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THE DIAGNOSTIC ACCURACY OF MODIFIED ALVARADO SCORE IN ACUTE APPENDICITIS

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ABSTRACT

Objective: To evaluate the usefulness of modified Alvarado score in diagnosis of acute appendicitis and to correct the high false appendicectomy rate .

Methods: In the period from July 1998 to April 1999 , 122 patients with lower right abdominal pain were admitted and subjected to this prospective trial .According to the modified Alvarado score(MAS) patients had either a score > 7 or a score < 7. For those patients with mostly suspected appendicitis (score > 7) (73 patients) appendicectomy was performed. For those patients with possible appendicitis (score < 7) (14 patients) diagnostic laparoscopy was performed whenever indicated to confirm or refute the diagnosis .

Results: The presence of a high score (over 7) was found to be an easy and satisfactory aid to early diagnosis of appendicitis in children and men with a diagnostic accuracy of 100% , 96.1% respectively , while in women, it falls disappointingly short of expectations (67%) with false positive rate over 30 %. In patients with low score (<7) the diagnostic accuracy of MAS was 60 %, 57.1 % and 50 % in men, women and children respectively without statistically significant difference. However the use of laparoscopy reduced the negative appendix rate to zero % in this group.

Conclusion: The Modified Alvarado score works extremely well in children and men but diagnostic laparoscopy should be considered in women particularly in the child bearing age and in patients with possible appendicitis (score < 7) .

INTRODUCTION

For many years it has been accepted that there is an inherent error rate of (20-40 %) in the diagnosis of appendicitis (Glimore *et al*., 1975 & Hoffmann, and Rasmussen, 1989). While the clinical diagnosis is frequently straight forward, symptoms and signs can be difficult to interpret in a significant number of patients. In these situations , the morbidity of unnecessary appendicectomy must be weighed against the potential morbidity and mortality of neglected acute appendicitis

(Lucian *et al.*, 1980 & Pledger *et al.* 1987) .

Although aids to enhance diagnosis, these are either complex or not easily available when most needed. Several scoring systems have been developed to aid the diagnosis of acute appendicitis and to decrease the rate of negative appendicectomies (Hoffmann and Rasmussen , 1989 & Ohmann *et al*, 1995) .

The original Alvarado score was described in 1986 and has subsequently validated in adult surgical practice. It included 3 symptoms (Right iliac fossa pain - anorexia — vomiting) 3 signs (Tender right lower quadrant — rebound tenderness - pvrexia > 37.5) and two investigations (Leucocytosis and left shift of neutrophil maturation) yielding a potential score of 10. The neutrophilic parameter was omitted by Kalan and his associates in 1994 , who found that this parameter is not routinely available in many laboratories and a new modification of Alvarado score was born and accepted by many authors (Macklin *et al*, 1997), yielding a potential score of 9. Patients with a score of 1-4 are considered unlikely to have acute appendicitis , those with a score of 5 - 6 have a possible diagnosis of acute appendicitis , not convincing enough to warrant urgent surgery, these were marked for further review. Those with a score more than 7 were considered to have an almost probable acute appendicitis and submitted to surgery (Kalan *et al*, 1994 & Macklin *et al* , 1997) .

Diagnostic laparoscopv is rapidly gaining wide acceptance as an alternative to diagnostic laparotomy. This largely due to surgeons growing familarity with laparoscopic surgery, improvements in instrumentation and the relatively high number of negative laparotomies. With careful attention to patient selection, laparoscopy has the potential to reduce the negative appendicectomv rate to 1-2% without increase the risk to the patient (Schrenk *et al.*, 1994) .

AIM OF THIS WORK:

Is a prospective evaluation of the modified Alvarado score in the diagnosis of acute appendicitis and to correct the high false appendicectomy rate .

PATIENTS AND METHODS

. In the period from July 1998 to April 1999, one hundred and twenty two patients with acute right iliac fossa pain presenting to the surgical department of Sohag University Hospital , were admitted and

selected for this prospective trial . Patients, were excluded if they had undergone a previous appendicectomv or if they were referred with known intraabdominal pathology. Our assessment included 43 men, 53 women and 26 children with median age of 30.60, 27 and 8.96 respectively (Range 3 – 64 years) . The highest age group affected in this study was found between 15 – 29 years .

All patients were subjected to thorough history including (Associated renal pain, anorexia/vomiting, dyspepsia, dysphagia, gynecological problem) and clinical examination including (Pulse, temperature, P.R/P.V, Rovsing's sign, hypersaethesia of Sherren's triangle). Routine laboratory investigations including (Leucocytic count, urine analysis and stool analysis) were performed. Ultrasonograhpy, plain x-ray and C-T scan were done when indicated

On admission: all patients with right iliac fossa pain were classified into two main groups:-

First group: included thirty five patients who had diagnoses other than acute appendicitis, based on the clinical assessment only without evaluation by the use of MAS.

