

## Research Article

### Histopathological Study in Appendectomy Specimens

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#### Abstract:

**Background:** Acute appendicitis is the commonest abdominal condition requiring emergency surgical intervention.

**Objective:** To determine the spectrum and frequency of various histopathological findings in appendectomy specimens of patients presenting with acute appendicitis at Central Park Medical College/Central Park Teaching Hospital, Lahore.

**Method:** It was cross-sectional study commencing from 15<sup>th</sup> April 2016 to 15<sup>th</sup> April 2021 conducted at the Pathology Department of Central Park Medical College, Lahore. Relevant record from previous histopathology reports were retrieved. Data were compiled using SPSS version 21. Frequency and percentages were calculated for age, gender, and histopathological findings. Test of significance (Chi square) was used to observe the relation of age and gender with morphology.

**Results:** A total of 429 appendectomy specimens were included in the study. These included 243 cases (56.6%) from males and 186 cases (43.4%) from females. Patients ranged in age from 1 to 75 years with a maximum of 158 cases (36.8%) in the age range of 11 to 20 years. On histopathology the commonest diagnosis was acute appendicitis in 125 cases (29.13%) with associated findings of peri appendicitis in 77 cases (18%), acute suppurative appendicitis in 61 cases (14.2%), perforated appendices in 11 cases (2.6%), fibrosed lumina in 7 cases (1.63%) and gangrenous appendix in 1 case (0.23%). Lymphoid hyperplasia constituted the second most frequent diagnosis in 114 cases (26.6%). Other significant unsuspected findings were pinworm infestation in 5 cases (1.16%), granulomatous inflammation in 2 cases (0.5%) and endometriosis in 2 cases (0.5%). Incidental tumors included 3 cases (0.7%) of neuroendocrine tumors (carcinoid) and 1 case (0.23%) of Low Grade Appendiceal Mucinous Neoplasm (LAMN). Normal appendectomies were reported in 4 cases (0.93%). Chi-square test of association was used to observe the statistically significant relation of age and gender with histopathological findings.

#### Conclusion:

Histopathological examination of appendectomy specimens is the “gold standard” for accurate diagnosis and confirmation of the clinical diagnosis of “acute appendicitis”. Certain coexistent, unexpected incidental findings may also be detected.

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**Key Words:** Histopathology, acute appendicitis, lymphoid hyperplasia, neuroendocrine tumor, pinworm infection.

#### Introduction:

Acute appendicitis is the commonest abdominal condition requiring emergency surgical intervention.<sup>1</sup> Appendicitis occurs predominantly in the younger age group with a peak incidence occurring between the ages of 10 and 30 years and a worldwide

reported life time risk of 7%.<sup>2</sup> In Pakistan, the incidence of acute appendicitis is also seen in young people aged 10-19 years.<sup>3</sup> Males are affected more as compared to females.<sup>4</sup> Its incidence seems to be increasing in the developing countries due to adoption of western dietary patterns.<sup>5</sup>

Patients usually present with complains of pain and tenderness in the right iliac fossa. Although recent diagnostic advances like clinical, hematological and radiological imaging do play a significant role in the diagnosis of acute appendicitis but still about 20% of such cases do not prove to be acute appendicitis on surgically excised appendectomies. Undoubtedly, histopathological examination remains the ultimate “gold standard” parameter for accurate diagnosis and confirmation of acute appendicitis.<sup>6,7</sup>

The most common cause of acute appendicitis is luminal obstruction due to fecoliths, lymphoid hyperplasia, fibrosis and foreign bodies.<sup>8</sup> Other important incidental findings may include parasitic infestation like *Enterobius vermicularis* and amebiasis, bacterial infection (tuberculosis),<sup>9</sup> endometriosis<sup>10</sup> and tumors, which can be diagnosed only on histopathological examination. This further emphasizes the importance of histopathological analysis of each surgically excised appendectomy.

The aim of the study was to determine the diversity of pathological findings in all surgically removed appendectomy specimens submitted in a given time-period correlating with age and gender related frequencies.

### Methods:

It was a cross sectional study carried out at a tertiary care hospital, Lahore for a period of 5-years from April 2016 to April 2021. Retrospective data of all appendectomy specimens received in the Histopathology Section of the Department of Pathology, Central Park Medical College, Lahore during this time were examined histologically. Patients of all ages and both genders were included in the study.

