

## Prospective assessment of the role of Alvarado Score and Ultrasound in Diagnosing and Preventing Negative Laparotomies in Acute Appendicitis

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### Abstract

**Aim:** To evaluate the role of Alvarado score and ultrasound in diagnosing and preventing negative laparotomies in acute appendicitis.

**Methodology:** A prospective study was conducted on 50 consecutive patients who underwent appendectomy in the department of general surgery at Sheikh Bhikhari Medical College and Hospital, Hazaribagh, Jharkhand, India, Depending on individual presentation of signs and symptoms, a score was calculated for each case of suspected appendicitis from 10 values (based on the Alvarado scoring system).

All patients were clinically examined after taking a detailed history using a structured questionnaire. Then, they underwent blood examination, ultrasound abdomen, followed by surgery. The histopathological examination (HPE) of the specimen was obtained. Finally, the histopathology reports were correlated with the findings of ALVARADO Score and USG abdomen.

**Results:** In our study of 80 patients, 31(62%) were male, and 19 (38%) were female. 23 (46%) patients were between 20-29 years of age followed by 14-20 years of age (32%). 50 (100%) of patients were admitted with pain in the abdomen. 39 (78%) complained of nausea or vomiting at admission, 33 (66%) had fever on admission and 41 (82%) of patients had anorexia at the time of admission. All patients (100%) had tenderness in the right iliac fossa. A shift to the left was seen in 40 (80%) of patients.

**Conclusion:** According to our study the use of Alvarado Scoring System with USG is more effective and accurate than USG performing alone. It can be recommended to perform USG on each patient with suspected appendicitis and to operate on patients with a USG-supported appendicitis diagnosis and an Alvarado score of 7 and above.

**Keywords:** Laparotomies, Appendicitis, Alvarado Score, Ultrasonography (USG).

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## Introduction

The appendix is a narrow tube that attaches to the large intestine. It is located in the lower right-hand side of the abdomen. Acute appendicitis is the sudden and severe inflammation of the appendix. It can cause pain in the abdomen, and this pain may occur quickly and worsen within hours. Any blockage or inflammation affecting the appendix can lead to swelling, causing acute appendicitis. As the swelling increases, the blood supply to the appendix reduces and stops. Without enough blood, the appendix may start to die, or it could tear or burst. Acute appendicitis is one of the most common situations that require emergency surgery [1].

Acute appendicitis is the most common surgical abdominal emergency with a lifetime prevalence of one in seven [2]. Appendicular abscesses occur in 2-6% and appendicular perforation in 25.8% of untreated patients [3].

Performing an appendectomy on clinical suspicion alone will lead to 15-30% of negative appendectomies [4, 5]. Negative appendectomy rates are reported to be between 13% and 34% in most series [6]. The accuracy of clinical examination ranges from 71-97%, depending on the examiner's experience [7]. However, a missed case of appendicitis can have dire consequences, so surgeons usually operate with a 20% negative appendectomy rate [8]. A study of more than 75,000 patients from 1999 to 2000 revealed a negative appendectomy rate of 6% in men and 13.4% in women [9]. Negative appendectomy was associated with significant morbidity and mortality at times. As the need to increase the diagnostic accuracy of appendicitis arose, different tools were used.

The Alvarado score was described in 1986 and has been validated in adult surgical practice. This scoring system can reduce the negative appendectomy rate to 5% [10]. It was later modified by Kalan M et al. [11]. In order to improve the diagnostic

accuracy, a number of diagnostic modalities have been proposed, including clinical scoring systems, ultrasonography, CT scans, MRI and laparoscopy [12, 13]. Graded compression ultrasonography is an accurate procedure that leads to the prompt diagnosis and early treatment of many cases of appendicitis [14].

## Materials and Methods

A prospective study was conducted on 50 consecutive patients who underwent appendectomy in the department of general surgery at Sheikh Bhikhari Medical College and Hospital, Hazaribagh, Jharkhand, India

### Inclusion criteria

All consecutive patients more than 14 years of age who had a provisional diagnosis of acute appendicitis and were willing for surgery and who gave consent for the study were included.

### Exclusion criteria

Patient coming to the hospital with pain abdomen along with distention of abdomen; Pregnant females; Patient not willing for surgery; and Children less than 14 years of age.

