

The Alvarado (MANTRELS) Score – an evaluation study for the early diagnosis and management of acute appendicitis in a tertiary care hospital.

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Abstract:

Background/ Aims: Acute appendicitis is the most common cause of an 'acute abdomen' in young adults worldwide with a prevalence of approximately 7% of population. The diagnosis of acute appendicitis is essentially clinical; however, a decision to operate based on clinical suspicion alone can lead to removal of a normal appendix in 15-30% of cases. A number of clinical and laboratory based scoring systems have been devised to assist the diagnosis of acute appendicitis and the most widely used is the Alvarado (MANTRELS) score. The objective of the study is the likelihood of acute appendicitis can be ascertained using the Alvarado (MANTRELS) scoring system for early diagnosis and management of acute appendicitis at TRIHMS.

MATERIALS AND METHODS:

The present study was a retrospective study of 133 patients presenting with symptoms and signs of acute appendicitis in the department of surgery at TRIHMS, Naharlagun for a period of one year from 01-01-2019 to 31-12-2019. Patients who met the inclusion criteria were evaluated using Alvarado(MANTRELS) scoring system and patients were operated by conventional method of open appendectomy. The diagnosis of acute appendicitis was confirmed by the histopathological examination of the appendectomy specimen. The efficacy of Alvarado (MANTRELS) Scoring system was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value and negative appendectomy rate.

RESULTS: Pain of the abdomen was the most common presenting symptom (100%) with migratory RIF pain in 43.60% of cases. The commonest age group of acute appendicitis from 21 years to 40 years. In the present study, 74 patients (55.64%) are in group III (Score range of 7-10), 34 patients (25.56%) are in the group II (score range of 5-6) and 25 patients (18.56%) are in the group I (score range of 1-4). In the present study, appendix was inflamed in 91.73% of cases and appendix was normal in 8.27% of cases.

CONCLUSION:

Acute appendicitis is the most common cause of “acute abdomen” in young adults and it is one of the commonest surgical emergencies requiring emergency appendicectomy. The diagnosis of acute appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen and surgical science. The proper application of the Alvarado(MANTRELS) scoring system can improve diagnostic accuracy and reduce the rate of negative appendicectomy in surgical practice.

Keyword: Acute appendicitis; Alvarado (MANTRELS) scoring system; Emergency Appendicectomy.

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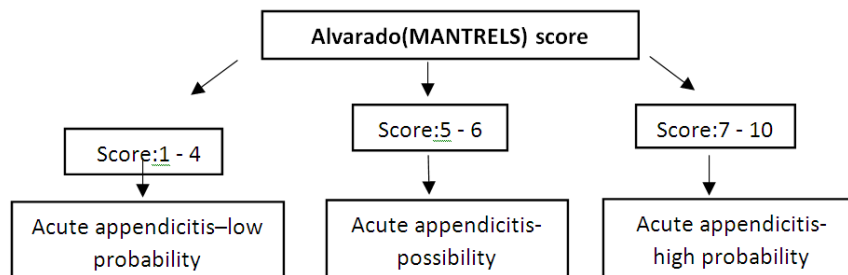
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I. Introduction:

The vermiform appendix is considered by the most to be a vestigial organ, its important in surgery due only to its propensity for inflammation that result in the clinical syndrome known as acute appendicitis. Acute appendicitis is the most common cause of an “acute abdomen” in young adults, and as such the associated symptoms and signs have become a paradigm for clinical teaching. Appendicitis is sufficiently common that appendicectomy (termed appendectomy in North America) is the most frequently performed urgent abdominal operation and is often in the first major procedure performed by a surgeon in training. Notwithstanding advances in modern radiographic imaging and diagnostic laboratory investigations, the diagnosis of acute appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen and surgical science. A decision to operate based on clinical suspicion alone can lead to removal of a normal appendix in 15-30% of cases. A number of clinical and laboratory-based scoring systems have been devised to assist the diagnosis of acute appendicitis. The most widely used is the Alvarado(MANTRELS) score (Alfredo Alvarado|contemporary,surgeon, plantation,FL,USA).A score of 7 or more is strongly predictive of acute appendicitis(1). The Alvarado (MANTRELS) scoring system can reduce thenegative appendicectomy rate to 0-5%(2).

