

A Comparative Study of Perforated and Non-Perforated Appendicitis With Respect to Clinical and Laboratory Findings.

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Abstract:

Introduction: The vermiform appendix is considered by most to be a vestigial organ, its importance in surgery is only due to its tendency for inflammation resulting in the syndrome called acute appendicitis. Acute appendicitis is the most common cause of an "acute abdomen" in young adults. Appendectomy is the most frequently performed emergency abdominal operation. Present study was undertaken to study the clinical pattern of presentation and to analyze the difference in the anatomical, biochemical, microbiological, histological determinants in patients of perforated and non-perforated acute appendicitis.

Materials and Methods: Present study was carried out in a tertiary care hospital over a period of two years. All patients were admitted in the emergency care unit as per hospital protocols. Patients were divided into two groups (Perforated and non-perforated). Patients found eligible as per inclusion and exclusion criteria were included.

Results: 150 cases were studied with median age being 35 years. Male preponderance was noted. Symptom duration was higher in perforated appendicitis. Patients with perforated appendix had high Alvarado score. Appendectomy was the most common surgical procedure. 81.33% had acute inflamed appendicitis. Incidence of gangrenous and suppurative appendicitis was higher in cases of perforated appendicitis.

Conclusion: Patients with longer duration of pain have higher incidence of perforation. Alvarado score can predict the likelihood of perforation. Hospital stay is more in cases of perforated appendix. Antibiotic sensitivity should be considered when change of antibiotic is contemplated.

Keywords: Perforated appendicitis, Non-perforated appendicitis, Alvarado Score, Gangrenous appendicitis

I. Introduction

The vermiform appendix is considered by most to be a vestigial organ, its importance in surgery is only due to its tendency for inflammation resulting in the syndrome called acute appendicitis. Acute appendicitis is the most common cause of an "acute abdomen" in young adults. Appendectomy is the most frequently performed emergency abdominal operation.

The life time rate of appendectomy is 12% for men and 25% for females (1). Acute appendicitis is relatively rare in infants, becomes increasingly common in childhood & early adult life, reaching a peak incidence in the teens & early 20s (2). Obstruction of the appendix lumen is important, some form of luminal obstruction by either a fecolith or stricture is found in the majority of cases. Obstruction of orifice by tumor (carcinoma of the caecum) is a cause of acute appendicitis, in middle age & elderly. (2) Inflammation of appendix is associated with obstruction in 50 to 80% of cases, mostly due to fecolith less commonly due to tumor, gall stone or worms. Continuous secretion of mucinous fluid in an obstructed viscus lead to increase in intraluminal pressure sufficient to cause collapse of draining veins this leads to ischemic injury to the appendix. Ischemia favors bacterial proliferation with additional inflammatory edema and exudation. Further hampering the blood supply.

It is observed that a significant minority of inflamed appendices does not have any luminal obstruction and the pathogenesis of inflammation remains unknown. Perforation of gangrenous appendix carries significant risk of morbidity and mortality. Overall rate of perforated appendicitis is 25.8% of the total cases. These patients who have perforated appendicitis differ in clinical presentation and laboratory parameters as compared to non-perforated cases of acute appendicitis (2). Fecoliths are found nearly in 90% of the patients with acute gangrenous appendicitis with rupture. It has been documented that perforated and non-perforated appendicitis may have different pathophysiology affecting the subsequent intraoperative and post-operative picture (3). Present study was undertaken to study the clinical pattern of presentation and to analyze the difference in the anatomical, biochemical, microbiological, histological determinants in patients of perforated and non-perforated acute appendicitis.

Materials and method

Present study was carried out in a tertiary care hospital over a period of two years. All patients were admitted in the emergency care unit as per hospital protocols. All patients were clinically evaluated and investigated with routine hematological tests, Chest X-Ray, and Electrocardiogram (if required), which are necessary for preoperative fitness. All patients who are suspected to have acute appendicitis are subjected to X-ray chest and abdomen, ultrasonography. Intraoperative findings noted. Patients found eligible as per inclusion and exclusion criteria were included.

Patient information sheets in three different languages were given to patients and their valid, written consents were taken. Data on patient characteristics was obtained by a proper personal interview and documented. Patients were examined preoperatively.

Following clinical, biochemical, microbiological, intraoperative and postoperative observations are made. Preoperative investigational criteria and laboratory parameters were recorded. Intraoperative findings and postoperative course of these patients were studied using a case record proforma.

Inclusion criteria

Patients presenting to a tertiary care center with intraoperative findings of appendicitis.

Exclusion criteria

Patients who are

- Diagnosed to be suffering from other organ pathology of bowel.
- Belonging to age group less than 12.
- Patients who have undergone other abdominal surgery affecting the small bowel.

