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STUDY OF CORRELATION OF MODIFIED ALVARADO SCORING WITH HISTOPATHOLOGY AND EARLY POST OPERATIVE COMPLICATIONS

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ABSTRACT: Appendicitis being the commonest acute abdominal surgical condition, although diagnosis can be made clinically but possess diagnostic difficulty to junior surgeons. The need for appropriate tool/scoring system that can be easily applicable, accurate & reproducible in the diagnosis of appendicitis is essential to have a low negative Appendicectomy rate. This prospective study is designed to assess one such scoring system, i.e., Modified Alvarado Score. **MATERIALS AND METHODS: SETTING AND DURATION:** Department of Surgery, Hassan Institute of Medical Sciences/Teaching Hospital, Hassan. From August 2013 to September 2014. A total of 227 consecutive male and female patients with age above 14 years presenting with right lower abdominal pain were enrolled in this study, analysed according to eight variables of Modified Alvarado scoring system and were accordingly placed into 3 groups. Group-I patients having score 1–4 were discharged, Group-II patients having score 5–6 were observed, while Group-III patients having score 7–10 were operated and all the operated patients were followed up for 30 days. These groups were compared with intra-operative findings, histopathological results & early post –operative complications. **RESULTS:** Of the total 227 patients included in this study, 155 underwent Appendicectomy based on the Modified Alvarado scoring system. Out of 155 operated patients 142(91.6%) had acute appendicitis, thus yielding a positive predictive value of 91.6% while negative appendicectomy rate 9.3%. Frequency of negative appendicectomy was 5.3% (5/94) among males and 9.4% (08/61) in females. Post-operative complication rate including wound infection, pelvic abscess, chest and urinary tract infection was 10.3% (16/155). **CONCLUSION:** The present study showed that Alvarado clinical scoring system has a high diagnostic value of 90%. Alvarado scoring system is dynamic one & its proper application improves diagnostic accuracy. There by reduce the rate of negative appendicectomy, anticipate the post-operative stay & complications. In acute appendicitis, modified Alvarado scoring can be used as an objective criteria for selection of patient for appropriate Medical or Surgical treatment. This scoring system is easy, simple and cheap complementary aid for supporting the diagnosis of acute appendicitis especially for junior surgeons. **KEYWORDS:** Acute appendicitis, appendicectomy, modified Alvarado scoring system.

INTRODUCTION: Acute appendicitis is the most common cause of an acute abdomen requiring surgery, with a lifetime risk of about 7%.^[1] Symptoms of appendicitis overlap with a number of other conditions making diagnosis a challenge, particularly at an early stage of presentation.^[2] Patients may be appropriately grouped for alternative management strategies-reassurance, alternative diagnosis, or observation/admission to hospital. If admitted to hospital, relevant investigations may be required prior to proceeding to an appendicectomy.^[3] Incidence of appendicitis is 1.5 & 1.9/1000 in male and female population.^[4]

Surgery for acute appendicitis is the most frequent operation performed (10% of all emergency abdominal operations).^[5]^[6] The diagnosis of acute appendicitis is primarily clinical,^[7]

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including history and physical findings, with additional assistance from laboratory findings.^[8] Radiological investigations do not appear to help.^[9] A typical patient is one presenting with right lower abdominal pain, nausea and vomiting, having tenderness and guarding in right iliac fossa on examination.

However these signs and symptoms are not very specific for acute appendicitis and can acute abdominal conditions.^[10] Therefore, decision making may be difficult especially for junior surgeons. Difficulty in diagnosis arise in very young, elderly patients and females of reproductive age because they usually have atypical presentation and many other conditions also present like appendicitis and literature shows that 2-7% of all adults on exploration have diseases other than appendicitis.^[11]

Although there is much advancement in gastroenterology but no major improvement in diagnostic accuracy of acute appendicitis, which ranges from 25-90% and optimum rate, is 80% which is less in females than males.

