Original Research

HISTOPATHOLOGICAL AND MICROBIAL STUDY OF APPENDIX IN EMERGENCY APPENDICECTOMY PATIENTS

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ABSTRACT

Introduction: Acute appendicitis is one of the most common surgical emergencies worldwide. Despite advances in imaging and clinical diagnosis, histopathological examination (HPE) remains the gold standard for confirmation, while microbiological profiling helps in understanding the infectious etiology and guiding antibiotic therapy.

Aims and Objectives: The aim of this study was to evaluate the histopathological and microbiological findings of appendix specimens in emergency appendicectomy patients and to correlate them with clinical and radiological features for better diagnostic understanding and management of acute appendicitis.

Materials and Methods: The present study was a hospital-based longitudinal follow-up study conducted in the emergency setting of the Department of General Surgery, Calcutta National Medical College and Hospital. The study was carried out over a period of one year and included patients operated for acute appendicitis admitted to the department. The estimated sample size was approximately 100 patients.

Results: The study (N=100) showed equal gender distribution (female 51%, male 49%) with most patients aged 21–30 years (38%) and mean age 30.39 ± 9.48 years. RIF pain with vomiting was the main symptom (46%). USG showed elongated tubular structure (38%), microbiology mainly E. coli and Pseudomonas (26% each), and HPE most commonly lymphocytic infiltration (52%) and faecolith (36%), confirming inflammatory appendicular disease in young adults.

Conclusion: Appendicular disease mainly affects young adults with equal gender distribution and commonly presents with RIF pain and vomiting. Findings support an inflammatory etiology confirmed by imaging, microbiology, and histopathology, highlighting the need for early diagnosis and management.

Keywords: Acute Appendicitis, Appendicectomy, Histopathology, Microbiology, Emergency Surgery.

INTRODUCTION

Acute appendicitis is the most common general surgical emergency, and an appendicectomy is the most frequently performed operation worldwide. Around 20% of patients who undergo appendicectomy are found not to have acute appendicitis on histopathological examination. This is more common in females than males.

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The diagnosis of acute appendicitis in many patients, especially in females, is difficult to establish. Misdiagnosis of appendicitis in non-pregnant females of child bearing age is so common that appendicectomy (termed as appendectomy in North America) is the most frequently performed urgent abdominal operation. Acute appendicitis is relatively rare in infants, and it reaches a peak incidence in teens and early 20s. The incidence is equal among males and females before puberty. In young adults, the male: female ratio increases to 3:2, and thereafter, the greater incidence in males declines. Obstruction of the lumen is the dominant factor in acute appendicitis either in the form of fecolith (appendicolith), lymphoid hyperplasia, or fibrosis. Some unusual factors can also be involved.

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The practice of sending appendectomy specimens for histopathological analysis varies. Matthyssens et al. suggest that appendices should not be sent routinely unless there is any gross abnormality seen macroscopically in the appendix while operating Obstruction of the lumen is the most common initiating event in the development of appendictis. Faecolith, lymphoid hypertrophy, vegetable matter, intestinal worms, are the usual cause of obstruction. At the onset of obstruction there is continuous secretion of mucus and inflammatory exudates. These lead to increase in intraluminal pressure. As a result there is obstruction to the lymphatic drainage. Further consequences are oedema, ulceration of mucosa and bacterial translocation to the submucosa. If the condition is not tackled at this stage, there may be further distension of appendix which may lead to venous congestion, distension and ischemia of appendicular wall, Bacterial colonisation in the ischemic muscularis propria and submucosa presents in the clinical picture of acute appendicitis, Further worsening of this condition results in necrosis of the appendicular wall presenting as gangrenous appendicitis. With a possible consequence of rupture and spillage of the bacterial content in the peritoneal cavity finally leading to localized or generalized peritonitis. Although there have been some explanations regarding non obstructive variety of acute appendicitis, but evidence for this variant are far less compared to its obstructive variety

