



ACCURACY OF ALVARADO SCORING SYSTEM IN DIAGNOSIS OF ACUTE APPENDICITIS AT TERTIARY CARE HOSPITAL IN RAYALASEEMA REGION

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KEYWORDS :

INTRODUCTION

Appendicitis is one of the most common surgical emergencies in contemporary medicine. Following appendectomy mortality is 0-0.24%; Morbidity is 5.2% - 11.3%, it correlates with the presence of perforation and severity of peritonitis at the time of operation.

Since Reginald Fitz¹ first described Acute Appendicitis in 1886, it has been recognized as one of the most common causes of acute abdomen worldwide. Appendicitis occurs most commonly in the second & third decades of life, with a peak in 10 to 20 years old age group with male preponderance.

The life time incidence being 8.6% in males compared to 6.7% for females².

The chance of undergoing appendectomy during a lifetime is higher, 23.1% in females and 12% in males³.

The discrepancy between frequency of appendectomy and acute appendicitis reflects 'number the of incidental and unnecessary appendectomies. The overall incidence of acute appendicitis has decreased by 40% females in and 34% in males in the period from 1975 to 1994 in the United Kingdom⁴.

With a good history, physical examination and few laboratory tests, if any are needed to diagnosis appendicitis. However, laboratory tests are useful for excluding other causes of symptoms. Thus the patients of acute appendicitis due to their subtle early signs and symptoms often pose a diagnosis challenge and can test the accuracy of an astute clinician especially if presented early and/or with equivocal signs. Even with the aid of some special investigations like ultrasound and CT false positive diagnosis ranges between 20 and 44%⁵.

To minimize this diagnostic dilemma, a number of scoring systems have been devised as aids to the early diagnosis of acute appendicitis. Alvarado, Teicher, Leindberg, Christian Fenyo, to name a few of these Alvarado score remains the most widely accepted one.

The Alvarado scoring system⁶ described by Alvarado in 1986 was designed to facilitate early diagnosis, and to reduce negative appendectomy rate without increasing morbidity and mortality. This scoring system is based on three symptoms, three signs and two laboratory findings. Each is scored 1 or 2 making the total score 10⁷. The Alvarado score was modified later by Kalam in 1988 which considered only one laboratory finding and a total score of 9 instead of 10.

The present study was undertaken to evaluate the accuracy of the Alvarado scoring system in 150 patients who were admitted with a presumptive diagnosis of acute appendicitis in a tertiary referral hospital who subsequently underwent appendectomy. The accuracy of the scoring system was studied by analyzing the sensitivity, specificity, positive and negative predictive values and percentage of true and false positive.

AIMS AND OBJECTIVES

The study was carried out with the following objectives:

1. To study 150 patients of suspected appendicitis using Alvarado scoring system.
2. To study the accuracy of Alvarado scoring system in diagnosis of Appendicitis by using sensitivity, specificity, positive and negative predictive values and percentage of positive and false negative.

METHODOLOGY

This is a clinical study comprising of 150 patients of suspected appendicitis who attended Surgical OPD and Emergency in Government General Hospital, Kurnool. The decision either for appendectomy or conservative management was taken by the operating surgeon irrespective of the score calculated by the observer.

INCLUSION CRITERIA:

1. Age above 14 years
2. Acute abdominal pain clinically presumed to be of appendicular origin who subsequently underwent appendectomy.

EXCLUSION CRITERIA:

1. Age less than 14 years.
2. Palpable mass on abdominal examination.
3. Signs of generalized peritonitis
4. Patients who were not taken up for appendectomy.
5. Patients with obstetric complaints.

COLLECTION OF DATA:

The data from 150 patients were collected over a period of 2 years.

METHOD OF STUDY:

All patients with presumptive diagnosis of acute appendicitis were admitted.

After admission detailed history was taken regarding presenting complaints, their duration, severity, sequence of onset of symptoms, mode of onset, progression, change in the pattern at the time of presentation and any atypical symptoms.

Enquiry was made into family history suggestive of appendicitis, menstrual and obstetric history and past history of appendicitis.

A careful and detailed abdominal examination of each patient made including local temperature, guarding/rigidity, site of maximum tenderness any swelling or mass formation, rebound tenderness, Rovsing's sign, Psoas sign, Obturator sign, Baldwin's sign and also per rectal examination is made to look for pelvic tenderness or mass formation.

Routine blood and urine investigations were done.

All patients were subjected to ultrasound examination by a qualified radiologist to exclude any other associated pathology and also to confirm the diagnosis in doubtful cases.

The clinical presentation of all these patients was studied with reference to the Alvarado scoring system.

