



STUDY OF SPECTRUM OF COMPLICATIONS OF ACUTE APPENDICITIS BY USING APPENDICITIS INFLAMMATORY RESPONSE SCORE (AIRS SCORE)

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ABSTRACT **INTRODUCTION:** Acute Appendicitis is a common surgical condition. Acute appendicitis can have mild to severe presentation and complications. Complications lead to significant morbidity and mortality. AIRS scoring is recent scoring system developed to stratify patients **MATERIALS AND METHODS:** 100 Patients presenting with right iliac fossa pain with other signs and symptoms suggestive of acute appendicitis and admitted in Bharati Hospital and research centre, Pune. **DISCUSSION:** In our study, out of 100 patients 75% of cases (31 out of 41 cases) were correctly grouped under advanced appendicitis and 88% of cases (52 out of 59 cases) were correctly grouped under observational and conservative management. AIRS scoring system is a simple scoring system and accurately stratifies the disease. **CONCLUSION:** Patients with complications stratified under high probability group will undergo surgical intervention. Patients with complications stratified under intermediate group with resolution of symptoms and signs can undergo conservative management. Those patients without resolution may be observed, with clinical examination and radiological investigations and surgical exploration later.

KEYWORDS : Acute Appendicitis, AIRS scoring, spectrum of acute appendicitis, complicated appendicitis.

INTRODUCTION:

Life time risk of acute appendicitis is 8.6% for males and 6.7% for females. Highest incidence being in second and third decade.¹ It is very common cause of acute abdomen. Acute Appendicitis as a pathology and appendicectomy as a treatment is quiet a underestimated situation. Acute appendicitis can have mild to severe presentation and complications. At times it can be life threatening and cause of high morbidity and mortality if not detected and treated on time.

Appendicitis inflammatory response score is most recent clinical scoring system in diagnosis of appendicitis.

Study of different spectrum of complications of acute appendicitis by using appendicitis inflammatory response score will help to find out early sign of complications, planning emergency treatment for better outcome. Individual factors may be weak discriminators but in conjunction, they have a high predictive value. Patients have various complications during the course of disease like abscess, appendicular lump² gangrene of appendix, perforation and peritonitis- localised or generalised, sepsis, adhesions, small bowel obstruction, cecal gangrene, faecal fistula and muocoele³ of appendix. These complications need to be evaluated, diagnosed preoperatively, intraoperatively during the course of disease by various methods and techniques.

AIM:

The aim is to study the spectrum of complications of acute appendicitis by using appendicitis inflammatory response score.

OBJECTIVES:-

- To assess the different complications such as appendicular abscess, appendicular lump, appendicular perforation, peritonitis and septicaemia with regard to appendicitis inflammatory response score.
- To correlate clinical diagnosis of complications with investigations modality.
- To formulate the plan for early detection of complication and its management for best outcome.

MATERIALS AND METHODS:-

- STUDY AREA:** Bharati hospital and research centre
- STUDY POPULATION:** 100 Patients presenting with right iliac

fossa pain with other signs and symptoms suggestive of acute appendicitis and admitted in Bharati Hospital and research centre, Pune from august 2018 to July 2020 will be included in the study.

- STUDY DESIGN:** Prospective observational study
- PERIOD OF STUDY:** 24 months

INCLUSION CRITERIA:-

Patient presenting with Right iliac fossa pain, vomiting and fever diagnosed as acute appendicitis.

EXCLUSION CRITERIA

Patient of chronic appendicitis.
Appendicular tumour.
Age < 18 years old

OBSERVATION AND RESULT:

In this study, out of hundred study population, 47% (47 out of 100) are males and 53% (53 out of 100) are females.

Majority of patients were in age group of 18 to 35 years. Incidence of the disease is very less in age groups of 55 to 75 as seen in this study.

Table - 1

Age group	Number of cases
18 to 25	42
25 to 35	29
35 to 45	9
45 to 55	13
55 to 65	3
65 to 75	3

Table - 3

	Light	Medium	Strong
Perforation	0	20	18
Abscess	0	12	0
Lump	21	25	0
Peritonitis	0	2	1
Septicaemia	0	0	1

Patients who presented with complaints, were evaluated and 64% (64 out of 100) were found to have vomiting and 36% (36 out of 100) were

not found to have vomiting.