Second group: included eighty seven patients with mostly suspected or possible appendicitis on whom MAS was applied.

The Modified Alvarado Score (MAS):

The Modified Alvarado Score (Table 1) was applied on the second group (87 patients) on admission. The elements of the score were recorded and the summation of the elements was not calculated until later, because the score could be increased or decreased on reassessment.

Table (1) The Modified Alvarado Score :

		SCORE
Symptoms	Migratory right iliac fossa pain	1
	Anorexia	1
	Nausea / vomiting	1
	Tender right lower quadrant	2
Sings	Rebound tenderness in the right iliac fossa	1
Investigation	Pyrexia > 37.5 C	1
	Leucocytosis > 10 x 10 $/^{9}$ L	2
	Total	9

Utilizing the score , patients were classified into three groups:-

-**Group A (n=73):** Patients with a score of more than 7 for whom appendicectomy was performed immediately .

-**Group B (n=10):** Patients with a score of 5 - 6 were candidates for laparoscopy to confirm or refute the diagnosis.

-**Group C (n = 4):** Patients with a score < 5. Neither surgery nor laparoscopy was done, but patients put under active observation for 24 hour. They were recovered completely, discharged from the hospital and diagnosed as non specific acute abdominal pain.

Role of laparoscopy:

The technique of laparoscopy in adults and children was done under general anaethesia .Carbon dioxide was the distending gas with pressure not more than 14 mmHg in adults. In children good delineation of the abdomnial cavity was reached with pressure not more than 10 mmHg and with elevation of the abdominal wall by towel forceps .A 10- mm supraumblical incision was chosen for the video-optic through which a trocar was placed .A probe was introduced through a small right lower quadrant stab wound , for manipulation of intra-abdominal viscera to permit adequate examination (Paterson and Thompson,1990).

The diagnosis of acute appendicitis was made on the laparoscopic examination if the appendix was seen,to be inflammed , if it was covered with adherent omentum. or if it was not possible to see the appendix because of inflammatory adhesions or oedema in the periceacal region. If the appendix was seen and judged to be normal, laparoscopic .examination of the pelvic organs, the intestinal tract, gall bladder, liver, duodenum and stomach was carried out, in search of another explanation for physical findings (McCall *et al*., 1997) .

If acute appendicitis. was diagnosed by laparoscopy, appendicectomy was carried out immediately, either laparoscopically or open surgery. If a non surgical diagnosis was established, or the examination was negative, the patient was considered as a false positive in the series and appendicectomy was not performed.

Histopathological examination:

In all cases, for whom appendicectomy was performed , acutely

inflammed appendix was confirmed by histological examination of the specimen.

Statistical analysis:-

All data were subjected to statistical analysis using Chi-Square test of the Statistical Analyzing System (SAS) program (SAS Institute, 1985) , to determine the significant difference among them at 0.0 5 probability level .

RESULTS

Our assessment categorized the patients into 2 groups:-

First group: included 35 cases who had diagnoses other than acute appendicitis. Urinary tract infection was presented in 24 cases (12 men, 11 women and 1 child). Gynecological disorders were presented in 2 women. Tonsillitis was presented in 4 children. Five cases presented with gastroenteritis (2 women and 3 children) (Table 2).

Table (2): The final diagnosis of the thirty five cases who had diagnoses other than acute appendicitis.

Diagnosis	Men		Women		Children		Total	
	No	%	No	%	No	%	No	%
Urinary tract infection	12	9.8%	11	9.1%	1	0.8%	21	19.7%
Gynecological disorders	-	-	2	1.6%	-	-	2	1.6%
Tonsilitis	-	-	-	-	4	3.3%	4	3.3%
Gastroenteritis	-	-	2	1.6%	3	2.5%	5	4.1%
Total	12	9.8%	15	12.3%	8	6.6%	35	28.7%

Second group: included 87 cases on whom MAS was applied. They were classified into groups (A , B , C) :-

1- *Group A:* Patients with high modified Alvarado score over 7 (Table. 3). Our results recorded 73 cases (26 men, 31 women, 16 children). Overall they indicate a diagnostic accuracy of 85% (negative appendix rate 15%) . There was statistically significant difference in favor of men and children versus women (P = 0.0018) .

Table (3): Shows the diagnostic accuracy of MAS in patients with score>7 (GroupA:n=73).

Group	Score >7	Confirmed appendicitis	Diagnostic accuracy	Negative appendix rate	P-Value
Men	26	25	96.1%	3.9%	0.0018
Women	31	21	67.7%	32.3%	
Children	16	16	100%	0%	
Total	73	62	85%	15%	Significant

Males (n = 26): Appendicitis confirmed in 25 out of the 26 cases . They had a diagnostic accuracy of 96.1% (negative appendix rate of 3.9%). A final diagnosis could not be made in one man with a normal appendix . He made an uneventful recovery .

