

ORIGINAL ARTICLE

Diagnostic Accuracy of Alvarado Score in Diagnosis of Acute Appendicitis in Patients with Acute Pain Right Iliac Fossa

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ABSTRACT

Background: The gold standard treatment of acute appendicitis is appendectomy. Early surgery reduces a number of complications such as appendicular mass formation, abscess and perforation. However, diagnostic inaccuracy especially in female gender can lead to negative appendectomy because other gynecological diseases have quite similar presentation. The objective of our study is to determine the diagnostic accuracy of Alvarado scoring system in the diagnosis of acute appendicitis in comparison to the gold standard histopathology in patients with acute pain right iliac fossa.

Methods: This descriptive Cross-sectional study was carried out on 253 patients with acute pain in right iliac fossa at Surgical Department of MTI, Lady Reading Hospital from 14th July 2020 to 14th January 2021.

Results: Mean age was 37 years with standard deviation ± 10.09 . 111(44%) patients were male and 142(56%) patients were female. 129(51%) patients were married while 124(49%) patients were unmarried. Based on Alvarado scoring Acute appendicitis was diagnosed in 197(78%) patients and missed in 56(22%) patients. Diagnosis of Acute appendicitis was confirmed by histopathology report in 245(97%) patients while in 8 (3%) patients histopathology did not reveal acute infection. Diagnostic accuracy of Alvarado scoring analyzed with histopathological diagnosis was 78.65%.

Conclusion: Alvarado scoring has a sensitivity of 79.18%, specificity 62.5%, PPV 98.47%, NPV 8.92% and diagnostic accuracy of 78.65% in diagnosis of acute appendicitis taking histopathology as gold standard in patients with acute pain right iliac fossa.

Keywords: Acute Appendicitis, Alvarado, Histopathology, Diagnostic accuracy

INTRODUCTION

Acute appendicitis is the inflammation of appendix as described by Reginald Fitz.⁽¹⁾ It is the most common surgical emergency and the lifetime risk for developing acute appendicitis is 8.6% and 6.7% for male and female respectively. ⁽²⁾ It is often regarded as disease of the young because the most vulnerable age for developing this condition is early 20s and 30s and it is diagnosed rarely in infancy and old age. ^(3,4) It may present with vague symptoms similar to other pathologies like pelvic inflammatory disease, gall bladder diseases, intestinal infection, crohn's diseases, acute pancreatitis, ruptured ovarian cyst, ectopic pregnancy and some other gender specific diseases. ⁽⁵⁾

The diagnosis of acute appendicitis is challenging despite vast literature and research and there is an ongoing debate about the diagnostic modalities. ⁽⁶⁾ To speed up and increase the accuracy of decision-making without increasing the morbidity and mortality rate in cases of acute appendicitis, an ideal scoring system is required. ⁽²⁾ Various diagnostic modalities such as clinical presentation, examination, laboratory investigations, ultrasound, CT scan and diagnostic laparoscopy help clinicians in the diagnosis of acute appendicitis. ⁽⁷⁾ X-ray may help exclude other causes of acute abdomen like bowel perforation. Ultrasound being operator dependent may under- or over-diagnose the disease. ⁽⁸⁾ CT scan is a good diagnostic modality but has certain issues like exposure to ionizing

radiation, availability, use of contrast medium and high cost. ⁽⁹⁾

Early appendectomy is the gold standard treatment of acute appendicitis. The accurate diagnosis of patients with early surgery reduces a number of complications such as appendicular mass formation, abscess and perforation. However, early surgery with diagnostic inaccuracy especially in female gender can lead to negative operation because other gynecological diseases have quite similar presentation. The worldwide acceptable rate for negative appendectomy is 20%-30%. ^(2,10)

Among various diagnostic modalities e.g RIPASA, Ohmann, Madan, Alvarado scoring discovered by Alvarado in 1986, is the best modality widely practiced nowadays. ⁽¹¹⁾ This scoring system has eight parameters for diagnosing patients with acute appendicitis and has a maximum score of 10 points. ⁽¹²⁾ These include three clinical symptoms (migratory right iliac fossa pain, anorexia, and nausea), three signs (tenderness, rebound tenderness and elevated temperature) and two laboratory findings (leukocytosis and shift to left/neutrophilia). It can help reduce the rate of negative appendectomy and improve quality of patient's care. ⁽⁶⁾ According to the Rushil et al, sensitivity, specificity, positive predictive value and negative predictive value Alvarado scoring is 89.66%, 92.86%, 94.55%, 86.67% respectively. ⁽⁸⁾ The negative appendectomy rate can be reduced to 14% using Alvarado score as a diagnostic tool according to the study published by Mahesh S.V et al. ⁽¹⁾ K

Marius et al⁽⁵⁾ reported a 66.3 % rate of inflamed appendix upon operation in patients with an Alvarado score of up to 7.

The objective of our study is to determine the diagnostic accuracy of Alvarado scoring system in diagnosis of acute appendicitis in comparison to the gold standard histopathology in patients with acute pain right iliac fossa.

MATERIALS AND METHOD

This descriptive Cross-sectional study was carried out on 253 patients at Surgical Department of MTI, Lady Reading Hospital, from 14th July 2020 to 14th January 2021 after obtaining necessary Ethical approval from the IREB department. (Ref: No.350/LRH/MTI.) Informed written consent was obtained from every participant. Sample size was calculated using WHO calculator using 95% confidence level while taking prevalence of the disease as 14.28% and taking 10% precision (\pm expected). The Sampling technique was a consecutive non-probability sampling. All patients having age between 16 and 55 years including both genders presenting to the emergency department with acute pain right iliac fossa who underwent surgery were included in the study. Any patient with comorbidities e.g diabetes mellitus, hypertension, cardiac diseases was excluded from the study. Female patients who were pregnant and those who did not have the capacity to give informed consent were also excluded from the study.