A similar past retrospective study conducted by Charfi in 2014 included all appendectomy specimens received from January 2003 to December 2011 & analyzed parameters of age, gender & histopathological diagnosis.<sup>11</sup>

Exclusion criteria included right hemicolectomy and unfixed specimens. Approval for the study was taken from the Institutional Review Board of the college, letter number CPMC/IRB-NO/1279A, dated 25/05/2021.

Relevant clinical data retrieved from the previous records included patients age, gender, pre-operative clinical features, and surgical notes. Paraffin blocks, Hematoxylin & Eosin-stained slides and histopathology reports were also retrieved from the previous records and files.

All specimens had been received in 10% buffered neutral formalin and processed according to the standard histopathological processing and staining procedure. Histopathology reports of these patients were reviewed and confirmed. Additional pathological findings like granulomatous inflammation, endometriosis, parasitic infestation, and tumors were also noted in the data. Additional sections were prepared wherever needed. Data were processed by using SPSS Version 21 and calculated as frequencies and percentages for age, gender, and histopathological diagnosis. Chi-square test of association was used to observe the relation of age and gender with histopathological findings.

The standard criteria for acute appendicitis under light microscopic examination includes neutrophils in the mucosa, wall of the appendix and congested blood vessels with fibrinous exudate on the serosal aspect.<sup>7</sup> Negative appendectomy is defined as one which is performed for a clinical diagnosis of acute appendicitis but is entirely normal on microscopic examination.<sup>7</sup>

### Results:

A total of 429 appendectomy specimens were received and reported during a 5- year study period commencing from 15<sup>th</sup> April 2016 to 15<sup>th</sup> April 2021. These included 243 cases (56.6%) from male patients and 186 cases (43.4%) from female patients giving a male to female gender ratio of 1.3:1.

Patients ranged in age from 1 year to 75 years with maximum number of 158 cases (36.8%) reported in the age range of 11-20 years (Table 1).

As regards histopathological diagnosis the commonest entity reported was acute appendicitis accounting for 125 cases (29.13%). Findings associated with acute appendicitis in the study included peri appendicitis in 77 cases (18%), acute suppurative appendicitis in 61 cases (14.2%), perforated appendicitis in 11 cases (2.6%) and a few cases of gangrenous appendicitis, necrotizing appendicitis and fecoliths. Lymphoid hyperplasia

**Table 1:** Age wise Distribution of Patients undergoing Appendectomy

Age in years	No of Cases	Percentages (%)
1-10	33	7.69
11-20	158	36.8
21-30	141	32.8
31-40	58	13.5
41 onwards	39	9.09
<b>Total</b>	<b>429</b>	<b>100%</b>

constituted a significant number of 114 cases (26.6%) in the study. (Table 2)

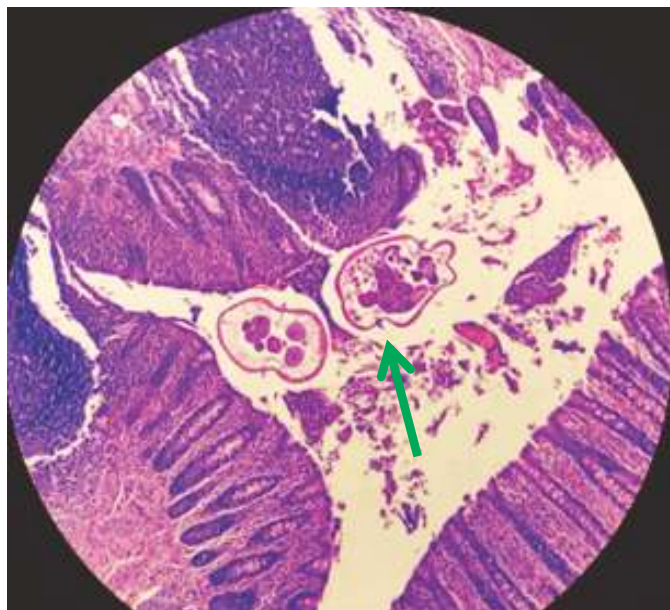
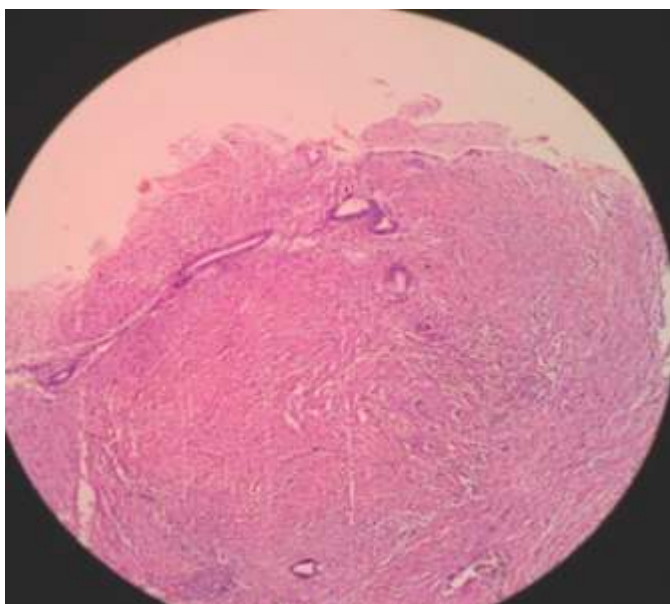
Chi-square test of association was used to observe the statistically significant relation of age and gender with histopathological findings. Test of significance tells the