Females (n = 31): Twenty one out of the 31 cases had proven appendicitis. They had a diagnostic accuracy of 67.7% (negative appendix rate of 32.3%). A finial diagnosis was made in all women. Gynecological disorders were predominant in women who had a normal appendix. Twisted ovarian cysts were found in 3 cases. salpingitis in 3, and rupture ovarian cysts in 4 .

Children (n = 16): All the sixteen children who had high score over 7, had proven appendicitis. They had a diagnostic accuracy of 100 % (negative appendix rate of zero %) .

2- *Group B:* Patients with modified Alvarado score 5-6 (Table 4). These patients had a questionable appendicitis, so they went to the theater for diagnostic laparoscopy, in order to confirm or refute the diagnosis.

Table(4): Shows the diagnostic accuracy of MAS aided by laparoscopy in patients with score 5-6(Group B: n=10).

Group	No	Vis infl. App.	Confirmed appendicitis	Negative appendix rate
Men	3	2	3	0%
Women	6	4	4	0%
Children	1	1	1	0%
Total	10	7	8	0%

Table (5): Shows the final diagnosis at time of discharge of 87 patients who were evaluated by MAS & laparoscopy.

Diagnosis	Men		Women		Children		Total	
	No	%	No	%	No	%	No	%
Acute appendicitis "Non perforated"	20	16.4%	18	14.8%	11	9%	49	40.2%
Acute appendicitis "perforated"	7	5.7%	5	4.1%	5	4.1 %	17	13.9%
Appendix mass	1	0.8%	2	1.6%	1	0.8 %	4	3.3%
Gynecological disorders	-	-	12	9.8%	-	-	12	9.8%
*Non specific Abdominal pain	3	2.45%	1	0.8%	1	0.8%	5	4.1%
Total	31	25.4%	38	31.1%	18	14.8%	87	71.3%
Confirmed appendicitis	28	23%	25	20.5%	17	13.9%	70	57.4%
Other diagnoses	3	2.45%	13	10.7%	1	0.8%	17	13.9%

Table (6) Shows the total results of the diagnostic accuracy of MAS n=87

Group	Pat. No	Modified Alvarado Score	Appendi-ctomy	onfirmedapendditis	Diagnostic accuracy	Negative appendex rate	p-value
Men	43	31	29	28	90.3%	3.4%	
Women	53	38	35	25	65.8%	28.6%	
Children	26	18	17	17	94.4%	0%	
Total	122	87	81	70	80%	13.6%	0.001

MAS = Modifed Alvarado score
Vis infl. app. = Visualized inflamed appendix by laparoscopy

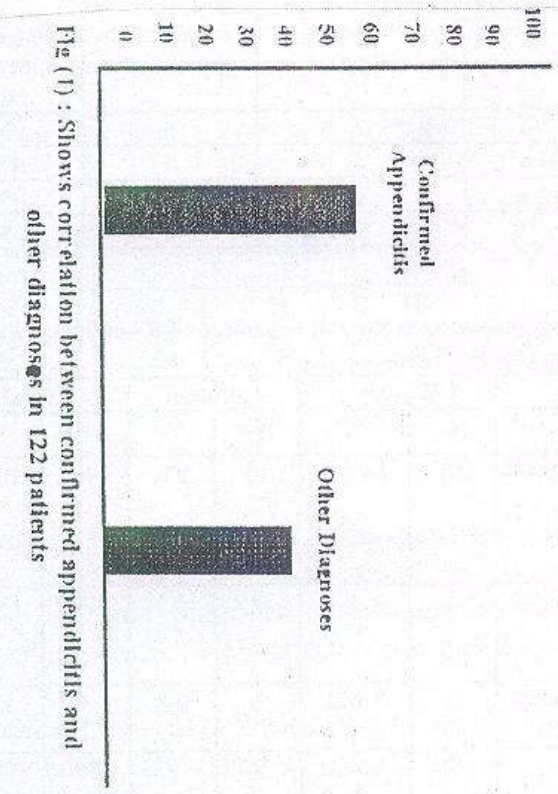


Fig (1) : Shows correlation between confirmed appendicitis and other diagnoses in 122 patients