The Alvarado (MANTRELS) score and its interpretation for acute appendicitis(3).

Alvarado (MANTRELS) score	
Feature	Score
M-Migratory RIF Pain	1
A-Anorexia	1
N-Nausea and vomiting	1
T-Tenderness (RIF)	2
R-Rebound tenderness	1
E-Elevation of temperature	1
L-Leucocytosis(>10000 W B C)	2
S-Shift to left (segmented Neutrophils) (>75% Neutrophils)	1
Total	10



In patients with an equivocal score (5-6), abdominal ultrasound or contrast-enhanced CT examination further reduces the rate of negative appendicectomy. Abdominal ultrasound examination is more useful in children and thin adults, particularly if gynecological pathology is suspected with a diagnostic accuracy in excess of 90% (fig.1). Contrast-enhanced C T scan (fig.2)

is the most useful in patients in whom there is diagnostic uncertainty, particularly older patients, in whom acute diverticulitis, intestinal obstruction or neoplasm are likely differential diagnoses.

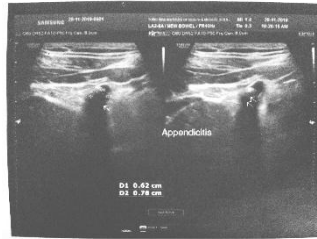


Figure 1: Abdominal ultrasound examination showing features of acute appendicitis, distended oedematous appendix (7.8mm). A faecolith (6.2mm) is seen.



Figure 2: Abdominal contrast-enhanced CT showing a distended (>0.6cm) appendix with stranding of periappendiceal fat indicative of inflammation.

II. Methods and Materials:

This retrospective study conducted in the department of surgery at TRIHMS, Naharlagun for a period of one year from 01-01-2019 to 31-12-2019. Total 133 patients presenting with symptoms and signs of acute appendicitis in this period included and evaluated using the Alvarado(MANTRELS) scoring system in the present study. Patients who fulfil the criteria of the scoring system operated by conventional method of open appendectomy. The diagnosis of acute appendicitis confirmed by histopathological examination of the appendectomy specimen.

Inclusion criteria

- (1) Male and female – both gender of patients admitted to the hospital with symptoms and signs of acute appendicitis.
- (2) Address for surgical intervention at TRIHMS.
- (3) Has given their written consent for anaesthesia for surgery.

Exclusion Criteria

- (1) Acute abdomen causes other than appendicitis.
- (2) Patients admitted to the hospital with pain abdomen along with distension of abdomen.
- (3) Pregnant female patients.
- (4) Any mass in abdomen including appendicular mass.
- (5) Patients who underwent elective/ interval appendectomy.
- (6) Patients not willing for surgery at TRIHMS.

A detailed history of all patients and through clinical examination were done. Investigations of routine blood test include Hb%, TC, DC, urine RE, pregnancy test for female patients, plain X-ray abdomen, ultrasonography of abdomen / pelvis were performed. Details of intraoperative findings were recorded and definitive diagnosis was based on histopathological examination of appendectomy specimen.

After thorough workup, the patients were decided into three group based on Alvarado scoring system.(fig.3)(4).

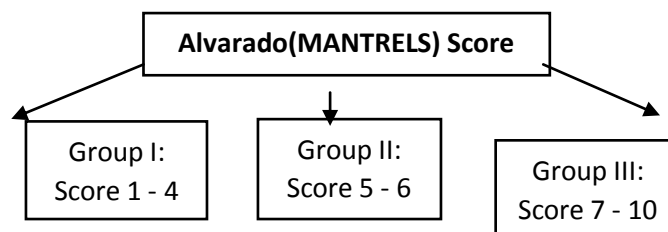


Figure 3: The division of patients into 3 groups.