Observations and Results:

Total 150 cases were studied with 75 cases in each group (perforated and non-perforated). Median age for a patient with appendicitis was 35 years with values ranging from 12 to 78 years. The data shows maximum no patients are young adults and in the 2nd or 3rd decade of life. 34 patients (22.67%) patients belong to the age group of 20-29 years and 28 (18.67%) belong to the population of 30 -39 years (Table 1).

Table 1:Age-wise distribution of the cases

Age groups	No.of patients
10 – 19	20 (13.33%)
20 – 29	34 (22.67%)
30 – 39	28 (18.67%)
40 – 49	18 (12%)
50 – 59	18 (12%)
60 – 69	24 (18%)
70 AND ABOVE	8 (5.3%)
TOTAL	150

In the present study 63.33% of the patients were males and 36.67% were females (Table 2).

Table 2: Sex-wise distribution of cases

Sex	Perforated appendicitis	Non-perforated appendicitis	Total
Male	49	46	95
Female	26	29	55
Total	75	75	150

The statistical difference in these group is not significant (p value > 0.05)

Symptom Duration:

99 out of 150 (i.e. 64.00 %) of patients had symptom duration less than 5 days. In patients with symptom duration less than 2 days maximum had acute inflamed but non perforated appendicitis. (78.4% amongst patients with symptom duration up to 2 days). Patients who had perforated appendicitis when analyzed they were found to have symptom duration more frequently ranging from 3 -5 days (34 out of 75 i.e. 45.33 %) and 6 -7 days (20 out of 75 i.e.26.67%)

Table 3: Distribution of cases on the basis of duration of symptom.

Symptom Duration	No. of patients	Perforated appendicitis (A)	Non perforated Appendicitis (B)

< 48 yrs (upto 2 days)	41 (27.33%)	9 (21.95%)	32 (78.04%)
3 – 5 days	55 (36.67%)	34 (61.81%)	21 (38.18%)
6 – 7 days	28 (18.67%)	20 (71.42%)	8 (28.57%)
More than 7 days	26 (17.33%)	12 (46.15%)	14 (53.84%)
Total	150	75	75

The difference of duration between these two groups is statistically significant (p value 0.0001)

Constitutional symptoms

Fever and vomiting were present in almost equal number of patients in perforated as well as non-perforated appendicitis. 115 out of 150 patients in the study presented with signs of localized peritonitis, 64 amongst them had perforated appendicitis (55.65%). Generalized peritonitis was seen in 47 patients, 36 out of them had perforated appendicitis (76.59%)

Table 4: Distribution of cases on the basis of constitutional symptoms.

Symptom	No.of patients (N)	Perforated Appendicitis	Non perforated Appendicitis
Abdominal Pain	150	75	75
Fever (A)	77	37	40
Vomiting (B)	70	31	39
Localised peritonitis (C)	115	64	51
Generalized peritonitis (D)	47	36	11

Alvarado score

A very small number of patients had Alvarado score between 4, 5 (3.33%). 40% of the patients have the score 6 or 7. 56.66% of patients had the Alvarado score as 8 or 9. The difference in the number of subjects having higher Alvarado score between pts having perforated and non-perforated appendicitis was found to be statistically significant (p value 0.01). (Table 5)

Table 5: Alvarado Score wise distribution of cases.

Score	Total no. of patients	Patients with perforated appendicitis	Patients with non-perforated appendicitis
4,5	5 (3.33%)	1 (20%)	4 (80%)
6,7	60 (40%)	23 (38.33%)	37 (61.66%)
8, 9	85 (56.66%)	55 (64.70%)	30 (35.29%)

Ultrasonography

Ultrasonography was done in all 150 patients with appendicitis. Probe tenderness was seen in maximum (78%) of patients with appendicitis Free fluid in periappendiceal area was seen in 67.33% of patients Lump formation was observed in 4 % of patients.

Choice of incision:

McBurneys incision was the most preferred incision used in 110 patients (73.33%) patients, midline incision was used in 25 cases and paramedian incision in 15 cases.

Procedure done

Appendectomy was the solution in 89.33% i.e. 134 patients. The occurrence of perforation per se does not alter the surgical plan as the perforation occur at tip or distal to the obstruction caused by fecoliths. The rest 10.66% of patients required other procedures. 11 patients underwent local resection of bowel with primary anastomosis (14 out of 75 i.e. 14 %), 4 underwent hemicolectomy with anastomosis (5.3%). one patient required bowel exteriorization in the form of a ileostomy. (1.3%)

Histopathology

Histologically, 81.33% of the patients had acute inflamed appendicitis, 11.33% patients had suppurative appendicitis and 7.33% had gangrenous appendicitis.(Table 6) Gangrenous and suppurative appendicitis was statistically high in patients in perforated group than in non-perforated group.