Scoring systems are valuable and valid instruments for discriminating between acute appendicitis and non-specific abdominal pain.^[12] There are several scoring system for diagnosis of Acute appendicitis in which modified Alvarado scoring is simple, easy & complimentary to aid diagnosis.^[13] This study was designed to evaluate the usefulness of this scoring system.

MATERIAL AND METHODS: This study was carried out at the surgical units of Sri Chamarajendra Hospital, Hassan Institute of Medical Sciences, Hassan from August 2013 to September 2014. A total of 225 consecutive patients presenting with signs and symptoms suggestive of acute appendicitis were included in this study. Children under 14 year of age, patients unwilling for surgery, mentally retarded and non-cooperative patients were excluded from the study. Similarly patients presenting with signs and symptoms suggestive of mass right iliac fossa, generalised peritonitis, gynecological and urinary tract problems were also excluded.

All patients included in this study were admitted to the ward, history with emphasis over complaints related to scoring parameters was taken, followed by detailed clinical examination. Routine investigations were carried out including total and differential leucocyte count. After initial assessment findings were recorded on a proforma designed according to eight variables (Table-I) of scoring system.^[14]

Based on aggregate scores, patients were placed into following 3 groups by senior residents working in the Department of General surgery: Group-I (aggregate score 1–4): These patients were discharged after initial assessment, with the strict advice to come back to the same unit and hospital if symptoms persist or recur.

Symptoms	Score
Migratory right iliac fossa pain	1
Nausea / Vomiting	1
Anorexia	1
Signs	
Tenderness in right iliac fossa	2
Rebound tenderness in right iliac fossa	1
Elevated temperature	1

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Laboratory findings	
Leucocytosis	2
Shift to the left of neutrophils	1
Total	10

Table 1: Modified Alvarado Score

Group-II: (Aggregate score 5–6): These patients after initial assessment were kept under observation and reassessed at 4–6 hourly interval till next 24–48 hours, to know whether the score rises or drops. If score dropped to < 4, patients were discharged with the advice to come back if symptoms persist or recur. Otherwise if score rose up to 7 or more they were operated.

Group III: (Aggregate score 7–10): These patients as per scoring system were having acute appendicitis and underwent appendicectomy. Antibiotics were used for a maximum of 3 doses in patients with un-complicated appendicitis & 5–9 days in perforated or gangrenous appendicitis.

Uncomplicated patients were discharged on 2nd/3rd postoperative day while those with complications were kept admitted till full recovery. The procedures were performed by general surgeons having more than 7 years experience in a teaching hospital. The diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of the appendicectomy specimen. Post-operative stay & complications were documented.

Finally the reliability of modified 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: We conducted this study in 225 consecutive patients with clinical features suggestive of acute appendicitis and 155 of them underwent appendicectomy. Among these patients 61 were female (39.6%) and 94 were male (60.3%) ratio of male to female is 1.5:1.0. Mean age was 22.8 years (range 14–65 years, standard deviation + 8.1 years), with median age of 23 years. Most of the patients were of younger age group.

AGE (years)	MALE NUMBERS (PERCENTAGE)	FEMALE NUMBERS (PERCENTAGE)
14 – 20	33(21.2)	17(10.9)
21 – 30	36(23.2)	20(12.9)
31 – 40	14(9.0)	16(10.3)
>40	11(7.0)	8(5.2)
TOTAL	94	61

Table 2: DEMOGRAPHIC DATA

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TOTAL ALVARADO SCORE	NO. OF PATIENTS	PERCENTAGE
1	nil	
2	3	1.3
3	18	7.9
4	28	12.3
5	28	12.3
6	35	15.4
7	30	13.2
8	40	17.6
9	23	10.1
10	22	9.7
TOTAL	227	100

Table 3: Frequency distribution of the patients according to Alvarado scoring system

Mean scores for the emergency surgery group, observation group and discharge home group were 8.32, 5.55 and 3.51 respectively (range of score 1-10).

