

Original Research Article

Analysis of intraoperative findings with clinico-pathological features in appendicitis-an observational study

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ABSTRACT

Background: Appendectomy is the most common abdominal surgery performed today. Appendicitis consists of vast spectrum ranging from acute to chronic to recurrent forms however existence of recurrent and chronic appendicitis is still doubted by many. In spite of various scoring systems and appendectomy being the ultimate treatment, its timing remains still controversial especially in chronic and recurrent variants of appendicitis.

Methods: A total of 100 consecutive cases of suspected appendicitis who were admitted investigated and treated at our centre were taken up for this observational study. Data pertaining to clinical, operative and histopathological findings were collected and tabulated. Mean and SD were used for continuous data and for categorical data, frequency and percentages were calculated. A chi-square test was used for categorical data to find statistical significance.

Results: Per operatively the appendix appeared non-inflamed in 57% of patients suggestive of chronic (recurrent) form and inflamed in 43% of patients suggestive of an acute form of appendicitis. The histopathological studies revealed chronic inflammatory cells in 63% of the resected specimens, suggestive of chronic appendicitis and acute inflammatory cells in 37% of the specimens, suggestive of acute appendicitis.

Conclusions: We conclude that the correlation of clinical findings, operative findings and the histopathological findings correlate with one another ($p < 0.001$). The surgeon's clinical and operative findings have specificity of around 87.30% and 90.47% respectively. Hence the diagnostic accuracy of the surgeon is directly dependent on the surgeons' expertise and there is no substitution for an experienced surgeon's judgement.

Keywords: Acute appendicitis, Chronic, Recurrent, Recurrence, Histopathological findings

INTRODUCTION

Acute appendicitis, perhaps the most common surgically correctable cause of abdominal pain, the diagnosis of which still remains difficult in many instances. Appendectomy even today remains the most common reason for abdominal surgery. The diagnosis may be

wrongly made or initially overlooked in case of acute appendicitis. The first error leads to an unnecessary operation while the second to unnecessary delay.¹

Some of the signs and symptoms can be subtle to both the clinician and the patient adding to the dilemma of arriving at a correct diagnosis, however, any delay may

progress to complications like perforation/abscess formation and significantly increased morbidity and mortality. Incorrectly diagnosing a patient with appendicitis although not catastrophic often subjects the patient to a multitude of diagnostic tests and/or an unnecessary operation.²

From time immemorial appendicitis has been a clinical diagnosis and the term appendicitis was synonymous with acute appendicitis; however, operating solely on clinical suspicion may result in the removal of a normal appendix in 15-30% cases.³

The existence of recurrent and chronic appendicitis still doubted by many and remains in question. It has been suggested by many that perforating and non-perforating appendicitis are separate entities and that resolving episodes represents attacks of non-perforating appendicitis. This finding has led to reclassifying appendicitis into acute and non-acute forms. A recent study of treatment of appendicitis with antibiotics alone found that 95% resolved but 35% re-presented with appendicitis within a period of 17.2 months.⁴ The prevalence of Chronic and recurrent appendicitis is denied by many but the condition is not uncommon.

The premise that it is better to remove a normal appendix than to delay diagnosis doesn't stand up close scrutiny, particularly in the elderly.³ This study was conducted to correlate the clinical findings, operative findings and the histopathological findings among the different (acute, chronic and recurrent) variants of appendicitis.

METHODS

This observational study, was done in department of general surgery at Adichunchangiri hospital and research centre, B. G. Nagara, considering the patients with complaints of pain in the right lower quadrant of abdomen, lasting fewer than seven days during the study period of one year from January 2020 and January 2021, diagnosed to appendicitis fulfilling the inclusion/exclusion criteria were taken up for this observational study. Relevant data pertaining to aims of the study were collected after a detailed history taking, through clinical examination of these patients. Data collected were entered into a specially designed case record form.

Patients with classic history of migratory pain (which is initially in the periumbilical/epigastric region and later localizes to the right lower quadrant), with other constitutional symptoms of nausea/vomiting, anorexia, who are provisionally diagnosed as appendicitis (acute form); patients presenting with recurrent attacks (non-acute forms) of right lower abdominal pain in whom other pathologies are excluded by radiological studies; patients provisionally diagnosed as appendicitis and who are fit for surgery were included in the study.