Table - 2

vomiting	present	absent
Number of patients	64%	36%

All the patients presented to emergency department, presented with pain in right lower abdomen. In patients who were diagnosed with perforation, 20 (20 out of 100) were found to have medium response and 18% (18 out of 100) were found to have strong response. In patients diagnosed to have abscess, 12 were found to have medium response. In patients diagnosed to have lump, 21% (21 out of 100) were found to have light response and 25 were found to have medium response. In patients diagnosed with peritonitis, 2 had medium response and 1 strong response.

In patients who presented to emergency department, 43% (43 out of 100) had fever and 55% (55 out of 100) did not have fever.

Out of total patients studied, 82% (82 out of 100) were found to have neutrophil count between 70-84% and 18% (18 of 100) were found to have count more than 85%. All the patients who had neutrophil count more than 85% were found to have counts more than 15,000.

C reactive protein is measured in all the patients on admission. C reactive protein is more than 50 g/dl in most of the cases of perforation, peritonitis, septicaemia and in some cases of lump and abscess. This shows there is overlap of high levels of c reactive protein indicating active infection in cases of appendicular lump and abscess. High levels of c reactive protein are seen in most cases of perforation, septicaemia and peritonitis.

Table-4

Complication	C -reactive protein <50g/dl	>50 g/dl
Perforation	4	34
Abscess	8	5
Lump	43	2
Peritonitis	0	3
Septicaemia	0	1

Patients were evaluated according to the AIRS scoring, and the patients are stratified according to their scores.

Table-5

Score	AIRS
0-4	LOW PROBABILITY, OUTPATIENT FOLLOW UP
5-8	INDETERMINATE GROUP, ACTIVE OBSERVATION OR DIAGNOSTIC LAPROSCOPY.
9-12	HIGH PROBABILITY. SURGICAL EXPLORATION.

Patients who satisfy the inclusion criteria, were scored initially and investigated. They were diagnosed to have complications during investigations, operative procedure with confirmation by histopathological diagnosis.

Out of 100 patients, 46 patients diagnosed to have lump. Patients with AIRS score between 5-8 were 44 and patients with score between 9-12 were 2. Most of the patients were managed conservatively and were discharged. One of them presented with abscess formation and obstruction. Hence underwent emergency appendectomy by lower midline incision and right hemi colectomy respectively.

Among 100 patients, 37 were found to have perforation. Patients with AIRS score between 5-8 were about 10 and score above 9 were about 27. All of the patients were operated and diagnosis was confirmed by histopathology.

Out of 100 patients, 13 patients diagnosed were diagnosed to have abscess. Patients with score between 5-8 were 8 and with score between 9-12 were 5. Out of 13 patients, 7 patients were also found to have perforation associated with abscess formation. All the 7 patients underwent appendectomy. Out of 7, 5 were found to have AIRS >9 and 2 between score of 5-8.

DISCUSSION

Acute appendicitis is one of the common cause of patients presenting

to emergency department with abdominal pain. Incidence of appendicitis is more in newly industrialized countries, compared to western countries where there has been decreasing trendⁱ. Incidence of appendicitis differs from region to region and differs in terms of sex, age, race, ethnicity, seasonal variations and diet modifications^{vi}. Females are more affected than males.^{vii}

Lifetime risk of appendicitis is 8.6% in males and 6.9% in females. Yearly incidence of acute appendicitis is between 110 to 140 per 100,000. Its highest incidence in patients 13 to 40 years of age. Incidence of non perforated appendix is most common in age group of 18 to 30 years.^{viii}

Patients present with wide variety of complications like perforation, abscess, peritonitis, gangrene and lump. Delayed presentation and diagnosis leads to increased morbidity and mortality. There is need for early diagnosis, intervention and treatment. Hence various scoring systems were proposed to understand the severity of the disease.

Acute appendicitis present with symptoms like anorexia, fever, nausea, vomiting and abdominal pain. On clinical examination, tachycardia, rebound tenderness with various signs were elicited which give idea about position of appendix and correlation of clinical symptoms along with provisional diagnosis. Routine investigations like haemogram reveal TLC counts, which give idea about the inflammatory status. TLC count more than 9400 has sensitivity of 76% and specificity of 65%. However low TLC counts does not exclude perforation and impending sepsis. Hence inflammatory markers, play an important role in the diagnosis of the disease. CRP and procalcitonin are important inflammatory markers useful in diagnosing and excluding complications of appendicitis. CRP has positive predictive value of 48% and procalcitonin has positive predictive value of 73%. High value of CRP, is observed in cases with perforation. CRP also distinguishes between phlegmatous and perforated appendicitis. It reduces negative appendectomy. Even though use of clinical acumen is vital, use of inflammatory markers with high discriminatory power are very useful in diagnosing the stage of disease and intervention.