Depending on individual presentation of signs and symptoms, a score was calculated for each case of suspected appendicitis from 10 values (based on the Alvarado scoring system). Patients were classified into three groups based on end score:

- Those patients with scores of  $\geq 7-9$  underwent appendectomy.
- Those patients with scores of 5-7 who were thought on clinical grounds to require appendectomy, it was performed.
- Those patients with a score of  $<5$  was observed initially, reassessed and later underwent surgery.

All patients were clinically examined after taking a detailed history using a structured questionnaire. Then, they underwent blood

examination, ultrasound abdomen, followed by surgery. The histopathological examination (HPE) of the specimen was obtained. Finally, the histopathology reports were correlated with the findings of ALVARADO Score and USG abdomen [5].

### Results:

In our study of 80 patients, 31(62%) were male, and 19 (38%) were female. 23 (46%) patients were between 20-29 years of age followed by 14-20 years of age (32%).

**Table 1: Demographic details of patients**

Variables		Number	%
Age (in years)	14-20	16	32
	20-29	23	46
	30-39	7	14
	>39	4	8
Gender	Male	31	62
	Female	19	38

50 (100%) of patients were admitted with pain in the abdomen. 39 (78%) complained of nausea or vomiting at admission, 33 (66%) had fever on admission and 41 (82%) of patients had anorexia at the time of admission. All patients (100%) had tenderness in the right iliac fossa. A shift to the left was seen in 40 (80%) of patients.

**Table 2: Sign and symptoms of patients**

Sign and symptoms	Number	%
Pain in abdomen	50	100
Tenderness	50	100
Nausea or vomiting	39	78
Fever	33	66
Shift to left	40	80
Anorexia	41	82

28 (56%) of patients in our study had conclusive evidence of appendicitis on ultrasound. Alvarado score calculated for the 80 patients showed that 44 (88%) had a score  $\geq 7$ . Histopathology revealed that 45 (90%) patients had appendicitis.

**Table 3: Predictive power of conclusive in USG in predicting appendicitis**

USG Abdomen	Appendicitis	Normal	Total
Conclusive	25	3	28
Inconclusive	20	2	22
Total	45	5	50

**Table 4: Predictive power of ALVARADO Score  $\geq 7$  in predicting appendicitis**

ALVARADO score	Appendicitis	Normal	Total
$\geq 7$	41	3	44
$< 7$	4	2	6
Total	45	5	50

## Discussion

As in a previous study by Hale et al., a similar picture was noted in the case of the gender predisposition, with males affecting 65% compared to females 35% [15]. The predominant clinical feature was pain abdomen seen in all the patients followed by nausea and vomiting in 82% of the subject. This was later followed by anorexia in 80% of patients, then fever in 70% of subjects. These results are consistent with the studies done by Hardin et al. and Wagner JM et al [16, 17].

Ultrasound abdomen findings are operator dependent, and an experienced sonographer can give far better positive findings than an experienced one. The inability of the Sonologist to achieve adequate compression of the right lower quadrant could be due to obesity of the patient, presence of severe pain or abdominal guarding, in case of excessive bowel gas, and an uncooperative patient can all affect the accuracy of the ultrasound. The anatomical location of the appendix, like in retrocecal position it is not easily visible due to the bowel being placed anteriorly.

The ALVARADO score is a scoring system that was developed to facilitate the diagnosis of acute appendicitis. In 2011, a compilation by Ohleda et al [18] showed that when the predictive value of the Alvarado score was taken as 5, the sensitivity was 99% and the specificity was 43%; when predictive value was taken as 7, the sensitivity was 82% and the specificity was 81%. ALVARADO score was found to be more than or equal to 7 in 70(88.8%) cases. They were comparable to a study done by Limpawattanasiri et al [19].

Although appendicitis is a common disease that requires emergency surgery, a timely and correct diagnosis can be difficult at times [20]. A patient suspected of appendicitis should be thoroughly evaluated for other causes of abdominal pain prior to surgery. The removal of a

normal appendix exposes the patient to unnecessary risks related to surgery and anaesthesia and can have further implications in the patient's life.

## Conclusion

According to our study the use of Alvarado Scoring System with USG is more effective and accurate than USG performing alone. It can be recommended to perform USG on each patient with suspected appendicitis and to operate on patients with a USG-supported appendicitis diagnosis and an Alvarado score of 7 and above.

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