

Histopathological Evaluation of Appendectomy Specimens in a Tertiary Care Hospital

Fozia Noreen, Lubna Ghazal, Salma Ambreen, Tariq Masood Malik, Anjum Iqbal, Tahira Tehseen

Wah Medical College, Wah/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To find out the histopathological findings in appendectomy specimens, negative appendectomy rate (NAR) and the association of gender and age groups which underwent negative appendectomies in our set up.

Study Design: Cross sectional study.

Place and Duration of Study: POF Hospital, Wah Cantt, from Jan to Aug 2017.

Methodology: The records of 1050 patients were assessed for the relevant clinical history, age, gender and date of their presentation in hospital. The appendectomy specimens were classified as positive specimens which contained fecoliths, worms, granulomatous inflammation, foreign body reaction, mucocele, or appendiceal tumors. All the data were entered and analyzed in SPSS-21.

Results: Among the 1050 patients with suspicion of acute appendicitis, 458 (43.6%) were cases of acute appendicitis followed by acute suppurative appendicitis 100 (9.5%) and fecolith 79 (7.5%) in appendiceal lumen. The negative appendectomy rate was calculated as 248 (23.6%). A significant association of normal appendices was found with female gender ($p=0.002$) and young age group ($p=0.02$).

Conclusion: Acute appendicitis was the most frequent histopathological finding in our study. The negative appendectomy rate was significantly associated with the females of young age.

Keywords: Acute appendicitis, Histopathology, Negative appendectomy.

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INTRODUCTION

Appendicitis is one of the most frequent causes of acute abdominal pain; with a life time risk of 8.6% in males and 6.7% in females.¹ Acute appendicitis is more common in adults and adolescents but may occur in any age group. Despite its high prevalence, the diagnosis can be difficult to confirm preoperatively. The clinical presentations of acute appendicitis mimic mesenteric lymphadenitis, diverticulitis, renal pathologies and Crohn's disease of the terminal ileum. In the females, the list of differentials include acute salpingitis, ectopic pregnancy and pelvic inflammatory diseases as well.²

Acute appendicitis is initiated because of increased intraluminal pressure that compromises venous outflow. Finally, ischemia develops in the appendiceal wall, which weakens the epithelial integrity and increases the organ's risk of bacterial invasion. In majority of the cases, acute appendicitis is associated with overt luminal obstruction, mainly due to fecoliths. There are some unusual factors associated with appendicitis such as lymphoid hyperplasia, intestinal worms, tumors,

fruit seeds, foreign bodies, strictures, gallstones and tuberculosis.²

The diagnosis of appendicitis is challenging even in the most experienced hands and is predominantly a clinical one.³ Delayed diagnosis of appendicitis can lead to complications such as perforation and peritonitis which increase patients' morbidity and mortality and prolong their hospital stay. Surgical removal of appendix called as appendectomy is considered to be treatment of choice. Despite advances in technology and imaging modalities, there are difficulties in the clinical diagnosis of acute appendicitis. Histopathological examination still remains the gold standard method for the confirmation of appendicitis.⁴

The practice of histopathological examination of resected appendices varies in each hospital setting. There are studies which recommend that appendices should be sent for examination only if there is an obvious macroscopic abnormality at surgery.⁵ However, a certain data have found aberrant incidental findings to be more common, and concluded that failure to examine all appendices histopathologically may lead to many significant pathologies being overlooked. Consequently, it may cause a disastrous impact on patient management.^{4,6}

Correspondence: Dr Fozia Noreen, Department of Histopathology, POF Hospital, Wah Cantt-Pakistan

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An ambiguity persists whether each resected specimen should be sent for histopathological analysis in a low income and poor resource country like Pakistan. This study was planned to find out the histopathological findings in appendectomy specimens as well as age and gender distribution in resected specimens of appendices. It was also aimed to calculate the negative appendectomy rate in our setup and find out the association of gender and age groups which underwent negative appendectomies.