Demonstration of appendix measuring <5 mm in diameter excludes, diagnosis of acute appendicitis. Ultrasonography is an very useful radiological investigation and most commonly performed for diagnosis in acute appendicitis, because of feasibility and less cost. In a study conducted, of systemic review and meta analysis of studies, ultrasonography showed sensitivity of 91% and specificity of 97%. Positive predictive value and negative predictive value are 91% and 94% respectively^{ix}. Ultrasonography is useful first diagnostic investigation with an experienced radiologist.

CT abdomen pelvis is a better investigation but usually avoided because of higher exposure and more cost. CT scan does give advantage over ultrasonography, in visualization of appendix and various complications including, inflammation, peri appendicular fat stranding, thickened mesoappendix, periappendiceal phlegmon, and free fluid. Various contrast and non contrast studies showed 92% to 97% sensitivity and 85% to 94% specificity. CT scan has lowered negative appendectomy to significant extent. Another study by kollár et al, concluded that use of CT scan judiciously is useful in diagnosis for patients belonging to medium category.^x

Various clinical scoring systems were introduced, helping in diagnosis, intervention and treatment of acute appendicitis. First clinical scoring system introduced in 1984 was alvarado score for appendicitis and it later modified in 1994. Alvarado scoring was based on retrospective study of cases admitted and various factors were derived from the study. It included symptoms signs and biochemical investigations. Various other studies were also introduced like ohmann score, tzankis scoring system and ripasa scoring system.

AIRS scoring system was developed by Walters and team in 2008. They have taken into consideration, history, clinical findings, and results of laboratory tests. These parameters were recorded for 502 patients who are admitted with suspicion of appendicitis to the hospitals in towns of Jonkoping and Eksjo between October 1992 and December 1993 and 249 patients admitted to the hospitals in Eksjo, Motala, and in Kalmar during a 3-month period in 1997 are included.

AIRS score was designed after collecting data from patients admitted

for suspected appendicitis, prospectively. As compared to other scoring systems, in AIRS score, was formulated after studying the patients and deriving factors from the patients prospectively. Variables in various studies and those thought to have high discriminating power were used as variables and score was constructed. Patients are graded and 3 sets of patients are identified, the patients who can be discharged with an outpatient follow-up having high sensitivity for appendicitis, indeterminate group of patients who need additional diagnostic workup and observation. Third group with a high specificity for appendicitis who can be operated on without further examination.

Scoring system results showed that it could classify 73% of non appendicitis patients to the low-probability group and 67% of the patients with advanced appendicitis to high-probability group with high accuracy. 37% of the patients remained in the indeterminate group. This scoring system has high specificity and classified advanced appendicitis to the high probability group. Because of higher negative predicative rate, patients without appendicitis are identified.^{xi} The likely use of investigations is vastly reduced in cases of low probable group.^{xix}

AIRS scoring is an simple scoring system which is feasible in suspected appendicitis.^{xiv} AIRS scoring system used inflammatory markers with high discriminating power and avoided variables with low discrimination. Hence the ability to correctly classify appendicitis has largely been enhanced^{xv}. This is an advantage of this scoring system. It out powers Alvarado scoring system^{xvi} in groups belonging to elderly, women and advanced appendicitis.^{xvii} Study by risk stratification showed that AIRS scoring, reduces negative appendectomy^{xviii}. New inflammatory markers like IL-6, chemokine ligand-8, chemokine C-C motif ligand -2, serum amyloid A, matrix metalloproteinase -9 and myeloperoxidase were used to compare existing predictors and found not to have higher discrimination ability.^{xix}

In our study, 47%, are males and 53 % are females comparable with other studies, showing higher incidence in females. In our study, most of the patients it is, 71% are comprised of age group between 18 to 35. This group comprises of all complications like perforation, abscess, lump formation and peritonitis. Remaining 29% are compromised of age group above 35 years and incidence of complications decreases with age.

Patients present to emergency department at various stages of appendicitis. Various factors play a role in the stage of disease like, onset of disease, presentation to hospital, dietary factors, infections-bacterial & viral, lymphadenopathy and general condition of the patient.