Patients with right lower abdominal pain due to involvement of other viscera like urinary tract infection, ureteric stone, acute gastroenteritis, Meckel's diverticulitis, disease of the urogenital systems, intussusception, Crohn's enteritis, caecal typhlitis, gynecological disorders-pelvic inflammatory disease, ruptured ectopic, torsion of ovarian cysts; patients with appendicular mass, appendicular abscess and patients with generalized peritonitis due to appendicular perforation; patients not willing for surgery; and pregnant women were excluded from the study.

Sampling technique

All consecutive patients admitted in the study setting meeting the inclusion criteria were included in the study.

Statistical analysis

Data was collected and tabulated with Microsoft excel 2016. Mean and standard deviation (SD) were used for continuous data and for Categorical data, frequency and percentages were calculated. A chi-square test was used for categorical data to find statistical significance. A p value is considered statistically significant if it is ≤ 0.05 . Further logistic regression was analyzed using odds ratio (OR) with 95% confidence interval (CI). The statistical package for the social sciences (SPSS) version 11 was used for analysis.

Ethical clearance

Institutional ethical committee clearance was obtained for the study.

RESULTS

A total of 100 consecutive cases of suspected appendicitis who were admitted, investigated and treated were taken for the study. After detailed examination and investigations the clinical, operative and histopathological findings were correlated.

Table 1: Depicting the age distribution among the study group.

Age (years)	No. of cases	No. of males	No. of females
01-10	3	1	2
11-20	26	15	11
21-30	51	24	27
31-40	15	8	7
41-50	4	1	3
51-60	1	0	1
Mean±SD	25.35±9.3		

The group with age range of 21-30 years had largest number of patients-51 (51%), followed by 11-20 years

age group 26 patients (26%). Mean number of patients in the groups were 25.35±9.3.

Table 2: Depicting the distribution of tenderness in right iliac fossa among the study group.

Tenderness	No. of cases
Mildly tender ‘+’	55
Moderately tender ‘++’	32
Severely tender ‘+++’	13

The 55% of the patients in the study group had mild tenderness in right iliac fossa, 32% had moderate tenderness and only 13% presented with severe tenderness.

Table 3: Depicting the frequency of vomiting among the study group.

Vomiting	No. of cases
Absent ‘-’	37
Occasional ‘+’	42
Severe persistent vomiting ‘+++’	21

While 37 cases in the group had no episodes of vomiting, rest of the patients presented with occasional (42 patients) or severe vomiting (21 patients).

Table 4: Depicting the frequency of fever among the study group.

Fever	No. of cases
Absence of fever ‘-’	43
Occasional low grade ‘+’	47
High grade fever >39.0° C ‘+++’	10

While 47 cases in the group presented with low grade fever, 43 patients had no raise in body temperature and rest of the patients had high grade fever (10 patients).

History suggestive of acute appendicitis in the study group was absent in 19 patients while positively present in rest 81 patients

Table 5: Depicting the distribution of operative Findings (OR) among the study group.

Operative room (OR) findings	No. of cases
Inflamed (local hyperemia) with excess peritoneal fluid around the caecum	43
Non inflamed (with or the without fibrosis and /or peri-appendicular adhesions)	57

In the operating room, 43 cases had inflamed appendix with excess peritoneal fluid around the caecum and 57 had non-inflamed appendix with/without fibrosis and/or peri-appendicular adhesions).

Histopathology showed acute pathology in 37 cases while 63 had chronic pathology.

Table 6: Depicting the association of past history suggestive of AA with histo-pathology report findings among the study group.

Past history suggestive of AA	Histo-pathology report (%)		Total (%)
	Acute	Chronic	
Absent	18 (95)	1 (5)	19 (100)
Present	19 (23)	62 (77)	81 (100)
Total	37	63	

X²=30.5, p<0.001 HS

The patients with history suggestive of appendicitis in the past were compared with the histopathology findings which were considered as gold standard for the final diagnosis. Among 19 patients with no previous history suggestive of appendicitis, 18 patients showed associated acute inflammation of the appendix while one patient showed chronic inflammation. Among 81 patients with previous history suggestive of appendicitis, 19 patients showed associated acute inflammation of the appendix while 62 patients showed chronic inflammation. Using the X² test, the p value was found to be highly significant.

Table 7: Depicting the relation between tenderness and operative findings among the study group.