METHODOLOGY

This cross sectional study was carried out at Pakistan Ordinance Factory (POF) Hospital Wah Cantt, which is a tertiary care facility for POF employees and areas around including Hasanabdal, Haripur, Taxila, Wah and other peripheral areas. The POF Hospital laboratory received resected surgical specimens for histopathological analysis from indoor surgical departments as well as hospitals from periphery. It was a retrospective analysis of all the appendices that were received in POF Hospital laboratory for histopathological examination between January 2007 and August 2017 was carried out. The sample size was calculated using WHO sample size calculator, taking confidence level of 95%, anticipated population proportion,⁷ 79.3% and absolute precision 5%. The sampling technique used was non-probability consecutive.

Inclusion Criteria: The surgical specimens of the patients, removed during the operation with the clinical presentation of appendicitis were included in the study.

Exclusion Criteria: Appendices removed during the course of other intra abdominal procedures were excluded from the study.

After the institutional ethics committee approval, the records of patients were assessed for the relevant clinical history, age, gender and date of their presentation in hospital. The histopathological reports were reviewed and different histopathological patterns were categorized. The appendectomy specimens were classified as either positive or negative for the features of appendicitis. Positive specimens contained fecoliths, worms, acute or granulomatous inflammation, foreign body reaction, mucocele, or appendiceal tumors. Obliteration of appendiceal lumen due to fibrosis and lymphoid hyperplasia were included as positive findings. Specimens were considered negative if proved to be microscopically normal, with no clue of inflammation.⁷ Negative appendectomy was defined as a specimen that microscopically contained no pathological features

[no evidence of inflammation, tumors, parasitic infestation, and any other abnormalities].⁷

All the data were entered and analyzed using Statistical Package for Social Sciences version-21. For qualitative variable (Gender) frequencies and percentages were calculated. Mean \pm SD was calculated for the age. The association of gender and age groups which underwent negative appendectomies were determined by applying chi square test. The *p*-value of <0.05 was considered significant.

RESULTS

The clinicopathological data of 1050 cases were reviewed. All the patients were suspected with acute appendicitis clinically and underwent appendectomies. Among the 1050 cases, 566 (53.9%) appendices were removed from male patients and 484 (46.1%) from female patients. Mean age of the patients was 25.65 \pm 14.84 years. Distribution of patients which underwent appendectomies with respect to different age groups was shown in Figure.

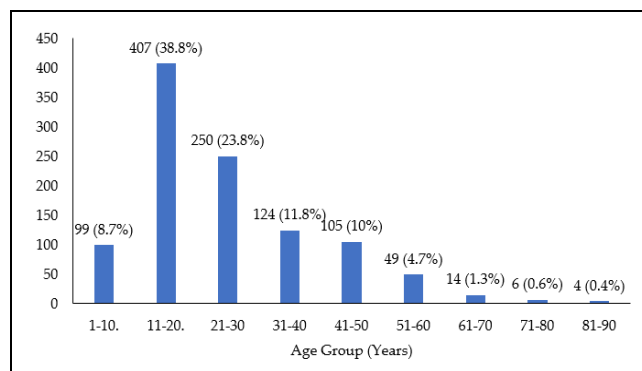


Figure: Age Distribution of patients which underwent appendectomy (n=1050).

The spectrum of histopathological findings seen in the appendectomy specimen was shown in the Table-I.

Table-I: Spectrum of histopathological findings in the appendectomy specimens (n=1050).

Findings	n (%)
Acute Appendicitis	458 (43.6)
Normal appendices	248 (23.6)
Acute suppurative appendicitis	100 (9.5)
Fecolith	79 (7.5)
Enterobius vermicularis	48 (4.6)
Lymphoid hyperplasia	45 (4.3)
Acute gangrenous appendicitis	27 (2.6)
Fibrosed appendices	25 (2.4)
Unusual findings	9 (0.9)
Acute resolving appendicitis	7 (0.7)
Chronic granulomatous inflammation	4 (0.4)

The appendices which contained fecolith in their lumen were 79 (7.5%) followed by *Enterobius vermicularis* which was detected in 48 (4.6%) resected appendices. The appendices which showed lymphoid hyperplasia, gangrene and fibrosis were 45 (4.3%), 27 (2.6%) and 25 (2.4%) respectively. Chronic granulomatous inflammation was noticed in 4 (0.4%) cases. Seven cases clinically suspected as appendicitis had other associated histological findings which include Meckel diverticulum, adenocarcinoma of omentum, cyst of Morgagni and twisted ovarian cyst. Exact number of each was depicted in Table-II.

