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General Surgery

EVALUATION OF HISTOPATHOLOGICAL CORRELATION WITH ALVARADO SCORE IN ACUTE APPENDICITIS

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ABSTRACT

Background: Acute appendicitis is one of the most frequent abdominal emergencies, and cannot be diagnosed with 100% accuracy in early stage. Various laboratory and imaging investigations though helpful are not 100% diagnostic. They have to be correlated to history and physical findings to achieve acceptable degree of diagnostic accuracy. Application of Alvarado score is one such method to diagnose acute appendicitis.

Material and Methods: This study was carried out to evaluate histopathological correlation with Alvarado score, in 56 patients admitted in the department of surgery. The patients were evaluated for total leucocyte count, clinically and using Alvarado score along with histopathological confirmation for the diagnosis of acute appendicitis.

Results: The incidence of acute appendicitis after clinical evaluation using Alvarado score was 23.42% (56) in 205 patients admitted with acute abdominal pain. Pain around the umbilicus shifting to right iliac fossa was the most common clinical symptom (87.5%). The leucocyte count used in Alvarado score showed the sensitivity of 83.67%, specificity of 42.85% with a diagnostic accuracy of acute appendicitis in 78.58% of patients. The histopathological findings confirmed appendicitis in 48 patients with acute appendicitis in 42 (87.50%) and uncomplicated appendicitis in 6 (12.50%) patients. In diagnosis of acute appendicitis, Alvarado score has high sensitivity (95.67%), high specificity (70%) and high diagnostic accuracy (91.08%).

Conclusion: The Alvarado score is a non-invasive, safe diagnostic procedure, which is simple fast, reliable and repeatable. It can be used in all condition, without expensive and complicated supportive diagnostic methods. Alvarado score increases the diagnostic certainty of clinical examination in diagnosis of acute appendicitis.

KEYWORDS : Appendicitis, histopathological, alvarado score, acute abdominal pain, sensitivity, specificity

INTRODUCTION

Acute appendicitis is a difficult diagnostic dilemma because differential diagnosis of the disease includes virtually every acute process that occurs within the abdominal cavity as well as some of the emergencies that affect the organs of the thorax.[1-4] Acute appendicitis is relatively rare in infants and elderly but becomes increasingly common in childhood and early adult life reaching peak incidents in the 20s. The incidence of appendicitis is equal amongst males and females before puberty. In teenagers and young adults the male female ratio increases to 3:2 at the age of 25 years.[5] Incidental appendicectomy is defined as the removal of a normal appendix along with treatment of another pathology to avoid confusion of diagnosis of appendicitis later or to prevent metachronous metastasis in malignancy.[6] Even after diagnostic aids as Ultrasonography, Barium enema, Computerized Tomography, Radionuclide Scanning and Laparoscopy are included the accuracy still does not usually reach up to 90%. Laparoscopy is an invasive procedure requiring general anesthesia. Although ultrasonography is non-invasive and available everywhere but as the most common presentation of Appendix is retrocaecal and due to presence of caecal gas, ultrasonography is unable to visualize appendix many times. Moreover interpretation of ultrasonography is subjected to individual bias. Though, ultrasonography may help in excluding other diagnosis, contrast enhanced CT scan is most useful in patients in whom there is diagnostic uncertainty particularly older patients, but its availability is limited and is not cost effective. Radionuclide scanning though a useful investigation is only limited to academic research and is not widely available. A number of clinical and laboratory based scoring system have been devised to assist diagnosis. But most widely used is the Alvarado score. Alvarado scoring system is easy, simple, cheap and useful tool in pre-operative diagnosis of acute appendicitis and can work effectively in routine practice. Score more than seven definitely warrants a virtual confirmed diagnosis of acute appendicitis and early operation is indicated to avoid complication like perforation.

Alvarado Scoring System

Symptom	Score
Migratory right iliac fossa pain	1
Anorexia	1
Nausea and vomiting	1
Sign	
Tenderness in Right iliac fossa	2
Temp > 37.3°C	1
Rebound tenderness in right iliac fossa	1
Laboratory Test	
Leucocytosis (10000 cells/microliter)	2
Neutrophilic shift to the left (>75%)	1
Total score	10

Patient within score range of [5-6] requires admission and needs re-evaluation for possible deterioration of clinical condition and earliest possible intervention. The application of Alvarado scoring system definitely improves diagnostic accuracy and which is purely based on history, clinical examination and few laboratory tests, is very easy to apply and possibly reduces the complication rates.[7] The aim of the study was to evaluate the reliability of Alvarado scoring system for diagnosis of acute appendicitis and correlate it with diagnostic modality and histopathology.

