

Original Research Article

Assessment of the accuracy of using the combination of modified alvarado score and abdominal ultrasound in acute appendicitis

Anita Samraj, Dharun Kumar S.*

Department of General Surgery, Saveetha Medical College and Hospital Chennai, Tamil Nadu, India

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***Correspondence:**

Dr. Dharun Kumar S.,

E-mail: chinus.kumar9@gmail.com

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ABSTRACT

Background: Appendix is a worm shaped blind tube of varying length (2-25) cm opening into the caecum 2cm below the ileocaecal valve in posteromedial valve. It is the only organ in the body that has no constant position. Incidence of acute appendicitis parallels that of lymphoid development with peak incidence in early adulthood. It is rare before the age of two. Before puberty the incidence of acute appendicitis is equal in both sexes. But after puberty there is a slight male preponderance. The objective of this study was to evaluate assessment of accuracy of the combined use of modified Alvarado scoring system and ultrasound in the diagnosis of acute appendicitis.

Methods: Around 136 patient's acute appendicitis were subjected to estimation of total leucocyte count and plain x-ray abdomen after thorough history evaluation and clinical examination before surgery. Alvarado score was found in all cases. All of them were operated on the day of admission itself and preoperative findings were noted. All appendicectomy specimens were subjected to histopathological examination (HPE).

Results: Acute appendicitis is the most common surgical abdominal emergency in our hospital. Acute appendicitis is more common in males and the commonest age group affected is 21 - 30 years. Right iliac fossa pain is the most common presenting symptom followed by nausea/vomiting. In diagnosis of acute appendicitis Alvarado score has a high diagnostic value (82.5%).

Conclusions: The combined use of modified Alvarado score with ultrasonogram done in patients with equivocal or low Alvarado score is useful in identifying the missed-out cases thereby preventing diagnostic delay and its attendant complications. Appendices that appear to be normal on macroscopic inspection may show features of acute appendicitis on histopathologic examination.

Keywords: Acute appendicitis, Alvarado score, Histopathological examination, Ultrasonogram

INTRODUCTION

Acute appendicitis is the commonest cause of surgical emergency which needs early diagnosis and correct management.¹ Acute appendicitis and its complications continue to be a significant source of morbidity and mortality, so prompt recognition and proper treatment is essential. Acute appendicitis has usually been a clinical diagnosis. Around 6% of the population is believed to have appendicitis in their lifespan.² Appendix usually

referred as a vestigial organ with no known function is now considered as a specialized part of gastro intestinal tract with concentration of lymphoid tissue. It is an integral part of gut associated lymphoid tissue (GALT). Appendix is useful in reconstructive biliary, tubal and urological surgery. Negative appendicectomy therefore robs the patient of a useful asset and also has a morbidity of 15%.³ There are study shows Alvarado scoring system reduces the number of negative appendectomies patients' history and physical examination is very important for proper diagnosis.^{4,5}

The objective of this study was to evaluate assessment of accuracy of the combined use of modified Alvarado scoring system and ultrasound in the diagnosis of acute appendicitis. To analyse the incidence of acute appendicitis in our Hospital in relation to the total number of surgical emergencies and in relation to age group and sex. To analyse the usefulness of modified Alvarado Score as the prime diagnostic criteria in the diagnosis of acute appendicitis. To analyse the combined usefulness of modified Alvarado Score and ultrasonogram in the diagnosis of acute appendicitis.

METHODS

This study was conducted in our unit in Saveetha Medical College and Hospital between July 2015 and May 2016. The study was approved by Institutional ethical committee of Saveetha University reference no. 005/05/2015/IEC/SU.

Patients more than twelve years of age who were operated on the same day of admission for acute appendicitis were included.

Inclusion criteria

- Persons with an Alvarado score of > 7
- Persons with an Alvarado score of < 7 but with ultrasonogram findings suggestive of acute appendicitis
- Persons not satisfying above criteria but clinical features favouring acute appendicitis.