Symptoms: *Migratory RIF pain, Nausea / vomiting, Anorexia.*

Signs: RIF tenderness, Rebound tenderness in RIF, Fever .

Laboratory tests : Total leucocyte count, Differential leukocyte count. Depending on the reference scale below, they were scored as per the Alvarado scoring system.

TABLE 1 Alvarado scoring system

Features	Score
Shifting of pain to right lower quadrant	1
Anorexia	1
Nausea, vomiting	1
Tenderness in right lower quadrant	2
Rebound tenderness	1
Elevation of temperature	1
Leukocytosis	2
Shift to left	1
TOTAL	10

Thus, all the 150 patients were admitted, evaluated and scored on the basis of the Alvarado scoring system and subsequently underwent appendicectomy as decided by the operating surgeon irrespective of their scores. The patients who did not undergo appendicectomy had either an alternate diagnosis or were managed conservatively.

The operated patients had their appendix evaluated by histopathological examination(HPE). The HPE results were subsequently collected and compared with the respective scores.

Negative Appendicectomy was defined when an appendix removed at surgery did not show evidence of appendicitis on HPE.

SCORE ANALYSIS

The scores were analysed by evaluating the following sensitivity, specificity, positive predictive value, negative predictive value, percentage of false positives and percentage of false negatives.

The scores were further analysed by broadly dividing them into 2 categories: sex wise males and females; those who scored more than or equal to 7 and those who scored less than or equal to 6. This categorization was done as it was done originally by Alvarado and in all subsequent studies.

ANALYSIS DESIGN

In the present study the following statistical methods were employed for the score analysis from the collected data:

- Simple frequency distribution
- cross tabulations
- Sensitivity, specificity, false Positive and false Negative.

OBSERVATIONS AND RESULTS

A total of 150 cases were studied. All the cases presented with presumptive symptoms of appendicitis were admitted and evaluated according to Alvarado scoring system. They were grouped into three categories.

- Group-1 contains patients having alvarado score 1-4.
- Group-2 contains patients having alvarado score of 5-6 and
- Group-3 contains patients having alvarado Score more than 7

RESULTS OF OUR STUDY ARE AS FOLLOWS

Group – I: In this group 35 patients were admitted treated conservatively, discharged after 2-3 days and followed up to 6 months and none of them required surgery.

Group – II : In this group 45 patients were admitted, 25 were operated upon high clinical suspicion of acute appendicitis. Rest were treated conservatively with antibiotics and discharged after 3 to 4 days and followed up to 6 months and none of them required surgery.. 14 out of 25 who underwent appendectomy had acute appendicitis. The negative appendicectomy rate of patients with scores < 6 is 40%.

Group – III : This Group includes 70 patients of which 68 patients underwent emergency appendicectomy.

Out of the 29 female patients 2 patients had missed periods and on ultrasonography of abdomen ruptured ectopic pregnancy was diagnosed and they were referred to obstetric department. Remaining 27 patients underwent Emergency appendicectomy.

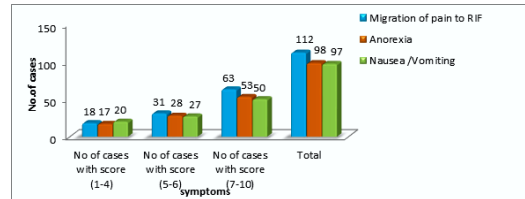
58 cases out of 68 cases had acute appendicitis. The sensitivity of the Alvarado score of > 7 was 86.76% (proportion of true positive).

The sensitivity was highest among males i.e., 90.2% while in females, it was 81.4%. Negative appendicectomy rate was highest among the females (18.5%), where as in case of males it was 10%.

INTERPRETATION :

In our study there were 89 (59.9%) male patients, 61 (40.6%) female.

GRAPH: SHOWING DISTRIBUTION OF SYMPTOMS



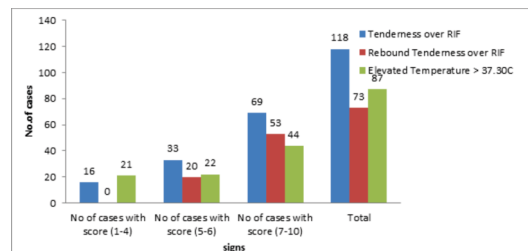
The common symptoms seen in the present study were as follows

- migrating pain (74.6%),
- anorexia(65.3%) and
- nausea and vomiting (64.6%).

All the patients with acute appendicitis had pain abdomen and most of the patients had pain in the right iliac fossa. Even though many of the patients presented with pain in the right iliac fossa, migrating pain was noticed in 112 out of 150 cases.