Table-II: Unusual histopathological findings in the appendectomy specimens (n=09).

Unusual Findings	n (%)	Percentage out of total 1050 cases
Low Grade Mucinous Neoplasms	1 (0.09)	0.1
Adenocarcinoma Omentum	1 (0.09)	0.1
Carcinoid Tumor	1 (0.09)	0.1
Ovarian Cyst	1 (0.09)	0.1
Cyst Of Morgagni	1 (0.09)	0.1
Meckel Diverticulum	4 (0.44)	0.4

One case each of carcinoid tumor and low grade mucinous neoplasm of appendix was reported. Total number of cases of acute appendicitis were 458 (43.6%), 100 (9.5%) cases show features of suppuration and 7 (0.7%) were resolving. There were 248 (23.6%) cases showing normal appendices on histopathological evaluation. Out of these, 136 were females and 112 were males ($p=0.002$). The normal resected appendices were seen more in the age group between 11-30 years ($p=0.02$). There was significant association of negative appendectomies with the age group between 11-30 years and female gender (Table-III). The negative appendectomy rate was calculated as 23.6%.

Table-III: Association of gender and age groups of patients with negative appendectomies.

Parameters		Negative appendectomies		p-value
		Yes, n (%)	No, n (%)	
Age Groups	1-10 years	22 (2.1%)	76 (7.2%)	0.020
	11-30 years	158 (15%)	494 (47%)	
	31-60 years	59 (5.6%)	219 (20.9%)	
	61-90 years	9 (0.9%)	13 (1.2%)	
Gender	Male	112 (10.7%)	454 (43.2%)	0.002
	Female	136 (13%)	348 (33.1%)	

DISCUSSION

The most frequently performed abdominal surgical procedure is appendectomy due to suspicion of acute appendicitis. In 15-30% of the cases diagnosed as acute appendicitis, there is discrepancy between the

histopathological and clinical diagnosis.⁸ There are certain risk factors such as dietary habits, socioeconomic status, age, gender and race which determine the variable incidence of acute appendicitis. None of laboratory test or technique is considered confirmatory for diagnosis of acute appendicitis. However, timely surgical intervention reduces the complications. The histopathological analysis of resected appendix has the advantage that it confirms the diagnosis of acute appendicitis. In addition, it discloses other pathological findings that may not be obvious intraoperatively but may impact clinical outcomes of patient.⁹

In our study, the highest number of appendectomy cases was seen in the 2nd and 3rd decades of life with a slight preponderance of male population. The age distribution was similar to findings of Nadir *et al*, who conducted a similar study in Rawalpindi.¹⁰ The studies conducted by Paidipelly *et al*,¹¹ and Patel *et al*,¹² revealed male dominance as compared to females which was in concordance to our findings.

Negative appendectomy rate which implies absence of appendiceal pathology in resected appendices varies from 15-30%.¹³ In our study, negative appendectomy rate was 23.6 % which is comparable to data published by Joshi *et al*.¹⁴ However, NAR is high comparatively to study by Mehmood *et al*.¹⁰

The possible explanation of this fact was the analysis of big data in our study. Out of 54.8% female patients underwent negative appendectomies in our study. Many studies have depicted the highest incidence of NAR in females of the reproductive age (15-49 years) because the symptoms of appendicitis are same to various diseases of female genital tract. The audit of histopathological specimens of appendix should be carried out in order to improve the clinical evaluation in females. Our study also recorded the significant association of young females of age 11-30 years with negative appendectomies. The findings are comparable to study done by Joshi *et al*,¹⁴ However, Kontopodis *et al*, concluded a very low NAR which may be due to use of preoperative imaging techniques in their study.¹⁵ Our data revealed 43.6% cases of acute appendicitis and 9.5% cases of acute suppurative appendicitis contrary to findings of Mehmood *et al*.¹⁰ Our data showed mild variation in the percentage of acute appendicitis when compared to study conducted by Jat *et al*.¹⁶

