



APPENDECTOMY SPECIMENS- HISTOPATHOLOGISTS PERCEPTIVE: A TWO-YEAR RETROSPECTIVE STUDY FROM A PUBLICLY FUNDED TEACHING HOSPITAL OF WESTERN INDIA

Histopathology

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ABSTRACT

Background: Acute appendicitis is the most common cause of acute abdomen in young adults requiring emergency surgery. Appendix removed for clinical suspicion of acute appendicitis may reveal varied underlying pathologies on histopathological examination. **Materials and Methods:** This record based retrospective study was conducted in Histopathology laboratory, Department of Pathology of a tertiary care publicly funded teaching hospital of Western India. Haematoxylin and eosin (H&E) stained tissue sections of appendectomy specimen submitted to Histopathology laboratory of the institute for clinical diagnosis of appendicitis during the two year study period from July 2020 to June 2022 were reviewed. **Results:** 217 appendectomy specimens were received during the two year study period. Male to female ratio was 1.8:1. Peak age incidence of acute appendicitis was between 11 to 30 years in both sexes. Various histopathological diagnoses include acute appendicitis (n=198, 91.2%), acute suppurative appendicitis (n=7, 3.2%), fibrous obliteration of appendix (n=4, 1.8%), two cases each of acute appendicitis with perforation and xanthogranulomatous appendicitis (n=2 each, 0.9% each), and one case each of granulomatous appendicitis, tuberculous appendicitis, appendiceal duplication and periappendicitis (n=1 each, 0.5% each). Negative appendectomy, parasites, fungal infections and appendiceal tumours were not found. **Conclusion:** There is a higher incidence of appendicitis in young adults. Histopathological examination may show incidental findings, which could have great impact on further patient management and outcome. The importance of routine histopathological examination of all appendectomy specimens cannot be undermined.

KEYWORDS

Appendicitis, appendectomy, histopathology of appendix

INTRODUCTION

Acute appendicitis is defined as an inflammation of the inner lining of the appendix vermiformis, which then spreads to other parts of the organ. Acute appendicitis is the most common abdominal surgical emergency.² An appendectomy is the most frequently performed operation. Acute appendicitis is most common in adolescent and young adults, with lifetime risk of 7%. Males are affected slightly more often than females.⁴ Obstruction of the lumen is the precipitating cause of acute appendicitis either in the form of fecolith (appendicolith), lymphoid hyperplasia or fibrosis, as it triggers the inflammatory process.⁵ Appendicitis has been less commonly attributed to unusual causes like enterobiasis¹, tuberculosis¹, amebiasis¹, granulomatous diseases^{1,6,7,8}, eosinophilic infiltration^{9,10,11} and diverticulitis^{1,12,13} as well as hyperplastic polyp¹, mucocoele¹, mucinous cystadenoma¹, and appendiceal malignancies such as carcinoid tumor^{1,14,15}, adenocarcinoma¹, mucinous cystadenocarcinoma¹, lymphoma¹ and leukemia¹.

Despite of advances in technology and imaging modalities, there is dilemma in the diagnosis of acute appendicitis. Histopathological examination still remains the gold standard for confirmation of appendicitis. Not only the pathologic diagnosis of acute inflammation, but unusual findings such as incidental tumours highlight the importance of the pathologic analyses of every single resected appendix. There is evidence that intra-operative normal appendices may have abnormal incidental finding on histology.

This study aimed to determine the various histopathological diagnoses of all surgically removed appendices (nonneoplastic and neoplastic), to find age and sex related occurrence of appendicitis, perforation rate, incidental findings, and rate of negative appendectomies.

MATERIALS AND METHODS

The study was conducted after obtaining approval from the Institutional Human Ethics Committee (IHEC). This retrospective study was conducted in Histopathology laboratory, Department of Pathology of a tertiary care publicly funded teaching hospital of Western India during the two years period from July 2020 to June 2022. All surgically resected appendices submitted to the laboratory were included in this study. All emergency appendectomies and interval appendectomies performed on clinically suspected appendicitis were included in the study. Appendectomies performed during other abdominal or pelvic surgeries were not included in the study. Sections taken from autolysed appendix were excluded from the

study.

Relevant clinical data, gross findings and histopathologic reports were retrieved from histopathology record registers and computer databases. Haematoxylin and eosin (H&E) stained slides of all cases containing one cross section from the middle part and one longitudinal section from the tip of the appendix, were reviewed by two Pathologists of more than 10 years' experience, blinded to the original histopathological diagnosis. Histopathologic features were systematically assessed with special attention given to luminal content, mucosal ulceration, haemorrhage, necrosis, granulation tissue, congested/thrombosed blood vessels, fibrosis and perforation. Cellular infiltrate, its type, grade and distribution were studied; and whether the inflammation was circumferential. The grade of inflammation was considered 0 in absence of inflammatory cells, 1 (mild) in presence of few scattered inflammatory cells, 2 when multiple small clusters of inflammatory cells (10 – 20/HPF × 10) were seen, 3 if multiple clusters of inflammatory cells (20 – 30/HPF × 10) tend to merge, and 4 (severe) if the inflammation was widespread (>30/HPF × 10).¹⁶

The histopathological diagnosis were analysed for incidence of age and sex. Incidental findings and negative appendectomy, if any were recorded.

