

## MODIFIED ALVARADO'S SCORE: A DIAGNOSTIC TOOL FOR ACUTE APPENDICITIS

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**ABSTRACT: BACKGROUND:** Alvarado score is simple and can be instituted easily as this scoring is clinical, non-invasive and can be used to support diagnosis of acute appendicitis. Alvarado system combined with ultrasound can be used as a cheap and inexpensive way to confirming acute appendicitis and reducing negative appendectomy rate. **METHODS:** The patients on admission were evaluated on the basis of Alvarado scoring. In this study we used a slightly modified version of Alvarado score by excluding one lab finding – shift to the neutrophils maturation. (Score 1), instead patients were subjected to ultrasonography of abdomen. **CONCLUSION:** Alvarado scoring system is dynamic allowing observation and critical reevaluation of evolution of clinical picture.

**KEYWORDS:** Alvarado score, acute appendicitis.

**INTRODUCTION:** Appendicitis is a great leveler in surgery, an antidote to diagnostic complacency. Albeit abdominal surgeons have been confronting acute appendicitis for more than 120 years its diagnosis remains elusive because of its notorious ability to stimulate other conditions and in the frequency it can be mimicked by other pathologies.

Delay in early diagnosis will lead to complications of acute appendicitis with their attendant increased morbidity. On the other hand, overzealous diagnosis may lead to a negative appendectomy. Further due to increase in use of appendix for urinary tract reconstruction<sup>1-3</sup> and biliary tract replacement it is probably important to save a normal appendix (for future) as it is to remove a pathological (inflamed) appendix.

Although aids exist to enhance diagnosis, these are either complex or not easily available when most needed Alvarado scoring system described by Alvarado was designed to reduce the negative appendectomy rate without increasing morbidity and mortality.

This present study aims to evaluate usefulness of this scoring system in patients who come to emergency OPD at Sree Siddhartha Medical College & Hospital, Tumkur and provisionally diagnosed as acute appendicitis [pain in right iliac fossa].

Alvarado score<sup>4-6</sup> is simple and can be instituted easily as this scoring is clinical, non-invasive and can be used to support diagnosis of acute appendicitis. It consists of 3 symptoms, 3 signs and 2 lab findings.

### Symptoms:

Migratory RIF pain	-	1
Anorexia	-	1
Nausea/ vomiting	-	1

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**Signs:**

RIF tenderness	-	2
Rebound tenderness	-	1
Increase in temperature	-	1

**Lab Findings:**

Leukocytosis	-	2
Shift to the left	-	1

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Patients, with score of 1-4 were not considered to have acute appendicitis; those patients with a score of 5-6 were considered to have a possible diagnosis of appendicitis, but not convincing enough to warrant immediate surgery, these were marked for review.

Those with a score of 7-8 were considered to have a probable acute appendicitis and those with a score of 9-10 were considered to have an almost definite appendicitis and submitted to surgery.<sup>4,5</sup>

Scoring system.<sup>6</sup>

Score	Inference
1 – 4	appendicitis unlikely
5 – 6	appendicitis possible
7 – 8	appendicitis probable
9 – 10	appendicitis definitive

**AIMS AND OBJECTIVES:**

1. To analyse validity of Alvarado score along with other diagnostic aids to decrease negative appendicectomy.
2. To use ultrasonography as an aid for diagnosis.
3. To confirm diagnosis/ pathology by histopathological examination.

**MATERIALS & METHODS:** The present study was conducted in surgical emergency wards of Sree Siddhartha Medical College & Hospital, Tumkur.

The patients on admission were evaluated on the basis of Alvarado scoring. In this study we used a slightly modified version of Alvarado score by excluding one lab finding – shift to the neutrophils maturation. (Score 1) This was not available from our laboratory on a routine basis; instead patients were subjected to ultrasonography of abdomen.

**USG Criteria of acute Appendicitis:<sup>6</sup>**

- Visualisation of appendix\*.
- Diameter > 6mm.
- Wall thickness > 3mm.
- Complex mass (echo poor, asymmetric).