The appendiceal lumens were obliterated mostly because of lymphoid hyperplasia and fibrosis that constitute 4.3% and 2.4% of our study. The presence of lymphoid aggregates lends credence to the theory that

obstructed lumen has a role in pathogenesis of acute appendicitis. The fibrosis of appendices results due to repeated acute or chronic inflammation which does not resolve completely. Both of these findings were comparable with the study conducted by Duduyemi.¹⁷

Another important cause of obstruction of lumen of appendix is fecolith. The fecoliths are fecal concretions or pellets. Our study shows a frequency of 7% of fecoliths which was in contrast to findings of Singh *et al.*¹⁸

The relationship of acute appendicitis and *E. vermicularis* remained controversial since first report of its presence in the lumen of appendix. The review of literature also shows a variable incidence of *E. vermicularis* in the appendiceal lumen and association of *E. vermicularis* with clinical signs of appendicitis. In our study, 4.6% of resected appendices revealed *E. vermicularis* which was in concordance with finding of Al-Fatah⁷ and Lala *et al.*¹⁹ Another important incidental finding in our study was granulomatous inflammation in 0.4% cases. The incidence of this rare entity has been reported as 0.14 to 0.3% in Western countries and as 1.3-2.3% in underdeveloped countries.²⁰ The non-infectious causes of granulomatous appendices include diverticulitis, Crohn's disease, foreign-body reactions and sarcoidosis. Tuberculosis is endemic in our country, so among the infectious agents, *Mycobacterium tuberculosis* remains the most important cause of granulomatous lesions. Other important pathogens leading to this condition are Yersinia, Campylobacter and Actinomyces species.¹² The different approaches of management of causes of these lesions signifies importance of histopathological evaluation of resected appendices.

About two thirds of appendix tumours are carcinoid tumours which originate in hormone-producing cells in various parts of the body, including the appendix. In our study, carcinoid tumor and mucinous adenocarcinoma were also reported. The incidence of carcinoid tumor is same as published by Patel *et al.*,¹² but mucinous adenocarcinoma is relatively less common in our setup when compared to different studies conducted in India and Egypt.^{13,7}

Other uncommon findings in our study included a case of cyst of Morgagni. This cyst is a variant of paratubal cyst, connected to the fimbriae of the fallopian tubes and may present with lower abdominal pain.²¹

Meckel diverticulum is the most common congenital malformation of the small bowel which is present in 1-3% of the population.²² Patients are often asymptomatic. However, it may cause bleeding, obstruction,

inflammation, or perforation.²³ In our study 0.4% of cases had Meckel diverticulum.

Similarly, other uncommon findings such as adenocarcinoma of caecum and ruptured ovarian cysts are the conditions which mimic the acute appendicitis clinically. Our findings are similar when compared to study conducted by Al-Fatah.⁷ This study was conducted retrospectively, so follow up of patients especially with uncommon findings was not carried out.

The negative appendectomy rate was 23.6%. Negative appendectomies were significantly associated with female gender and young age group. Based on our findings, it is recommended that all the specimens of resected appendices should be sent for histopathological analysis. The uncommon although less frequent findings need different management protocols.

CONCLUSION

Acute appendicitis was the most frequent histopathological finding in our study. The negative appendectomy rate was significantly associated with the females of young age.

Conflict of Interest: None.

Authors' Contribution

FN: Conception, design, acquisition of data, LG: Drafting, Data analysis and interpretation, SA: Concept and design, acquisition of data, TMM: Critical revision of article for intellectual content final approval, AI: Critical revision of article for intellectual content, TT: Acquisition of data.

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