Out of 100 patients, 64 patients developed vomiting and 36 patients didn't have vomiting. Vomiting occurs because of peritoneal irritation, pain and increased intraluminal pressure. Pain in right lower quadrant was present in all the patients presenting to emergency (100 out of 100). Pain is initially present in umbilical region and then localised to right lower abdomen. This occurs because of involvement of visceral afferent thoracic nerves at first and becomes localized as peritoneum is inflamed. Fever is present in about 43% of patients. It signifies the active infection and inflammation.

Rebound tenderness is elicited in all the hundred patients presenting to emergency department. We observed that, 38 out of 100 patients were diagnosed to have perforation, 28 patients had strong response and 10 patients had medium response. All the 12 patients diagnosed to have abscess had medium response. In patients who were diagnosed to have lump, 21 had light response and 25 had medium response. All patients of peritonitis and septicaemia had strong response. From the information obtained we can infer that; local peritoneal irritation is more in cases of advanced appendicitis. Lump formation occurs to contain infection from spreading. Local peritoneal irritation is less in cases of lump formation.

Polymorphonuclear leucocytes > 85% and WBC count > 15,000 was seen in 18%(18 out of 100) patients and remaining 72% had polymorphonuclear leucocyte count between 70 to 85% and WBC count between 10,000 to 14,999. It signifies the infection in all the patients at various stages in the patients presenting with complicated appendicitis.

C reactive protein is more than 50 g/dl in most of the cases of

perforation, peritonitis, septicaemia and in some cases of lump and abscess. This shows there is overlap of high levels of c reactive protein indicating active infection in cases of appendicular lump and abscess. A study by Sheikh Muzamil Shafi Et al showed that percentage of neutrophil count, WBC count and C reactive protein have specificity up to 88% and positive predictive value up to 98% in conjunction.^{xx} In a study conducted by Mazhar H Raja ET al, C reactive protein more than 50 g/dl is found in inflammatory appendicitis and high levels of CRP, are found in perforated, gangrenous and necrotizing appendicitis.^{xxi}

Out of 46 patients diagnosed to have lump, AIRS score between 5-8 were 44 and patients with score between 9-12 were 2. Most of the patients were managed conservatively and were discharged. One of them presented with abscess formation and other intestinal obstruction. Hence underwent emergency appendectomy by lower midline incision and right hemi colectomy respectively. A study conducted by Malik AA Et al, Conservative management is the choice of management in cases with lump.^{xxii} Most of patients recover with antibiotics and ochsner sheren regimen.

Among 100 patients, 37 were found to have perforation. Patients with AIRS score between 5-8 were about 10 and score above 9 were about 27. All of the patients were operated and diagnosis was confirmed by histopathology. Out of 100 patients, 13 patients diagnosed were diagnosed to have abscess. Patients with score between 5-8 were 8 and with score between 9-12 were 5. Out of 13 patients, 7 patients were also found to have perforation associated with abscess formation. All the 7 patients underwent appendectomy. Out of 7, 5 were found to have AIRS >9 and 2 between score of 5-8.

AIRS scoring system classified all the complications according to the severity of disease as per the above observation. This system helps in classifying patients who need out patient management to low probability group, observation or diagnostic laparoscopy for intermediate group and surgery in high probability group. In our study, advanced appendicitis like perforation, peritonitis and septicaemia were grouped in high probability and patients with abscess and lump who need conservative management. In our study, 75% of cases (31 out of 41 cases) were correctly grouped under advanced appendicitis and 88% of cases (52 out of 59 cases) were correctly grouped under observational and conservative management.

Overall, AIRS scoring system is a simple, feasible cost-efficient scoring system useful in diagnosis, intervention and observation during hospital stay. It stratifies patients according to severity of disease. In our study it confirms that complications of appendicitis were also stratified and helps in the treatment of disease. Patients could be reassessed anytime during conservative management and decision can be taken anytime to perform surgery. Score > 9, indicates the need for surgery and active intervention. For cases which fall within intermediate group should be followed up with clinical examination, radiological investigations and expertise in field for doing a conservative management or active intervention.

CONCLUSION:

AIRS scoring is a simple system useful for stratifying the patients presenting with complications of acute appendicitis. Patients with complications stratified under high probability group will undergo surgical intervention. Patients with complications stratified under intermediate group with resolution of symptoms and signs can undergo conservative management. Those patients without resolution may be observed, with clinical examination and radiological investigations and surgical exploration later.

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