The efficacy of Alvarado (MANTRELS) scoring system was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value and negative appendectomy rate.

III. Results:

The patients admitted to the hospital with symptoms and signs of acute appendicitis from 01-01-2019 to 31-12-2019 in the department of surgery at TRIHMS, Naharlagun, Arunachal Pradesh included in the study.

Table 1: Age- wise distribution of patients in acute appendicitis.

Age(Years)	No. of Male Patients	No. of Female Patients	Total No. of Patients	Percentage
1 – 10	4	5	9	6.77
11–20	14	13	27	20.30
21– 30	18	15	33	24.81
31 – 40	12	21	33	24.81
41 – 50	6	12	18	13.53
51 – 60	4	6	10	7.51
>60	3	0	3	2.25
Total	61	72	133	100

There were 61 males and 72 females patients with a M:F ratio of 1:1.18. The youngest patient was 2 years of age and the eldest patient was 73 years old. Acute appendicitis was common in the age group 11 years to 40 years.

Table 2: Features of the Alvarado (MANTRELS) score for acute appendicitis.

Feature	No. of Patients	Percentage
M- Migratory RIF Pain	58	43.40
A- Anorexia	84	63.16
N- Nausea and vomiting	89	66.92
T- Tenderness RIF	127	95.49
R- Rebound tenderness	75	56.30
E- Elevated temperature	71	53.38
L- Leucocytosis	97	72.93
S- Shift to left (segmented neutrophils)	67	50.37

Pain on abdomen was the most common presenting symptom (100%) with migratory RIF pain in 43.60% of cases. Nausea and vomiting was present in 66.92% and anorexia in 63.16% of cases. Tenderness on RIF was present in 95.39% of cases and leukocytosis was present in 72.93% of cases in the study.

Table 3: Results of application of the Alvarado (MANTRELS) scoring system in acute appendicitis.

Group	Score	No. of patients	Percentage
I	1 – 4	25	18.80
II	5 – 6	34	25.56
III	7 – 10	74	55.64

In this study, 75 (55.64%) patients are in the group of III (Score range of 7 – 10), 34 (25.56%) patients are in the group of II (Score range of 5 – 6) and 25 (18.80%) patients are in the group of I (Score range of 1 – 4).

Table 4: Results of the operative findings and histopathological examination of the appendix.

Finding		
Acute appendix	No. of patients	Percentage
Uncomplicated acute appendicitis	75	56.39
Perforated appendix	25	18.80
gangrenous appendix	22	16.54
Normal appendix	10	7.50
Meckel's Diverticulitis	1	0.75
Total	133	100

In the study, appendix was inflamed in 91.73% of cases and normal appendix was found in 8.73% of cases.

Table 5. Rates of negative appendectomy

Gender	Negative appendectomy	percentage
Male	5	3.76
Female	6	4.50
Total	11	8.27

In the study, Negative appendectomy rate was 8.27%; in males 3.76% and females 4.5%.

Table 6. Showing the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of Alvarado(MANTRELS)score with a cut-off of 7 in the present study.

SENSITIVITY	59.02%
SPECIFICITY	81.82%
POSITIVE PREDICTIVE VALUE	97.29%
NEGATIVE PREDICTIVE VALUE	15.25%
ACCURACY	60.90%

In the study, the sensitivity and specificity of the Alvarado scoring system with a cut-off of 7 were 59.02% and 81.82% respectively. Positive predictive value was 97.29% and negative predictive value was 15.25%.