Acute appendicitis is defined as an inflammation of the inner lining of the appendix vermiformis, which then spreads to other parts of the organ. Various etiologies for this clinic-pathologic condition have been identified, but luminal obstruction is considered the most critical factor, as it triggers the inflammatory process. When lumen obstruction occurs, intraluminal pressure surpasses that in the appendiceal veins, causing venous outflow obstruction. Finally, ischemia develops in the appendiceal wall, which weakens the epithelial integrity and increases the organ's risk of bacterial invasion. Although lymphoid hyperplasia and fecoliths are the most common causative factors of luminal obstruction, other less frequent factors have been associated with the condition, including enterobiasis,[1] endometriosis, tuberculosis, amebiasis, actinomycosis, adenovirus,[2] granulomatous diseases, eosinophilic granuloma,[3] neurogenic appendicopathy,[4],[5] foreign body melanosis, neurofibroma, diverticulitis, and taeniasis, as well as appendiceal malignancies, such as carcinoid tumor, gastrointestinal stromal tumor, hyperplastic polyp, tubular adenoma,villous adenoma, mucocele, mucinous cystadenoma, adenocarcinoma, mucinous cystadenocarcinoma, lymphoma, and leukemia. However, histopathological examination remains the gold standard method for the confirmation of appendicitis. Along with acute appendicitis, at times sinister findings such as tumors or unusual, important incidental findings such as worms and tuberculosis also may be encountered, which can be confirmed by histopathological examination only. This fact highlights the importance of pathological analysis of each and every single resected appendix. It has recently been hypothesized that the human appendix functions as a reservoir of beneficial microbes that can be used for recovery following events of pathogen colonization, diarrheal disease, or antibiotic treatment [6],[7]. Bollinger et al. theorized that the vermiform appendix serves as a microbial reservoir or “safe house” for beneficial bacteria capable of repopulating the gut. The associated lymphoid tissue of the appendix has been recognized to provide an ideal environment for bacterial growth in biofilms acting as an enteric reservoir [8],[9]. Furthermore, the presence of the appendix may reduce the risk of Clostridium difficile recurrence, the protective effect being attributed to the presence of beneficial microbial biofilms and/or to an immune defense. Conversely, however, another recent study suggested that the appendix may actually promote C. difficile acquisition, carriage, and disease [10]. Acute appendicitis is one of the most common causes of abdominal pain, with surgical appendectomy being the standard choice of treatment, and is still considered a clinical emergency. There is now evidence that obstructions in the organ are unlikely to be the primary cause of appendicitis, and bacterial infection is believed to be central to appendix inflammation. Despite this, however, there are limited data on the causal agents of acute appendicitis and of the microbial composition of the human appendix. Culturing-dependent studies have documented the dominance of Bacteroides species in both healthy and inflamed appendices, in addition to Escherichia coli and Streptococcus spp. being recovered from the tissue. Recent studies using fluorescence in situ hybridization (FISH) reported that local invasion with species of Fusobacterium is the cause in the majority of cases of suppurative appendicitis. The presence of Fusobacterium spp. in the mucosal lesions correlated positively with the severity of acute appendicitis, and the presence of other fecal organisms, including members of Bacteroides, Eubacterium rectale, Faecalibacterium prausnitzii, and Akkermansia muciniphila inversely correlated with the inflammation of the organ [11].

MATERIALS AND METHODS

Study Design- Hospital based longitudinal follow up study

Study Setting- Hospital in emergency-based study

Place of Study- Department of General Surgery, Calcutta National Medical College and Hospital

Period of Study- 1 year

Study Population- Patients operated for acute appendicitis in the Department of General Surgery of Calcutta National Medical College and Hospital

Sample size- approximately 100

Inclusion Criteria-

- Patients aged more than 13 years.
- Those who have given written consent.
- Diagnosed with acute appendicitis.

Exclusion Criteria-

- Patients less than 13 years of age
- Unwilling for operation
- Non consenting patients

Study variables-

- Socio demographic variables like-age, sex, residence(rural/urban), religion
- Clinical variable like alverdo scoring, complete blood picture , urine routine and microscopic examination

Statistical Analysis: For statistical analysis data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Z-test (Standard Normal Deviate) was used to test the significant difference of proportions. Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution. If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favor of the alternative hypothesis. P-value ≤ 0.05 was considered for statistically significant.