Exclusion criteria

- Persons less than twelve years of age
- Patients who were managed conservatively.

Total number of patients studied = 136.

All patients in the study were subjected to estimation of total leucocyte count and plain x-ray abdomen after thorough history evaluation and clinical examination. Alvarado score was found in all cases. Shift to left was not taken into consideration. Ultrasonogram was done in all patients. All of them were operated on the day of admission itself and preoperative findings were noted. All appendicectomy specimens were subjected to Histopathological examination (HPE). All cases were operated with clinical diagnosis irrespective of the Alvarado score and ultrasonogram findings and analyzed retrospectively with HPE report. Nearly 44% of emergency surgeries performed in our hospital during the study period were for the treatment of Acute Appendicitis.

RESULTS

Right iliac fossa pain was the most common symptom (97.8%), followed by nausea/vomiting (88.2%). Anorexia

is less common in adult population 54% as compared to 95% in paediatric population. Leucocytosis was present in 134 cases.

Table 1: Age wise sex distribution.

Age	Sex		Total
	M	F	
<20	26	13	39
20-30	29	20	49
30-40	20	14	34
40-50	2	5	7
>50	6	1	7
Total	83	53	136

Table 2: Signs and symptoms.

Signs and symptoms	Present/absent	Frequency	Percent
RIF pain	Present	133	97.8
	Absent	3	2.2
Nausea	Present	120	88.2
	Absent	16	11.8
Anorexia	Present	73	53.7
	Absent	63	46.3
RIF tenderness	Present	134	98.5
	Absent	2	1.5
Rebound tenderness	Present	124	91.2
	Absent	12	8.8
Leucocytosis	Present	126	92.6
	Absent	10	7.4
Temperature	Present	84	61.8
	Absent	52	38.2

Table 3: Alvarado Score.

Alvarado Score	Frequency	Percent
SCORE >7	106	77.9
SCORE <7	30	22.1
Total	136	100.0

Table 4: Histopathological examination and USG.

	Frequency	Percent
Positive	125	91.9
Negative	11	8.1
Positive	77	56.6
Negative	59	43.4
Total	136	100.0

Table 5: Alvarado score * HPE cross tabulation.

Score	HPE		Total
	Positive	Negative	
Alvarado Score >7	103	3	106
Alvarado Score <7	22	8	30
Total	125	11	136

Sensitivity: 82.4%; Specificity: 72.7%.

Table 6: USG * HPE cross tabulation.

USG	HPE		Total
	Positive	Negative	
Positive	73	4	77
Negative	52	7	59
Total	125	11	136

Sensitivity: 58.4%; Specificity: 63.6%.

Table 7: When both USG and Alvarado score used. New * HPE cross tabulation.

Combined	HPE		Total
	Positive	Negative	
Positive	120	7	127
Negative	5	4	9
Total	125	11	136

Sensitivity: 96%; specificity: 36.3%.

This study was conducted on 136 patients who underwent emergency appendectomy in Saveetha Medical College Hospital, Chennai, from May 2015 to July 2016 and the following conclusions were made.

- Acute appendicitis is the most common surgical abdominal emergency in our hospital.
- Acute appendicitis is more common in males and the commonest age group affected is 21 - 30 years.
- Right iliac fossa pain is the most common presenting symptom followed by nausea / vomiting.
- In diagnosis of acute appendicitis Alvarado score has a high diagnostic value (82.5%). Alvarado score is a noninvasive, safe diagnostic procedure, which is simple, fast, reliable and repeatable; it can be used in all conditions, without expensive and complicated supportive diagnostic methods. Alvarado score increases the diagnostic certainty of clinical examination in diagnosis of acute appendicitis.
- Combined use of modified Alvarado score with Ultrasonogram done in patients with equivocal or low Alvarado score is useful in identifying the missed-out cases thereby preventing diagnostic delay and its attendant complications viz, appendicular perforation and abscess formation.
- Appendices that appear to be normal on macroscopic inspection may show features of acute appendicitis on histopathologic examination.