Tenderness	OR findings (%)		Total (%)
	Inflamed	Non inflamed	
Mild rebound tenderness ‘+’	5 (9)	50 (91)	55 (100)
Moderate rebound tenderness ‘++’	25 (78)	7 (22)	32 (100)
Severe rebound tenderness ‘+++’	13 (100)	0	13 (100)
Total	43	57	

X²=59.14, p<0.001 HS.

The patients with rebound tenderness were compared with the gross findings per operatively. Among 55 patients with mild rebound tenderness denoted by ‘+’ in the right iliac fossa, 5 patients showed associated inflammation of the appendix while 50 patients showed no inflammation. Among 32 patients with moderate rebound tenderness denoted by ‘++’ in the right iliac fossa, 25 patients showed associated inflammation of the appendix while 7 patients showed no inflammation. The rebound tenderness was very severe in 13 patients and all showed inflammation of the appendix. Using the X² test, the p value was found to be highly significant.

Table 8: Depicting the association between tenderness and histo-pathological findings among the study group.

Tenderness	Histo-pathology report (%)		Total (%)
	Acute	Chronic	
Moderate to severe (++, +++)	37 (82)	8 (18)	45 (100)
Mild (+)	0	55 (100)	55 (100)
Total	37	63	100

$X^2 = 71.78$, $p < 0.001$ HS, sensitivity=100, specificity=87.30.

The patients with rebound tenderness were compared with the histopathology findings which were considered as gold standard for the final diagnosis. Among 45 patients with moderate rebound tenderness denoted by '++' or severe tenderness in the right iliac fossa, denoted by '+++', 37 patients showed associated acute inflammation of the appendix while 8 patients showed chronic inflammation of the appendix. Among 55 patients with mild rebound tenderness in the right iliac fossa, denoted by '+', no patients showed associated acute inflammation of the appendix while all 55 patients showed associated chronic inflammation of the appendix. In this study it was found that the surgeon's findings had a sensitivity of 100% and a specificity of 87.30%. Using the X^2 test, the p value was found to be highly significant.

Table 9: Depicting the relation between operative (OR) findings and HPR distribution among the study group.

OR finding	Histo-pathology report (HPR) (%)		Total (%)
	Acute	Chronic	
Inflamed	37 (86)	6 (14)	43 (100)
Non inflamed	0	57 (100)	57 (100)
Total	37	63	

$X^2 = 74.2$, $p < 0.001$ HS, specificity: 90.47%, sensitivity: 100%.

The per operative gross appearance of the appendix was compared with the histopathology findings which were considered as gold standard for the final diagnosis. Among 43 patients with grossly inflamed appendix, 37 patients showed associated acute inflammation of the appendix while 6 patients showed chronic inflammation. These 6 patients probably represent the acute on chronic (recurrent) type of appendicitis.

Table 10: The results of the findings of Jones et al study.^{11d}

Appendix	HPR		Total
	Acute	Chronic	
Inflamed	143	25	173
Non inflamed	0	40	40

Specificity: 61.50%, sensitivity: 100%.

In the study conducted by Jones et al the surgeons' classified the appendix as normal, mild to moderate inflamed, acutely inflamed or suppurative and gangrenous or perforated. There was a lot of discrepancy among group consisting of mild to moderate inflammation, hence the specificity was low at 61.5%.¹¹

DISCUSSION

In present study, the predominance of symptoms-pain in the right iliac fossa>vomiting>fever, along with presence of similar complaints in the past. In 81% there was a previous history suggestive of acute appendicitis, while 19% of them who presented for the first time with pain abdomen. Hence history taking is prudent when one has to rule out chronic or recurrent appendicitis.

On examination there was a constant finding of tenderness in the right iliac fossa of variable severity. Intra-operatively, gross appearance of the appendix was used as a means of augmenting the clinical diagnosis of appendicitis by the surgeon, before an appendicectomy was performed. Presence of increased vascularity or local hyperemia was taken as a sign of inflammation and absence of the same was termed as non-inflamed. To fit the intraoperative criteria at least one of them should be present.⁵

Histopathology of the resected specimen was taken as gold standard. We looked for acute and chronic findings to make a final diagnosis.