**Table 2:** Spectrum of Histopathological Findings in Appendectomy Specimens and their Frequency.

Sr. No.	Diagnosis	No of Cases	%ages
1	Acute appendicitis	125	29.13
2	Lymphoid hyperplasia	114	26.6
3	Acute appendicitis with peri-appendicitis	77	18
4	Acute suppurative appendicitis	61	14.2
5	Fecoliths in lumen	13	3.03
6	Perforated appendicitis	11	2.6
7	Fibrosed appendix	07	1.63
8	Worms (Enterobius)	05	1.16
9	Neuro endocrine tumor (NET)	03	0.7
10	Granulomatous inflammation	02	0.5
11	Endometriosis	02	0.5
12	Acute Necrotizing appendicitis	01	0.23
13	Gangrenous appendix	01	0.23
14	Low grade appendiceal mucinous neoplasm (LAMN)	01	0.23
15	Mucocele	01	0.23
16	Negative appendectomy (Normal)	04	0.93
17	Appendicitis with associated Cholecystectomy	01	0.23
<b>Total</b>		<b>429</b>	<b>100%</b>

probability that significant relationship exist. Age was statistically significantly associated with morphology ( $X^2 = 42.54$ ,  $p$ -value = 0.00). There was a significant relation between gender and morphology ( $X^2 = 116.47$ ,  $p$ -value = 0.00).

Incidental findings reported include fibrosed lumina in 7 cases (1.63%), Enterobius infestation in 5 cases (1.16%), neuroendocrine tumours in 3 cases (0.7%), endometriosis and granulomatous inflammation in 2 cases (0.5%) each. Low grade appendiceal mucinous neoplasm (LAMN) and mucocele constituted of 1 case

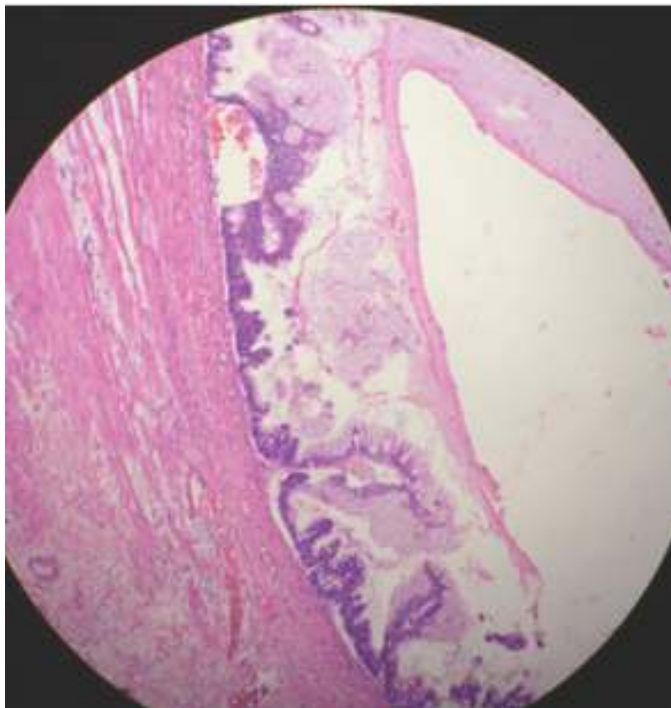
**Figure 1:** Enterobius Worms (Pinworms) in the Lumen of the Appendix (arrows) (Hematoxylin & Eosin X40)**Figure 2:** Low Power Image showing Endometriosis Involving the wall of the Appendix (Hematoxylin & Eosin X40).

