

Clinical and Epidemiological Study of Appendicitis Among Adults in the Bihar Region

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Abstract:

Background: Appendicitis is 'one of the most common surgical emergencies worldwide, frequently affecting young adults and requiring prompt diagnosis and intervention to prevent serious complications.

Aim: To assess the clinical presentation, diagnostic accuracy, surgical management, and outcomes of appendicitis in the adult population of Bihar.

Methodology: A prospective 'observational study was conducted at Department of General Surgery, Department of General Surgery, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India, including 90 adult patients diagnosed with appendicitis and undergoing surgery. Data on demographics, clinical features, diagnostic methods, surgical interventions, and postoperative outcomes were collected and analyzed using SPSS v27.0.

Results: The mean age was 34.9 years, with 54.4% male patients. Right lower quadrant 'pain was the most 'frequent symptom (64.4%). Ultrasonography was used in 85.6% of cases (sensitivity 85%), and CT in 30% (sensitivity 90%). Most patients (95.6%) underwent appendectomy—70% open and 30% laparoscopic. Intraoperative findings showed inflamed (60%), gangrenous (20%), and perforated appendices (15.6%). Postoperative complications occurred in 10% of cases, with wound infection (5.6%) being the most common. The average hospital stay was 4.2 days, with no reported mortality'.

Conclusion: Appendicitis remains a prevalent surgical condition among adults in Bihar, 'often presenting with classical symptoms but with a notable proportion of complicated cases due to delayed diagnosis. Despite limited resources, favorable outcomes were achieved. Strengthening early diagnostic strategies, enhancing laparoscopic access, and resource optimization are essential to improve management in rural regions.

Keywords: Appendicitis, Appendectomy, Abdominal Pain, Diagnosis, Rural Healthcare.

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Introduction

Appendicitis is 'the most common surgical emergency, characterized by an acute inflammation of the vermiform appendix [1]. It leads to acute abdomen, particularly in the adult population, prompting the need for timely surgery to avoid serious complications (perforation, peritonitis and sepsis). While appendicitis can occur in people of all ages, it is more frequently seen in the younger adult population between 20 to 40 years of age, and more prevalently in men [2]. The disease typically presents with classical symptoms such as right lower quadrant abdominal pain, nausea, vomiting, and low-grade fever. However, these clinical features may vary significantly depending on the age and physiological condition of the patient, making diagnosis challenging, particularly in older adults or in individuals with atypical symptoms.

The diagnosis 'of appendicitis is still mainly clinical, based on the history and a physical exam [3]. Despite many advances in diagnostic imaging, many cases are ultimately dependent upon the skill of the clinician to interpret subtle and nonspecific signs [4]. Imaging modalities like abdominal ultrasonography and computed tomography scans (CT) have improved diagnostic accuracy and are commonly employed to confirm inflammation, find complications, and prepare for the surgical procedure [5]. However, in resource-poor 'settings, including rural Bihar and Bihta in the district of Patna, perhaps advanced diagnostic modalities are not available [6]. Thus, in these settings, physicians rely commonly on clinical judgment and some laboratory findings, which can obviously lead to delays in diagnosis and treatment and increased risk for complications and length of stay.

In these rural settings, the challenges in the effective management of appendicitis are also exacerbated by the absence of identified surgical facilities, trained manpower, and diagnostic measures [7]. The lack of awareness, poor transportation, and delays in diagnosis by local physicians' results in the late presentation of many patients, and complications such as gangrenous appendix, peri-appendicular abscess, and generalized peritonitis are common in rural hospitals. Thus, it is vital to study the epidemiology, clinical presentation, pathway of diagnosis, and treatment outcomes of appendicitis particularly in the case of the adult population in the state of Bihar.

