

Comorbidities, particularly diabetes and hypertension, were strongly linked with perforation in our study. Diabetes was present in 35.7% of perforated cases versus 13.5% in non-perforated cases, while hypertension affected 42.9% of perforated patients compared to 17.0% of non-perforated patients. These findings align with Khalid et al, who reported perforation rates of 62.5% in people with diabetes and 54.5% in hypertensive patients (18). The metabolic and vascular complications of these conditions, such as impaired immune response and microvascular dysfunction, likely exacerbate appendiceal inflammation and delay healing, increasing the risk of perforation.

Our study reinforces the role of age and comorbidities as key determinants of appendix perforation while challenging some earlier assumptions about gender and residential disparities.

CONCLUSION

In conclusion, the frequency of appendix perforation in patients presenting with acute appendicitis in our study was 16.6%. We found that increasing age and comorbidities such as hypertension and diabetes were associated with appendix perforation.

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (IRB)

Consent for publication

Approved

Funding

Not applicable

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTION

UZMA MIR (PGR)
Conceived the study, collected data, performed initial analysis, and prepared the first draft of the manuscript
ANWAR UL HAQUE (PROFESSOR)
Supervised the research, provided expert guidance, critically reviewed the manuscript, and approved the final version
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All authors read and approved the final version of the manuscript

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