RESULTS

Total 217 specimens of appendix were received in the histopathology department of the institute during the two years study period from July 2020 to June 2022. Appendectomy were performed on 140 (64.4%) males and 77 (35.6%) females, with the male: female ratio of 1.8:1. In the present study, the peak incidence of appendicitis was found to be between 11 and 30 years. More than 80% cases occurred below the age of 40 years. The mean age for male was 26 years with a range of 3 to 64 years. The mean age for female was 27 years with a range of 9 to 67 years. The distribution of acute appendicitis according to age group is shown in Table-1.

Table 1: The distribution of acute appendicitis according to age group

Age group (yrs.)	Number of Cases	Male 140 (64.4%)	Female 77 (35.6%)
01-10	12	09 (75)	03 (25)
11-20	69	45 (65.2)	24 (34.8)

21-30	71	45 (63.4)	26 (36.6)
31-40	35	21 (60)	14 (40)
41-50	20	13 (65)	07 (35)
>50	10	07 (70)	03 (30)

In the present study 198 (91.2%) cases were found to have histologically proven acute appendicitis followed by acute suppurative appendicitis (n=7, 3.2%), fibrous obliteration of appendix (n=4, 1.8%), two cases each of acute appendicitis with perforation and xanthogranulomatous appendicitis (n=2 each, 0.9% each), and one case each of granulomatous appendicitis, tuberculous appendicitis, appendiceal duplication and periappendicitis (n=1 each, 0.5% each). (Table-2)

Table 2: The distribution of various histopathological findings of appendectomy specimen

Histopathological findings	Number of Cases (%)
Acute appendicitis	198 (91.2)
Acute suppurative appendicitis	07 (1.8)
Fibrous obliteration of appendix	04 (1.8)
Acute perforated appendicitis	02 (0.9)
Xanthogranulomatous appendicitis	02 (0.9)
Granulomatous appendicitis	01 (0.5)
Tuberculous appendicitis	01 (0.5)
Duplication of appendicular lumen	01 (0.5)
Periappendicitis	01 (0.5)

Grade of neutrophilic infiltrate ranged from 0 to 4 ['Grade 0' in 1 case (0.5%), 'Grade 1' in 108 cases (49.8%), 'Grade 2' in 26 cases (12%), 'Grade 3' in 24 cases (11.1%) and 'Grade 4' in 58 cases (26.7%)]; 'Grade 1' being the commonest. Other inflammatory infiltrate in the muscularis propria were eosinophils (49.8%), lymphocytes (47%), plasma cells (43.3%), histiocytes and hemosiderin-laden macrophages (1.8% each), xanthoma-like cells (0.9%) and foreign body giant cells (0.5%). Fecolith and lymphoid hyperplasia was found in nearly same number of cases, 25 cases (11.5%) and 24 cases (11.1%) respectively. Mucosal ulceration was seen in 169 cases (77.9%), haemorrhage and thrombosed blood vessels in 108 cases each (49.8%), necrosis in 53 cases (24.4%) and granulation tissue in 32 cases (14.7%).

Negative appendectomy, parasites, fungal infections, and appendiceal tumours were not found.

DISCUSSION

Acute appendicitis has been the most common surgical emergency and appendectomy is the most frequently performed abdominal operation. Acute appendicitis account for about 40% of all surgical emergencies in the western world.¹⁷

Various studies have reported that 80% cases of appendicitis occur below 40 years of age.¹⁸ In the current study higher incidence of acute appendicitis was seen in second and third decade in both sexes, and about 86% of appendicitis occurred below 40 years of age.

In the present study male: female ratio for appendicitis was 1.8:1. The range of male to female ratio in published literature is between 1.1 to 2.9:1.¹⁹ Study by Saleh Al-Mulhim showed male preponderance, with male to female ratio of 1.6:1.²⁰ Study by Shrestha R et al however showed slight female preponderance with the female to male ratio of 1.1:1.²¹

The histopathological examination of the appendix serves two purposes. First it allows confirmation of clinical diagnosis of acute appendicitis. Second, histopathological examination of the appendix may disclose additional pathologic findings that may affect subsequent clinical management of the patient.

