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Original Research Article

Microbiological profile and antibiotic resistance patterns in complicated versus uncomplicated acute appendicitis: a prospective cohort study from a tertiary care centre

G. V. Ramana Reddy, Moodu Vamshi Kiran*, Uttakalla Likitha, Puttapati Anusha, Pakeerugari Pavani

Department of General Surgery, S.V.S. Medical College and Hospital, Mahabubnagar, Telangana, India

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***Correspondence:**
Dr. Moodu Vamshi Kiran,
E-mail: vamshikiranmoodu1996@gmail.com

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ABSTRACT

Background: Acute appendicitis is a common surgical emergency with variable microbiological patterns influencing disease severity and outcomes. Regional data from South India remains limited.
Methods: A prospective cohort study was conducted on 100 patients diagnosed with acute appendicitis at a tertiary care centre. Patients were classified into uncomplicated (UAA) and complicated appendicitis (CAA). Intraoperative samples were subjected to microbiological analysis and antibiotic sensitivity testing.
Results: Out of 100 patients, 60% had UAA and 40% had CAA. Mean age was significantly higher in CAA (50.33±7.2 years) compared to UAA (31.82±7.46 years, $p<0.001$). Culture positivity was 100% in CAA and 50% in UAA. Polymicrobial infections were observed exclusively in CAA (62.5%). Common organisms included Escherichia coli, Bacteroides and Pseudomonas. High resistance rates were observed for meropenem (34%), ceftriaxone (30%) and amoxicillin (31%). Surgical site infections occurred only in CAA (25%).
Conclusions: Complicated appendicitis demonstrates a distinct microbiological profile with higher polymicrobial infection and antibiotic resistance. Empirical antibiotic therapy should include anaerobic coverage and be guided by regional antibiograms.

Keywords: Appendicitis, Microbiology, Antibiotic resistance

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies worldwide, with a lifetime risk of approximately 7-8%.[1] It is broadly classified into uncomplicated and complicated appendicitis, with the latter associated with increased morbidity, prolonged hospital stays, and higher healthcare costs.[1]

The microbiological profile plays a crucial role in determining disease severity and guiding antibiotic therapy.[2] However, regional variations exist, particularly in developing countries where antimicrobial resistance is increasing.[3] There is limited data from South India, especially Telangana, regarding microbial patterns in appendicitis.[4] This study aims to analyse the microbiological spectrum and antibiotic resistance patterns in complicated and uncomplicated appendicitis and correlate them with clinical outcomes.

METHODS

This prospective cohort study was conducted at SVS Medical College and Hospital, Telangana, from March 2024 to February 2026. A total of 100 patients diagnosed with acute appendicitis were included in the study. The sample size was considered adequate to assess the microbiological spectrum and antibiotic resistance

patterns based on patient availability, prevalence of appendicitis cases at the tertiary care center, and comparison with similar previously published regional studies.

Patients fulfilling the inclusion and exclusion criteria were recruited consecutively during the study period using a consecutive sampling technique. The study included patients of all age groups and both sexes diagnosed with acute appendicitis.

Patients presenting with appendicular mass, suspected malignancy, or congenital anomalies were excluded from the study.

Patients were clinically diagnosed with acute appendicitis supported by imaging modalities such as ultrasonography and computed tomography. Intraoperative appendicular or peritoneal samples were collected for microbiological analysis, including gram staining, aerobic culture, and antibiotic sensitivity testing.

Statistical analysis

Statistical analysis was performed using SPSS version 30. Chi-square test and Student's t-test were used for comparison between groups, and a p value<0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Ethics Committee prior to commencement of the research. Informed consent was obtained from all participants included in the study, and confidentiality of patient information was maintained throughout the study period.

This hospital-based observational study was conducted after obtaining approval from the Institutional Ethics Committee. Informed consent was obtained from all study participants.

Patients fulfilling the inclusion and exclusion criteria were recruited consecutively during the study period using a consecutive sampling technique. The study included all eligible patients admitted during the specified duration of the research.

RESULTS

Important finding: Patients with complicated acute appendicitis (CAA) had significantly higher mean age compared to uncomplicated acute appendicitis (UAA) (p<0.001).

Table 1: Demographic characteristics.

Group	N	Mean	Std. Deviation	T value	P value
UAA	60	31.82	7.464	-12.438	<0.01
CAA	40	50.33	7.018		

Microbiological Profile: UAA: mostly E. coli or no growth, CAA: polymicrobial with anaerobes.

Table 2: Clinical features associated with complicated appendicitis.