A thorough history was taken from all patients with proper examination and appropriate investigations were ordered. Alvarado score was calculated. A score equivocal 1 to 4 has no appendicitis and was discharged and follow up. A score of 5 to 6 was observed and/or evaluated further by using ultrasound or CT scan. A score of 7 or above was strongly predictive of acute appendicitis. All patients with acute pain right iliac fossa were admitted to the surgical ward and pre-operative preparation was done. A separate informed consent was taken for the surgery and anesthesia. The intravenous fluids, antibiotics and analgesics were administered. Open appendectomy was performed and appendix specimen was sent for evaluation by experienced CPSP fellow pathologist. The regular postoperative care and follow up was done. The histopathology report was considered gold standard and evaluated for acute infection and compared with the pre-operative Alvarado score. The data received was documented on a performa for subsequent analysis.

All the collected data was analyzed. Continuous data such as age of the patients was described as Mean \pm SD. Categorical variables like Alvarado scoring/histopathology report (positive or negative) were presented in form of frequency and percentages. The sensitivity, specificity, positive & negative predictive values and diagnostic accuracy of Alvarado scoring were calculated against the gold standard histopathology from tables of 2x2. All the results were presented in tabulated form.

RESULTS

In the present study a total of 253 patients with acute pain right iliac fossa were observed. Mean age was 37 years with standard deviation \pm 10.09. 111(44%) patients were

male and 142(56%) patients were female. Based on Alvarado scoring Acute appendicitis was diagnosed in 197(78%) patients and missed in 56(22%) patients (Table I). Diagnosis of Acute appendicitis was confirmed by histopathology report in 245(97%) patients while in 8 (3%) patients histopathology did not reveal acute infection (Table II). Diagnostic accuracy of Alvarado scoring analyzed with histopathological diagnosis was 78.65% (Table III).

Table1: Acute Appendicitis On Alvarado Scoring

ALVARADO SCORING	FREQUENCY	PERCENTAGE
Positive	197	78%
Negative	56	22%
Total	253	100%

Table 2: Acute Appendicitis On Histopathology

HISTOPATHOLOGY	FREQUENCY	PERCENTAGE
Positive	245	97%
Negative	8	3%
Total	253	100%

Table 3: Diagnostic Accuracy Of Alvarado Scoring

		HISTOPATHOLOGY		Total
		Positive	Negative	
Alvarado Score	Positive	194 TP	3 FP	197
	Negative	51 FN	5 TN	56
Total		245	8	253

Sensitivity = 79.18%

Specificity = 62.5%

Positive predictive value = 98.47%

Negative predictive value = 8.92%

Diagnostic Accuracy = 78.65%

DISCUSSION

Acute appendicitis is an abdominal emergency throughout the world. Because of wide variation in the signs & symptoms of this disease, it is still challenging to diagnose appendicitis accurately. Advances in diagnostic fields like Ultrasonography, Computed Tomography, and NMR can help reach the diagnosis of appendicitis with certainty. However, there are certain limitations with these investigations such as high cost, availability, time consumption and exposure to ionizing radiation.

In our present study a total of 253 patients were observed in which mean age was 37 years with SD \pm 10.09. 111(44%) patients were male and 142(56%) patients were female. Diagnosis of Acute appendicitis was confirmed by histopathology report in 245(97%) patients while in 8 (3%) patients histopathology did not reveal acute infection. More over Alvarado scoring had sensitivity 79.18%, specificity was 62.5%, PPV was 98.47%, NPV was 8.92% and the diagnostic accuracy was 78.65%.

Sensitivity and specificity results of other studies include; Malik et al⁽¹³⁾ 74.15% sensitivity, Talukder et al⁽¹⁴⁾ 89% sensitivity, Al-Hashemy et al⁽¹⁵⁾ 53.9% sensitivity & 80% specificity, Copez SZ⁽¹⁶⁾ 94.7% sensitivity & 88.9% specificity and Phophrom J⁽¹⁷⁾ 48% sensitivity & 100% specificity.

Memon Z et al⁽¹⁸⁾ carried out a study on 110 cases (79 males, 31 females), in which surgery was performed in

98.2% of cases. Histopathologically acute appendicitis was confirmed in 77 (71.3%). Based on Alvarado score acute appendicitis was accurately diagnosed in 89.8% of the cases with a sensitivity & specificity of 93.5% & 80.6% and PPV & NPV of 92.3% & 83.3%, respectively.

Similarly another study reported the diagnostic accuracy of 61% with a sensitivity & specificity of 58.2% & 88.9% and PPV of 98.1%.⁽¹⁹⁾ These studies recommend that Alvarado score of ≥ 7 can be helpful particularly for young surgeons in deciding urgent surgery. Avais S et al⁽²⁰⁾ reported PPV of 100% with a score of >7 in the diagnosing acute appendicitis in female gender while Hashemy et al⁽²¹⁾ and Nautiyal H et al⁽²²⁾ reported a positive predictive value of 85% and 83.5% respectively. Pruekprasert et al⁽²³⁾ reported that the Alvarado score of ≥ 7 had low sensitivity of 79% in comparison to those who were diagnosed clinically on surgeon's experience with a sensitivity of 96%.

CONCLUSION

Our study concludes that Alvarado scoring had sensitivity 79.18%, specificity, 62.5%, PPV 98.47%, NPV 8.92% and diagnostic accuracy 78.65% in diagnosis of acute appendicitis taking histopathology as gold standard.

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