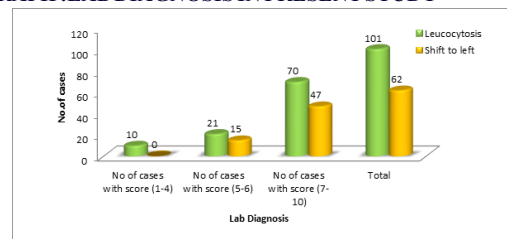
Anorexia was seen in 65% of the cases, while nausea is less constant is seen in 64% of the cases The most common sign seen in the present study was tenderness over RIF (78.6%), next to rebound tenderness over RIF (48.6%) and elevated temperature > 37.30 C (43.2%).

GRAPH : Distribution OF SIGNS



The lab diagnosis leucocytosis seen in present study is 67.3% and shift to left present in 47.1% patients.

GRAPH : LAB DIAGNOSIS IN PRESENT STUDY



DISCUSSION

Acute appendicitis is the most common cause of an 'acute abdomen' in young adults and associated symptoms and signs have become a paradigm for clinical teaching.

Although surgeons have been confronting acute appendicitis as a clinical entity, an accurate preoperative diagnosis remains difficult as it mimics other diseases. Although there is much improvement in gastroenterology but no major improvement in the diagnostic accuracy of acute appendicitis which ranges from 25 to 90%.

To minimize the confusion and delay in diagnosis, various scoring systems came into practice of which Alvarado scoring system is most commonly practiced. the reliability of Alvarado scoring was assessed by calculating sensitivity, negative appendicectomy rate (Proportion of operated patients having normal appendix removed).

In our study all the cases were evaluated according to Alvarado scoring system and treated according to it.

The Diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of appendectomy specimen.

INCIDENCE:

Addis and associates¹² estimated the incidence of acute appendicitis to be 11 cases per 10,000 population annually.

The life time risk for developing appendicitis is 8.6% for males and 6.7% for females Addiss DG, Shaffer N, Fowler BS Tauxe RV study.

SEX DISTRIBUTION:

In our study out of the 150 cases studied there are 89 male and 61 female patients, having a ratio of 3:2.

Kini et al (1950) gave an incidence of 4.21: 1 ratio of males to females, as suffering from acute appendicitis.

An analysis of 1,030 cases from the K.R.Hospital, Mysore shows 3.72:1 males to females suffering from Acute Appendicitis and the sex ratio is of the order of 19:5.

AGE DISTRIBUTION:

Our study found appendicitis to be more common in 3rd decade followed by 2nd decade, which constituted to be 37.3% and 30% respectively. The average mean age of presentation was found to be 25.46 years.

Lewis et al¹¹ (1975) in their study found that the 2nd and 3rd decade were the most common age groups for acute appendicitis

PAIN :

In this study, pain was present in almost all the patients which coincides with the figures of Hubbel, Barter, Solomon(1960). Most of the patients present with pain in RIF but migrating pain is present in 74.6% patients.

VOMITING :

figures of Hubbel, Barter, Solomon (1960) are compared with this study. In our study vomiting is seen in 64.6% of patients

ANOREXIA:

Anorexia was seen in 65.3% of the cases, while nausea was present in 64% of the cases. This study is comparable to Lewis et al¹¹.

FEVER:

Fever is uncommonly encountered among patients in our study, being present in 43.2%, except in cases of abscess and generalized peritonitis. Berry et al⁷ found that temperature elevation is rare and changes of greater magnitude indicate that the complication has occurred or some other diagnosis should be considered.

SITE OF TENDERNESS:

In our study most of the patients have tenderness in Right Iliac Fossa out of 150 patients 118 have Right Iliac Fossa tenderness which comprises 78.6% in the Group-3 i.e., Score more than 7, sixty nine patients out of 70 had tenderness in Right Iliac Fossa 99.99%. Mcburney's tenderness noticed in 102 patients out of 115 in the Group-2 and Group-3.

In 1899 Charles Mcburney of New York illustrated that exact locality of maximum tenderness is at Mcburney's point.

Rebound Tenderness:

This is the most specific sign in the acute appendicitis. In our study Group-1 patient showed rebound tenderness. In Group-2 44.4% patients have Rebound tenderness. In the Group-3, 75.75% patients had Rebound Tenderness.

Leukocytosis and Shift to Left:

In acute appendicitis total count and differential count are necessary in the diagnosis of acute appendicitis. Total count of more than 14000 and Neutrophilia with shift to left is seen in acute appendicitis.

In our study 67.3% patients out showed Leukocytosis. In Group-3,

100% patients showed Leukocytosis. In our study 47.1% patients showed shift to left I differential leucocyte count.

Ohmann in 1995¹⁰ conducted a prospective study involving 1254 patients to evaluate the performance of different diagnostic scoring systems for acute appendicitis on one data base using standardized criteria and to compare the results with published data.

