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Original Research Article

Assessment of the Usefulness of Alvarado Scoring and Ultrasound Abdomen to Diagnose Acute Appendicitis and Reduce Negative Appendectomy Rates

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Abstract

Aim: To use Alvarado scoring and ultrasound abdomen to diagnose acute appendicitis and reduce negative appendectomy rates.

Material & Methods: This was a prospective study conducted on 100 consecutive patients who underwent appendicectomy in the Department of General Surgery, NMCH, Patna, Bihar, India from June 2019 to July 2020 . 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.

Results: In our study of 100 patients, 58% were male, and 42% were female. The most number of patients, 45%, were between 20-29 years of age. Taking histopathology as the gold standard and comparing it with the Alvarado score, the Alvarado score was >=7 in predicting appendicitis 94% of patients with a sensitivity of 95.7, specificity of 82.4and an accuracy of 94.6.

Conclusion: Clinical assessment is the mainstay of diagnosis with ALVARADO score and ultrasound significantly contributing to the more efficient diagnosis and reduction in negative laparotomies.

Keywords: Alvarado score, ultrasound abdomen, negative appendicectomy, acute appendicitis

Introduction

Acute appendicitis (AA) is considered one of the most common causes of surgical emergencies worldwide [1]. The reported mortality rate is from <1% in younger patients up to 5% in the elderly [2, 3]. Abdominal pain is one of the most common cause of acute appendicitis, yet 34% of cases [4, 5] are still misdiagnosed, which results in unnecessary surgery. This high rate of negative appendectomy can be decreased by careful and accurate diagnosis of appendicitis, thus preventing acute appendicitis from progressing to perforation and peritonitis [6].

Abdominal ultrasound (US), computed tomography (CT), and magnetic resonance imaging (MRI) have also been used in the identification or exclusion of AA. The US's sensitivity and specificity in identifying AA have been reported to range from 71 to 92% and 83%, respectively, for normal contrast-enhanced

CT 98 and 91%, and MRI 97 and 93% [7–9].

The definitive diagnosis of acute appendicitis is only possible with histopathology results after appendectomy. However, the decision to perform surgery is based solely on clinical evaluation supported by laboratory data. Therefore, diagnostic errors are common, resulting in amedian incidence of perforation of 20% and a negative laparotomy rate ranging from 2 to 30% [10].

Ultrasonography and computed tomography (CT) scan are used nowadays to decrease the incidence of negative laparotomies. Nevertheless, ultrasonography cannot replace clinical evaluation, as false-negative rates of up to 24% have been reported [11].

Thus, we aim to use Alvarado scoring and ultrasound abdomen to diagnose acute appendicitis and reduce negative appendectomy rates.

Material & Methods:

This was a prospective study conducted on 100 consecutive patients who underwent appendicectomy in the Department of General Surgery, NMCH, Patna, Bihar, India from June 2019 to July 2020

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
- Any mass per abdomen
- Patient with a previous history of any abdominal surgeries
- Patient not willing for surgery • Children less than 14 years of age.
- Patients undergoing interval appendicectomy

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[12].

In order to get the sensitivity, specificity, predictive values and other results, the data analysis was done using SPSS software version 14.

Statistical Analysis

The statistical hypothesis was tested with the help of the student‘t’-test and the randomness of the two groups with respect to age, sex etc. The chi-square test for association was used. Mean and Median scores were calculated. 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 >/= 7-9 underwent appendicectomy.
- Those patients with scores of 5-7 who were thought on clinical grounds to require appendicectomy, it was performed.
- Those patients with a score of <5 were observed initially, reassessed and later underwent surgery.

