

Prospective Randomized Study to Determine the Role of Abdominal Ultrasound and Alvarado Score in Diagnosing and Preventing Negative Laparotomies in Acute Appendicitis

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Conflict of interest: Nil

Abstract

Aim: Role of abdominal ultrasound and alvarado score in diagnosing and preventing negative laparotomies in acute appendicitis.

Methods: The prospective randomized study was conducted in the Department of General Surgery, MGM Medical College Kishanganj, Bihar, India from July 2019 to January 2020. The study constituted of 100 consecutive patients who were above the age of 15 and underwent surgery and gave consent for the study. The patients were assessed by clinical examination, Alvarado score and an ultrasound abdomen. The results of histopathology were compared with the Alvarado score and ultrasound abdomen, and their accuracy were assessed.

Results: In our study of 100 patients, 65(65%) were male, and 35(35%) were female. The number of patients, 50(50%), were between 20-29 years of age. 100(100%) of patients were admitted with pain in the abdomen. 60(60%) of patients had a duration of hospital stay of 3-5 days. The mean hospital stay was 5.3 ± 1.5 . 52(52%) of patients in our study had conclusive evidence of appendicitis on ultrasound. Alvarado score calculated for the 100 patients showed that 91 had a score ≥ 7 . Of the 100 patients, 74(74%) were inflamed, 8(8%) were gangrenous, 9(9%) perforated, and 9(9%) were normal per operatively. Histopathology revealed that 94(94%) patients had appendicitis. All the 100(100%) patients had primary closure after surgery. Surgical site infection was seen in 9(9%) patients postoperatively. Post-operative fever was seen in 45(45%). Taking histopathology as standard gold ultrasound proved conclusive in predicting appendicitis 46(50%) of patients with a sensitivity of 51, specificity of 17.7 and an accuracy of 48.5. Taking histopathology as the gold standard and comparing it with the Alvarado score, the Alvarado score was ≥ 7 in predicting appendicitis 90(95.7%) of patients with a sensitivity of 95.6, specificity of 84.3 and an accuracy of 94.8.

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.

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Introduction

Acute appendicitis is one of the most common emergency conditions requiring surgery. Clinical and physical examination findings of the patient are important for the diagnosis. Besides, blood tests such as CRP and procalcitonin, scoring systems, ultrasonography and radiologic examinations including computed tomography (CT), and magnetic resonance imaging (MRI) are used in the diagnosis[1]. Clinical symptoms and findings, major complaints, elevated white blood count (WBC) counts and levels of c-reactive protein paves the road for different scoring systems. The Alvarado score is one of the most common clinical scoring systems used in the diagnosis of acute appendicitis. The high diagnostic value of this scoring system has been confirmed in a number of studies all around the world. This scoring system is accepted as non-invasive, safe, simple, reliable, and repeatable diagnostic method. Delays in diagnosis and treatment increase the rates of morbidity and mortality[2]. The rate of negative appendectomy is seen by 8-30%[3,4]. 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%. It was later modified by Kalan M et al[5]. Graded compression ultrasonography is an accurate procedure that leads to the prompt diagnosis and early treatment of many cases of appendicitis[6]. 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[7]. The aim of this study is to use the Alvarado score and ultrasound and to determine the diagnostic efficiency and reduce negative appendectomy rates.

Material and methods

The prospective randomized study was conducted in the Department of General Surgery, MGM Medical College Kishanganj, Bihar, India from July 2019 to January 2020

Methodology

100 consecutive patients more than 15 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. 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 15 years of age and Patients undergoing interval appendectomy were excluded from the study.

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]. In order to get the sensitivity, specificity, predictive values and other results, the data analysis was done using SPSS software version 25.0.