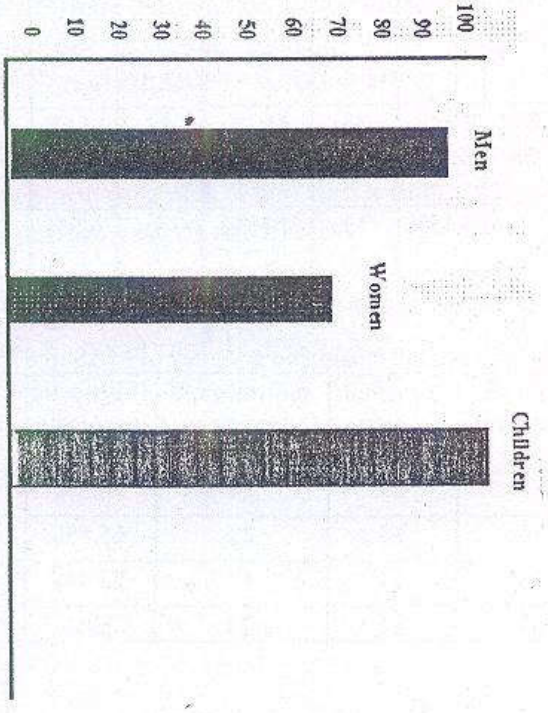
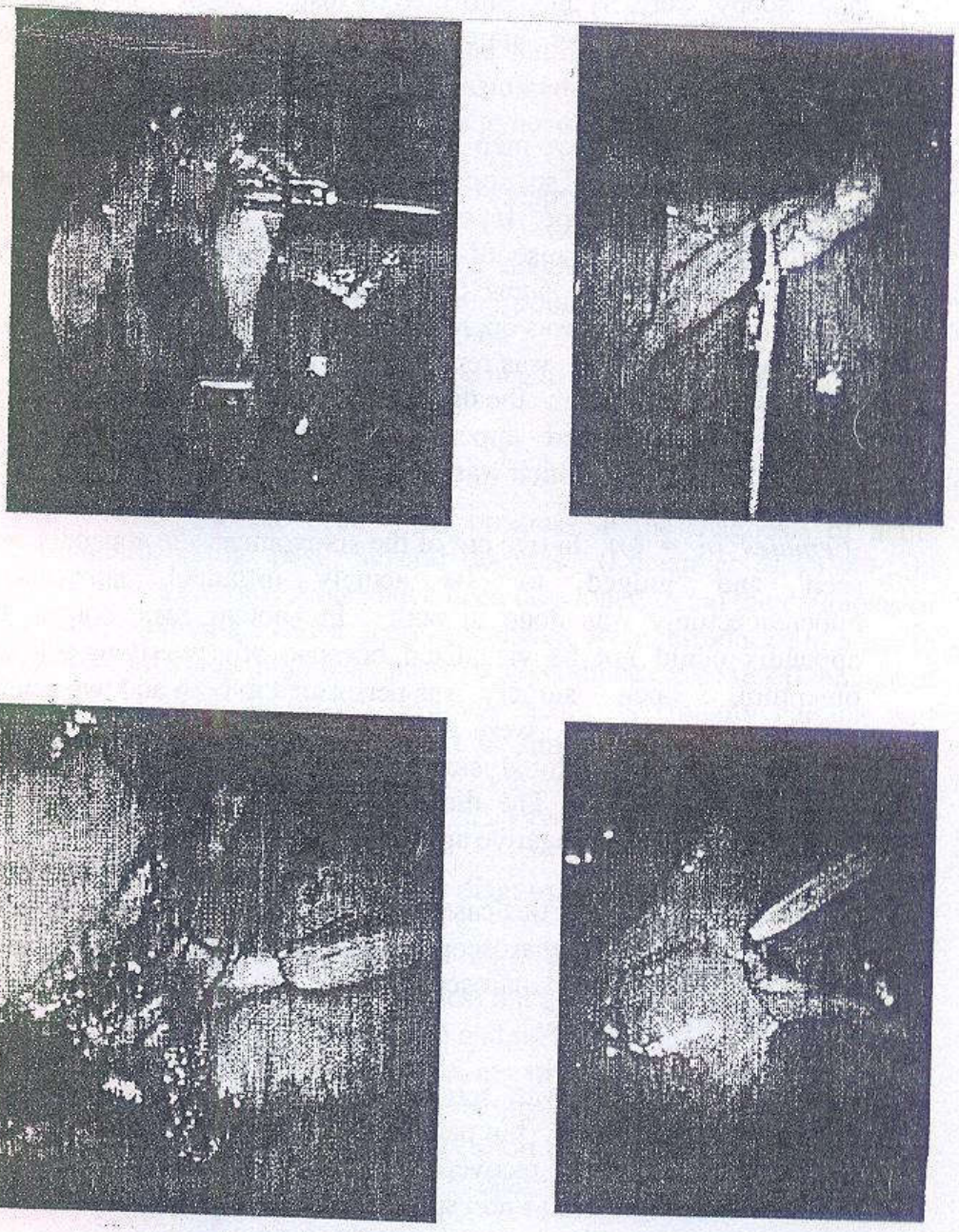


Fig (2) : Diagnostic accuracy of MAS in patients with score > 7



Inflamed appendix by laparoscopy