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Original Research Article

Evaluation of Alvarado scoring system (MANTRELS scoring) as a diagnostic aid in preoperative diagnosis of acute appendicitis at Nalanda Medical College and Hospital, Patna

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ABSTRACT

Background: Acute appendicitis is one of the commonest surgical emergencies. The rate of negative appendicectomy has been reported to be between 20-30%. The aim of this study is to evaluate the efficacy of Alvarado scoring system in cutting down the rate of negative appendicectomy without increasing morbidity and mortality.
Methods: A study of 100 patients presenting with pain abdomen and diagnosed provisionally as acute appendicitis, was undertaken. Depending on individual presentation, a score was calculated for each case, based on Alvarado scoring system. Operative and conservative intervention was undertaken in patients with scores between 5 and 10 and <5 respectively. The results of Alvarado scoring system, on table operative findings and HPE, were reviewed.
Results: A total of 94 patients with score of 7-10 and 5-6 were operated. Among males with score of 7-10, 33 patients were operated and 31 were found to have inflamed appendix. Among females with score of 7-10, 33 patients were operated and 28 were found to have inflamed appendix. The sensitivity of Alvarado scoring system in males with score of 7-10 was found to be 81.57% and among females with score of 7-10 was found to be 75.67%.
Conclusions: The Alvarado scoring system is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without extra expense and complications.

Keywords: Acute appendicitis, Alvarado score, Sensitivity

INTRODUCTION

Appendicitis today is the most common reason for emergency abdominal surgery and has a lifetime risk of 7-8%.[1] Simple appendicitis can progress to perforation, which is associated with a much higher morbidity and mortality, and surgeons have therefore been inclined to operate when the diagnosis is probable rather than wait until it is certain.[2] As a result of their concern about this, surgeons create for themselves 'a surgical security zone which allows them to accept a 15-30% negative laparotomy rate with impunity'.[2]

These rates of negative appendicectomy have been considered acceptable because the morbidity associated with complicated appendicitis is significantly higher than that of non-therapeutic appendicectomy.

Removing normal appendix is an economic burden both on patients and health resources. Misdiagnosis and delay in surgery can lead to complications like perforation and finally peritonitis.[3]

Scoring systems are valuable and valid instruments for discriminating between acute appendicitis and non-specific abdominal pain.[4,5]

At present many scoring systems for the diagnosis of acute appendicitis are available. Alvarado scoring system is one of them and is purely based on history, clinical examination and few laboratory tests and is very easy to apply.[6]

The Alvarado score was described in 1986 and has been validated in adult surgical practice. The use of an objective scoring system such as the Alvarado system can reduce the negative appendicectomy rate to 0-5%.[6-8]

The purpose of this study is to evaluate the role of Alvarado scoring system (Mandrels scoring) in diagnosis of acute appendicitis.

METHODS

A prospective study of 100 patients who were suspected enough to warrant surgery for acute appendicitis admitted in Nalanda Medical College and Hospital under various surgical units was conducted during a period from November 2017 to January 2020.

Inclusion criteria was patients coming to hospital with pain abdomen and diagnosed provisionally as acute appendicitis and willing for surgery.

Exclusion criteria were pregnant females, any mass per abdomen, patients with recent history of any abdominal surgeries and patients not willing for surgery.

Diagnostic criteria for acute appendicitis

History of right lower quadrant pain or periumbilical pain migrating to the right lower quadrant with nausea and/or vomiting. Fever of more than 38°C. Right lower quadrant guarding and tenderness on physical examination.

All included patients were admitted after taking informed written consent about the participation in the study. In case of children, consent was taken from their parents. Initially they were subjected for detailed history taking which included symptoms and duration of the disease; general physical examination and systemic examination.

Base-line investigations (full blood count, urine routine examination, ultrasonography (USG) abdomen and peripheral smear for shift to left) were done. Then a specially designed proforma was filled in for each patient. These proforma had general information about the patients plus eight variables based on the Alvarado scoring system.

Alvarado scoring system

Alvarado scoring system which is purely based on history, clinical examination and few laboratory tests and is very easy to apply. It is based on 3 symptoms, 3 signs and 2 laboratory parameters (Table 1).

The sum of all the scores was calculated for each patient and based on the results patients were divided into three groups.

Table 1: The Alvarado scoring system.

	Score
Symptom	
Migratory RIF pain	1
Anorexia	1
Nausea and vomiting	1
Sign	
Tenderness over RIF	2
Rebound tenderness RIF	1
Elevated temperature	1
Lab findings	
Leucocytosis	2
Shift to left	1
Total	10

RIF: right iliac fossa.

Those patients with scores of ≥7 underwent appendicectomy. Those patients with scores of 5-6 who were thought on clinical grounds to require appendicectomy, it was performed. Those patients with a score of <5 was observed and managed conservatively and reassessed. Those patients who had mass in the right iliac fossa were observed and managed conservatively.

Diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of the appendicectomy specimen. Finally, the reliability of Alvarado scoring system was assessed by calculating negative appendicectomy rate (the proportion of operated patients having normal appendix removed) and positive predictive value (the proportion of patients with a positive test result who actually have the disease).

RESULTS

In this series of 100 cases, the patients who presented with acute symptoms and pre-operatively diagnosed to have acute appendicitis were studied. The total No. of cases operated suspecting acute appendicitis were 94 of which 78 were found to have acutely inflamed appendix. The percentage of inflamed appendix found on operation was 82.97%.

The ratio of male to female patients was almost 1:1. Most cases of acute appendicitis were found in the age group 11-30. Pain abdomen constituted the most common presenting complaint with all the patients complaining of it. Right iliac fossa pain was found in 88% of cases with the classical shift of pain seen in 36%. The rest had diffused abdominal pain. Anorexia and nausea were found in about 80% of patients. Mild fever was present in 71% of cases. Total leucocyte count was elevated in 74% of cases in our present study. The results of Alvarado

score applied to patients with typical right iliac fossa pain are as follows (Table 2).

Total of 94 patients were operated, out of which 44 were males, 47 females and 3 children. 31 males having score of 7-10 had acute appendicitis, 2 patients had normal appendix (1 with Meckel's diverticulitis and 1 with mesenteric lymphadenitis). Male patients having score of 5-6 were 11, out of which 7 patients had acute appendicitis, 4 patients had normal appendix and with all the 4 having mesenteric lymphadenitis.

Table 2: Results of Alvarado score.

Variables	No. of patients	Score		
		7-10	5-6	<5
Male	48	33	11	4
Female	49	33	14	2
Children	3	3	0	0
Total	100	69	25	6

In 33 female patients having a score 7-10, 28 had acute appendicitis, 5 patients had normal appendix with other diseases, out of which 3 patients had pelvic inflammatory disease (PID) and 2 patients had mesenteric lympha-denitis. In 14 females with score 5-6, 9 had acute appendicitis, 5 had normal appendix with other diseases (4 PID and 1 mesenteric lymphadenitis). All the children subjected to appendicectomy had acute appendicitis (Table 3).

Table 3: Diagnostic value of Alvarado scoring system.

Alvarado score	Histopathological examination result	
	Appendicitis	N. appendix
7-10 (n=69)	62 (89.85)	7 (10.15)
5-6 (n=25)	16 (64.00)	9 (36.00)

Odd's ratio =4.98 (1.62-15.42); p value=0.01.

The sensitivity of the Alvarado scoring system in males with score ≥7 to 10 was 81.57% with specificity of 66.66%. The positive predictive value in males was 93.93%. The sensitivity of the scoring system in females with score ≥7 to 10 was 75.67% with specificity of 50%. The positive predictive value in females was 84.84% (Table 4).

Table 4: Diagnostic value of Alvarado scoring system.

Variables	%
Males with score 7 to 10	
Sensitivity	81.57
Specificity	66.66
Positive predictive value	93.93
Females with score 7 to 10	
Sensitivity	75.67
Specificity	50.00
Positive predictive value	84.84

Patients with score <5 were kept under observation. None of the patients required surgery. All patients with appendicular mass were excluded out of study and managed conservatively and advised for interval appendicectomy after 6-8 weeks. Histopathological examination of the resected appendix proved acute suppurative 39.36% and acute catarrhal 32.97% type to be predominant.

DISCUSSION

Acute appendicitis remains a common abdominal emergency throughout the world. In addition to significant morbidity and mortality, negative appendicectomy is also responsible for loss of precious staff hours and financial resources. The diagnosis of acute appendicitis continues to be difficult due to the variable presentation of the disease and the lack of reliable diagnostic test. So, even today, a thorough clinical examination with basic investigations like WBC count remains the cornerstone in the diagnosis of acute appendicitis. Initial assessment can be improved by use of a clinical scoring system. Alvarado scoring system is one of the many scoring systems available today. It is based on history, physical examination and few laboratory tests. It is a simple, easy to apply and cheap complimentary aid for supporting the diagnosis of acute appendicitis.

The present study was undertaken to evaluate the usefulness of Alvarado scoring system in reducing the number of negative appendicectomy and to evaluate its sensitivity and positive predictive value in the diagnosis of acute appendicitis. Our results and observations were discussed and compared with various other studies (Table 5).

Table 5: Comparative evaluation of various study series.