DISCUSSION

Appendix is a worm shaped blind tube of varying length (2-25) cm opening into the caecum 2 cm below the ileocaecal valve in posteromedial valve. It is the only organ in the body that has no constant position. Its only constant feature is it arises from the site at which the three taenia coli coalesce. The overall rate of perforated appendicitis is 25.8% and so emergency appendectomy is the main modality of treatment of acute appendicitis for the known risk of progression to perforation. Patients less

than 5 years of age and older than 65 years of age have the highest rate of perforation (45 and 51% respectively).⁶

It has been found that late presentations are responsible for the majority of perforated appendices. There is no accurate way of determining when an appendix will rupture. Appendiceal rupture occurs most frequently distal to the point of luminal obstruction along the antimesenteric border of the appendix. Rupture should be suspected in the presence of high grade fever of 39°C (102°F) or more and an increased WBC count of 18000/mm³ or more. In the majority of cases, rupture is contained and patients display localised rebound tenderness. If the walling off process is ineffective in containing the rupture, Generalised peritonitis will be present. In 2 to 6% cases, a vague mass will be found on physical examination. This could represent a Phlegmon (matted loops of small bowel adherent to adjacent inflamed appendix) or a periappendiceal abscess. The ability to distinguish acute appendicitis with perforated appendicitis is on the basis of clinical findings. CT scan is beneficial in this setting.

Management of acute appendicitis

Well localised abscesses can be managed with percutaneous drainage with USG/CT guidance. Complex abscesses should be considered for surgical drainage. If operative drainage is required, it should be performed by an extraperitoneal approach with appendectomy reserved only for cases in which appendix is easily accessible. Otherwise interval appendectomy after 6 weeks following the acute event is the classical recommendation, for those patients treated non-operatively or with simple abscess drainage. Generalized peritonitis needs a laparotomy with drainage of abscess cavities and appendectomy with peritoneal lavage and drainage.

Management of appendicular mass

Occasionally, a walled off perforated appendix will form an inflammatory mass. Usually there is a history of 4 or 5 days of pain. The clinical features are a shifting temperature with an increased pulse rate. There is a tender mass in the right iliac fossa that can often also be palpated on rectal examination. However, there is no evidence of a generalized peritonitis, in that the rest of the abdomen is soft and bowel sounds are present. The WBC count is raised considerably. The conservative Ochsner-Sherren regimen is the standard line of management if appendicular mass is present. This is based on the concept that the inflammation is already localised and that inadvertent surgery is difficult and may be dangerous. It may be difficult to find the appendix and, may end up in complications like, a faecal fistula. For these reasons, it is wise to observe a conservative approach, but to be ready to operate should clinical deterioration occur. Careful monitoring of the patient's condition and the extent of the mass should be made, and

the abdomen regularly reexamined. It is helpful to mark the limits of mass on the abdominal wall using a skin pencil. A nasogastric tube, intravenous fluid and antibiotic therapy instigated. Temperature and pulse rate should be recorded 4 hourly and an input output record should be maintained. Clinically if patient is not improving or evidence of peritonitis is indication for early laparotomy.⁷ If improvement is there it is usually within 24-48 hours then the nasogastric tube can be removed and oral fluids introduced. Failure of the mass to resolve should raise the suspicion of a ileocaecal tuberculosis, carcinoma or Crohn's disease. Using this regime approximately 90% of cases resolve without incident. Interval appendectomy can be done after 6-8 weeks. Acute appendicitis is most often a clinical diagnosis.⁸ The diagnosis of acute appendicitis continues to be difficult due to variable presentation of disease and lack of reliable diagnostic test. History and clinical examination provide useful information regarding diagnosis and now a day the diagnosis of appendicitis is mainly done on clinical basis. Now there are various types of diagnostic techniques have come among these laparoscopy and ultrasonography abdomen have shown good results, but they also have some limitations and drawbacks.