Table 6: Distribution of the cases on the basis of histopathological findings.

Pathological Description	Perforated appendicitis	Patients with non-perforated	Total No. of patients
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		appendicitis	
Acute Inflamed appendix	56 (74.66%)	66 (88%)	122 (81.33%)
Gangrenous appendicitis	9 (12%)	2 (2.66%)	11 (7.33%)

Microbiology:

Diagnostic yield of the smear microscopy in identifying the presence of organism is 12.67%. (Table 7)

Table 7: Distribution of the cases on the basis of presence of organisms on microscopy of the smears

Pathology	Organisms identified on smear	No Organism seen on Smear
Perforated appendicitis	10 (13.33%)	65 (86.33%)
Non-perforated appendicitis	9 (12%)	66 (88%)
Total	19 (12.67%)	131 (87.33%)

Culture report and implications:

The pus aspirates from the appendicular stump was cultured in the routine culture media. Organisms were identified in 44 cases (Table 8) whereas no growth in culture medium was noted in 28 cases.

Table 8: Distribution of cases on the basis of organisms identified on culture

Culture pathogen	Perforated appendicitis	Non perforated appendicitis
E.Coli	14	3
Pseudomonas	5	0
Klebsiella	6	0
Acinetobactor	10	0
Others	6	0
Total	41	3

Antibiotic sensitivity of the pus aspirate was analysed there was no consistent pattern of the antibiotic sensitivity which can give conclusive results.

II. Discussion

Acute appendicitis is most common surgical emergency. Its clinical profile determines the need for emergent operative intervention. The preoperative symptom duration intraoperative findings are direct determinants of patient outcome.

Age group

Appendicitis is considered as a disease of adolescent age groups. In the present study, maximum no of patients belong to 2nd or 3rd decade of life (age group of 20-29 had 22.67% of patients and 30-39 had 18.67% of patients) 13% of patients were from age group of 11-20 & 7% of the study population belong to the age group of more than 70 years of age. In comparison with the study done by Hale et al where median age was 23 years the results of our study are comparable. (4) (2)

Sex

It affects young adult male population more as compared to feamels. 63.33% of the patients in the study were males. 36.67% of patients were females in the study. In the study proposed by Hale Et al 64% of the population was males and 36% were females (4) Similarly as per the study done by Hale et al (4) Females had a significantly higher rate of normal appendices (19% vs. 9%) and a lower rate of perforation (18% vs. 23%) Such an observation is not consistent with our study.

Symptom Duration

Duration of symptoms i.e. abdominal pain, vomiting etc. can vary from less than 24 hrs. to more than 7 days in patients with symptom duration less than 2 days maximum had acute inflamed but non perforated appendicitis. (78.4% amongst patients with symptom duration upto 2 days). Patients with long duration symptoms who remain unattended untreated presents with signs of peritonitis (local or generalized) and sepsis. Patients who had perforated appendicitis when analyzed they were found to have symptom duration more frequently ranging from 3-5 days (34 out of 75 i.e. 45.33%) and 6-7 days (20 out of 75 i.e. 26.67%) These observation are consistent with the study done by Korner et al which concluded that patients with appendicular perforation has higher symptom onset to presentation duration.

Similarly in a study conducted by David Olick et al patients with non-perforated appendicitis reported an average of 22 hours of symptoms prior to presentation to the hospital, while patients with perforated appendicitis reported an average of 57 hours. (5) Results of our study are comparable to both these studies described in literature.

Symptomatology

Fever and vomiting are present in almost equal number of patients in perforated as well as non-perforated appendicitis. 115 out of 150 patients in the study presented with signs of localized peritonitis, 64 amongst them had perforated appendicitis (55.65%) Generalized peritonitis was seen in 47 patients, 36 out of them had perforated appendicitis (76.59%) which suggest a possibility of complicated appendicitis.