Series	Sensitivity (%)
Kalan et al[11]	81.63
Denizbasi et al[13]	95.40
Al-Hashemy et al[12]	53.90
Shrivastava et al[14]	92.40
Present study	79.48

When compared with previous studies, our study was found to have comparable results with Kalan et al and more sensitivity than Hashemy et al series.[9,10] Series of Denizbasi and Shrivastava et al showed a much higher sensitivity of more than 90% (Table 5).[11,12]

In our series a score of 7-10 using Alvarado scoring system had a total sensitivity of 79.48%. Increased proportion 36% of negative appendicectomy is noticed for the Alvarado score 5-6 and significantly decreased proportion 10.15% negative appendicectomy is noticed for the Alvarado score 7-10 with an odd's ratio of 4.98

and p value 0.01. In our series negative appendicectomy rate in females with score 5-6 was 35.71% and with score 7-10 was 15.15%. Men with score 5-6 had negative appendicectomy rate of 36.36% and with score 7-10 had negative appendicectomy rate of 6.06%. Hence in the overall, females 19.23% had more negative appendicectomy rate compared to males 12.5%, as the other diseases like pelvic inflammatory diseases were more common in the reproductive age group. Since intra-abdominal infection in females, particularly lower abdomen, can be quite confusing, it is difficult to differentiate acute appendicitis from gynecological conditions like twisted ovarian cyst and PID. The overall Alvarado score ≥5 has got more sensitivity and diagnostic accuracy of diagnosing patients for appendicitis and by particularly adopting this system, negative laparotomies can be reduced to a figure of 16%.

In our present study, usefulness of the scoring system was demonstrated beyond doubt by reducing number of negative laparotomies especially in men. However, in women the negative laparotomy was high and this can be avoided by laparoscopy. Since intra-abdominal infection in females particularly in lower abdomen can be quiet confusing, as it is difficult to differentiate appendicitis from gynecological condition like twisted ovarian cyst and PID, laparoscopy and abdomino-pelvic USG scan can be advised as a diagnostic tool to minimize negative appendicectomy. In our series only 3 cases were in paediatric age-group. All of them had score of 7-10 and were operated within 6 hours. However, a greater number of patients in paediatric age group is required to comment upon the usefulness of this scoring system.

CONCLUSION

Alvarado score is very effective in the diagnosis of acute appendicitis men but some other diagnostic modality is necessary to ascertain the diagnosis in females along with the clinical scoring system to rule out other pelvic pathology. Though in this study, the test was found to be very sensitive in children, however the number of patients in child age group was very less so it is difficult to conclude anything. Further study with a large sample size of children is required. In the diagnosis of acute appendicitis, the Alvarado score is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without extra expense and complications. It is very handy in peripheral hospitals where back up facilities like USG scan or CT scan is not available. It can be very helpful for junior doctors provided it is applied purposefully and objectively in patients of abdominal emergencies. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendicectomy and thus reduces complication rate. However, this system has got its limitations and is not a substitute for clinical judgment and just an aid in diagnosing acute appendicitis and assist in arriving at a conclusion whether a particular case should be operated or not, so that the number of negative laparotomies will be reduced.

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REFERENCES

1. Wakeley CP. The position of the vermiform appendix as ascertained by an analysis of 10,000 cases. J Anat. 1933;67:277-83.
2. Hoffmann J, Rasmussen O. Aids in the diagnosis of acute appendicitis. Br J Surg. 1989;76:774-9.
3. Ohmann C, Yang Q, Franke C. The abdominal pain study group. Diagnostic scores for acute appendicitis. Eur J Surg. 1995;161:273-81.
4. Fenyo G, Lindberg G, Blind P, Enochsson L, Oberg A. Diagnostic decision support in suspected acute appendicitis: validation of a simplified scoring system. Eur J Surg. 1997;163;831-8.
5. Scott GB. The primate caecum and appendix vermiform is a comparative study. J Anat. 1980;131:549-63.
6. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med. 1986;15:557-64.
7. Teicher I. Scoring system to aid in diagnoses of appendicitis. Ann Surg. 1983;198:753.
8. Lamparelli M. A prospective evaluation of the combined use of the modified Alvarado score with selective laparoscopy in adult females in the management of suspected appendicitis. Ann R Coll Surg Engl. 2000;82:192.
9. Kalan M, Rich AJ, Talbot D, Cunliffe WJ. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. Ann R Coll Surg Engl. 1994;76:418-9.
10. Al-Hashemy AM, Seleem MI. Appraisal of modified Alvarado score for acute appendicitis in adult. Saudi Med J. 2004;25(9):1229-31.
11. Denizbasi A, Unlever EE. The role of the emergency medicine resident using the Alvarado score in the diagnosis of acute appendicitis compared with the general surgery resident. Eur J Emerg Med. 2003;10(4):296-301.
12. Shrivastava UK, Gupta A, Sharma D. Evaluation of the Alvarado score in the diagnosis of acute appendicitis. Trop Gastroenterol. 2004;25(4):184-6.

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