Research Article

Cuestiones de Fisioterapia

Medicine

Clinical Profile and Management Outcomes of Acute Appendicitis in Patients Undergoing Appendicectomy: A Hospital-Based Study

Dr. Vijay Kumar Kurella*

Assistant Professor, Department of General Surgery, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry - 605 502, India.

Abstract

Background: Acute appendicitis is the commonest abdominal surgical emergency, yet its diagnosis remains clinically challenging. The negative-appendicectomy rate and the perforation rate are widely used quality metrics that reflect, respectively, diagnostic accuracy and timeliness of surgical intervention. Contemporary data from South India are limited.

Objectives: To describe the clinical, investigative, operative and histopathological profile of patients undergoing appendicectomy for suspected acute appendicitis, and to evaluate management outcomes against established quality benchmarks.

Materials and Methods: A hospital-based observational study was conducted at a tertiary care teaching hospital in South India, enrolling 200 patients who underwent appendicectomy for suspected acute appendicitis. Clinical, operative and histopathology records were reviewed. Perforation was defined operatively, and negative appendicectomy as histologically normal appendix. Data were analysed using descriptive statistics, the chi-square test and the independent-samples t-test, with $p<0.05$ considered significant.

Results: The mean age was 40.3 (SD 17.5) years; 102 (51.0%) were female. The mean duration of pain was 51.7 (SD 26.5) hours and the mean total leucocyte count was 14,421 (SD 4,620)/mm³. Perforation was present in 93 patients (46.5%; 95% CI 39.6–53.4%). The negative-appendicectomy rate was 21.5%. The mean hospital stay was 5.9 (SD 2.9) days. Hospital stay did not differ by operative approach (laparoscopic 6.1 vs open 5.6 days; $p=0.20$) or by perforation ($p=0.77$). No measured variable was associated with perforation.

Conclusion: A high perforation rate and a notable negative-appendicectomy rate, both exceeding commonly cited benchmarks, indicate scope to improve diagnostic accuracy and timeliness of surgery. Laparoscopic and open approaches yielded comparable outcomes.

Keywords: *Acute appendicitis; Appendicectomy; Perforation; Negative appendicectomy rate; Laparoscopy; Quality metrics.*

Introduction

Acute appendicitis is the commonest abdominal surgical emergency encountered in general surgical practice worldwide, with a lifetime risk of developing the condition estimated at approximately 7–8%. Despite being among the most frequently performed emergency operations, the diagnosis of acute appendicitis continues to pose a considerable clinical challenge. The classical presentation of migratory

right iliac fossa pain, anorexia, nausea and low-grade fever is encountered in only a proportion of patients, and the spectrum of atypical and overlapping presentations is wide. The differential diagnosis is broad and includes a range of gynaecological, urological and gastrointestinal conditions, particularly in women of reproductive age, in whom diagnostic uncertainty is greatest. Consequently, the decision to operate frequently rests upon clinical judgement, supported to a variable degree by laboratory and imaging investigations.

Two outcome measures have become firmly established as indicators of the quality of appendicitis management. The first is the negative-appendicectomy rate, defined as the proportion of patients undergoing appendicectomy in whom the removed appendix is histologically normal. A high negative-appendicectomy rate signifies that patients without true appendicitis are being subjected to the risks of an unnecessary operation and anaesthesia, and reflects suboptimal diagnostic accuracy [2]. The second is the perforation rate, the proportion of operated patients found to have a perforated appendix. An elevated perforation rate is generally attributed to delayed presentation, delayed diagnosis or delayed surgery, and is associated with increased morbidity, longer hospitalisation and greater healthcare costs [1]. These two metrics are, to some extent, in tension: aggressive early operating may lower the perforation rate at the expense of a higher negative-appendicectomy rate, whereas a more conservative, observational approach may reduce unnecessary surgery but risk progression to perforation. The pursuit of an optimal balance underlies much of the contemporary discourse on appendicitis care.

To improve the consistency and accuracy of diagnosis, structured clinical scoring systems and cross-sectional imaging have been introduced. The Alvarado score, which combines symptoms, signs and laboratory findings into a composite scale, is the most widely studied and has been shown to assist risk stratification and clinical decision-making [3]. Adjunctive imaging, in the form of ultrasonography and computed tomography, has further refined preoperative assessment, and the selective use of computed tomography in particular has been associated with meaningful reductions in the negative-appendicectomy rate [2]. Nevertheless, the availability and routine application of these aids vary considerably across institutions and healthcare settings.