However now-a-days most of the doctor's order ultrasonogram prior to evaluation, where ultrasonography has sensitivity up to 90% and specificity of 80-90% in the diagnosis of acute appendicitis.⁹ However ultrasound alone should not supersede the clinical judgment in patients with a high probability of appendicitis.¹⁰ However there are no signs/ symptoms or diagnostic tests that are 100% reliable in diagnosing acute appendicitis. In our study modified Alvarado score system that the accuracy of diagnosis is acceptable and very dependable with higher score patients (Table 3 and 5). Thus, the diagnostic score may be used to decide whether patient needs surgery or observation. Patients with 8 and above should undergo surgery and patients with 5-7 should be kept under observation and evaluated every 4 hours to note if the score remains same or increases accordingly decision may be taken for surgery. Patients with score 4 or less are very unlikely, but not impossible to have appendicitis and they can be discharged from hospital after conservative treatment, with the advice to come back if the symptoms persist or condition become worse. Pain in right iliac fossa with guarding, accompanying fever and elevated leucocyte count are found to be more predictive of appendicitis in most of the cases.

Alvarado system is dynamic one allowing observation and critical evaluation of clinical picture. Its application improved diagnostic accuracy and reduced negative exploration and complication rates. A meta-analysis of different studies shown high sensitivity and specificity of USG in diagnosis of acute appendicitis.¹⁰ But drawback is operator dependent and diagnosis becomes difficult when obscured by bowel gases. The specificity of USG is less than sensitivity, because of number of false negatives,

some of which cannot be controlled (patients poor tolerance, presence of bowel gas, obesity and unusual appendix location).¹¹ These difficulties can be reduced by employing high resolution real time imaging and by improving the graded compression technique, the high specificity is useful for differential diagnosis of associated pathology.¹² In present study Alvarado scoring has high sensitivity and specificity and also high positive predictive value. Alvarado score is useful tool in clinical decision making especially when USG is unavailable are inconclusive. USG is unnecessary when one's degree of clinical suspicion is high.¹³ However the additional information provided by USG does improve diagnostic accuracy in case of negative or equivocal Alvarado score (Table 4, 6, 7). So, Alvarado scoring system is best test in diagnosis of acute appendicitis compared to USG alone, and use of USG along with Alvarado score is most useful in increasing diagnostic accuracy. Ultrasound and Alvarado scoring system is the least expensive and invasive of these and has been reputed to have an accuracy of 71% to 95%.¹⁴ Studies show that appendicitis is more common in age group of 11-30 years.¹⁵ In most of the appendectomy the naked eye examination of appendix shows inflammation quite often confirms diagnosis, but at times a normal looking may be reported as one with appendicitis. Hence, histological report was taken as the final word in the diagnosis of acute appendicitis.¹⁵ A negative rate of appendectomy is about 20-40% in surgical literature. In our study, it was 12%.

CONCLUSION

Acute appendicitis is the most common acute abdominal condition necessitating surgery. There is high prevalence among young age in adults. Diagnosis of Acute appendicitis remains challenge. Although USG is used frequently for diagnosis of acute appendicitis, using Alvarado score is a useful tool in clinical decision making. As Alvarado score is simple, easily applicable in peripheral hospitals where backup facilities are sparse. It can be useful for junior doctors in patients with abdominal emergencies. As there is no clear advantage of ultrasonography over Alvarado score for diagnosis of acute appendicitis, USG is unnecessary when one has a high degree of clinical suspicion. However, the additional information provided by USG does improve diagnostic accuracy in case of negative or equivocal Alvarado score. Thus, we conclude that in establishing the diagnosis in patients suspected of having acute appendicitis, Alvarado scoring system is better compared to USG alone. So, when used both for diagnosis of acute appendicitis diagnostic accuracy increases and reduces negative appendectomy rates.

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