

## Clinical Diagnosis and Sonological Evidence in Diagnosis of Acute Appendicitis

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### Abstract

**Introduction:** Appendicitis is notorious in its ability to simulate other conditions and also it can be mimicked by other possibilities. Although considered one of the most elemental of general surgical disease processes, it is difficult to obtain an accurate preoperative diagnosis in many cases, regularly confounding the diagnostic acumen of many surgeons. Therefore delay in diagnosis and surgery result in perforation, the rate of which rises by 5% per 12 hour period, 36 hours after the onset of symptoms **Methodology:** Patients admitted in Victoria hospital, Bengaluru with features suggestive of Acute Appendicitis and undergoing surgery for the same were included in this study. For each patient Alvarado Score was calculated and the result of Ultrasonography was noted **Results:** Maximum number of positive cases was associated with Alvarado Score of 5 to 7 **Conclusion:** Right Tenderness was more common clinical sign

**Keywords:** Appendicitis; Clinical Signs; Alvarado Score.

### Introduction

Acute appendicitis is the most common acute abdominal condition in young adults [1]. "Diagnosis of Appendicitis is usually easy" thus wrote Sir Zachary Cope, but with the order: "but with the difficulties which need to be discussed". It has been more than a century since Reginald Heber Fitz was able to consolidate a fragmented

surgical philosophy regarding appendicitis, yet diagnosis of appendicitis continues to be a challenge. Appendicitis is notorious in its ability to simulate other conditions and also it can be mimicked by other possibilities. Although considered one of the most elemental of general surgical disease processes, it is difficult to obtain an accurate preoperative diagnosis in many cases [2], regularly confounding the diagnostic acumen of many surgeons. Therefore delay in diagnosis and surgery result in perforation, the rate of which rises by 5% per 12 hour period, 36 hours after the onset of symptoms [3]. To prevent this high morbidity and mortality from perforation, traditionally early surgical intervention has been advocated accepting a negative appendectomy rate ranging from 2% to 30% [4]. But this causes considerable clinical and financial costs [5], which led to research, to identify clinical, laboratory, and radiological findings diagnostic of appendicitis and development of clinical scoring systems to guide the clinicians in making the correct diagnosis thus reducing the delay in diagnosis and decreasing the rates of negative appendectomy. As this disease is amenable for treatment by surgery, early diagnosis plays an important role. Despite extraordinary advances in modern radiography imaging and diagnostic laboratory investigations, the accurate diagnosis of acute appendicitis still remains an enigmatic challenge. Commonly used modalities for diagnosing acute appendicitis are various diagnostic scores, USG, CECT abdomen, Laparoscopy etc. One such diagnostic scoring is the Alvarado Scoring [6].

Ultrasound is an easily available, portable, repeatable, noninvasive, non-ionising method. Hence, now ultrasound in experienced hands is recognized to improve diagnostic accuracy in cases of suspected acute appendicitis [7]. This recognition came after Puylaert published his article in 1986 [8]. Studies point out that sonographic imaging is

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useful as a diagnostic tool even in patients with a clinically high probability of acute appendicitis [9].

## Methodology

Patients admitted in Victoria hospital, Bengaluru with features suggestive of Acute Appendicitis and undergoing surgery for the same were included in this study. For each patient Alvarado Score was calculated and the result of Ultrasonography was noted. Diagnosis of Appendicitis was confirmed on the basis of the Histopathological examination of the resected appendix specimen. Efficacy of Alvarado Scoring System and Ultrasonography in making the accurate diagnosis of Appendicitis were compared. Data was collected from inpatient and outpatient records of the subjects included in the study.

### Inclusion and Exclusion Criteria

Those Satisfying Following Conditions were Included

- All patients above the age of 15yrs and above diagnosed clinically to have Acute appendicitis and subjected to Appendicectomy in Victoria hospital, Bengaluru.
- Patients willing for investigations and surgery.

Those Excluded from the Study Included

- Patients less than 14 years of age.
- Patient with h/o recurrent pain in right iliac fossa.
- Patients with appendicular mass/peritonitis.
- Pregnant females.
- Other comorbid conditions.

## Results

**Table 1:** Age distribution

Age in yrs	Number of Patients
≤20	9
21-30	26
31-40	6
41-50	3
51-60	4
≥60	2

Range was 15 years to 75 years. Majority of the patients were in the age group 21–30 years (52%).

Mean age was 30 years with a Standard

deviation of 12.40 Clinical findings revealed that Right tenderness was observed in 100% of patients and Leucocytosis was found in 68% of patients Maximum number of positive cases was associated with Alvarado Score of 5 to 7.