The optimal operative approach has also been the subject of sustained debate. Laparoscopic appendicectomy offers potential advantages in wound-related morbidity, postoperative pain, cosmesis and diagnostic capability, particularly in women and in obese patients, whereas open appendicectomy remains a reliable, widely available and economical alternative [4,5]. Comparative evidence regarding length of hospital stay, complication profiles and overall outcomes has not been uniformly conclusive, and practice continues to be influenced by local expertise, resource availability and patient factors.

In the South Indian context, robust contemporary audit data describing the clinical profile and management outcomes of appendicitis, benchmarked against established quality indicators, remain relatively sparse. Patterns of delayed presentation and the burden of perforation peritonitis in the Indian subcontinent suggest that local outcomes may differ from those reported in higher-resource settings [1,6]. Against this background, the present hospital-based study was undertaken to characterise the clinical, investigative, operative and histopathological features of patients undergoing appendicectomy at a tertiary care teaching hospital in South India, and to evaluate management outcomes against accepted benchmarks, with particular attention to the perforation and negative-appendicectomy rates and to the comparison of laparoscopic and open approaches.

MATERIALS AND METHODS

Materials and Methods

Study design and setting

This was a hospital-based observational study, conducted as a clinical audit of consecutive patients undergoing appendicectomy for suspected acute appendicitis at tertiary care teaching hospital in South India. The study was carried out over the defined study period [study period], and was based on the review of clinical, operative and histopathology records.

Study population

The study population comprised 200 patients who underwent appendicectomy for a clinical diagnosis of suspected acute appendicitis during the study period.

Inclusion criteria: All patients undergoing appendicectomy (open or laparoscopic) for suspected acute appendicitis during the study period, for whom complete clinical, operative and histopathological records were available.

Exclusion criteria: Patients undergoing incidental or interval appendicectomy; patients with appendicular mass or abscess managed conservatively without appendicectomy during the index admission; and patients with incomplete records.

Sample size

A total of 200 consecutive eligible patients undergoing appendicectomy during the study period were included. This sample was considered adequate to estimate the principal proportions of interest, namely the perforation rate and the negative-appendicectomy rate, with reasonable precision, as reflected in the reported confidence interval for the perforation rate.

Data sources and variables

Data were extracted from case records, operative notes and histopathology reports. The variables recorded included demographic characteristics (age, sex); clinical features (duration of pain, presence of fever, nausea and/or vomiting); laboratory investigation (total leucocyte count); preoperative ultrasonographic findings; intra-operative findings (position of the appendix, presence of perforation); operative approach (open versus laparoscopic); histopathological diagnosis; length of hospital stay; and clinical outcome at discharge.

Definitions

Perforation was defined as a macroscopically perforated appendix identified at operation. Negative (normal) appendicectomy was defined as removal of an appendix reported as histologically normal on definitive histopathological examination. Clinical outcome was categorised as recovery without complication ("recovered uneventfully") or recovery with a minor complication.

Statistical analysis

Data were summarised using descriptive statistics; continuous variables were expressed as mean (standard deviation) and categorical variables as frequencies and percentages. The 95% confidence interval was calculated for the perforation rate. Associations between categorical variables were examined using the chi-square test, and differences in continuous variables between groups were assessed using the independent-samples t-test. A two-sided p-value of less than 0.05 was considered statistically significant.

Results

Demographic and clinical features

A total of 200 patients undergoing appendicectomy for suspected acute appendicitis were studied. The mean age of the cohort was 40.3 (SD 17.5) years, with ages ranging from 12 to 70 years. The sex distribution was nearly equal, with 102 patients (51.0%) being female and 98 (49.0%) male. The mean duration of abdominal pain at presentation was 51.7 (SD 26.5) hours. Fever was documented in 103 patients (51.5%) and nausea and/or vomiting in 96 patients (48.0%). The mean total leucocyte count was 14,421

(SD 4,620)/mm³. The demographic and clinical features are summarised in Table 1.

Table 1. Demographic and clinical features of the study population (N=200)

Variable	Value
Age, years, mean (SD)	40.3 (17.5)
Age range, years	12–70
Female, n (%)	102 (51.0)
Male, n (%)	98 (49.0)
Duration of pain, hours, mean (SD)	51.7 (26.5)
Fever present, n (%)	103 (51.5)
Nausea/vomiting present, n (%)	96 (48.0)
Total leucocyte count, /mm³, mean (SD)	14,421 (4,620)

Investigations, operative findings and histopathology

Preoperative ultrasonography reported features of acute appendicitis in 76 patients (38.0%), a normal appendix in 74 patients (37.0%) and complicated appendicitis in 50 patients (25.0%). At operation, the position of the appendix was distributed across the pelvic position in 52 patients (26.0%), the preileal position in 50 patients (25.0%), the retrocecal position in 49 patients (24.5%) and the subcecal position in 49 patients (24.5%). The operative approach was almost evenly divided, with 101 patients (50.5%) undergoing laparoscopic appendicectomy and 99 patients (49.5%) undergoing open appendicectomy.