MATERIAL AND METHODS

Present study was conducted in the department of surgery, Department of Surgery, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, U.P.,. after approval of ethical committee. Individuals with the complaint of abdominal pain were thoroughly examined clinically and investigated. Out of 205 cases, 56 individuals were diagnosed as patients of acute appendicitis in which 39 were males and 17 were females aged between 6 to 65 years.. These 56 patients were further investigated and explored for appendicectomy and histopathological examination was done and

findings were co-related with total leucocyte count, Ultrasonography and Alvarado Score calculation.[8]

STATISTICAL ANALYSIS

All the data was analyzed for the Sensitivity, Specificity, Positive Predictive value, Negative Predictive value, False positive Rate, False Negative Rate and Diagnostic accuracy by using the formula in Microsoft excel.

RESULT

Table 1 show that a higher proportion of acute appendicitis cases belonged to age group 11 – 30 years (67.86%). In our study the youngest patient was a 6 year old male child and the oldest was a 65 year old male. Male to female ratio was : 2.29: 1 (Male > Female). There was drop in incidence of acute appendicitis in older age. 48 patients were histopathologically proved for acute appendicitis and are presented in table-1.

LEUCOCYTE COUNT Out of the 56 patients, 45 patients (80.35%) had leucocyte count more than 10000 cells/ mm^3, of these 41 (91.11%) patients were true positive and 4 (8.89%) patients were false positive. Out of remaining 11 patients (19.64%) who had leucocyte count of less than 10000 cell/mm^3, 8 (72.73%) patients with acute appendicitis on histological examination were false negative and 3 (27.27%) patients were true negative (*table-2*). Leucocyte count had the sensitivity of 83.85%, specificity of 42.87%, positive predictive value as 91.12%, negative predictive value as 27.28%, false positive rate as 57.15%, false negative rate as 16.33%, diagnostic accuracy of leucocyte count was 78.58% (table-3).

ALVARADO SCORING Alvarado scoring was done in all the 56 patients at the time of admission. 45 (80.36%) patients had a score of 7, out of which 42 (93.34%) patients were true positive and 3 (6.67%) patients were false positive. [8](14.28%) patients had a score < 5, out of which 2 (25%) patients were false negative and 6 (75%) patients were true negative. Rest of 3 (5.35%) patients had score 5-6 (equivocal), out of which 2 (66.66%) patients were true positive and 1(33.34%) patient was true negative as shown in table-2. Out of the 56 operated patients, 45 (80.36%) had Alvarado score 7 or more, of these 42 (93.34%) patients were histopathologically proved for acute appendicitis. 3 (3.35%) patients had score 5–6, out of which 2 (66.66%) patients were histopathologically proved for acute appendicitis. 8 (14.28%) patients had Alvarado score less than 5, out of these histopathologically proved acute appendicitis was seen in 2 (25%) patients. Alvarado score had the sensitivity of 95.67%, specificity of 70%, positive predictive value of 93.62%, Negative predictive of 77.78%, False positive rate of 30%, false negative rate of 4.35% and diagnostic accuracy as 91.08% as presented in table-3.

ULTRASONOGRAPHY FINDINGS

Ultrasonography was done in all patients at the time of admission. 38 (67.86%) patients were having acute appendicitis (complicated + uncomplicated), out of which 28 (73.79%) were true positive and 10 (26.32%) were false positive, 16 (28.58%) were normal on ultrasonography. The remaining 2 patients had non-specific findings. Out of which 1 (50%) patient was true positive and other 1(50%) was true negative as presented in table-2. Out of 56 patients, 38 (67.86%) patients were diagnosed with acute appendicitis with ultrasonography, out of which 28(73.79) patients were proved to the acute appendicitis after correlation with histopathology. 16 (28.58%) patients were normal on ultrasonography, out of which 9 (56.26%) patients were proved to be acute appendicitis after correlation with histopathology. Remaining 2 (3.60%) patients had non-specific findings, out of which 1 (50%) patient was histopathologically proved with acute appendicitis. Ultrasonography had the sensitivity of 76.31%, specificity of 44.45%, positive predictive value of 74.36%, negative predictive value of 47.06%, false positive rate of 55.56%, false negative rate of 23.69% and diagnostic accuracy of ultrasonography was 66.08% are presented in table-3.

DISCUSSION

In this study the patients complained of abdominal pain mimicking the pictures of acute appendicitis. Every effort was made to establish the clinical diagnosis by thorough clinical history, physical examination and relevant investigation. Final diagnosis was confirmed by histopathological examination.

Incidence of acute appendicitis was greater among males than females (ratio 2.29:1), maximum number of patients in both sexes was in the age group of 11 to 30 years and the incidence reduced in the older age. Similar findings were reported by Tripathi et al.[5] Sensitivity and specificity of leucocyte count in present study 83.67% and 42.87% are comparable to the results of other studies such as Marchand et al.[9] Diagnostic accuracy of leucocyte count for diagnosis of acute appendicitis in the present study is 78.58% which is comparable to study of a Manchand et al.[9] In our study, all the 56 operated patients received Alvarado score at the time of admission and appendicectomy was done. In order to verify the diagnosis, we used histopathological findings. Our finding of sensitivity and specificity of Alvarado score 95.67% and 70% in diagnosis of acute appendicitis is comparable to the results of the study by Crnogorae et al [10]. Positive and negative predictive value of Alvarado score 93.62% and 77.78% are comparable to result of study of Srivastava et al.[11] Diagnostic accuracy of Alvarado score for diagnosis of acute appendicitis in

the present study 91.08% is comparable to the study of Crnogorac et al.[10] In the present study graded compression ultrasonography was done in the 56 operated patients at the time of admission. The ultrasonography data was correlated with histopahological findings after appendicectomy. Sensitivity & specificity of ultrasonography in present study are 76.31% and 44.45% and is comparable to the results of other studies such as Wade et al [12]. Nosaka et al,[13] Chen et al,[14] Crombe et al.[15]

