BRIEF REPORT

Histological analysis and revisiting the diagnostic accuracy of acute appendicitis

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Abstract

A retrospective study conducted at a tertiary-care hospital in Sri Lanka analyzed 429 appendectomy samples from patients suspected of acute appendicitis. The mean age was 21 years; 58% were male. Intraoperatively, 80.4% had acute appendicitis, mass formation (2.1%) and rupture (0.4%). Histology showed lymphoid hyperplasia(58.7%), suppurative appendicitis(8.6%), granulomatous changes [tuberculosis (2.3%), Crohn's(0.7%)], and neoplasms [mucinous dysplasia(3%), carcinoid(0.5%)]. Malignant or premalignant lesions showed no age or gender specificity and were not always evident during surgery. The 12% negative appendectomy rate highlights the need to revise diagnostic criteria.

Introduction

From 1990 to 2019, global appendicitis rates rose by 0.58% annually, with South Asia seeing the largest increase [1]. Appendicitis is caused by luminal obstruction from lymphoid hyperplasia in children and by faecoliths, fibrosis, neoplasms, or foreign bodies in adults. We report unique causes of acute appendicitis in a Sri Lankan cohort and emphasize the need to reassess diagnostic criteria due to a high rate of negative appendectomies.

Materials and methods

A retrospective study was conducted at the National Hospital of Sri Lanka. Consecutive appendicectomy samples from patients diagnosed with acute appendicitis between June 2021 and December 2022 across all surgical units, were analysed. Cases with clinical features of chronic appendicitis and incidental appendectomy were excluded. Acute appendicitis diagnosis relied primarily on clinical signs like right iliac fossa pain, fever, tenderness, positive Rovsing and Psoas signs, and an Alvarado score of seven or more. Priority was given to the clinical diagnosis over biochemical or ultrasound scan findings.

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Results

The study included 429 patients (mean age 21 years; 58% male). Intraoperatively, 80.4% (n=345) showed acute appendicitis, 6.7% (n=29) abscess formation, 2.8% (n=12) mass formation, 2.1% (n=9) ruptured appendix, and 0.4% (n=2) large bowel intussusception. Luminal obstruction by faecoliths (n=64) and *Ascaris lumbricoides* (n=1) was noted. Microscopy revealed lymphoid hyperplasia with serositis (58.7%, n=252), suppurative appendicitis (8.6%, n=80), necrosis (1.4%, n=6), fibrosis (2%, n=9), granulomatous changes of tuberculosis (2.3%, n=10), Crohn's (0.7%, n=3) or sarcoidosis (0.2%, n=1), mucinous neoplasms (3%, n=13) and carcinoid tumours (0.5%, n=2). Mucinous dysplasia was classified as non-invasive low-grade dysplasia (1.6%, n=7) and high-grade dysplasia (0.9%, n=4) and infiltrative mucinous dysplasia (0.5%, n=2). High grade mucinous dysplasia, infiltrative dysplasia and carcinoid tumours were considered premalignant and malignant. Most (pre)malignant lesions (62.5%, n=5) were suspected as acute appendicitis during surgery, but lacked distinct radiological or intraoperative features beyond this suspicion. There were no significant differences in age distribution (Mann-Whitney U test, p=0.052) or gender distribution (Pearson's Chi-Square test, X2= 0.012, p=0.913) between benign and (pre)malignant lesions. However, 12% (n=53) of specimens did not exhibit microscopic evidence of any lesions.

Discussion

Diagnosing acute appendicitis is challenging, especially in children, with missed diagnoses in 20–40% of adults and 10–34% undergoing unnecessary appendectomy [2]. Negative appendectomies can lead to surgical site infections as a complication of unnecessary surgery [3]. A 2014 Sri Lankan study found that 46% of 125 appendectomy specimens showed no microscopic features of appendicitis [4]. We found a 12% rate of negative histology, indicating a decline over the past decade likely due to improved diagnostics, though the rate remains high. Clinical symptoms of appendicitis may subside following the removal of a negative appendix [5], implying the possibility of missed underlying pathologies. While clinical and biochemical findings are important in the diagnosis, imaging techniques

such as ultrasound scan and computed tomography (CT) significantly improve diagnostic accuracy. Changes of fat around the appendix/cecum, fluid or gas around the appendix/cecum, appendiceal abscess formation, increased cecal wall thickness, dilated intestinal arches are considered positive findings of acute appendicitis and associated complications [6]. Ultrasound has a sensitivity of 77% and specificity of 60% [7], while CT has a sensitivity of 87% and specificity of 82% in diagnosing appendicitis [6]. Artificial intelligence-based algorithms have been shown to enhance the diagnostic accuracy of acute appendicitis [8]. Due to our resource limitation, CT scan is used when the biochemical and ultrasonographic evidence is inconclusive of acute appendicitis.

Acute appendicitis can vary in its presentation (Table 1). Sarcoidosis-induced appendicitis is rare, with under 20 cases

Tabel 1.