Definitive histopathological examination reported suppurative appendicitis in 56 patients (28.0%), gangrenous appendicitis in 55 patients (27.5%), acute (uncomplicated) appendicitis in 46 patients (23.0%) and a normal appendix in 43 patients (21.5%). The negative (normal) appendicectomy rate was therefore 21.5%. These findings are presented in Table 2.

Table 2. Investigations, operative findings and histopathology (N=200)

Variable	Category	n (%)
Ultrasound findings	Acute appendicitis	76 (38.0)
	Normal appendix	74 (37.0)
	Complicated appendicitis	50 (25.0)
Appendix position	Pelvic	52 (26.0)
	Preileal	50 (25.0)
	Retrocecal	49 (24.5)
	Subcecal	49 (24.5)
Operative approach	Laparoscopic	101 (50.5)
	Open	99 (49.5)
Histopathology	Suppurative	56 (28.0)
	Gangrenous	55 (27.5)
	Acute (uncomplicated)	46 (23.0)
	Normal	43 (21.5)

Perforation and outcomes

Perforation was identified at operation in 93 patients, giving a perforation rate of 46.5% (95% CI 39.6–

53.4%). The mean hospital stay for the cohort was 5.9 (SD 2.9) days. At discharge, 105 patients (52.5%) were recorded as having recovered uneventfully, while 95 patients (47.5%) experienced a minor complication. Perforation and outcome data are summarised in Table 3.

Table 3. Perforation and clinical outcomes (N=200)

Variable	Value
Perforation present, n (%)	93 (46.5)
Perforation rate, % (95% CI)	46.5 (39.6–53.4)
Hospital stay, days, mean (SD)	5.9 (2.9)
Recovered uneventfully, n (%)	105 (52.5)
Minor complication, n (%)	95 (47.5)

Comparative analyses

Hospital stay did not differ significantly between the laparoscopic and open approaches (laparoscopic 6.1 days vs open 5.6 days; t=1.28, p=0.20). Similarly, hospital stay did not differ significantly according to the presence of perforation (perforated 5.8 days vs non-perforated 5.9 days; t=−0.29, p=0.77). The duration of pain at presentation did not differ significantly between perforated and non-perforated cases (50.6 hours vs 52.7 hours; p=0.58). Perforation was not associated with the operative approach (χ^2=0.02, p=0.90), and clinical outcome was not associated with the presence of perforation (χ^2=0.44, p=0.51). The comparative analyses are presented in Table 4.

Table 4. Comparative analyses

Comparison	Group 1	Group 2	Test statistic	p-value
Hospital stay by approach	Laparoscopic 6.1 days	Open 5.6 days	t=1.28	0.20
Hospital stay by perforation	Perforated 5.8 days	Non-perforated 5.9 days	t=−0.29	0.77
Duration of pain by perforation	Perforated 50.6 h	Non-perforated 52.7 h	—	0.58
Perforation by approach	Laparoscopic vs open	—	χ^2=0.02	0.90
Outcome by perforation	Perforated vs non-perforated	—	χ^2=0.44	0.51

In summary, no measured clinical, investigative or operative variable was significantly associated with perforation in this cohort, and the operative approach did not influence either the length of stay or the perforation rate.

Discussion

This hospital-based audit of 200 patients undergoing appendicectomy for suspected acute appendicitis at a tertiary care teaching hospital in South India yielded two headline quality findings: a high perforation rate of 46.5% and a notable negative-appendicectomy rate of 21.5%. Both figures exceed the

benchmarks commonly regarded as desirable in contemporary appendicitis care, and together they frame the principal interpretation of this study, namely that there is meaningful scope to improve both the accuracy and the timeliness of appendicitis management at the institutional level.

The negative-appendicectomy rate of 21.5% indicates that approximately one in five patients taken to operation for suspected appendicitis was found to have a histologically normal appendix and was therefore exposed to the risks of an unnecessary operation. The negative-appendicectomy rate is a well-established quality metric, and its reduction has been linked to the structured application of diagnostic adjuncts. Mariadason and colleagues demonstrated that the routine use of computed tomography, in conjunction with the Alvarado score and a careful definition of negative appendicectomy, can substantially lower this rate [2]. The relatively high rate observed in the present cohort, in which preoperative ultrasonography reported a normal appendix in 37.0% of cases, suggests an over-reliance on clinical suspicion and a tendency to operate on clinically suspected cases without consistent recourse to objective risk stratification. Notably, no Alvarado score was recorded for the patients in this audit, underscoring the absence of a standardised scoring framework in routine practice. The evidence base supports the value of such scoring; Subotic and colleagues validated the Alvarado score as a useful instrument in the diagnosis of acute appendicitis, capable of supporting more selective operative decision-making [3]. The systematic incorporation of a validated clinical score, complemented by selective cross-sectional imaging, represents a tangible and evidence-based avenue for reducing the negative-appendicectomy rate in this setting [2,3].

