Original Article

Alvarado score and ultrasonographic criteria to diagnose acute appendicitis: A clinical study of 100 cases

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Abstract

Acute appendicitis is one of the most common surgical emergencies around the world with a life time prevalence of approximately one in seven. It's incidence is 1.5-1.9/1000 in male and female population. Scoring systems are valuable and valid instruments for discriminating between acute appendicitis and nonspecific pain abdomen. Alvarado scoring is one of them and is purely based on history, clinical examination and few laboratory tests and is very easy to apply. Advent of cross sectional computer based imaging modalities (USG, CT and MRI) in early eighties opened up new methods for diagnosis of acute appendicitis. It was also found that ultrasound was able to establish alternative diagnosis in up to one-third cases of right iliac pain like ureteric colic and gynaecological disorders. Statistical analysis of data in our study gave sensitivity of Alvarado score as 94.9%, specificity 61.9%, positive 90.3% and negative predictive value 76.4% while sensitivity of ultrasonography was 91.9%, specificity 85%, positive 95% and negative predictive value 77.2%.When both modalities were positive for acute appendicitis, no false positive result obtained. So it is concluded that the combination of Alvarado score and ultrasonography increases the sensitivity and specificity for the diagnosis of acute appendicitis.

Key Word: Alvarado score, ultrasonography.

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INTRODUCTION

Surgery for acute appendicitis is the most frequent operation performed, being 10% of all emergency abdominal operations.[4,5] Large surgical series have shown overall normal appendicectomy rate of 20-25%[6,7].In less than 10 yrs. (5-15%) or in more than 50 yrs. (40-65%) of age the incidence of perforation is high due to atypical presentation and delay in surgery[8]. Clinical suspicion of appendicitis in any form compels one to operate upon it. Scoring systems are valuable and valid instruments for discriminating between acute appendicitis and nonspecific pain abdomen[9].Alvarado scoring is purely based on history, clinical examination and few laboratory tests and is very easy to apply. The Alvarado score is 10 point scoring system for diagnosis of acute appendicitis taking eight predictive factors according to their diagnostic weight.In his original paper, Alvarado recommended an operation with score 7 or more than 7 and observation for patients with score 5or 6.[9] CT scanning and MRI have also been found to be very efficacious but are more expensive and time consuming due to use of contrast media, so the focus has remained on sonographic diagnosis of acute appendicitis, as it is non-invasive, non-ionizing, economic, easily available. CT scanning and MRI have also been found to be very efficacious but are more expensive and time consuming due to use of contrast media, so the focus has remained on sonographic diagnosis of acute appendicitis, as it is

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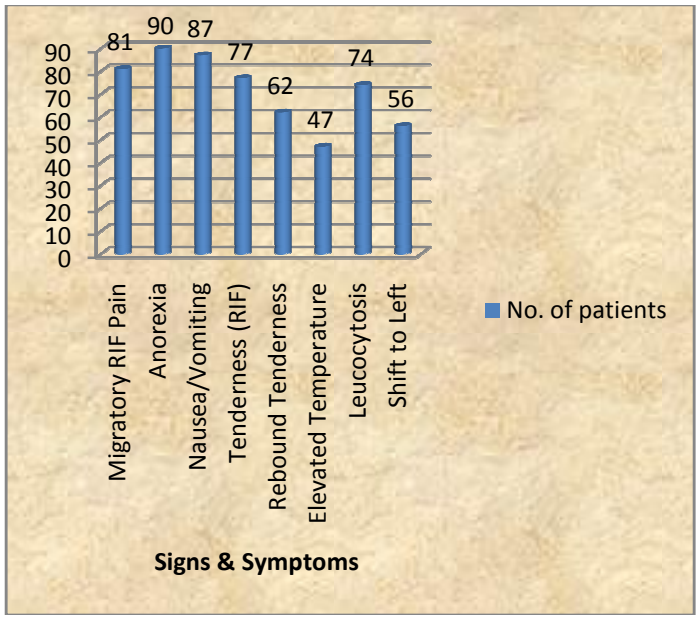
non-invasive, non-ionizing, economic, easily available and can provide quite accurate information. Advances in ultrasonographic technology and improvement in image quality have allowed visualization of normal appendix too and additional criteria like outer diameter, compressibility, periappendiceal changes[10] and Doppler signals[11] etc. have been described to suggest acute appendicitis, each of which have their own pitfalls with resultant false positive and negative results. In 1986, J.B.C.M. Puylaert[12] published the first study on USG diagnosis of acute appendicitis and described the graded compression technique, which has since then been a standard for USG evaluation of acute appendicitis.
The following signs and symptoms are included in deriving the score:

PARTICULAR	POINTS
Symptoms-	
• Migrating pain RIF	1
• Anorexia	1
• Nausea/Vomiting	1
Signs –	
• Tenderness at RIF	2
• Rebound tenderness	1
• Elevated temperature	1
Laboratory investigations-	
• Leucocytosis	2
• Shift to left	1
Total Score	**10**

OBSERVATIONS AND DISCUSSION



Graph 1: Presentation of signs and symptoms in patients with RLQ pain

Table 1: Operative findings in patients with various alvarado score

Alvarado score	No. of Pt.	Operative findings	No. of patients	%
Revised <5 with USG diagnosis of acute appendicitis	7	Inflamed appendix	4	57.14
		No pathology	3	42.86
Revised >6	5	Inflamed appendix	4	80
		No pathology	1	20
Initial ≥7	78	Inflamed appendix	71	91
		Other pathology*	4	5.14
		No pathology	3	3.86

*Other pathology included 2 cases of acute salpingitis and one case each of Meckel's diverticulitis and ruptured right ovarian cyst. Preoperative USG was not done in case of ruptured right ovarian cyst.