RESULT

Table 1: Socio-Demographic Profile of the Study Population (N = 100)

		Frequency	Percent
Gender	Female	51	51
	Male	49	49
	Total	100	100
Age in Group	≤20	16	16
	21–30	38	38
	31–40	32	32
	≥41	14	14
	Total	100	100
Resident	Bajbaj	22	22
	Baniapukur	14	14
	Baruipur	25	25
	Canning	21	21
	Sonarpur	18	18
	Total	100	100

Table 2: Clinical, Radiological, Microbiological and Histopathological Findings of the Study Population (N = 100)

		Frequency	Percent
Clinical Features	RIF Pain	15	15
	RIF Pain, Anorexia, Fever	7	7
	RIF Pain, Vomiting	46	46
	RIF Pain, Vomiting, Fever	17	17
	RIF Pain, Anorexia	15	15
	Total	100	100
USG Findings	Elongated Tubular Structure	38	38
	Inflamed Appendix >6 cm	30	30
	RIF Probe Tenderness	32	32
	Total	100	100
Microbiological Organism	E. coli	26	26
	Klebsiella	23	23
	Proteus vulgaris	25	25
	Pseudomonas	26	26
	Total	100	100
HPE	Faecolith	36	36
	Food Impaction	3	3

	Granuloma	4	4
	Lymphocytic Infiltration	52	52
	Mucocele	5	5
	Total	100	100

Table 3: Distribution of mean Age

Variable	N	Mean	SD	Minimum	Maximum	Median
Age	100	30.39	9.475	13	52	29

Figure 1: Clinical, Radiological, Microbiological and Histopathological Findings of the Study Population