Study	Number of participants	Clinical presentation	Histology
Jones, A.E et al., 2007 (United Kingdom) [14]	1225	Acute appendicitis (n=941)	Normal appendix (n=284) Intraluminal parasites (n=11) Tumours • Benign tumours (hyperplastic polyps, low grade appendiceal mucinous) (n=10) • Primary malignant (n=3) • Carcinoids (n=13) • Secondary deposits (n=1) Crohns disease (n=6) Endometriosis (n=3)
Connor, S.J., et al., 1988 (New Zealand) [13]	7970	Acute appendicitis (n=36) Appendicular abscess/mass (n=5) Bowel obstruction (n=1)	Tumours • Benign tumours (n=12) • Primary malignant (n=2) • Carcinoids (n=27) Tumours • Benign tumours (n=1) • Primary malignant disease (n=1) • Carcinoids (n=3) Tumours • Carcinoids (n=1)
Ranaweera, C., et al., 2019 (Canada) [15]	5059	Uncomplicated acute appendicitis (n=24) Perforated appendicitis (n=48)	Carcinoid (n=32)
Charfi, S., et al., 2014 (North Africa) [16]	24697	Acute appendicitis (n=24697)	Normal appendix (n=3723) Intraluminal parasites (n=1599) Tumours • Benign tumours (n=60) • Primary malignant (n=15) • Carcinoids (n=90) Crohns disease (n=28) Tuberculosis (n=4) Endometriosis (n=2)
Emre, A., et al., 2013 (Turkey) [17]	1255	Acute appendicitis (n=1255) -Phlegmonous (n=880) -Gangrenous and perforation (n=148)	Normal appendix (n=76) Intraluminal parasites (n=8) Tumours • Carcinoids (n=11) Granulomatous (n=6) Tuberculosis (n=4) Endometriosis (n=2)
Kadi, M., et al., 2022 (Saudi Arabia) [18]	940	Acute appendicitis (n=805) -Perforation (n=153) -Suppuration (n=583)	Normal appendix (n=135) Tumours (n=5) Crohns disease, Granulomatous, Endometriosis and Parasites (n=37)
Lal, D.P.C.K.A., et al., 2014 (Sri Lanka) [4]	125	Acute appendicitis (n=125)	Normal appendix (46%) Faecoliths (49%) Lymphoid hyperplasia (38%) Fibrosis (8%) Parasites (3%) Endometriosis (3%) Neoplasm – not common finding
Present study (Sri Lanka)	429	Acute appendicitis (n=345) -Abscess formation (n=29) -Mass formation (n=12) -Ruptured appendix (n=9) -Large bowel intussusception (n=2)	Normal appendix (n=53) Tumours • Carcinoids (n=2) • Mucinous dysplasia (n=13) Granulomatous • Tuberculosis (n=10) • Crohns disease (n=3) • Sarcoidosis (n=1) Intraluminal parasites (n=1)

reported worldwide. While gastrointestinal involvement is typically asymptomatic [9], it can occasionally manifest as acute appendicitis, necessitating surgical exploration due to the risk of perforation [10].

Gastrointestinal tuberculosis (8 to 24% of all tuberculosis), mainly affects the ileocecal region, especially in young Asian and Black females [11]. Although the appendix lies adjacent to the cecum, tuberculosis involvement of the cecum is relatively uncommon [11]. The higher rate of tuberculous appendicitis in our study likely reflects the region's elevated tuberculosis prevalence. Our study identified *Ascaris lumbricoides* as a rare cause of acute appendicitis, a phenomenon seldom reported in the literature.

In the West, appendiceal tumours are rare (2.14% annually), with carcinoid tumours being the most common, followed by mucinous neoplasms, serrated adenomas and adenocarcinomas [12]. Unlike in the West, where secondary malignancies and carcinoid tumours are more common, our study found a higher prevalence of primary mucinous neoplasms and high-grade mucinous dysplasia [13]. Acute appendicitis was the most frequent presentation of appendiceal tumours, with 9.5% of malignancies detected incidentally [13]. Appendicular masses may be evident in 2% to 6% of cases and are known to increase the risk of appendiceal malignancies [12]. These findings are in line with our results; however, intraoperative appendicular abscess formation exhibited a higher prevalence of appendiceal malignancies in our cohort.

Conclusions

Standardization of clinical criteria in diagnosing acute appendicitis is needed due to the high prevalence of negative appendectomies in our cohort. We have identified rare etiologies such as sarcoidosis, tuberculosis, and infestations by *Ascaris lumbricoides* that manifest as acute appendicitis. Malignant lesions of the appendix may not always manifest conspicuously during surgery, such as abscesses or mass formations, nor are they necessarily associated with a specific age or gender. Therefore, it is important to routinely submit the appendicectomy specimens for histology.

Conflicts of interests

The author(s) declare that they have no competing interests.

Ethics approval statement

Ethical clearance for this study was obtained from the ethics review committee of the National Hospital of Sri Lanka (ERC No: AAJ/ETH/COM/2024).

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Authors' contributions

MP, YM, RC and JE conceived the study. MP, YM, JS, RC and JE collected, analysed the data, drafted and referenced the article. MP, YM, RC and JE reviewed the draft, made corrections and suggestions for improvement. MP, JE, YM, RC and JS revised the article. All authors read and approved the final draft.

Data Availability Statement

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

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