

Evaluate Specificity, Sensitivity, Predictive Value of Positive Test and Predictive Value of Negative Test in Diagnosis of Acute Appendicitis

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Abstract

Introduction: Recent advances have included improved preoperative diagnostic studies, interventional radiologic procedures to drain established periappendiceal abscesses, and the use of laparoscopy to confirm the diagnosis and exclude other causes of abdominal pain. Laparoscopic appendectomy was first reported by the gynecologist Kurt Semm in 1982 but has only gained widespread acceptance in recent years. **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:** The sensitivity, specificity, positive predictive value and negative predictive value for Alvarado Scoring considering a score of >7 as positive in diagnosing acute appendicitis are 52.08%, 100%, 100%, 8% respectively. The diagnostic accuracy is 54%. **Conclusion:** No statistical difference could be proven between Alvarado scoring and Ultrasonography in diagnosing Acute Appendicitis.

Keywords: Appendicitis; Alvarado Score; Ultrasonography.

Introduction

Appendicitis is defined as the inflammation of the vermiform appendix. In 1886, Reginald Fitz of Boston correctly identified the appendix as the primary cause of right lower quadrant inflammation. He coined the

term appendicitis and recommended early surgical treatment of the disease. Richard Hall reported the first survival of a patient after removal of a perforated appendix, which launched focused attention on the surgical treatment of acute appendicitis. In 1889, Chester McBurney described characteristic migratory pain as well as localization of the pain along an oblique line from the anterior superior iliac spine to the umbilicus. McBurney described a right lower quadrant muscle-splitting incision for removal of the appendix in 1894. The mortality rate from appendicitis improved with the widespread use of broad-spectrum antibiotics in the 1940s. Recent advances have included improved preoperative diagnostic studies, interventional radiologic procedures to drain established periappendiceal abscesses, and the use of laparoscopy to confirm the diagnosis and exclude other causes of abdominal pain. Laparoscopic appendectomy was first reported by the gynecologist Kurt Semm in 1982 but has only gained widespread acceptance in recent years [1].

Alfred Alvarado [2], conducted a retrospective study of 305 patients admitted at Nazereth Hospital, Philadelphia from Jan, 1975 to Dec, 1976 with presentation suggestive of Acute appendicitis with an aim to formulate a practical scoring system for early diagnosis of acute appendicitis. Signs, symptoms and laboratory findings were analyzed for sensitivity, specificity, predictive value and joint probability. It was found that none of the signs or symptoms or laboratory investigations were sensitive or specific enough to make the accurate diagnosis of appendicitis alone. Thus a scoring system consisting of 3 symptoms, 3 signs and 2 laboratory investigations was formulated.

Methodology

Patients admitted in Victoria hospital, Bengaluru with features suggestive of Acute Appendicitis and

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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.

The sonographic diagnosis of appendicitis was based on the demonstration of a hypo echoic, non compressible, aperistaltic, blind ending structure with a diameter greater than 7 mm in the antero-posterior dimension. Based on the ultrasound results, patients were categorized into 1. Positive 2. Negative and 3. Equivocal groups. Equivocal when appendix was not visualized but still patient had probe tenderness in the right iliac region in the absence of any other pathology or when acute appendicitis was not ruled out.

The results of the ultrasound and the Alvarado score to determine the sensitivity, specificity, positive predictive value, negative predictive values and the diagnostic accuracy were made with the following assumptions:

Diagnosis of Appendicitis

Usg or Alvarado Score	Positive Negative	Diagnosis of Appendicitis	
		Positive	Negative
		True Positive (TP) False Negative(FN)	False Positive(FP) True Negative(TN)

- Sensitivity = $TP / (TP + FN)$
- Specificity = $TN / (TN + FP)$
- Positive predictive value (PPV) = $TP / (TP + FP)$
- Negative predictive value (NPV) = $TN / (TN + FN)$
- Diagnostic accuracy(DA) = $(TP+TN)/\text{Total number of cases}$
- All the values are multiplied by 100, to get percentages.

The data was tabulated in Microsoft Excel. Data analysis was done using SPSS version 20.0

Results

Table 1: Sensitivity and specificity of alvarado score considering a score of >7 as positive

Score	Appendicitis	Not appendicitis	Total
> 7	25	0	25
≤7	23	2	25
Total	48	2	50

Sensitivity———52.08 %

Specificity———100 %
PPV———100 %
NPV———8%
DA———54%

The sensitivity, specificity, positive predictive value and negative predictive value for Alvarado Scoring considering a score of >7 as positive in diagnosing acute appendicitis are 52.08%, 100%, 100%,8% respectively. The diagnostic accuracy is 54%.

Table 2: Sensitivity and specificity of alvarado score considering a score of >5 as positive

Score	Appendicitis	Not appendicitis	Total
> 5	46	1	47
≤5	2	1	3
Total	48	2	50

Sensitivity———95.83 %
Specificity———50%
PPV———97.87 %
NPV———33.33%
DA———94%

The sensitivity, specificity, positive predictive value and negative predictive value for Alvarado Scoring considering a score of >5 as positive in diagnosing acute appendicitis are 95.83%, 50%, 97.87%, 33.33 % respectively. The diagnostic accuracy is 94%.

Discussion

Data of Various Studies

Studies	year	sensitivity	specificity	PPV	NPV
joshi et al ³	1996	96.00%	93%	97.04%	50%
zielke A et al ⁴	1998	79.70%	96.70%	87%	94.60%
chen SC et al ⁵	1998	99.30%	68.10%	90.50%	97%
franke C ⁶	1999	55%	95%	81%	85%
assefa G ⁷	2006	87.90%	86.50%	80.90%	91.70%
fung HS et al ⁸	2008	75.90%	89.70%	73.20%	91%
Present study	2012-2014	79.16 %	50%	97.43%	9.09%

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 [9] reported the interpretive pitfalls of ultrasound in diagnosing appendicitis.

Conclusion

No statistical difference could be proven between Alvarado scoring and Ultrasonography in diagnosing Acute Appendicitis

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