GROUP	ALVARADO SCORE	MEAN SCORE	NO.OF PATIENTS	PERCENTAGE
I	1-4	3.51	49	21.5
II	5-6	5.55	63	27.8
III	7-10	8.32	115	50.7
TOTAL			227	100

Table 4: Group wise results were as follows

Group I: Modified Alvarado score (below 4) contains 49 patients 21.5%. All of these patients were seen in the emergency & discharged to follow up in Surgery outpatient after 24 hrs. Only 29 patients came back to out-patient and out of which 20 patients were completely relieved of symptoms & 9 were admitted for observation. In 5 patients who complained of increase in pain & tenderness in right iliac fossa having their modified Alvarado score increased up to 7 underwent appendicectomy & found inflamed appendix, later on confirmed by histopathology report except for one.

Group II: Modified Alvarado score (5 & 6) contains 45 patients out of 225 patients were admitted in surgery ward for observation. After admission 28 patients improved clinically & discharged & in 35 patients Modified Alvarado score raised 7 & above were operated. In these patients appendix were found normal in 6 patients in which 4 were female (2 had rupture ovarian cyst & 2 had ectopic pregnancy). Appendix were also removed in these patients to avoid any confusion & diagnostic difficulty in future due to incision given.

Group III: Modified Alvarado score (7-10) contained 115(50.7%) patients, all were admitted & underwent appendicectomy. During surgery in 6 patients appendix was found normal & 68 had acutely inflamed appendix, while in 35 patients were found to have complicated appendicitis

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(gangrenous, perforated & appendicular abscess). Later on histopathology confirmed the above described data. Out of 6 normal looking appendixes 4 were female 2 had ectopic pregnancy & 2 patients with ovarian cyst were referred to obstetrics & gynecology unit. Out of 155 operated, the rate of negative appendicectomy was 13 in whom 5 male & 8 female.

Suggested management	score	Results	Mean score
Group 1-discharge	49 - 5	44(19.5 %)	3.51
Group 2-observation	63 - 35	28 (12.4%)	5.55
Group 3 -surgery	115+35+5	155(68.9%)	8.32

Table 5: Suggested management after application of Modified Alvarado score (n= 225)

As a whole positive predictive value of Modified Alvarado score was 91.7% while in male 95.3% & 81.5% were female.

Gender	Operated number	Percentage	Negative appendicectomy No. (%)	Positive predictive value
Male	94	60.3	5 (5.3)	94.7%
Female	61	39.6	8 (13)	86.9%
Total	155	100	13 (9.15)	91.6%

Table 6: Positive predictive value (n=155)

There was significant difference among negative appendicectomy rates of subjects of group 3 & those with groups 2 & 1 who underwent surgery due to their raised Modified Alvarado score.

Present study also observed the duration of hospital stay by the different groups. The group I, group II & group III patients were treated in hospital for (1-4days), 3.5(2-6days) & 5.5(3-9days) respectively. Postoperative complications observed were also more with increasing Modified Alvarado score, group I patients no complications observed, where as in group II three patients(4.7%) had complications, two developed urinary tract infection & one had surgical site infection & group III: 13 patients developed complications, 3 patients having Modified Alvarado 10 score had pelvic abscess, 3 patients had post-operative ileus, 2 patients developed fever due to respiratory infections were age more than 60 years & 4 developed urinary tract infection.

Group	Duration of hospital stay	Post-operative complications (%)
I	Not admitted	Nil
II	3.5(2-6days)	3 (4.7%)
III	5.5(3-9days)	13 (11%)

Table: 7 Group wise comparison

DISCUSSION: Acute appendicitis being a common abdominal emergency is diagnosed on clinical findings^[15] Classically the patient is young, more common in male during 2nd & 3rd decade of life but can occur at any age. It is rare below the age of two years & in old people, i.e., at both extremes of life. The principal objective of the clinical decision process is to make, a correct diagnosis with maximal economy of resources and as soon as possible.^[16]

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When the decision is whether or not a patient has acute appendicitis the importance of this choice is heightened, by the urgency of the situation and the need of surgical intervention which carries a definitive risk of morbidity and mortality.^[17] The morbidity & mortality rates related to appendicitis are decreased. This is because recognition of complications of acute appendicitis & aggressive treatment strategies involving early operation with acceptance of high negative appendectomy rates of 15- 30% is universal.