In the current study, acute appendicitis accounted for 91.2% cases. Various studies have reported incidence of acute appendicitis as 47.9%¹⁷, 57.5%²¹ and 86.3%²². Authors of the present study used the minimum criteria for histopathological diagnosis of acute appendicitis of neutrophilic infiltration in the appendiceal muscularis propria.⁴ Neutrophils in the mucosa (catarrhal inflammation) and/submucosa, and not in muscularis propria do not qualify for the diagnosis of acute appendicitis. A diagnosis of infective enteritis should be considered in such cases.²³ Few scattered neutrophils (Grade 1) in the muscularis propria was most frequently observed (49.8%). Other inflammatory infiltrates commonly seen in the muscularis propria were eosinophils (49.8%), lymphocytes (47%) and plasma cells (43.3%). Intraepithelial

lymphocytes, lymphocytes and plasma cells in lamina propria, and lymphoid aggregates in lamina propria and submucosa are normally present, which provide defence against invasive microorganisms.²⁴

A negative appendectomy refers to an appendicular specimen in which there are no inflammatory infiltrates in the mucosa and/or wall, particularly polymorphonuclear leucocytes, lymphocytes, or plasma cells. Applying a stricter definition, the incidence of negative appendectomy rate has declined to 6-8%.²⁵ However, we did not find a single case of negative appendectomy in our study.

The histologic hallmark for the diagnosis of eosinophilic appendicitis is infiltration of eosinophils in muscularis propria with oedema separating the muscle fibres with very few or no neutrophilic infiltration.²⁶ Though we observed eosinophilic infiltrate in nearly 50% cases in the present study, they were however accompanied by neutrophilic infiltrate. Thus, none of the cases qualified as eosinophilic appendicitis.

Fecolith and lymphoid hyperplasia, the precipitating causes of acute appendicitis were found in 11.5% and 11.1% cases respectively.

Suppurative appendicitis (phlegmonous appendicitis) is characterized by presence of neutrophilic infiltrate in muscularis propria, generally circumferential.²³ The frequency of acute suppurative appendicitis seen in the current study was 3.2%. Various studies have reported incidence of suppurative appendicitis as 14.1%¹⁷, 33.7%¹⁹ and 18.7%²¹.

The perforation rate of appendix in this study was 0.9%, which was slightly lower than observed in other study²⁷. The two cases observed were males of 17 and 28 years old. The low perforation rate might be due to early visit in the surgical clinic and a prompt decision to operate for suspected appendicitis by the surgeons. Low perforation rate is associated with reduced morbidity and mortality.

Xanthogranulomatous inflammation is characterized histologically by a collection of lipid-laden macrophages admixed with lymphocytes, plasma cells, neutrophils, and often multinucleated giant cells with or without cholesterol clefts. Xanthogranulomatous process is usually associated with inflammation, hemorrhage, and necrosis.²⁸ Two cases (0.9%) of xanthogranulomatous appendicitis were found in the current study. Dasanayake D et al reported it as 0.03%.⁶

Granulomatous appendicitis may be discovered incidentally in a patient with a clinical presentation of acute appendicitis. The incidence is reported as 0.14% to 0.3% in Western countries and as 1.3% to 2.3% in underdeveloped countries.^{6,7} Granulomatous appendicitis can be caused by various infectious and non-infectious factors. Infectious causes of granulomatous appendicitis include *Yersinia* spp, *Mycobacterium tuberculosis*, blastomycosis, *Schistosoma* spp, *Actinomyces* spp, *Campylobacter* spp, and *Histoplasma capsulatum*.^{1,6,7,8} Non-infectious causes include Crohn's disease and sarcoidosis. Crohn's disease develops in 5% to 10% cases of granulomatous appendicitis.²⁹ In the current study, 0.5% of patients were histologically diagnosed with granulomatous inflammation; similar result was also showed in other study done by Emre A et al.²⁹

In our study, one case (0.5%) of tubercular appendicitis was discovered as an incidental histopathological diagnosis. The diagnosis was confirmed by acid fast stain (AFB). Tubercular appendicitis can either be primary or secondary; the former being very rare with reported incidence of 0.1-0.6%.³⁰

Fibrous obliteration of appendix accounted for 1.8% cases in the present study. This occlusive process comprises of appendiceal lumen replacement by fibrous tissue and chronic inflammatory cells accompanied by remarkably increased proliferation of nerve cells and neuroendocrine cells. Neurogenic appendicopathy and appendiceal neuroma are therefore the alternative diagnostic terminologies used for the condition.³¹

There was a single case of appendiceal duplication in our study. The reported incidence of appendiceal duplication is 0.004%.³² The condition should be differentiated from appendiceal diverticulum. Presence of muscular wall excludes diverticulum.²

Periappendicitis is characterised by neutrophilic infiltrate of serosa and subserosa, not extending beyond outer layer of muscularis propria.

It is an important diagnosis to make because it is abdominopelvic inflammation that causes inflammatory reaction of the appendiceal surface.²³ The incidence of periappendicitis in the current study was 0.5%. Shrestha R et al reported it as 0.2%.²¹

CONCLUSION

Histopathological examination of the appendix may yield unusual infectious and neoplastic findings requiring further management and should therefore be undertaken in all cases of acute appendicitis. Wide variation in incidence of various patterns of appendicitis may be due to lack of uniformity in histopathological diagnostic criteria. Obsolete terms like chronic appendicitis and subacute appendicitis still exist in recent published literature.

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