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- Irregular asymmetry.
- Loss of contour.
- Free fluid.
- Local adynamic ileus.
- Graded tenderness over McBurney's point.

\*If the appendix can be seen on USG examination this is taken to indicate the presence of acute appendicitis. If the organ cannot be seen, appendicitis is excluded.<sup>6</sup>

**OBSERVATIONS AND RESULTS:** In this series out of 100 patients 55 were male and 45 were female patients. Most patients presented with classical symptoms of appendicitis including abdominal pain (migratory pain), nausea and vomiting, anorexia, typical signs such as right lower abdominal tenderness.

Symptoms	No. of patients	Percentage
Nausea	89	89%
Anorexia	94	94%
Migratory pain	51	51%
Raised temperature	47	47%
Rebound tenderness	74	74%
Increased TLC	48	48%

### CLINICAL SYMPTOMATOLOGY:

1. **Migratory Right iliac fossa pain:** In our study 50% of patients presented with pain around umbilicus which later shifted to right iliac fossa. Majority had aching type of pain while colicky type was noted in 40% of patients.
2. **Anorexia:** Anorexia nearly always accompanies appendicitis in our study 94% had symptoms of anorexia
3. **Nausea or vomiting:** This was second most common symptom (89%). Most patients complained of 1 or 2 episodes only. Vomiting appeared after onset of pain in all cases.
4. **Physical signs:**
  - a) Right iliac fossa tenderness – all of our patients had RIF tenderness at time of presentation
  - b) Rebound tenderness – in our study rebound tenderness was present in 74% of cases, in these cases post operatively they were found to have anteriorly placed appendix.
  - c) Rise in temperature – low rate fever was noted in 47% of patients.
5. **Investigations:**
  - a) WBC count – In our series total leukocyte count was raised in more than 48% of cases.
  - b) Ultrasound – all cases were subjected to ultrasonography and graded tenderness was present in 80% of cases.

Patients were divided in to two groups according to sex, males and females and according to age incidence

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### Age and Sex Incidence:

Age in years	Male	Female	Total
1 - 10	-	-	
11 - 20	13	11	24
21 - 30	24	21	45
31 - 40	12	10	22
41 - 50	4	3	7
51 - 60	1	-	1
61 - 70	1	-	1
	55	45	100

Patients were distributed according to frequency of alvarado scores

Alvarado scores	No. of patients
Score 4	2
Score 5	12
Score 6	11
Score 7	28
Score 8	40
Score 9	6
Score 10	1

### ULTRASONOGRAPHIC FINDINGS:

USG FINDINGS	NO. OF PATIENTS	PERCENTAGE
Visualization of appendix	30	30%
Diameter > 6mm	5	5%
Wall thickness > 3mm	20	20%
Complex mass (echo poor, asymmetric)	-	-
Irregular asymmetry	-	-
Loss of contour	-	-
Free fluid	-	-
Local adynamic ileus	71	71%
Graded tenderness over McBurney's point	80	80%
Normal study	9	9%

**MANAGEMENT:** All the patients under this study were operated. Both open and laparoscopic surgeries (Fig 1 and 2) were done. 2 male patient with normal appendix had Meckel's diverticulum which was operated in same sitting, one elderly male was found have a ceecal mass per-operatively and hemicolectomy was done suspecting ileocaecal Koch's/caecum. Histopathology in this case was carcinoma caecum. Cause for symptoms could not be made out in another one male patient with normal appendix (HPE report).

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1 female patient with score of 4 was initially managed conservatively with provisional diagnosis of gastroenteritis but later, as pain did not subside, (score increased to 5 with onset of new symptom) laparoscopy (diagnostic) was undertaken & appendectomy was done. HPE report was normal appendix. The cause for symptoms in this case could not be established. Remaining 5 female patient had ectopic pregnancy (1), Meckel's diverticulitis (1), ovarian torsion (1), diagnosis for two other cases could not be established.