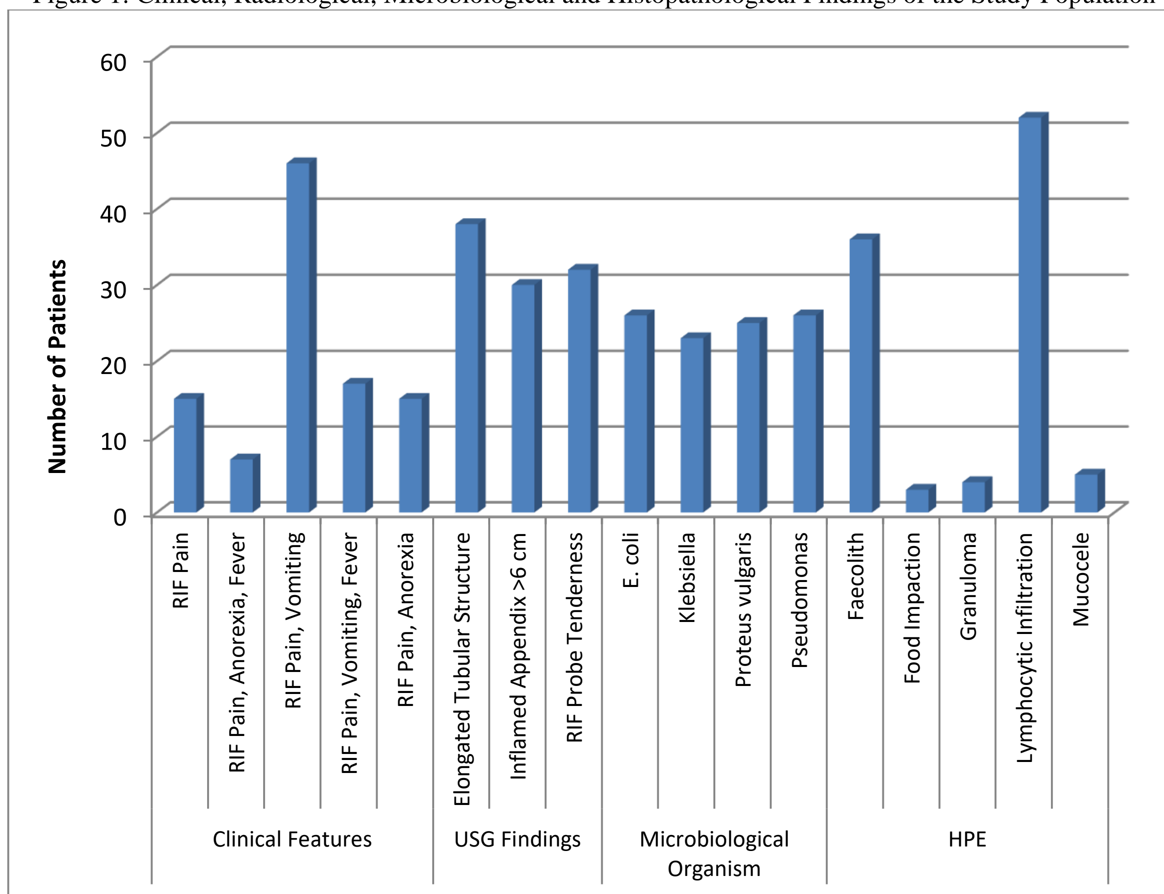
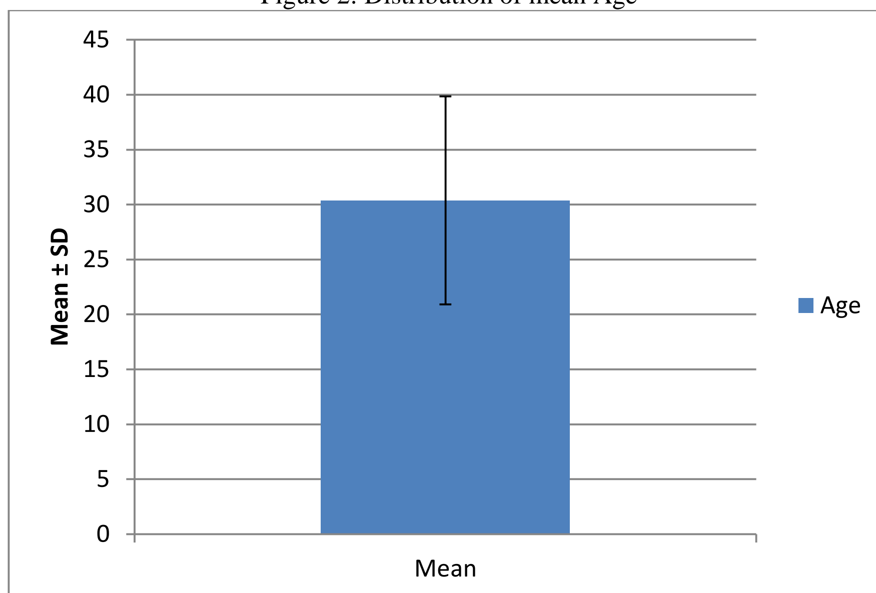


Figure 2: Distribution of mean Age



Socio-demographic Profile of the Study Population (N = 100)

Result

In the present study, out of 100 patients, 51% (n = 51) were female and 49% (n = 49) were male, showing an almost equal gender distribution. Regarding age distribution, the majority belonged to the 21–30 years age group (38%), followed by 31–40 years (32%), ≤20 years (16%), and ≥41 years (14%), indicating predominance of young adults. In terms of residence, the highest proportion of patients was from Baruipur (25%), followed by Canning (21%), Bajbaj (22%), Sonarpur (18%), and Baniapukur (14%), showing a slightly higher contribution from suburban areas.

Interpretation

The study population shows a nearly equal gender distribution, with a predominance of young adults (21–40 years). The variation in residence suggests that cases were distributed across multiple surrounding regions, with a relatively higher burden from Baruipur.

Clinical, Radiological, Microbiological and Histopathological Findings of the Study Population (N = 100)

Result

Clinical Features:

The most common presentation was RIF pain with vomiting (46%), followed by RIF pain with vomiting and fever (17%), RIF pain alone (15%), and RIF pain with anorexia (15%), while the least common was RIF pain with anorexia and fever (7%).