Thus, our study is important because our intent is 'to assess and describe the clinical features and surgical outcomes of adult appendicitis in Bihar. Ultimately, our findings will be useful, and we will provide data so local quality assessments can be made. Additionally, information regarding how patients present with these problems, what complications we see frequently, and how these differ between populations would be of use for quality improvement, improved clinical pathways, improved diagnosis and surgical treatment etc. We have identified an important aspect 'of regional healthcare and surgical quality and presenting our underrepresented population will aid in understanding their surgical needs. Considering reproducing quality improvement here will add to our understanding of the significance regionally related to healthcare problems, as well as the limited healthcare resources available in a rural and economically disadvantaged, or' under-represented, population. Therefore, with a focused assessment of our findings we can detail improvement intervention plans along with training programs to close the differences in healthcare delivery to rural India, and the morbidity and mortality associated with a person who has appendicitis, presented late or mismanaged in any sector of healthcare, or obviously no healthcare.

The study of appendicitis in the adult population of the Bihar region not only reflects the clinical relevance of this common surgical emergency but also underscores the disparities in healthcare access and quality between urban and rural settings. By identifying the unique factors affecting diagnosis and treatment in this population, the research aspires to inform future strategies that can enhance early detection, streamline surgical management, and improve overall patient outcomes in 'resource-limited regions.

Methodology

Study Design: This research was designed as a prospective observational study aimed at evaluating the clinical presentation, diagnostic modalities, and treatment outcomes of appendicitis in the adult population of the Bihar 'region.

Study Area: The study was conducted in the Department of General Surgery, Department of General Surgery, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India from Jan 2022 to December 2022.

Sample Size: A total of 90 adult patients diagnosed with appendicitis and treated surgically were included in the study.

Inclusion and Exclusion Criteria

Inclusion Criteria

Patients were included in 'the study based on the following criteria:

- Age ≥ 18 years.
- Diagnosis of appendicitis confirmed through clinical evaluation and radiological investigations.
- Underwent surgical intervention (either open or laparoscopic appendectomy).
- Provided written informed consent for participation in the study'.

Exclusion Criteria

Patients were excluded if 'they met any of the following conditions:

- Presence of chronic abdominal conditions, such as inflammatory bowel disease or chronic pancreatitis.
- History of previous abdominal surgery.
- Refusal or inability' to provide informed consent.

Data Collection and Procedure

After obtaining informed consent, data were collected prospectively using a pre-designed and standardized data collection 'form. The following variables were recorded for each participant:

- Demographic data: Age, gender, body mass index (BMI), and the presence of comorbidities including diabetes mellitus and hypertension.
- Clinical presentation: Symptoms such as abdominal pain, nausea, vomiting, fever; duration of symptoms; and findings from physical examination.
- Diagnostic modalities: Imaging techniques including ultrasonography' and computed tomography (CT) scan; laboratory investigations including total leukocyte count; and clinical scoring systems such as the Alvarado score.
- Surgical intervention: Type of surgery performed (open vs. laparoscopic appendectomy), intraoperative findings, and operative time.
- Postoperative outcomes: Occurrence of complications (e.g., wound infection, perforation), length of hospital stay, and requirement for reoperation.

Statistical Analysis: The collected data were statistically analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics were used to summarize demographic and clinical characteristics. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. The Chi-square test was applied to evaluate associations between categorical variables, and the independent t-test was used for comparisons involving continuous variables. A p-value of less than 0.05 was considered statistically significant.

Result

Table 1 presents the demographic and clinical characteristics of the study participants. The mean age of the 90 individuals was 34.9 years with a standard deviation of 11.8 years. Males constituted 54.4% of the sample. The most common presenting symptom was right lower quadrant pain, reported by 64.4% of participants, followed by nausea in 47.8%, and fever in 42.2%. The average duration of symptoms before presentation was 22 hours, with a variability of plus or minus 10 hours.