All open surgery cases were given spinal anesthesia while patients undergoing laparoscopy were given general anesthesia.

### Condition of Appendix per Operatively:

Condition of appendix	No. of patients
Inflamed appendix	84
Normal appendix	10
Perforated appendix	2
Gangrenous appendix	4

**Postoperative Complications:** Appendectomy is a common operation which has a low risk of complications and mortality.<sup>7</sup> During postoperative period 4 patients developed wound infection.

The pathological diagnosis of specimen of appendix sent for histopathological examination showed the following:

Histopathology	No. of cases	Percentage
Acute appendicitis	86	86%
Normal appendix	10	10%
Gangrene appendix	4	4%

**DISCUSSION:** We conducted our study in 100 consecutive patients with clinical features suggestive of acute appendicitis. This discussion is based on observations and analysis of results in this study with regard to incidence, age, sex, symptoms, signs, investigations, operative findings and Alvarado scores compared to other previously reported studies. Men are at greater risk than women for developing appendicitis.<sup>7</sup> In our study also men were affected more than women. (1.27:1).

Appendicitis is most frequently seen in patients in their second decades of life.<sup>8</sup> It occurs infrequently during first 3 years of life.<sup>9</sup> In our study we had similar results with 45% of patients between 20-30 years and 22% in 30-40 age group (mean age of 28.23 years and median age of 26 years).

According to study conducted by Michelle Colson et al<sup>10</sup> female patients were more likely to have negative explorations. In a study conducted by Kalan M et al negative appendix rate in women using alvarado score (it was modified by deleting last parameter –shift of neutrophils to left) was 33% v/s 22%. In a study conducted by Sudhir Kumar Mohanty et al where USG finding was added to modified alvarado score (shift of neutrophils to left was deleted from original score) negative appendectomy rate was 4.8% for males and 6.7% for females. In a study conducted by Bhattacharjee

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PK<sup>10</sup> who also incorporated USG for modified alvarado score by deleting last parameter shift of neutrophils to left incidence of negative appendectomy was highest among females (28.1%).

In a study done by Owen TD (using original Alvarado score) males with score >7 had sensitivity of 94% while women with >7 score had 78%. In a study done by Kalan et. Al. men with alvarado score > 7, sensitivity was 93% while for women with score > 7 it dropped to 67%. In a study conducted by Bhattacharjee<sup>10</sup> overall sensitivity in men with scores > 7 was 94.1% while in females scores > 7 it was only 71.9%. In our study overall sensitivity score in men with scores > 7 was 100%.while in females with scores > 7 it was 94.1%

In a study conducted by Kalan et al men with scores < 7 had sensitivity of 67% while women with scores < 7 had sensitivity of 50%.In a study conducted by Bhattacharjee P.K. et. al<sup>11</sup> men with alvarado score < 7 (<6) had sensitivity of 83.3% while women with same scores had sensitivity of 66.7%. In our study men with alvarado score <7 sensitivity was 71.4% and women with alvarado score < 7 sensitivity was 63.63%.

Open surgery have wound complication rates of upto 20% but its 5% in lap surgeries.<sup>12</sup>In a study conducted by Samuel elder et.al.<sup>13</sup> post-operative complications occurred in 10% of cases with simple acute appendicitis, was about 20% with gangrenous/perforated appendicitis. In our study out of 4 cases of wound infections that had undergone open surgeries two had gangrenous appendix, one had perforated appendix and one had simple appendicitis

**CONCLUSION:** Alvarado scoring system combined with ultrasonography is a cheap and quick tool that can be applied in emergency department to diagnose acute appendicitis. Scoring system is dynamic allowing observation and critical reevaluation of evolution of clinical picture. Its application improves diagnostic accuracy and reduces negative appendectomy without increase in morbidity and/or mortality.

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**Fig. 1: Open Appendectomy:**



**(1) Appendix brought out with cecum (mesoappendix being ligated)**



**(2) Base of appendix crushed, ligated and being cut**

**Fig 2: Laparoscopic appendectomy in progress:**



**Figure 2**

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