In the present study positive and negative predictive value of ultrasonography findings 74.35% and 47.06% are comparable to the results of other studies as, Chen SC et al[13]and RiouxM.[16] Crombe A et al.[15] In the present study diagnostic accuracy of ultrasonography is 66.08% comparable to the studies of Chen et al[14] and Rioux M.[16]

CONCLUSION

Thus we concluded from our study that Alvarado score is a non-invasive, safe diagnosis procedure, which is simple fast, reliable and repeatable. It can be used in all conditions, without expensive and complicated supportive diagnostic methods. Alvarado score increases the diagnostic certainty of clinical examination in diagnosis of acute appendicitis. Leucocyte count may support the clinical diagnosis of acute appendicitis but is not diagnostic because leucocyte count may increase in other intraperitonial pathology also. For doubtful cases ultrasonography can provide excellent sensitivity not only to diagnose acute appendicitis but also to confirm localized collection around appendix and exclude other pathology. Inspite of using different investigations negative appendicectomies are bound to occur as no investigation has 100% sensitivity and specificity and clinical presentations differ according to the position of the appendix. Thus we have to

rely on our clinical diagnosis because it is better to go for surgery when ever in doubt rather than to land in complication. In the present study we concluded that the sensitivity of Alvarado Score was comparable to the leucocyte count and more than ultrasonography. But specificity is higher than other individual investigations like leucocyte count and ultrasonography. Thus we can rely on Alvarado score.

Table 1: Age and sex wise distribution of histopathology proved acute appendicitis patients

Age wise distribution	Age (Years)	Male (n=39)	Female (n=17)	Total (n = 56)
		No. of cases (%)	No. of cases (%)	No. of cases (%)
	0-10	2(5.13%)	0(0.00%)	2(3.57%)
	11-20	11(28.21%)	5(29.41%)	16(28.57%)
	21-30	15(38.46%)	7(41.18%)	22(39.29%)
	31-40	8(20.51%)	3(17.65%)	11(19.64%)
	41-50	2(5.13%)	1(5.88%)	3(5.36%)
	>50	1(2.56%)	1(5.88%)	2(3.57%)
Histopathology proved acute appendicitis	Acute appendicitis (Uncomplicated+complicated)	36(75.00%)	12(25.00%)	48(85.71%)
	Uncomplicated acute appendicitis	32(76.10%)	10(23.80%)	42(75.00%)
	Complicated acute appendicitis	4(66.60%)	2(33.30%)	6(10.71%)
	Normal Appendix	3(37.50%)	5(62.50%)	8(14.29%)

Table 2: Co-relation of histopathology of acute appendicitis with leucocyte count, alvarado score and ultrasonography findings

Laboratory tests	Total cases	Histopathology proved (n= 56)	Normal /Non acute appendicitis (complicated + uncomplicated)	Specific
		No. (%)	No. (%)	No. (%)
Leucocyte counts (cell /mm3)	>10000	45(80.35%)	41(91,11%)	4(8.89%)
	<10000 cells	11(19.64%)	8(72.73%)	3(27.27%)
Alvarado Score	7	45(80.36%)	42(93.34%)	3(6.67%)
	5- 6	3(5.35%)	2(66.66%)	1(33.34%)
	< 5	8(14.28%)	2(25.00%)	6(75.00%)
Ultrasonography findings (acute Appendicitis)	(Complicated +	38(67.86%)	28(73.69%)	10(26.32 %)
	Uncomplicated)			
	Non-Specific	2(3.60%)	1(50.00%)	1(50.00%)
	Normal	16(28.58%)	9(56.26%)	7(43.76%)

Table 3: Sensitivity, specificity, predictive values and diagnosis accuracy of individual laboratory tests in diagnosis of acute appendicitis

Parameter (%)	Total Leucocyte Count	Alvarado Score	Ultrasonography Abdomen
Sensitivity	83.67%	95.67%	76.31%
Specificity	42.85%	70.00%	44.45%
Positive Predictive value	91.12%	93.62%	74.36%
Negative Predictive	27.28%	77.78%	47.06%
value			
False Positive Rate	57.15%	30.00%	55.56%
False Negative Rate	16.33%	4.35%	23.69%
Diagnostic Accuracy	78.58%	91.08%	66.08%

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