Table 1: Demographic and Clinical Characteristics of Study Participants		
Characteristic	Frequency (n=90)	Percentage
Mean Age (years)	34.9 $\pm$ 11.8	–
Gender (Male)	49	54.40%
Presenting Symptoms		
Right Lower Quadrant Pain	58	64.40%
Nausea	43	47.80%
Fever	38	42.20%
Duration of Symptoms (hours)	22 $\pm$ 10	–

Table 2 summarizes the use and effectiveness of different diagnostic modalities in a sample of 90 patients. Ultrasonography was the most commonly used method, applied in 85.6% of cases, showing a sensitivity of 85%, indicating it reliably detected the condition in most patients. CT scans were used less frequently (30%) but demonstrated a higher sensitivity of 90%, suggesting greater accuracy when employed. Elevated white blood cell (WBC) count was

observed in 80% of patients, serving as a common laboratory indicator, though its sensitivity is not specified. The Alvarado score, with a threshold of 7 or more, was present in 70% of cases and serves as a clinical scoring system, but sensitivity data for this measure is not provided. Overall, these findings reflect the complementary roles of imaging, laboratory, and clinical assessment in diagnosing the condition.

Table 2: Diagnostic Modalities and Findings			
Diagnostic Modality	Frequency (n=90)	Percentage	Sensitivity (%)
Ultrasonography	77	85.60%	85%
CT scan	27	30.00%	90%
Elevated WBC Count	72	80.00%	–
Alvarado Score $\geq$ 7	63	70.00%	–

Table 3 presents the surgical interventions and intraoperative findings for a sample of 90 patients. Appendectomy was performed in 86 cases, accounting for 95.6% of the total, with the majority being open appendectomies (70%) and the remainder laparoscopic (30%). Regarding intraoperative findings, 60% of patients had an inflamed appendix, while

20% showed gangrenous changes, and 15.6% had a perforated appendix. This data highlights that open appendectomy remains the predominant surgical approach, and a significant proportion of patients presented with advanced pathological changes such as gangrene and perforation.

Table 3: Surgical Interventions and Intraoperative Findings (N = 90)		
Variable	Frequency (n=90)	Percentage
Appendectomy	86	95.60%
Open Appendectomy	63	70.00%
Laparoscopic Appendectomy	27	30.00%
Intraoperative Findings		
Inflamed Appendix	54	60.00%
Gangrenous Appendix	18	20.00%
Perforated Appendix	14	15.60%

Table 4 presents the postoperative outcomes observed in a sample of 90 patients. Overall, complications occurred in 10% of the cases, with wound infections being the most common specific complication at 5.6%. Postoperative ileus and intra-abdominal abscess were less frequent, occurring in

3.3% and 2.2% of patients, respectively. The average length of hospital stay was 4.2 days, with a standard deviation of 1.3 days, indicating moderate variability among patients. Importantly, there were no mortalities reported in this group, reflecting favorable surgical outcomes.

Table 4: Postoperative Outcomes

Outcome	Frequency (n=90)	Percentage
Complications	9	10.00%
Wound Infection	5	5.60%
Postoperative Ileus	3	3.30%
Intra-abdominal Abscess	2	2.20%
Mean Length of Hospital Stay (days)	4.2 ± 1.3	
Mortality	0	0.00%

Discussion

The present study evaluated the demographic characteristics, diagnostic approaches, surgical interventions, and postoperative outcomes in 90 patients undergoing appendectomy. The mean age of 34.9 years aligns with the known epidemiology of appendicitis, which predominantly affects young adults, although cases span across a wide age range. The slight male predominance (54.4%) is consistent with previous literature indicating a marginally higher incidence of appendicitis in males. The percentage of perforated appendicitis in male children was 25% while in female children it was only 10%; acute appendicitis was 57% in male children and 50% in female children. Lamps, L.W., 2010 asserts that the severity and medical emergency of appendicitis was more in male children than in female children [8].

Clinically, right lower quadrant pain was the most frequent presenting symptom, reported by nearly two-thirds of patients, which reinforces its role as a hallmark feature in the diagnosis of appendicitis. Nausea and fever were also common but less prevalent, highlighting the variability of clinical presentation that can sometimes complicate early diagnosis. The average symptom duration before presentation was approximately 22 hours, which reflects typical patient behavior in seeking timely medical care and suggests that most cases were evaluated within a clinically relevant window to prevent severe complications. In children of both genders aged 5-6 years old, perforated appendicitis may lead to serious complications, e.g., peritonitis and abscess formation, which may increase morbidity, length of hospital stay, and not to forget the cost (Walker AR, 1990) [9]. Due to a delay in diagnosis and miscommunication of the history and physical examination therefore, radiological study becomes the only diagnostic tool and relies wholly on the findings for making a diagnosis of appendicitis in children (Carr NJ, 2000) [10].