Results:

In our study of 100 patients, 58% were male, and 42% were female. The most number of patients, 45%, were between 20-29 years of age. [Table 1]

Table 1 Percentage distribution of the patients according to age

AGE	N%
<20	29
20 – 29	45
30 – 39	16
>=40	10
Mean ± SD	25 ± 9

In our study of 100 patients, 52(65%) were male, and 28(35%) were female. [Table 2]

Table 2 Percentage distribution of the patients according to sex

SEX	NUMBER
Male	58
Female	42

100% of patients were admitted with pain in the abdomen. 69% of patients had a duration of hospital stay of 3-5 days. The mean hospital stay was 5.7 ± 1.3. [Table 3]

Table 3: Percentage distribution of the patients according to duration of stay in hospital

DURATION OF STAY IN HOSPITAL IN DAYS	NUMBER
3 – 5	65
6 – 8	30
>8	5
Mean ± SD	5.7± 1.3

Taking histopathology as standard gold ultrasound proved conclusive in predicting appendicitis 47% of patients with a sensitivity of 50.1, specificity of 17.4 and an accuracy of 48.9. [Table 4]

Table 4: Predictive power of conclusive in USG in predicting Appendicitis if HPR is gold standard

USG abdomen	HPR		
	Appendicitis	Normal	Total
Conclusive	48	4	52
Inconclusive	47	1	48
Total	95	5	100
Sensitivity		50.1	
Specificity		17.4	
False Negative		50.1	

False positive	85.6
Predictive value of positive test	82.7
Predictive value of negative test	2.4
Positive Likelihood ratio	0.7
Negative Likelihood ratio	3.4
Accuracy	48.9

Taking histopathology as the gold standard and comparing it with the Alvarado score, the Alvarado score was >=7 in predicting appendicitis 94% of patients with a sensitivity of 95.7, specificity of 82.4and an accuracy of 94.6. [Table 5]

Table 5: Predictive power of ALVARADO Score>=7 in predicting Appendicitis if HPR is gold standard

ALVARADO Score	HPR		
	Appendicitis	Normal	Total
>=7	79	2	81
<7	15	4	19
Total	94	6	100
Sensitivity		95.7	
Specificity		82.4	
False Negative		5.8	
False positive		16.9	
Predictive value of positive test		97.9	
Predictive value of negative test		53.5	
Positive Likelihood ratio		5.9	
Negative Likelihood ratio		0.1	
Accuracy		94.6	

Discussion:

Computed tomography (CT) scan is considered as the gold standard in preoperative diagnosing acute appendicitis patients, and it is seen in the past that preoperative imaging with CT has significantly lowered the negative appendectomy rates (NARs) to 1.7% [13, 14], but it exposes to ionizing radiation, is expensive and time-consuming and has its diagnostic insufficiencies [15].

Doria et al. [15] compared CT and ultrasound in pediatric and adult populations. Again, surgery or follow-up was the gold standard. In the adult population, the combined sensitivity and specificity were 83 and 93%, respectively. Giljaca et al. [16] showed a sensitivity of 69% and specificity of 81%, which was different from the present study, stating the ability to identify acute appendicitis patients more accurately. Another similar Meta-analysis was performed by Orr et al. [17], showing sensitivity and specificity of

84.7 and 92.1%; however, the specificity of Orr et al. was very high when compared with the present meta-analysis showing a high ability to identify the patients without acute appendicitis, which differ from the present analysis. Orr et al. [17] concluded that the US should not be used in the diagnosis of acute appendicitis cases where clinical signs and symptoms are definitive. According to Orr et al., ultrasound should be used in cases where patients are with intermediate probability of acute appendicitis after the clinical evaluation.

Taking histopathology as the gold standard and comparing it with the Alvarado score, the Alvarado score was >=7 in predicting appendicitis 94% of patients with a sensitivity of 95.7, specificity of 82.4and an accuracy of 94.6. They were comparable to a study done by Limpawattanasiri et al [18]. The appendix was found to be normal in 6 patients out of 80 cases, giving the negative appendectomy rate of 7% using both USG abdomen and ALVARADO score, which was less compared to other studies where it ranged from 12% to 22.3% [19-21].

Conclusion:

Clinical assessment is the mainstay of diagnosis with ALVARADO score and ultrasound significantly contributing to the more efficient diagnosis and reduction in negative appendectomy

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