Results

In our study of 100 patients, 65(65%) were male, and 35(35%) were female. The number of patients, 50(50%), were between 20-29 years of age. 100(100%) of patients were admitted with pain in the abdomen. 60(60%) of patients had a duration of hospital stay of 3-5 days. The mean hospital stay was 5.3 ± 1.5 . In our study, 79(79%) complained of nausea or vomiting at admission. 54(54%) had fever on admission. 64(64%) of patients had anorexia at the time of admission. 30(30%) of patients in our study had a pulse rate 81-90 per minute. All patients in the study had tenderness in the right iliac fossa, and 54(54%) had rebound tenderness. The majority, 50(50%), of patients had complete blood count between 10000 and 15000. 52(52%) of patients in our study had

conclusive evidence of appendicitis on ultrasound. Alvarado score calculated for the 100 patients showed that 91 had a score ≥ 7 . Of the 100 patients, 74 (74%) were inflamed, 8 (8%) were gangrenous, 9 (9%) perforated, and 9 (9%) were normal per operatively. Histopathology revealed that 94 (94%) patients had appendicitis. All the 100(100%) patients had primary closure after surgery. Surgical site infection was seen in 9(9%) patients postoperatively. Post-operative fever was seen in 45(45%).

Taking histopathology as standard gold ultrasound proved conclusive in predicting appendicitis 46(50%) of patients with a sensitivity of 51, specificity of 17.7 and an accuracy of 48.5.

Taking histopathology as the gold standard and comparing it with the Alvarado score, the Alvarado score was ≥ 7 in predicting appendicitis 90(95.7%) of patients with a sensitivity of 95.6, specificity of 84.3 and an accuracy of 94.8.

Table 1: Percentage distribution of the patients according to age

Age (In years)	Number	Percent
<20	30	30.0
20 – 29	50	50.0
30 – 39	12	12
≥ 40	8	8
Mean \pm SD	25.5 \pm 9.7	

Table 2: Percentage distribution of the patients according to sex

Sex	Number	Percentage
Male	65	65.0
Female	35	35.0

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

Duration Of Stay in Hospital In Days	Number	Percentage
3 – 5	60	60
6 – 8	36	36
>8	4	4
Mean \pm Sd	5.3 \pm 1.5	

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

USG abdomen	HPR		
	Appendicitis	Normal	Total
Conclusive	46	6	52
Inconclusive	46	2	48
Total	92	8	100

Sensitivity	51.0
Specificity	17.7
Predictive value of positive test	89.1
Predictive value of negative test	3.6
Accuracy	48.5

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

ALVARADO Score	HPR		
	Appendicitis	Normal	Total
\geq 7	90	1	91
$<$ 7	4	5	9
Total	94	6	100

Sensitivity	95.6
Specificity	84.3
Predictive value of positive test	99.6
Predictive value of negative test	56.6
Accuracy	94.8

Discussion

In the present study, the disease is seen mainly in young patients, with 80% of patients falling in the age group between 15

and 29 years. This result is close to the previously done study results[8,9]. 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%.10 [10]. The only few patients had prolonged hospital stay due to the complication of appendicitis, else the mean duration of stay in hospital was 5.3 ± 1.5 days. This result is very close to previous results[11,12]. The predominant clinical feature was pain in the abdomen seen in all the patients followed by nausea and vomiting. This was later followed by anorexia and fever. These results are consistent with the studies done by Hardin et al. and Wagner JM et al[13]. USG abdomen was found to be conclusive in 52 patients out of 100 individuals. This gives the sensitivity of USG as 51%, the predictive value of positive test came out to be 89.1 with 48.5% accuracy, which was lower than a previous study by Ajerami et al. had a sensitivity of 84.8% and a positive predictive value of 93.3%[14]. The low sensitivity can be due to various causes. 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, is not easily visible due to the bowel being placed anteriorly. ALVARADO score was found to be more than or equal to 7 in 90 cases, and the sensitivity came to be 95.6 with the specificity of 84.3. The predictive value of the positive test with ALVARADO Score was 99.6, with 94.8% accuracy. They were comparable to a study done by Limpawattanasiri et al.[15]. Acute appendicitis is a common condition that makes it imperative that a surgeon or a trainee surgeon be well versed in it. 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. So it is of paramount importance that a practising surgeon should have a good clinical acumen, use proper diagnostic tools to come to a diagnosis of acute appendicitis. Thereby reducing the negative appendectomy rates and averting unnecessary complications[16,17].

Conclusion

This study was to evaluate the use of the ALVARADO score and USG abdomen in diagnosing acute appendicitis. The lifetime prevalence of acute appendicitis is one in seven, and it is very important to diagnose it early to prevent serious complications which may follow if left untreated. Proper clinical assessment is the mainstay of diagnosis in acute appendicitis and ALVARADO score and USG abdomen help in clearing the diagnostic dilemma and preventing negative appendectomies to a great extent.

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