The authors believed that an adequate scoring system should fulfill the following criteria:

1. A negative appendectomy rate of 15% or less
2. A potential perforation rate of 35% or less
3. A missed perforation rate of 15% or less
4. A missed appendicitis rate of 5% or less.

A revaluation of the published data showed that the Alvarado scoring system is the only one that fulfilled all four of these criteria. And the Lindberg, Fenyo and the Christian scores fulfilled two criteria each. Since then many studies have been undertaken to determine the diagnostic accuracy of the Alvarado scoring system.

Chan and Teo³ did a retrospective study on 148 patients to assess the accuracy of Alvarado score in predicting appendicitis for patients with right iliac fossa pain. The positive and negative predictive values of Alvarado scores of 7 or more were 77% and 97.6% respectively. Thus it was concluded that the Alvarado score is a useful tool of appendicitis especially at both ends of the scale.

Patients with score a 1 to 4 were not considered for surgery, score 5-6 were Observed, scores above 7 were operated.

ALVARADO SCORING SYSTEM – NEGATIVE APPENDECTOMY RATE

The incidence of negative appendectomies was found to have significantly reduced on implementing Alvarado scoring system in diagnosing acute appendicitis¹.

But in females the sensitivity rate is 81.4% and negative appendectomy rates were quite high in groups with score of 5 to 6 as well as 7 to 10. The negative appendectomy rate in the above groups being 45.5% and 18.5% respectively.

Owen and Williams⁸ assessed 215 patients over one year period and concluded that in comparison, the high negative appendectomy rate during the year prior to the study was reduced considerably using the Alvarado scoring system without increasing morbidity and mortality. Bhattacharjee⁹ in his study had a negative appendectomy-rate of 22%.

ALVARADO SCORING SYSTEM ULTRASOUND COMPARISON

Though ultrasound scan was not routinely used in the diagnosis of acute appendicitis it is of significant importance especially when the diagnosis is in doubt.

ALVARADO SCORING SYSTEM - IN COMBINATION WITH LAPAROSCOPY

Since the false positive rate in females was high using the scoring system, studies were conducted evaluating the combined use of modified Alvarado scores with selective laparoscopy in adult females.

SUMMARY

The study was conducted at Government General Hospital, Kurnool there are 150 cases included in our study.

Acute appendicitis is most common during 3rd decade followed by 2nd decade.

Appendicitis is slightly more common in male than female 3:2.

Most of the patients present with migratory pain (74%). Next common symptoms are Anorexia 65% and Vomiting (64.6%).

Most common sign is tenderness in Right Iliac fossa (78.6%). Rebound tenderness is seen in 48.6%.

Leukocytosis is seen in 67.3% patients. In Group-3 most of the patients presented with tenderness (78.6%), Rebound tenderness 48.6% Leukocytosis 47.1%.

Alvarado scoring system could thus be considered as a simple, practical, and satisfactory diagnostic tool for the early diagnosis of acute appendicitis especially in men.

In females however, the false positive rate is found to be high, in certain cases unacceptably high. It is extremely sensitive at both the ends of the score spectrum - improving the accuracy by reducing the negative appendectomy rate. It can be considered as a highly dependable aid which practically involves no cost.

The sensitivity of Alvarado scoring system may be further increased by selective use of ultrasonography or laparoscopy especially in females thereby reducing the incidence of negative appendectomies.

Though CT scan is most accurate and specific in equivocal cases, CT scan is not routinely used.

CONCLUSION

The study was conducted from November 2015 to October 2017 for the period of 24 months in Government General Hospital, Kurnoll there are 150 cases included in our study.

The following conclusions were drawn from present study.

- Acute appendicitis is most common during 3rd decade followed by 2nd decade.
- Appendicitis is slightly more common in male than female 3:2. . Males (60%) were predominant in present study.
- All patients presented with pain in the right lower quadrant of abdomen, lasting fewer than 7 days.
- Most common symptom is RIF pain
- Most common sign is tenderness in RIF.
- Rebound tenderness is most specific sign
- Alvarado scoring system is a cheap and quick tool to apply in emergency room
- Alvarado scoring system is more accurate in males when compared to females.
- Accuracy of Alvarado scoring system can be increased by Ultrasonography.
- Rate of negative appendectomy can be reduced by using Alvarado score
- High scores (7-9) in men is dependable in early diagnosis of acute appendicitis, whereas it is not so in case of females, because of other conditions mimicking appendicitis like pelvic inflammatory disease, ruptured ectopic pregnancy.
- Ultrasonography of abdomen is a useful tool in avoiding negative appendectomy rates particularly in females.

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