Clinical features	Association with CAA	P value
Fever	Strong association	<0.001
Vomiting	Strong association	<0.001
Pain>24 h	Strong association	<0.001

Important finding: Fever, vomiting, and abdominal pain lasting more than 24 hours were strongly associated with complicated appendicitis.

Table 3: Microbiological profile.

Group	Common findings
UAA	Mostly E. Coli or no growth
CAA	Polymicrobial infections with anaerobes

Important finding: Complicated appendicitis showed polymicrobial growth with anaerobic organisms, whereas

uncomplicated appendicitis mainly showed E. coli or sterile cultures.

Table 4: Clinical outcomes.

Outcomes	UAA	CAA
Surgical site infection (SSI) (%)	0	25
Mean hospital stays (days)	2.77	7.25

Important finding: Surgical site infection occurred only in complicated appendicitis cases, and hospital stay was significantly longer in the CAA group.

DISCUSSION

Previous histopathological studies have also suggested that appendiceal obstruction and vascular thrombosis may contribute to the progression of acute appendicitis and tissue ischemia.[6,11] Recent evidence further indicates that alterations in gut microbiota and mucosal immune response may influence the inflammatory process in appendicitis and contribute to disease severity.[18,19] Inflammatory mediators and cytokine activation have also been implicated in the pathogenesis and progression of complicated appendicitis.[19]

The present study demonstrated significant microbiological and clinical differences between uncomplicated acute appendicitis (UAA) and complicated acute appendicitis (CAA). Patients with complicated appendicitis were significantly older than those with uncomplicated appendicitis, with a mean age of 50.33±7.2 years compared to 31.82±7.46 years ($p<0.001$). Similar findings were reported by Sharma et al and Bhangu et al, who observed that elderly patients are more likely to present with perforated or complicated appendicitis due to delayed presentation and atypical clinical features.[1,13]

In the present study, fever, vomiting, and abdominal pain lasting more than 24 hours were strongly associated with complicated appendicitis. Previous studies by Wang et al and Tanveer et al also demonstrated that delayed presentation and systemic inflammatory response are associated with increased disease severity and postoperative complications.[12,14]

Microbiological analysis in our study revealed that Escherichia coli was the most common organism isolated in both uncomplicated and complicated appendicitis. Similar observations were reported by Memon et al and Jayalakshmi et al in South Asian populations.[4,5] However, polymicrobial infections involving anaerobic organisms such as Bacteroides, Fusobacterium, and Enterococcus were predominantly observed in complicated appendicitis. Yang et al and Bansal et al also reported increased anaerobic bacterial growth and polymicrobial infection in perforated appendicitis cases.[2,17]

The higher prevalence of anaerobic organisms in complicated appendicitis suggests a significant role of microbial synergy and biofilm formation in disease progression. Studies by Swidsinski et al and Zhao et al demonstrated that bacterial biofilms contribute to tissue inflammation, perforation, and resistance to antimicrobial therapy in appendicitis. Shakya et al further highlighted the role of microbial biofilms in promoting antibiotic resistance and severe appendiceal inflammation.[8-10]

Antibiotic resistance patterns observed in the present study showed high resistance against meropenem (34%), amoxicillin (31%), and ceftriaxone (30%). Similar resistance patterns were reported by Akbarzadeh et al and Bansal et al, emphasizing the growing burden of antimicrobial resistance in developing countries.[3,17] The increasing resistance to broad-spectrum antibiotics may be attributed to inappropriate antibiotic usage and empirical overuse of carbapenems in surgical infections.

In the current study, surgical site infection (SSI) was observed only in patients with complicated appendicitis, and hospital stay was significantly prolonged in this group (7.25 days versus 2.77 days). Similar findings were observed by Iqbal et al and Ramesh et al, who reported increased postoperative morbidity and prolonged hospitalization in patients with complicated appendicitis and resistant bacterial infections.[15,16] The findings of the present study emphasize the importance of early diagnosis, prompt surgical intervention, and institution-specific empirical antibiotic protocols guided by local microbiological patterns. Routine intraoperative culture and sensitivity testing may help optimize antibiotic therapy and reduce postoperative complications, particularly in complicated appendicitis.

Despite important findings, the present study has certain limitations. It was a single-center study with moderate sample size, which may limit generalizability. Anaerobic culture facilities were limited, potentially underestimating the prevalence of anaerobic pathogens. Further multicenter studies with larger sample sizes and advanced molecular microbiological techniques are recommended to better understand the microbiological spectrum and resistance patterns in appendicitis.

CONCLUSION

Complicated appendicitis is associated with increased microbial diversity and resistance. Tailored antibiotic therapy based on local microbiological patterns is essential to improve outcomes. However, the findings should be interpreted considering the single-center design and moderate sample size of the study.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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