**Table 2:** Prevalence of various clinical and laboratory parameters in acute appendicitis patients

Clinical parameter	Percent in acute appendicitis
Right iliac fosa pain	98%
Nausea/ vomiting	64%
Anorexia	68%
Rif tenderness	100%
Rebound tenderness	58%
Fever	36%
Leucocytosis	68%
Shift to left	70%

**Table 3:** Association between Alvarado Score and Acute appendicitis

Score	Acute Appendicitis Positive	Acute Appendicitis Negative	Total
Less than 5	2	1	3
5 to 7	21	1	22
Above 7	25	0	25
	48	2	50

## Discussion

Acute appendicitis mimics many other intraabdominal conditions due to which the surgeon faces a dilemma in arriving at a confident preoperative diagnosis, due to which various modalities were evaluated to supplement the surgeon's clinical judgment in improving diagnostic accuracy among which Ultrasound is one modality. Ultrasound in experienced hands is recognized to improve diagnostic accuracy in cases of suspected acute appendicitis and also in patients with a clinically high probability of acute appendicitis.

In the present study, the overall sensitivity, specificity, positive predictive value and negative predictive value for Alvarado score when a score of >7 was considered positive in diagnosing acute appendicitis are 52.08%, 100%, 100%, 8% respectively. These values suggest that if only Alvarado score was used as a criterion to diagnose appendicitis, a score of ≤ 7 would not have predicted the presence of appendicitis with a good accuracy, in which case many cases would have been missed, which means the predictive value of an Alvarado score ≤ 7 is not good. But on the other hand, the specificity and the predictive value of Alvarado score >7 is fairly good (100%), which means, a score >7 is a good indicator to the presence of appendicitis as seen in our study, where out of the 25 patients whose score was >7, all of them turned to be appendicitis positive.

In the present study ,the overall sensitivity, specificity , positive predictive value and negative predictive value for Alvarado score when a score of > 5 was considered positive in diagnosing acute appendicitis are 95.83%, 50%, 97.87%, 33.33% respectively. The sensitivity of Alvarado Score goes up when a score of >5 is considered positive for appendicitis, but the specificity drastically goes down.

In the present study, positive ultrasound showed an overall sensitivity of 79.16 %, a specificity of 50%, a positive predictive and negative predicitive value of 97.43% and 9.09% respectively. The predictive

value of positive ultrasound is very good at 97.43% as shown in the study, where out of the 39 cases which Ultrasound reported as positive for appendicitis 38 cases were proven to have appendicitis on histopathology.

The overall performance of USG for investigation of acute appendicitis in this study is also comparable to the data reported in the literature .The reviewed literature mentions the sensitivity, specificity, predictive values for the positive and negative test to be in between 55 – 99 % , 68 -93 % , 73 -97 % ,and 50 -97% respectively, the values being comparable to our study.

Studies	Year	Sensitivity	Specificity	PPV	NPV
Joshi et al <sup>10</sup>	1996	96.00%	93%	97.04%	50%
Zielke A et al <sup>11</sup>	1998	79.70%	96.70%	87%	94.60%
chen SC et al <sup>12</sup>	1998	99.30%	68.10%	90.50%	97%
Franke C <sup>13</sup>	1999	55%	95%	81%	85%
Assefa G <sup>14</sup>	2006	87.90%	86.50%	80.90%	91.70%
Fung HS et al <sup>15</sup>	2008	75.90%	89.70%	73.20%	91%
Present study	2012-2014	79.16 %	50%	97.43%	9.09%

#### Data of Various Studies

So this study substantiates the strengths of ultrasonography as a useful investigation to supplement the clinician’s decision. At the same time it also emphasizes the limitations of the imaging modality and substantiates the published literature in this regard. To understand the nature and impact of these limitations, Jeffery et al [16] reported the interpretive pitfalls of ultrasound in diagnosing appendicitis.

#### Pitfalls in the Ultrasound Diagnosis of Appendicitis

##### False Positive Ultrasonographic Diagnosis

Not infrequently the normal appendix is more than 7 mm, especially in children which is due to lymphoid hyperplasia and in adults due to fecal impaction. In some cases due to surrounding inflammation appendix may be thickened reactionarily which can be seen as appendicitis on ultrasound, as in ileitis. An inflamed Meckel’s diverticulum may be mistaken as appendicitis.

##### False Negative Ultrasonographic Diagnosis

Air filled dilated bowel loops pose a problem in locating the appendix. One pitfall is demonstration of the normal proximal part while overlooking the distal inflamed tip which is obscured by bowel gas. Also in obese patients, it is difficult to locate the appendix.

In this study, the statistical analysis to compare the Alvarado Scoring with Ultrasonography was not possible as there were only a limited number of negative appendicectomies. The overall negative appendicectomy rate was 5.61% proves that when Alvarado score in the addition of ultrasound decreases the false negative decisions of the surgeon. However findings at sonography should not supercede the clinical judgement. Hence the results of ultrasound should be interpreted always, in correlation to clinical evaluation bearing in mind the pitfalls in ultrasound examination.

#### Conclusion

Alvarado score is a simple aid in diagnosing acute appendicitis but significant number of cases are missed if entirely relied upon it

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