IV. Discussion:

Acute appendicitis is the acute inflammation of the appendix. It is the most common cause of an 'acute abdomen' requiring emergency appendectomy. Lifetime risk factor of acute appendicitis is about 7% and emergency appendectomy account for 1% of all surgical operations (5). Incidence of acute appendicitis is rare before the age of two, acute appendicitis becomes increasing common during childhood and adolescence. The maximum incidence is between the age of twenty and thirty; thereafter is gradual decline, but no age is exempt. There is no unifying hypothesis regarding the aetiology of appendicitis. Decreased dietary fibre and increased consumption of refined carbohydrates may be important. The classical features of acute appendicitis begin with poorly localised colicky abdominal pain is associated with anorexia, nausea and usually one or two episodes of vomiting which follow the onset of pain and low grade pyrexia – so call “ Murphy’s syndrome” (John Benjamin Murphy|1857-1916, professor of surgery, North-western university, Chicago, U.S.A). Anorexia is a useful and constant clinical feature, Particularly in children. Typically, two clinical syndromes of acute appendicitis can be discerned, acute catarrhal (non-obstructive) appendicitis and acute obstructive appendicitis. The latter is characterised by a much more acute course. The diagnosis of acute appendicitis rests more on through clinical examination of the abdomen than on any aspect of the history or laboratory investigations. The cardinal features are those of an unwell patient with low-grade pyrexia, localised abdominal tenderness in RIF and maximum tenderness on the Mc Burney’s point - Mc Burney’s sign(Charles Mc Burney I 1845-1913, Professor of Surgery , Columbia University, New York, USA), muscle guarding and rebound tenderness - Blumberg’s or Release sign (Jacob Moritz Blumber I 1873-1955, Surgeon, German). Other signs which are helpful in supporting a clinical diagnosis of acute appendicitis include the pointing sign, Rovsing’s sign (ThorikildRovsingI 1862-1937, professor of surgery, Copenhagen, Denmark), The Cope’s psoas sign and Cope’s obturator sign (Sir Vincent Zachary Cope |1881-1975, Surgeon, St. Mary’s Hospital, London) .

It must be remembered that acute appendicitis is essentially a clinical diagnosis, there is no laboratory or radiological test yet that is 100% diagnostic. The likelihood of appendicitis can be ascertained using the

Alvarado (MANTRELS) score. This scoring system designed to improve the diagnosis of acute appendicitis and have been devised by giving relative weight to specific clinical manifestation.

In patients with scores of 9 to 10 are almost certain to have acute appendicitis, there is little advantage in further workup, and they should go to the operating room. Patients with scores of 7 to 8 have a high likelihood of appendicitis, while scores of 5 to 6 are compatible with, but not diagnostic of appendicitis and in those patients whose scores of 1 to 4 make it extremely unlikely (but not impossible) that they have appendicitis (6).

Ultrasonography done by good sonologist has an accuracy greater than 90% (7).

Sonographically, the appendix is identified as a blind-ending, non-peristaltic bowel loop originating from cecum. A scan is considered positive if a non-compressible appendix 6mm or greater in the anteroposterior direction is demonstrated. The presence of an appendicolith establishes the diagnosis.

Many studies have proved CT scan as having more accuracy than USG. On CT scan, the inflamed appendix appears dilated (greater than 6mm) and the wall is thickened. There is usually evidence of inflammation with “dirty fat” thickened mesoappendix, and even obvious phlegmon.

Recent development includes radionuclide imaging studies that are supposed to be highly accurate in diagnosis.

Diagnostic laparoscopy has a sensitivity and specificity of 100%, as evidenced by many studies (8). There are various studies which have considered Alvarado scoring in acute appendicitis as follows-

AUTHORS	YEAR	NO. OF PATIENTS	Percentage of accuracy
T.Dowellelal et al.	1992	215	78%
M.Y.P chan et al.	2001	148	79%
M.I.Selum et al.	2002	125	72%
B.L.Nabulsi et al.	2003	125	84%
N.Baidy et al.	2006	231	88%
O. Seda et al.	2014	74	65.70%
A. Upender et al.	2016	128	87%
S. Mahesh et al.	2016	50	86%
Z. Ozsoy and E. Yenidogen	2017	156	80%
Anupriya et al.	2019	70	41.43%
Present study	2019	133	60.90%

In the present study, the age range of patients was 2 years to 73 years. Acute appendicitis was common in the age group of 11-40 years (69.92%) and it is comparable to the study conducted by Addis DG et al.