The indication for operative treatment remains based on clinical examination^[18] and the accuracy of diagnosis has improved little in decades, with a negative appendectomy rate as high as 30%.^[19] Of all the different diagnostic aids that have appeared recently, only laparoscopy, ultrasonography and computer-aided diagnosis have demonstrated good clinical results, but all have their own drawbacks.^[17]

Clinical scoring systems have proved useful in the management of many surgical conditions. In recent years various scores have been developed to aid the diagnosis of acute appendicitis for Junior staff, in particular, may get benefit from the use of structured data forms by adopting a more systematic approach to patient assessment. Also the structured data collection may lead to improved history taking and decision-making behavior among hospital staff.

Modified Alvarado Score works with data collected routinely on suspected cases of appendicitis in General surgical wards and it can be applied in very short period. In our study, out of total 155 patients, 94 were male & 61 female with male to female ratio 1.5:1. which is comparable to similar studies conducted by Wazir et al.^[20] Arain et al^[21] and Ijaz et al.^[23] The mean age of the patients was 22.7 years (median age was 24 years) with the range of 14–65 years. The study done by Walker et al^[22] showed the median age of the patient 18 years with range of 6–81 years.

Similarly the study conducted by Arain et al^[21] recorded a mean age of 19.9 years with the median age of 22 years, so the values obtained in our study are comparable to these studies conducted earlier. Ijaz et al^[23] recorded sensitivity of 96%, specificity of 85%, positive predictive value of 85% and diagnostic accuracy of 84% while evaluating a similar other scoring system for appendicitis, which is closely comparable to positive predictive value (91.66%) observed in our study. Arain et al recorded sensitivity of 97.2%, specificity of 84.6% and positive predictive value of 85.5% while evaluating Modified Alvarado Score.

The frequency of negative appendectomies was 9.0% which is comparable to the results shown by various authors in their studies, e.g., Arain et al (14.3%), Ijaz et al (16%). In males the frequency of negative appendectomies was 5.3% (5/94) while in females it was 13.1% (8/61) which can be compared to published results of 25%, 21%, 17.5%, 14.8% documented by Ijaz et al, Ohmann et al,^[24] Fenyo et al.^[25] and Alvarez et al^[26] respectively. Fenyo et al recorded sensitivity, specificity and positive predictive value of 73%, 87% and 72% respectively while assessing scoring system in their study. Therefore our recorded statistical values are closely comparable to their values.

Variable	Our study	Arain et al ^[21]	Ijaz et al ^[23]
Sensitivity	73.2%	97.2%	96%
Specificity	92.3%	84.6%	85%
PPV	94.8%	85.5%	85%
NPV	64.3%		84%

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Present study also observed the duration of hospital stay by the different groups. The group I, group II & group III patients were treated in hospital for 2.5(1-4days), 3.5(2-6days) & 4(3-7days) respectively.

In present study, post-operative complications observed were also more with increasing Alvarado score, Group I none of the patient developed any complications, where as in Group II- three patients(4.7%)had complications, two patients developed urinary tract infection & one patient had surgical site infection & Group III: 13 patients had complications out of which 8 were having Alvarado 9 & 10 score, 3 patients had pelvic abscess, 3 patients developed post-operative ileus, 3 patients developed fever due to respiratory infections were age more than 60 years & 4 patients developed urinary tract infection.

CONCLUSION: The present study showed that Modified Alvarado clinical scoring systems has a high diagnostic value of 90%. Modified Alvarado scoring system is dynamic one & its proper application improves diagnostic accuracy. This scoring system is easy, simple and cheap complementary aid for supporting the diagnosis of acute appendicitis especially for junior surgeons Thereby reduce the rate of negative appendicectomy, anticipate the post-operative stay & complications.

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