each (0.23%). Normal appendectomy specimens were reported in 4 cases (0.93%). Co-existent appendicitis and cholecystitis was reported in 1 case (Table 2).

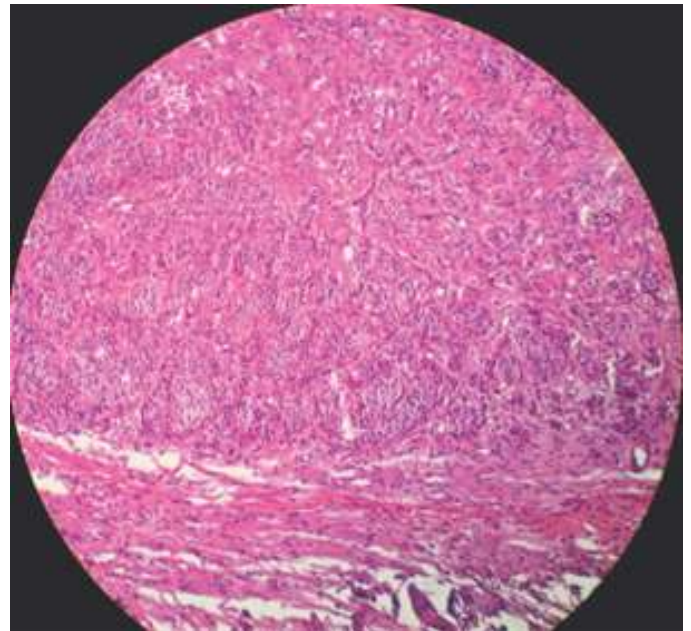
Images of a few significant lesions seen in the study are shown (Figure 1 – Figure 5).



**Figure 3:** Gross Image showing multiple cross sections from the case of Low Grade Appendiceal Mucinous Neoplasm (LAMN).



**Figure 4:** Low power view of Low Grade Appendiceal Mucinous Neoplasm (LAMN) showing loss of Lamina Propria and Muscularis mucosae. Submucosal Fibrosis is also noted (Hematoxylin & Eosin X100).



**Figure 5:** Neuroendocrine Tumour (Carcinoid) showing Typical Nesting Pattern (Hematoxylin & Eosin X200).

#### Discussion:

Among the different surgical specimens, appendectomy is the commonest specimen received for histopathological evaluation.<sup>12</sup> In the western world, diagnosis of acute appendicitis accounts for about 40% of all surgical cases but its incidence is now also increasing in the low socioeconomic Asian countries due to adoption of western dietary patterns.<sup>5</sup>

The appendix is a small tubular organ located in the right iliac fossa and its narrow lumen is prone to obstruction with maximum pain & tenderness in right iliac fossa as described by Charles Mc Burney in 1891.<sup>13</sup> In the present study constituting of 429 patients, 400 (93.24%) presented with pain in the right iliac fossa.

Histological examination of all resected appendectomy specimens is important for two reasons, firstly to confirm the clinical diagnosis of acute appendicitis and secondly it reveals certain unexpected additional pathological findings that mimic the clinical symptoms of acute appendicitis but require different medical and surgical management.

Regarding age distribution, the present study showed 90% cases in patients less than 40 years of age with a maximum number of 158 cases (36.8%) reported in 11-20 years age range. The youngest patient in the present study is a 1 year old female child and the oldest patient is

a 75 years old female. Similar study by Oguzhan Dincel in 2018<sup>2</sup> and Marudanayagam R in 2006 also reported maximum cases in the age group 10–19 years.<sup>14</sup>

As regards gender distribution, males outnumbered females by a male to female ratio of 1.3:1 in the present study. There were 243 males (56.6%) and 186 females (43.4%). A similar ratio was observed by Mohd Ayub et al in their study in 2015<sup>7</sup>. A study by Tamjeed Gul et al in 2014 at Khyber Teaching Hospital, Peshawar, Pakistan also quoted a similar male to female gender ratio of 1.3:1.<sup>15</sup> Another study by Abd Al- Fatah in 2017 also showed similar male to female ratio of 1.4:1 with 57.7% males and 42.3% females.<sup>16</sup> A study by Saleh Al- Muhim showed 61.2 % males and 38.8% females with a ratio of 1.6:1 which is also in accordance with the present study.<sup>17</sup> The reason for this male predominance is still uncertain.

