

APPENDIX UNDER THE LENS: HISTOPATHOLOGY A GOLD STANDARD APPROACH IN PATIENT CARE

Histopathology

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ABSTRACT

Background: Acute appendicitis is one of the most common surgical emergencies worldwide. Although clinical and radiological investigations aid in diagnosis, histopathological examination remains the gold standard for confirming appendicitis and detecting unexpected pathological findings that may influence patient management and prognosis. **Aim:** To evaluate the importance of routine histopathological examination of appendectomy specimens that may affect patient morbidity and mortality. **Materials and Methods:** This retrospective study included 300 appendectomy specimens received in the Department of Pathology at tertiary care hospital over a period of one year. All specimens were fixed in 10% formalin, processed routinely, and stained with haematoxylin and eosin stain. Consent taken, clinical details, intraoperative findings, and histopathological diagnosis were analysed. **Results:** Among the total 300 appendectomy specimens studied, the majority showed features of acute appendicitis (56.33%). Other findings included chronic appendicitis, acute suppurative appendicitis, gangrenous appendicitis, and incidental pathologies such as parasitic infestations (1%), granulomatous inflammation and neoplasms like neuroendocrine tumor (0.67%), followed by appendiceal mucinous neoplasm (0.67%), low-grade appendiceal mucinous neoplasm (0.33%), and mucinous adenocarcinoma (0.33%). Routine histopathological examination helped identify unexpected diagnosis that were not suspected clinically. Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 22.0. **Conclusion:** Routine histopathological examination of appendectomy specimens remains the gold standard for confirming diagnosis and detecting incidental pathologies. Such findings may significantly influence postoperative management and ultimately reduce patient morbidity and mortality.

KEYWORDS

Appendicitis, Appendectomy, Histopathology, Morbidity, Mortality.

INTRODUCTION

Acute appendicitis is the most common cause of acute abdomen requiring emergency surgery. The lifetime risk of developing appendicitis is approximately 7–8% in the general population. Appendectomy is therefore one of the most frequently performed surgical procedures worldwide.¹ While most appendectomy specimens show features of acute inflammation, a small but clinically significant number may reveal unexpected pathological lesions. These include neoplasms, parasitic infestations, granulomatous diseases, and inflammatory bowel disease. Detection of such lesions is important because they may require additional treatment or follow-up.² Histopathological examination remains the gold standard for confirming appendicitis and identifying incidental pathologies that may impact patient morbidity and mortality.³ This study was undertaken to evaluate the spectrum of histopathological findings in appendectomy specimens and to highlight the importance of routine microscopic examination.

Materials and Methods:

Study Design: Retrospective study

Study Location: Department of Pathology, Tertiary Care hospital, Central India.

Study Period: 1 year

Sample Size: 300 appendectomy specimens.

Procedure:

All specimens were processed using standard histopathological techniques.

Sections were stained with haematoxylin and eosin (H&E) and examined under light microscopy. Reporting done by two pathologists.

Statistical Analysis

Data were analysed using descriptive statistics. Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 22.0. Results were expressed as percentages and frequencies.

RESULTS:

A total of 300 appendectomy specimens were analysed.

Table 1: Age and Gender Distribution of Patients (n = 300)

Age Group (years)	Female (n)	Male (n)	Total (n)	Percentage (%)
0–10	6	6	12	4.0
11–20	23	27	50	16.7
21–30	52	48	100	33.3
31–40	42	32	74	24.7
41–50	20	23	43	14.3
51–60	7	8	15	5.0
>60	6	0	6	2.0
Total	156	144	300	100

- The most affected age group was 21–30 years (33.3%).
- Females (156; 52%) slightly outnumbered males (144; 48%).
- The least common age group was >60 years (2%).

The majority of patients were in the 21–30-year age group (33.3%), followed by 31–40 years (24.7%). Females constituted 52% of cases while males accounted for 48%, showing a slight female predominance.

Table 2: Histopathological Diagnosis of Appendectomy Specimens (n = 300)

Category	Histopathological Diagnosis	Number of Cases (n)	Percentage (%)
Non-neoplastic lesions	Acute appendicitis	169	56.33
	Chronic appendicitis	55	18.33
	Acute on chronic appendicitis	34	11.33
	Chronic healed appendicitis	29	9.67
	Granulomatous appendicitis	1	0.33
	Appendicular abscess	1	0.33

	Calcified appendicitis	1	0.33
	Appendiceal neuroma (fibrous obliteration)	1	0.33
	Parasitic infection (Enterobius vermicularis)	1	0.33
	Appendiceal lipomatosis	1	0.33
Total Non-neoplastic		294	98.0
Neoplastic lesions	Neuroendocrine tumor	2	0.67
	Appendiceal mucinous neoplasm	2	0.67
	Low-grade appendiceal mucinous neoplasm (LAMN)	1	0.33
	Mucinous adenocarcinoma	1	0.33
Total Neoplastic		6	2.0
Grand Total		300	100

Among 300 appendectomy specimens, non-neoplastic lesions constituted 98% of cases, while neoplastic lesions accounted for 2%. The most common diagnosis was acute appendicitis (56.33%). Rare incidental findings included calcified appendicitis, appendiceal neuroma (fibrous obliteration), and parasitic infestation, each accounting for 0.33% of cases.