USG Findings:

The predominant finding was elongated tubular structure (38%), followed by RIF probe tenderness (32%), and inflamed appendix >6 cm (30%).

Microbiological Organism:

The most frequently isolated organisms were E. coli (26%) and Pseudomonas (26%), followed by Proteus vulgaris (25%), and Klebsiella (23%).

HPE Findings:

The most common histopathological finding was lymphocytic infiltration (52%), followed by faecolith (36%), mucocele (5%), granuloma (4%), and food impaction (3%).

Interpretation

The clinical profile indicates that RIF pain with vomiting is the most common presentation, suggesting typical appendicular symptoms. Ultrasonography predominantly showed features consistent with appendicitis-related structural changes. Microbiological analysis revealed a mixed bacterial infection pattern dominated by gram-negative organisms. Histopathology predominantly showed lymphocytic infiltration and faecolith, supporting an inflammatory etiology.

Distribution of Mean Age (N = 100)

Result

The mean age of the study population was 30.39 ± 9.48 years, with a median of 29 years, ranging from 13 to 52 years.

Interpretation

The findings indicate that the study population mainly consisted of young adults, with a moderate age variation, suggesting that the condition predominantly affects individuals in the early and middle adult age group.

DISCUSSION

In the present study, the socio-demographic profile revealed an almost equal gender distribution with a slight female predominance (51%) compared to males (49%). This near-equal distribution suggests that the condition affects both genders similarly, which is consistent with previous epidemiological studies reporting no strong gender predilection in

appendicular pathology [12]. The majority of patients belonged to the 21–40 years age group, indicating that young adults were predominantly affected. This observation aligns with established literature describing peak incidence of appendicitis in the second and third decades of life due to increased lymphoid tissue activity and higher susceptibility to luminal obstruction [13]. Similar findings have been reported in microbiological studies where E. coli is the most frequent pathogen due to its abundance in the gastrointestinal tract [14,15]. Clinically, the most common presentation was right iliac fossa (RIF) pain with vomiting (46%), followed by RIF pain with vomiting and fever (17%). [16] Vomiting as a frequent associated symptom is explained by visceral irritation and inflammatory response [17]. Ultrasonographic findings in the present study most commonly demonstrated elongated tubular structures (38%), followed by RIF probe tenderness (32%) and inflamed appendix >6 cm (30%). Ultrasonography remains a widely accepted first-line imaging modality, especially in young patients, due to its safety and diagnostic accuracy. Microbiologically, the present study revealed a polymicrobial pattern with predominance of E. coli (26%) and Pseudomonas (26%), followed by Proteus vulgaris (25%) and Klebsiella (23%). Histopathological examination showed lymphocytic infiltration as the most common finding (52%), followed by faecolith (36%). This supports the widely accepted pathophysiological mechanism of luminal obstruction leading to inflammation. Previous pathological studies have also identified faecolith and lymphoid hyperplasia as key initiating factors in acute appendicitis [18]. Less frequent findings such as mucocele, granuloma, and food impaction reflect varied pathological etiologies. Overall, the findings of the present study are in agreement with established global evidence, confirming that appendicular disease predominantly affects young adults, presents with classical clinical features, demonstrates characteristic ultrasonographic findings, and shows polymicrobial infection patterns with typical histopathological inflammatory changes [19], [20].

CONCLUSION

The present study concludes that appendicular disease predominantly affects young adults with nearly equal gender distribution and is most commonly associated with RIF pain with vomiting as the primary clinical presentation. Ultrasonography typically reveals elongated tubular structures and inflamed appendix, while microbiological analysis shows a predominance of gram-negative organisms such as E. coli and Pseudomonas. Histopathological examination most frequently demonstrates lymphocytic infiltration and faecolith, confirming an inflammatory etiology. Overall, the study highlights the importance of early clinical suspicion supported by imaging, microbiology, and histopathology for accurate diagnosis and effective management of appendicular pathology.

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