In the present study the commonest diagnosis was acute appendicitis accounting for 125 cases (29.13%) followed by lymphoid hyperplasia which accounted for 114 cases (26.6%). Other significant associated conditions included acute suppurative appendicitis in 61 cases (14.2%), periappendicitis in 77 cases (18%), perforation in 11 cases (2.6%) and fecoliths in 13 cases (3.03%). Similar observations were noted by Riti T.K Sinha and Aniruna in their study conducted in 2016.<sup>6</sup> Perforation of the appendix was seen in 2.5% of cases by Mohd Ayub in 2015.<sup>7</sup> The present study reveals an exactly similar figure of 11 cases (2.6%) out of a total 429 cases.

Abd Al–Fatah reported an incidence of 6% as Negative appendectomy.<sup>16</sup> However in the present study there were only 4 cases (0.93%) with normal histology.

The present study revealed a number of diverse unexpected histopathological features, which included pinworm infestation, endometriosis, granulomatous inflammation and tumors like neuroendocrine tumours and low grade appendiceal mucinous neoplasm (LAMN). In different studies, the incidence of Enterobius infestation with symptoms of acute appendicitis ranges from 0.2% to 40%.<sup>18,19</sup> In the present study, there are 5 cases (1.16%) showing pinworm infection. This additional finding in appendectomy specimens requires anti-helminthic treatment with no benefit from surgical excision only. In Pakistan,

Enterobius infection is very common in school children due to lower socioeconomic status and poor hygienic conditions<sup>20</sup>. Several studies support the observation that the clinical features of appendicitis in these cases occurs due to luminal obstruction by parasites and not true inflammation of the appendiceal wall.

In the present study endometriosis is observed in 2 cases (0.5%) which is in accordance with the study of Abd Al- Fatah published in 2021 with 3 cases (0.4%) showing this diagnosis.<sup>16</sup> Granulomatous inflammation of the appendicular wall was noted in 2 cases (0.5%) in the present study. A study by Akbulut S in 2010 reported an incidence of granulomatous inflammation ranging from 0.1 to 3% in their study.<sup>21</sup>

Neuroendocrine tumors are the most common appendiceal tumors. Studies report neuroendocrine tumors in 0.3%-2.27% cases undergoing appendectomy.<sup>22</sup> The present study reported 3 cases of incidental unsuspected neuroendocrine tumors (Carcinoid tumors), which accounts for 0.7% of the total cases. Hof et al. in their study showed a somewhat similar figure of 0.47% cases.<sup>23</sup> Another study quoted a figure of 0.49%.<sup>24</sup> These tumors are smaller than 1cm in 70 - 90% of cases The calculated risk of metastasis in these small tumors is nearly zero and can be managed by simple appendectomy alone.<sup>25</sup> In the present study all 3 carcinoids measured less than 1cm in size.

Mucinous tumors of appendix are classified as Low grade and High grade tumors according to the WHO 2010 classification. Low grade appendiceal neoplasms (LAMNs) are associated with Low grade pseudomyxoma peritonei with no nodal and peritoneal spread. The reported prevalence of mucinous neoplasms is 0.2%-0.4% of appendectomies<sup>26</sup>. In the present study there is only a single case of unsuspected low grade appendiceal neoplasm (LAMN).

### Conclusion:

Acute appendicitis is the commonest histopathological diagnosis in appendectomy specimens. However, the possibility of other causes should be considered especially in children and elderly. Therefore, all appendectomy specimens should be thoroughly evaluated and subjected to histopathological assessment to rule out the possibility of unexpected

incidental and coexistent pathologies like tumors and parasitic infestations which require additional treatment.

**Ethical Approval:** Given

**Conflict of Interest:** The authors declare no conflict of interest.

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