Scoring system

Alvarado Scoring system was used in the study population. A very small number of patients have Alvarado score between 4, 5 (3.33%). This indicates possibility of appendicitis 40% of the patients have the score 6 or 7. This represents high likelihood for appendicitis. 56.66% of patients had the Alvarado score as 8 or 9. A high Alvarado Score amongst the study group indicates complicated, perforated appendicitis. (6) The difference in the number of subjects having higher Alvarado's score between pts having perforated and non-perforated appendicitis was found to be statistically significant. (p value 0.038) That implies that patients with perforated appendicitis always has significantly high Alvarado score. (4,6,7)

Cultures and Antibiotic Sensitivity

Pus aspirates were sent for smear microscopy and culture sensitivity Diagnostic yield of the smear microscopy in identifying the presence of organism is 12.66% this may be attributed to the presence of pus cells and no organisms in the aspirates. Hence smear microscopy may not guide the antibiotic in all cases (8). The pus aspirates were subsequently cultured. The culture could isolate organisms in 38.88% of cases. The organisms isolated include Escherichia Coli (41.46%) pseudomonas (12.19%), klebsiella (14.63%) Acinetobactor (24.39%) , others (14.63%) In the available literature in the study done by Perovic Z. Positive cultures were obtained from peritoneal swabs in in (57%), of which all had pure growth of aerobes (Escherichia coli and Pseudomonas aeruginosa, mixed or pure). (9)

Histopathological Findings

Histologically 81.33% of the patients had acute inflamed appendicitis 11.33% patients had suppurative appendicitis 7.33% had gangrenous appendicitis Gangrenous and suppurative appendicitis was statistically in higher number of patients in perforated group than in Non-perforated group. These features coincide with the clinical profile of the patients in our study.

Antibiotic Protocol and Its Change

Treatment of appendicitis with antibiotic is as per the severity of the disease and the organisms responsible (7) Patients who have mild appendicitis on intraoperative evaluation were given Ciprofloxacin along with metronidazole. Moderate to severe appendicitis patients were subjected to III generation cephalosporin along with aminoglycoside (garamycin or amikacin) with metronidazole patients who have complicated appendicitis like perforated ones or in presence of gross intra-abdominal sepsis choice of antibiotic Cefrixone / ceftriaxone Sulbactam / Piperacillin tazobactam with amikacin with metronidazole.

In the present study amongst the perforated group (N= 75) 8% patients were treated with Cifran + metronidazole 66% treated with III generation cephalosporin + amikacin + metronidazole 25.33% treated with Piperacillin Tazobactum + amikacin + Metronidazole

In the present study amongst the Non perforated group (N= 75)

33% were treated with Cifran + metronidazole

60% treated with III generation cephalosporin + amikacin + metronidazole

6.66% treated with Piperacillin Tazobactum + amikacin + Metronidazole

Multidrug therapy is treatment of choice. A study done by Nadler Et al suggested a single drug higher antibiotic therapy for complicated appendicitis, but such a step lead to increased wound infection in our set of patients. (10)

The duration of antibiotic should be 3-5 days in non-perforated group where as it is 7 – 9 days in perforated group. (11)

III. Conclusion

Perforated appendicitis can be distinguished from non-perforated appendicitis based on admission factors. Appendicitis who present with pain of two or more days duration, have a much higher incidence of perforation. Alvarado score is best preoperative determinant of appendicitis and can predict the likelihood of perforation in select cases. Management of patients with either very high or very low scores can proceed more expeditiously and with less expense. Ultrasound coupled with accurate clinical examination increases diagnostic accuracy of appendicitis, its complications and perforated nature. Computed tomography frequently changes

management if the clinical diagnosis is indeterminate and is also important to determine the extent and nature of disease in perforated appendicitis. McBurneys incision is the preferred one in maximum no of cases of appendicitis, even in perforated cases with minimal contamination. Midline approach should be considered in severe complicated appendicitis with perforation with moderate to severe contamination. Fast and adequate surgical intervention followed by adequate antibiotic therapy successfully resolve the cases of perforated appendicitis. Perforation of appendix is associated with mild contamination in most of the cases but can be severe in gross peritonitis with perforation. Appendectomy is the procedure of choice even in perforated appendicitis if base of caecum is healthy. Patient with associated caecal involvement and gross contamination require local resection, hemi-colectomy or exteriorization. Hospital stay is more in cases of perforated appendicitis as compared to non-perforated group. Complications like wound infection, Burst abdomen, Post-operative collection / ileus are more with perforated group then non-perforated.

Antibiotic selection should be based on following criteria.

- Clinical parameters of grade of intra-abdominal sepsis
- Intraoperative contamination
- Procedure done

Ciprofloxacin (Fluroquinolones) with Metronidazole for mild appendicitis with no contamination. A combination regimen of third generation cephalosporin (Cefotaxim / Ceftriaxone) combined with aminoglycoside and metronidazole for moderate to severe appendicitis with minimal contamination. A higher spectrum of antibiotic Like Piperacillin Tazobactam along with Aminoglycoside and metronidazole should be utilized in complicated appendicitis with perforation with significant contamination or evidence of intra-abdominal sepsis.

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