Some authors have proposed a criterion for chronic appendicitis-persistence of symptoms for more than two weeks; no alternative diagnosis, confirmation of chronic appendices inflammation on pathological exam; relief of symptoms following appendicectomy.^{6,7} The signs and symptoms of chronic are same as that of acute appendicitis but with a more prolonged duration and reduced intensity.⁶

Although the exact pathophysiology of chronic and recurrent appendicitis is unknown, it has been proposed that Chronic appendicitis-caused by persistent/partial/recurring obstruction of the appendiceal lumen. Recurrent appendicitis-caused by recurring/intermittent/transient obstruction of the appendiceal lumen. Luminal obstruction can be due to fecoliths, lymphoid hyperplasia, tumors and foreign bodies. With gradual accumulation of luminal secretions and progressive dilatation of the appendix until the intraluminal pressure overcomes the obstruction resulting in a relief of symptoms.⁶⁻¹⁰

In this study, 43 out of 100 patients showed inflamed appendix intraoperatively where only 37 patients showed evidence of acute appendicitis in histopathology report. Study conducted by Jones et al revealed that the appendix was inflamed in 173 (81.2%) out of the total 213 appendectomies performed while the pathologists

confirmed that only 148 (69.5%) of them showed histological evidence of inflammation.¹¹

Fifty-seven patients had non inflamed appendix (with/without fibrosis and/or peri-appendicular adhesions) intraoperatively whereas 63 patients had evidence of chronic appendicitis in histopathology report in current study. Similar study conducted by Grunewald et al suggested of 11 (26%) out of 43 appendectomy specimens described as normal by surgeons showed acute appendicitis on histopathological examination.¹² This disparity between intra-operative and histopathology may account for until recently non-existent term 'recurrent appendicitis'.

In present study, no appendectomy specimen showed normal histology on histopathology section. Many reports have re-established both the term and the concept of recurrent appendicitis.¹³ It is the clinical scenario in which a patient with pathologically confirmed acute appendicitis relates to one or more prior episodes of identical symptoms that resolved without surgical intervention. The diagnostic criteria proposed for this entity being-history of similar and recurrent attacks of right iliac fossa pain; histopathological diagnosis of chronic inflammation of appendix; relief post appendectomy. If along with the above criteria there is the presence of acute inflammation intraoperatively, it can be termed as recurrent appendicitis.^{13,14}

Despite the practice of offering interval appendectomy to all patients treated non operatively, only a small proportion of them have proceeded with this additional surgery. In the study conducted by Rautio et al showed the incidence of non-operative series recurrent appendicitis is reported to occur in 0% to 20% of patients, as compared this current study revealed 19% of recurrent appendicitis cases.¹⁵ The interval between presentation was three weeks to 12 years (mean 8 months), with most recurrences occurring within the first three to six months and number of patients who refused interval appendectomy have presented with recurrent symptoms of appendicitis and eventually underwent appendectomy. On the operating table, surgeons can establish the diagnosis with 94% specificity and 78% sensitivity. There is an excellent correlation between the clinical symptomatology, intraoperative findings and histo-pathological abnormalities.

The existence of recurrent appendicitis serves as a reminder not to discount the diagnosis of appendicitis in patients with a previous episode of similar abdominal pain.¹⁶ Leukocyte counts are predictably normal and CT scans are generally non diagnostic.⁷

Alvarado scoring is easy, simple, cheap, noninvasive tool in preoperative diagnosis of acute appendicitis and repeatable at no cost. It improves diagnostic accuracy and consequently reduces false appendectomy.^{17,18}

Limitation of this study is that it consisted of 100 study participants at a single center. A multi-centric study with a larger study population is probably required to generalize the above findings.

CONCLUSION

The clinical findings, operative and histo-pathological findings correlate with one another. The surgeon's clinical and operative findings have a specificity of around 87.3% and 90.47% respectively. The surgeon's accuracy at diagnosing the chronic forms both clinically and per operative was 100% while the acute forms were clinically diagnosed at 86% and preoperatively at 82%. Hence the diagnostic accuracy of surgeon is directly dependent on surgeons' expertise and there is no substitution for an experienced surgeons' judgment. There is emerging evidence to suggest appendicitis includes a vast spectrum ranging from acute to chronic to recurrent forms.

This study brings to light the importance of recognition of non-acute variants of appendicitis and how a correlated approach involving clinical, intraoperative and histological findings brings you closer to a diagnosis in a wide spectrum of appendicitis. However, larger multi-centric prospective studies are required to endorse the above findings.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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