Table 2: Correlation between alvarado score and proved acute appendicitis in all patients

Alvarado Score	No. of patients	Operative findings confirming acute appendicitis		Remarks
		No. of patients	%	
4	7	4	57.14	4 false negative cases
7	35	30	85.71	5 false positive cases
8	28	25	89.28	3 false positive cases
9	12	12	100	-
10	8	8	100	-

In male patients the accuracy of prediction of acute appendicitis was 100% with Alvarado score 9 and 10 while it was 94.11% with a score of 8.In female patients the accuracy of prediction of acute appendicitis was 100% with Alvarado score of 9 and 10 while it was 81.81% with a score of 8.

Table 3: Statistical comparison of alvarado score and ultrasonology in acute appendictis

S. No.	Parameter	Alvarado score	Ultrasonology
1	Sensitivity	94.9%	91.9%
2	Specificity	61.9%	85%
3	Positive predictive value	90.3%	95%
4	Negative predictive value	76.4%	77.2%

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The present study was conducted in various surgical wards of the department of Surgery, Mahatma Gandhi and associated group of hospitals attached to Dr. Sampurnan and Medical College, Jodhpur on 100 patients over a period of one year extending from January 2014 to December 2014.

On clinical presentation, RLQ pain was present in every patient while anorexia was an associated symptom in 90% patients followed closely by nausea and vomiting in 87%patients, followed by tenderness in RIF and rebound tenderness in77and 62% patients respectively, fever in 47% of the patients. The symptomology in our patients were similar to the findings of Roy *et al*[22] 1969 who noted that pain is present in all patients followed by anorexia in 82%, nausea and vomiting in 70% and fever in 48% of patients.

In the present study we received 4 patients with initial Alvarado score of 4. All of them were proved to have aetiologies other than acute appendicitis and were managed accordingly. 50% of these patients have pelvic inflammatory disease while 25% each were diagnosed as having right lower ureteric calculus and mesenteric adenitis. Chan MY *et al*[23] in 2001 observed that 46 patients out of 148 patients who had Alvarado score of 1-4, did not have acute appendicitis. Same author in his study in 2003 reobserved and found that 56 patients out of 175 patients who had Alvarado score of 1-4, did not have acute appendicitis. Inflamed appendix was present on exploration in 91% of the patients with initial Alvarado score ≥7 and other pathologies were detected in 5.14% of the patients. Pathology could not be detected in 3.86% of the patients. The predictive value of Alvarado score of 7 or more for the diagnosis of acute appendicitis was 90.3%. Chan My *et al*[23] in 2001 found that predictive value of Alvarado score of 7 or more for the diagnosis of acute appendicitis was 77.4%. Ikramulhah Khan[24] 2005 reported that predictive value of Alvarado score of 7 or more for the diagnosis of acute appendicitis was 86.5%.Ohman*et al*[25] 1995 concluded that if negative appendicectomy rate is less than 10-15% than the surgeon is operating on too few patients thus increasing the risk of complications. Overall the incidence of negative appendicectomy in our study was 11 (12.3%). Ohman *et al*[25] 1995 in his study, reported negative appendicectomy

rate 14.3%. Arian G M *et al*[26] 2001 reported 16.1%, Ikramulhah Khan[39] 2005 had 15.6% of negative appendicectomies. Most studies show higher negative appendicectomy rate in females than in males. This is probably due to various gynaecological pathologies mimicking acute appendicitis. The accuracy of prediction of acute appendicitis was 100% with Alvarado score 9 and 10 while it was 94.11% with a score of 8. The prediction rate was 85.71 and 57.14% with Alvarado score of 7 and 4 respectively. Chan MY *et al*[23] in 2001 found that predictive value of Alvarado score of 9-10 for the diagnosis of acute appendicitis was 100%.

Accuracy of USG diagnosis of acute appendicitis in patients with Alvarado score of 9 was cent percent while with scores of 8 and 7it was 86.95 and 73.52% respectively. Overall for the diagnosis of acute appendicitis, the sensitivity of Alvarado score was 94.9%, specificity 61.9%, positive predictive value 90.3% and negative predictive value 76.4%. Denizbasi[27] in 2003 found that sensitivity of Alvarado score was 95.4% and specificity 45.7%. Ikramullah Khan[24] 2005 noted that predictive value of Alvarado was 84.3% (88% in male and 82% in female). Predictive value of Alvarado score in our study was 90.3% (92.3% in male and 87.1% in females), so our results are comparable to the other studies. In the present study, it was found that combination of Alvarado and USG improves sensitivity and specificity in the diagnosis of acute appendicitis. If used independently, Alvarado score alone provides sensitivity of 94.9% and specificity of 61.9% while USG alone provides sensitivity of 91.9% and specificity of 85%.

In our study, it was concluded that use of Alvarado score alone for the diagnosis of acute appendicitis would have resulted in unnecessary operation in as many as 8 cases (8.8% false positive) and another 4 patients (4.4% false negative) would have been missed. Similarly if USG alone was used for the diagnosis of acute appendicitis, 3 unnecessary operations (3.6% false positive) would have been performed and 5 appendices (6% false negative)would have been missed.So our results are in agreement with the Stephens P L[1] who found that if Alvarado score alone was used for diagnosis, it gave 7.2% false positive and 5.9% false negative results and if USG alone was used for diagnosis it gave 4.6% false positive and 10% false negative results.

CONCLUSION

It was concluded that when both modalities were positive for appendicitis, no false positive result obtained. So the combination of Alvarado score and ultrasonography increases the sensitivity and specificity for the diagnosis of acute appendicitis.

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