Table 3. Incidental Neoplastic Findings Detected on Histopathological Examination in Clinically Suspected Appendicitis (n = 300)

Incidental Neoplastic Lesion	Number of Cases (n)	Percentage (%)	Clinical Suspicion	Remarks
Neuroendocrine tumor (carcinoid)	2	0.67	Acute appendicitis	Most common appendiceal tumor; usually small and located at tip of appendix; often incidental
Appendiceal mucinous neoplasm	2	0.67	Acute appendicitis with fecolith	May cause mucocele of appendix; risk of pseudomyxoma peritonei if ruptured
Low-grade appendiceal mucinous neoplasm (LAMN)	1	0.33	Acute appendicitis	Characterized by mucin-producing epithelium with low-grade dysplasia and mural fibrosis
Mucinous adenocarcinoma	1	0.33	Appendicular mass	Malignant tumor; may spread to peritoneum causing pseudomyxoma peritonei
Total incidental neoplasms	6	2.0		

Incidental neoplastic lesions were identified in 6 out of 300 appendectomy specimens (2%). The most common neoplasm was neuroendocrine tumor (0.67%), followed by appendiceal mucinous neoplasm (0.67%), low-grade appendiceal mucinous neoplasm (0.33%), and mucinous adenocarcinoma (0.33%).

These lesions were not suspected clinically and were detected only on histopathological examination, emphasizing the importance of routine microscopic evaluation of all appendectomy specimens.

Table 4. Statistical Analysis: Clinicopathological Correlation Between Clinical Diagnosis and Histopathological Findings (n = 300)

Test	Value
Chi-square (χ^2)	12.84
Degrees of freedom	4
p-value	0.012

Clinicopathological correlation showed that the majority of clinically suspected cases of acute appendicitis were confirmed on histopathology. However, a small proportion of cases revealed chronic inflammatory lesions, unusual pathologies, or incidental neoplasms. The association between clinical and histopathological diagnosis was statistically significant ($p = 0.012$).

Table 5: Photomicrographs of Benign and Malignant Disorders of Appendix:

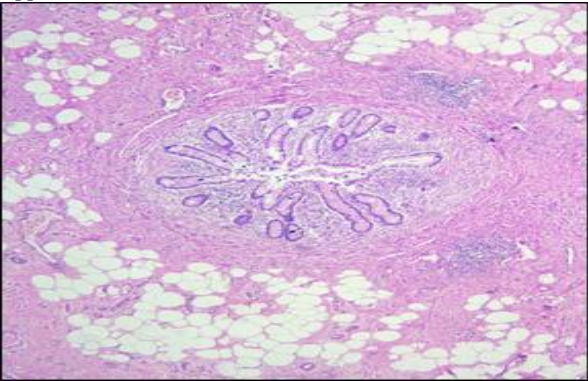


Figure-1-Appendiceal lipomatosis

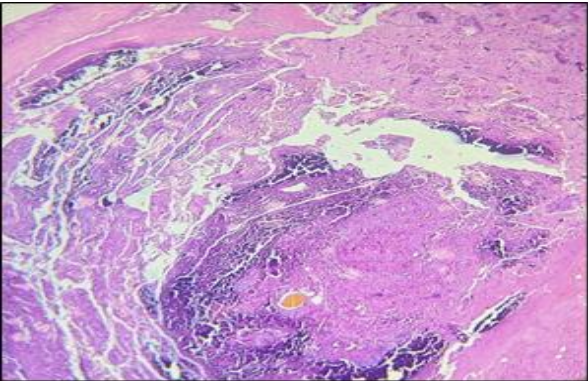


Figure-2- Gangrenous appendicitis

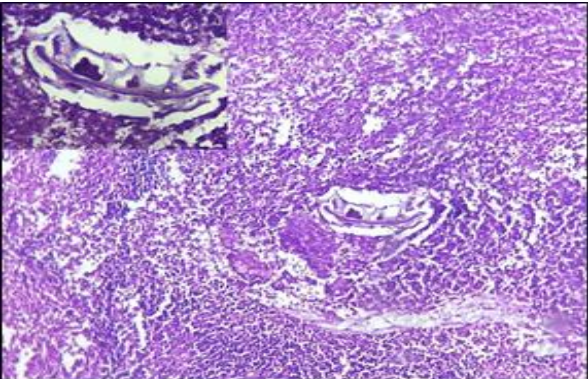


Figure-3-Parasite in appendix

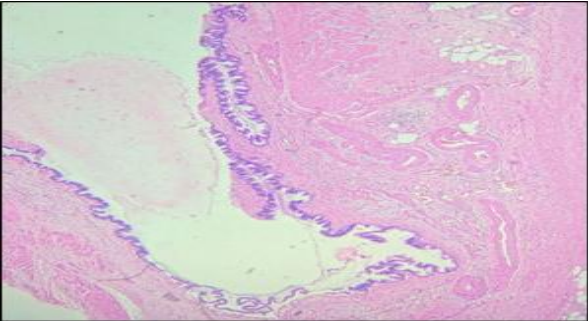


Figure:4- Low grade appendiceal mucinous neoplasm(LAMA)

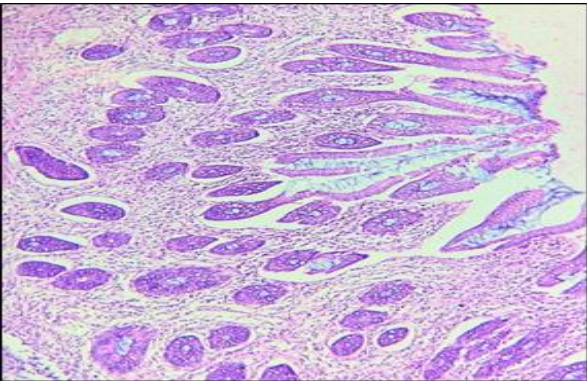


Figure: 5- Mucinous neoplasm of appendix

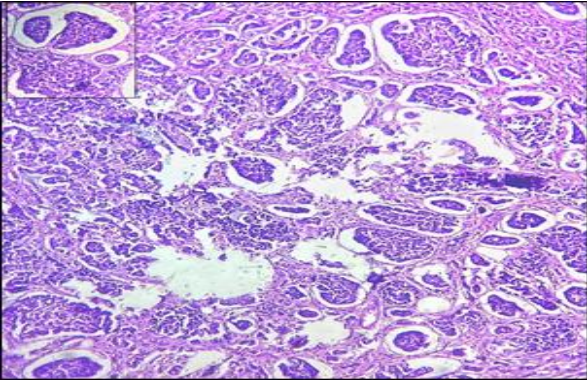


Figure:6- Neuroendocrine tumor of appendix

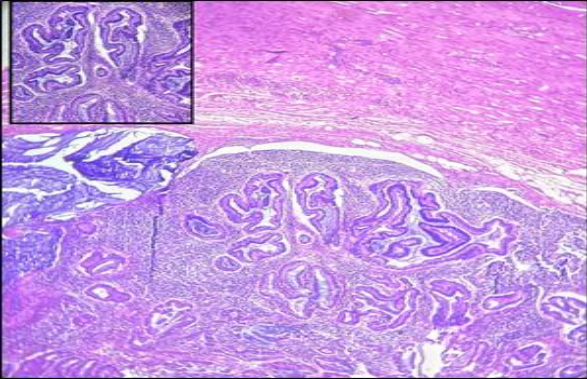


Figure: 7- Adenocarcinoma appendix

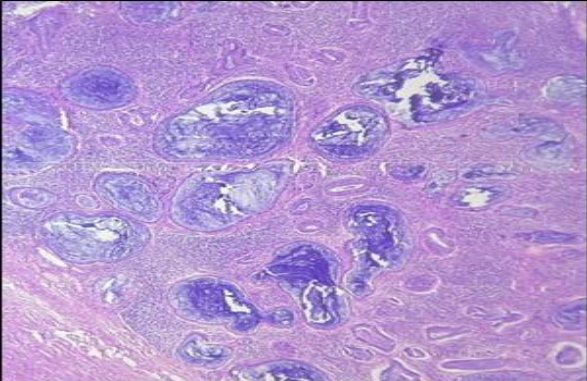


Figure:8- High grade appendiceal mucinous neoplasm(HAMA)

DISCUSSION:

Comparison of Incidence of Appendiceal Neoplasms in the Present Study with Previously Published Studies (2015–2025)

Author	Year	Country	Total Appendecto my Specimens	Neoplastic Cases (n)	Incidence (%)
82	International Journal of Scientific Research				

Charfi et al. ³	2015	Tunisia	2400	28	1.16
Collins et al. ¹²	2017	USA	3400	42	1.24
Ahmed et al. ⁴	2018	Pakistan	820	10	1.22
Khan et al. ⁶	2019	India	950	15	1.58
Fernandes et al. ⁸	2020	Brazil	1200	18	1.50
Sah et al. ²¹	2021	Nepal	760	9	1.18
Gupta et al. ⁷	2022	India	1100	14	1.27
Carr et al. ¹	2023	Spain	2993	64	2.14
Sharma et al. ²²	2024	India	680	12	1.76
Topete-Rodriguez et al. ²³	2025	Mexico	1050	16	1.52
Present study	2026	India	300	6	2.0

- The incidence of appendiceal neoplasms in the present study was 2%, which is comparable with previously published studies (1–2%).
- The most common tumor reported in most studies is neuroendocrine tumor, followed by mucinous neoplasms.
- Routine histopathological examination of all appendectomy specimens is essential because most tumours are clinically unsuspected and detected incidentally.