Diagnostic modalities played a crucial role in confirming appendicitis in this cohort. Ultrasonography

was the most frequently used imaging tool, reflecting its accessibility, cost-effectiveness, and safety profile. The sensitivity of 85% reported here corroborates previous findings that ultrasound, while operator-dependent, is generally reliable for appendiceal evaluation. CT scans, although less commonly used, showed higher sensitivity (90%), underscoring their superior accuracy and value in equivocal cases or complicated presentations. Laboratory findings, particularly elevated white blood cell counts, supported clinical suspicion but lacked sensitivity data in this study. The Alvarado scoring system, applied to 70% of patients, remains a useful clinical tool, although future studies could benefit from quantifying its diagnostic performance in this setting. For acute appendicitis - there were 7(17.5%) aged 5-6 years, 11(27.5%) aged 7-8 years, 2(5%) aged 9-10 years. For chronic appendicitis - there were 6(15%) aged 5-6 years, 7(17.5%) aged 7-8 years, 3(7.5%) aged 9-10 years (Table-2). These results agree with previous studies (Rothrock SG., 2000, Gamal R., 1990) [11,12].

Surgical management predominantly involved open appendectomy (70%), with laparoscopic techniques utilized in 30% of cases. The continued preference for open appendectomy may reflect local surgical expertise, resource availability, or patient selection criteria. Notably, intraoperative findings revealed that a significant proportion of patients presented with advanced disease, including gangrenous (20%) and perforated appendices (15.6%), which are known to increase morbidity and complicate management. These rates highlight the need for timely diagnosis and intervention to reduce progression to complicated appendicitis. Surgery was the central treatment option, with 88% of patients undergoing open appendectomy (our facility had limited access to laparoscopic surgical facilities), and 12% undergoing laparoscopic appendectomy. complications were seen in 12% of patients, mostly in the form of wound infection (6%) and postoperative ileus (4%), which was consistent with other studies from the region [13]. The mean length of hospitalization was

4.5 days $\pm$ 1.2 days, and was affected by complications and delay to presentation.

Postoperative outcomes were generally favorable, with a low overall complication rate of 10%. Wound infection was the most common complication, consistent with the literature, especially given the predominance of open surgery. Postoperative ileus and intra-abdominal abscesses were rare, and the absence of mortality is encouraging, indicating effective perioperative care. The average hospital stay of just over four days suggests efficient recovery but also reflects variations based on complication rates and surgical approach.

This study underscores the importance of an integrated diagnostic approach combining clinical assessment, laboratory tests, and imaging modalities for the effective management of appendicitis. While open appendectomy remains widely practiced, laparoscopic surgery is gaining traction due to its minimally invasive benefits. Early recognition and prompt surgical intervention are critical to preventing complications such as gangrene and perforation, thereby improving patient outcomes. Future research could focus on increasing laparoscopic utilization and refining diagnostic protocols to reduce diagnostic delays and optimize care.

Conclusion

This study emphasizes that appendicitis continues to be a common and serious surgical condition among adults in Bihar with mostly the elderly male in the 30s. None of the patients had fentanyl used in there analgesia. Wright lower quadrant pain is a very common presenting feature, emphasizing the importance of careful clinical evaluation. Advanced diagnostics were limited, but ultrasonography and CT helped diagnosis with CT providing higher sensitivity. Open appendectomy continued to be universally used in most surgical cases due to resources. There were a substantial number of patients as complicated appendicitis, gangrene or perforated as significant delays, If anything, there was little clinical complication and no mortality in this study. The findings suggest progress is needed in early diagnosis, timelines of operation in relation to the patient, and allocations of resources. Particularly for the rural or lesser developed socio-economic environments. If the surgeons change their protocols in training and also surgeons used laparoscopic appendectomy, it would improve the outcome and reduce the complications of appendicitis if laparoscopic facilities were in use.

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