There is a slight male to female predominance (M:F 1.2 to 1.3:1) in acute appendicitis. In the present study, the male to female ratio was 1:1.18.

In the present study, pain (100%) with migratory RIF pain (40%), Nausea & vomiting (66.92%) and anorexia (63.16%) was the common symptoms. Tenderness RIF (95.49%) was the common sign and leukocytosis was present in 72.93 of cases in acute appendicitis in the present study. These findings are comparable to those of Lameris et al.

In the present study, the patients group I (score range of 1-4) was 25 (18.80%), group II (score range of 5-6) 34 (25.56%) patients and group III (score range of 7-10) 74 (55.64%) patients in acute appendicitis. Mahesh S V et al reported 6% of patients in the group I, 24% in group II and 70% of patients in group III.

In the present study, acute appendicitis was confirmed uncomplicated acute appendicitis (56.39%) of patients, perforated appendix in 18.80% of cases and gangrenous appendix in 16.54% of patients. Subedi N et al reported inflamed appendix (84%) followed by perforated appendix (7.5%), gangrenous appendix (3.5%) and appendicular lump (1.5%) in their study.

In the present study, appendix was inflamed in 91.73% of cases and normal appendix was found in 8.27% of cases. Negative appendectomy rate was 8.27%; in males 3.75% and females 4.50%. Shrestha R et al observed that acute appendicitis accounted for 88.80% in their study.

In the present study, the sensitivity and specificity of the Alvarado (MANTRELS) scoring system with a cut-off of 7 were 59.02% and 81.82% respectively. Mahesh SV et al reported in their study the sensitivity and specificity of the Alvarado scoring system with cut-off of 7 were 74.42% and 57.14% respectively.

In the present study, positive predictive value and negative predictive value was 97.29% and 15.25% respectively. Mahesh SV et al reported positive predictive value and negative predictive value 91.43% and 26.67% respectively. It was high in Shrivastava UK et al with negative predictive value 52.40% and in Memon ZA et al at 83.30%.

V. Conclusion:

Acute appendicitis is the most common cause of an “acute abdomen” in young adults and it is one of the commonest surgical emergencies requiring emergency appendicectomy. The diagnosis of acute appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen and surgical science. The proper application of Alvarado (MANTRELS) scoring system can improve the diagnostic accuracy and reduce the negative appendicectomy rate as well as possible complications in acute appendicitis in surgical practice.

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Reference:

- [1]. William NS, Bulstrede CJK, O’Connell PR. The vermiform appendix. Bailyand Love’s short practice of surgery . 25th edition. 2008;67: 1204-18.
- [2]. Mahesh SV, Hota PK, Sneha P. A study of Alvarado score and its correlation with acute appendicitis. *Int Surg J.* 2016;3:1950-53.
- [3]. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med.* 1986; 5:557-64.
- [4]. Schogilev DJ, Duus N, Odom SR, Shapiro NI. Diagnosis appendicitis. Evidence based review of the diagnosis approach in 2014. *West J Emerg Med.* 2014; 15(7): 859-71.
- [5]. Ergul E. Importance of family history and genetic for the prediction of acute appendicitis. *Internet J surg.* 2007; 10:12-15.
- [6]. Brunnicardi C F, Andersen DK, Dunn DL, Hunter JG, Pollock RE. The Appendix. *schwartz’s Principles of surgery.* 8th edition. 2005; 29: 1119-37.
- [7]. Rioux. Sonographic detection of the normal and abnormal appendix. *Am J Radiol.* 1992;158:773-74.
- [8]. Guller U, Hervex S, Purves H, Muhlbaier LH, Peterson ED. Laparoscopic versus open appendectomy. Outcomes comparison based on a large administrative data-base. *Ann Surg J.* 2004;239(1):43-52.

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