Acute appendicitis remains one of the most common surgical emergencies worldwide and appendectomy is among the most frequently performed emergency surgical procedures. Histopathological examination of appendectomy specimens plays a crucial role not only in confirming the clinical diagnosis but also in identifying unexpected or incidental pathological findings including neoplasms and unusual inflammatory conditions. Routine histopathological evaluation is therefore recommended for all appendectomy specimens.¹²

In the present study, most patients belonged to the 21–30 years age group, which accounted for the highest proportion of cases. Similar age distribution has been reported in several previous studies Charfi S, et al. , Ahmed I, et al , where appendicitis was found to be most common in the second and third decades of life.^{3,4} This predilection for younger individuals is thought to be related to lymphoid hyperplasia and increased luminal obstruction in this age group.⁵ Gender distribution in the present study showed a slight female predominance (52%) compared to males (48%). Although many studies report a slight male predominance, some regional studies have demonstrated similar gender distributions.³⁻⁶ Differences may be attributed to demographic variations, referral patterns, and clinical diagnostic criteria used in different institutions. The most common histopathological diagnosis in the present study was acute appendicitis (56.33%), followed by chronic appendicitis (18.33%) and acute on chronic appendicitis (11.33%). Similar findings have been reported in other histopathological studies like Gupta S, et al.Fernandes H, et al. of appendectomy specimens where acute appendicitis accounts for most cases.⁷⁻⁸

The inflammatory process typically begins with luminal obstruction leading to increased intraluminal pressure, vascular compromise, bacterial invasion, and transmural inflammation.⁵ In addition to common inflammatory lesions, a small proportion of cases demonstrated unusual findings such as granulomatous appendicitis, parasitic infestation, appendiceal neuroma (fibrous obliteration), and calcified appendicitis. Granulomatous appendicitis may be associated with infections such as tuberculosis or Crohn disease, while parasitic infections, particularly *Enterobius vermicularis*, have also been reported as rare causes of appendiceal inflammation.^{9,10} Fibrous obliteration or appendiceal neuroma represents a reactive process characterized by proliferation of neural elements and fibrous tissue within the appendiceal lumen.¹¹ One of the important objectives of histopathological examination of appendectomy specimens is the detection of incidental appendiceal neoplasms. In the present study, neoplastic lesions were identified in 2% of cases, which is consistent with previously reported incidence rates in studies done by Collins DC, Connor SJ, et al ranging from 0.9% to 2.5% and in various other studies.¹²⁻¹³ Among the neoplastic lesions identified, neuroendocrine tumor was the most common, followed by mucinous neoplasms including low-grade appendiceal mucinous neoplasm (LAMN) and mucinous adenocarcinoma. Neuroendocrine tumours are the most frequent appendiceal tumours and are typically located at the tip of the appendix. They are often small and asymptomatic and are usually discovered incidentally during histopathological examination.¹⁴⁻¹⁵

Mucinous neoplasms of the appendix are clinically significant because of their association with pseudomyxoma peritonei, a condition characterized by accumulation of mucin within the peritoneal cavity. Early identification of these lesions is essential because their management and prognosis differ significantly from those of simple inflammatory conditions.^{16,17}

The findings of the present study further emphasize the importance of routine histopathological examination of all appendectomy specimens, even when the clinical diagnosis strongly suggests uncomplicated appendicitis. Several authors like Duzgun AP, et al, and Swank HA, et al, have highlighted that incidental tumours and rare pathological conditions may remain undetected if specimens are not examined microscopically.¹⁸⁻¹⁹ Overall, the present study demonstrates that while inflammatory lesions constitute the majority of appendiceal pathology, a small but clinically significant proportion of cases harbour unexpected neoplastic or unusual pathological findings. Therefore, routine histopathological evaluation remains an essential component in the management of appendectomy specimens.²⁰

CONCLUSION:

The present study demonstrates that acute appendicitis is the most common histopathological finding in appendectomy specimens, while incidental neoplasms constitute a small but clinically important proportion of cases. Rare findings such as granulomatous appendicitis, parasitic infestation, and appendiceal neuroma may also be encountered. These findings highlight the importance of routine histopathological examination of all appendectomy specimens for accurate diagnosis that may significantly influence postoperative management and ultimately reduce patient morbidity and mortality.

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