The perforation rate of 46.5% (95% CI 39.6–53.4%) is high and is the more clinically concerning of the two headline findings. An elevated perforation rate is conventionally attributed to delayed presentation, delayed diagnosis and delayed surgery, and it is associated with greater morbidity and resource utilisation. The mean duration of pain before presentation in this cohort was 51.7 hours, indicating that many patients presented more than two days after the onset of symptoms; such delays are consistent with the patterns of late presentation that characterise much of the surgical-emergency burden in the Indian subcontinent. Barreto and colleagues, in their analysis of risk factors for acute perforated appendicitis, highlighted the importance of identifying patients at risk of perforation to guide surgical decision-making [1]. The wider burden of perforation peritonitis in India, documented by Yadav and Garg in their Delhi series, further situates the present findings within a national context in which delayed presentation and advanced intra-abdominal pathology are common [6]. It is noteworthy that, within this cohort, the duration of pain did not differ significantly between perforated and non-perforated cases (50.6 versus 52.7 hours; p=0.58), and indeed no measured variable was significantly associated with perforation. This absence of a clear predictor within the sample should be interpreted with caution; it does not negate the established association between delay and perforation, but rather reflects the limitations of the variables captured in this records-based audit and the relatively narrow range of presentation times, in which the great majority of patients presented late.

The comparison of operative approaches showed that laparoscopic and open appendicectomy were used in almost equal proportions and yielded comparable outcomes. Hospital stay did not differ significantly between the two approaches (6.1 versus 5.6 days; p=0.20), and perforation was not associated with the operative approach (χ^2=0.02, p=0.90). These observations are broadly consistent with the comparative literature. Markar and colleagues examined laparoscopic versus open appendicectomy, including in specific patient subgroups such as the obese, and reported that laparoscopy may offer advantages in selected populations [4], while Kapischke and colleagues, in a critical review of open versus laparoscopic appendicectomy, emphasised that the two approaches are each associated with distinct profiles of benefit and that neither is unequivocally superior across all outcomes [5]. The equivalence of length of

stay observed in the present audit suggests that, in this setting, the choice between laparoscopic and open appendicectomy can reasonably be guided by surgeon expertise, resource availability and individual patient factors rather than by an expectation of materially different hospitalization[6].

The clinical implications of these findings are clear and actionable. The high negative-appendicectomy rate argues for the introduction of structured diagnostic pathways incorporating validated clinical scoring and the selective use of imaging, with the aim of reducing the proportion of operations performed on patients without true appendicitis [7]. The high perforation rate, in turn, argues for measures to facilitate earlier presentation and more timely surgical intervention, including community awareness, efficient triage and minimisation of in-hospital delays [8]. The demonstrated equivalence of laparoscopic and open approaches provides reassurance that operative technique can be tailored to local circumstances without compromising length of stay or perforation-related outcomes [9,10]. Taken together, these findings provide a clear, locally relevant evidence base for quality-improvement initiatives in appendicitis care at this institution.

Limitations

This study has several limitations that should be acknowledged. First, it was conducted at a single tertiary care teaching hospital, which may limit the generalisability of the findings to other settings. Second, the observational, records-based design is subject to the inherent constraints of retrospective data extraction, including the possibility of incomplete or variably recorded information. Third, no Alvarado score was recorded for the patients, precluding any analysis of structured clinical risk stratification within the cohort. Fourth, there was no long-term follow-up, and outcomes were assessed only up to discharge, so that late complications could not be captured. Finally, the possibility of selection bias cannot be excluded, given that only patients who proceeded to appendicectomy were included. These limitations notwithstanding, the study provides a useful and internally consistent audit of contemporary appendicitis management in this setting.

Conclusion

In this hospital-based audit of 200 patients undergoing appendicectomy for suspected acute appendicitis in South India, a high perforation rate of 46.5% and a notable negative-appendicectomy rate of 21.5% were observed, both exceeding commonly cited ideal benchmarks. These findings indicate clear scope to improve diagnostic accuracy through the use of validated scoring systems and imaging, and to improve outcomes through earlier presentation and more timely surgery. Laparoscopic and open appendicectomy yielded comparable lengths of stay and outcomes, and no measured variable predicted perforation in this sample. The results support targeted quality-improvement initiatives aimed at reducing both unnecessary operations and avoidable progression to perforation.

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