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Research Article

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A clinical comparative study of different scoring systems in acute appendicitis

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ABSTRACT

Background: Diagnosis of appendicitis continues to be an issue in surgeon's lives. Despite the wide availability diagnostic methods, clinical dilemma persists. An ideal diagnostic tool helps avoid unnecessary surgeries without missing on potential complications.

Methods: Current study evaluates the role of three diagnostic scoring systems in cases of appendicitis.

Results: Out of the 48 cases the mean age for appendicitis was 30.12 (SD 13.27; Range: 10-55 yrs). Males (75%) predominated over females (25%). Pain in right iliac fossa (97%), nausea/ vomiting (94%) and fever (69%) were common presenting symptoms while shift of tenderness to right iliac fossa (90%), guarding (83%) were common clinical signs elicited. Alvarado had lowest Negative Appendicectomy Rate (18.9) and Missed Perforation Rate (nil) while Izbicki had lowest Potential Perforation Rate (14.3) among all.

Conclusions: Although, a spectrum of diagnostic methods is available, careful use of clinical scoring systems may supplement as a tool in taking management decisions. This study shows that the Alvarado score fairly predicts appendicitis by minimizing negative appendicectomies. Patients presenting as emergency in resource limited settings, could benefit from Alvarado score.

Keywords: Appendicitis, Alvarado, Christian, Izbicki, Clinical scoring systems

INTRODUCTION

Despite tremendous advancements in the diagnosis and management, acute appendicitis continues to be a diagnostic dilemma. A common clinical emergency presenting as acute abdominal pain, it involves inflammation of the vermiform appendix. The presenting symptoms of appendicitis quite often overlap with other etiologies of acute abdomen making it difficult to make correct diagnosis at an early stage of presentation. The diagnostic dilemma is further compounded by the fact that the classic clinical symptoms may not be present in about half of the cases.

Person's lifetime risk of suffering from appendicitis varies from 7 to 10%.^{1,2} Appendicitis being a progressive disease, early diagnosis becomes imperative to reduce resultant morbidity and mortality. The diagnostic dilemma in women with acute abdomen has resulted in negative appendectomies rates as high as 15 – 50% in women of reproductive age group.³Improved diagnostic accuracy not only helps in taking early management decisions but also curtails negative appendectomy rates.

Various scoring systems have been devised to improve the diagnostic accuracy of acute appendicitis.³⁻⁵ Since, Van Way first published his score in 1982 many scores have been developed and proposed for acute appendicitis.⁶ The Alvarado in 1986 described his score

based on eight signs, symptoms and laboratory values. 4,5,7 All patients with scores higher than 6 were recommended immediate surgery while those below 5 were offered outpatient follow up. The score proposed by Izbicki in 1990, is based on 7 items (gender, leucocytes, guarding, rebound pain, migration of pain, duration of pain and type of pain). In 1992, Christian published a simpler score, based on 5 items with 1 or 0 points (abdominal pain, vomiting, tenderness, low grade fever and polymorphonuclear leucocytosis). It separated patients in two groups, those who require immediate surgery to those who could be observed. The current study aims to compare Alvarado, Christian and Izbicki scores for the diagnosis of acute appendicitis.

METHODS

This was a retrospective observational study carried out at the Department of Surgery of a medical college hospital of central India from November 2002 to October 2004. The hospital records of all patients admitted with acute right lower abdominal pain and suspected appendicitis were included in the study. All cases had undergone thorough history and detailed clinical examination at the time of admission as part of routine management. Complete blood picture, total and differential white blood cell counts, C- reactive protein, abdominal X- ray and ultrasonography were ordered for all as per institutional protocol. Patients were either subjected to emergency laparotomy at the time of admission or after few hours of conservative management. Patients who were managed exclusively by conservative management and did not undergo appendicectomy were excluded out of the study. Intraoperative findings were correlated with clinical findings and histopathology. Alvarado, Christian and Izbicki clinical scores were calculated for all depending on the patient's signs, symptoms and laboratory values (Table 1, 2, 3). The initial presenting symptoms varied from acute abdominal pain, nausea, vomiting, anorexia, fever, constipation, diarrhea or urinary symptoms. The observations were analyzed using descriptive statistical methods and scores compared applying "Z" test and computing confidence interval and p value.

Table 1: The Alvarado scoring system for appendicitis (Total Score 10).

	Migratory Right Iliac Fossa pain	1			
Symptoms	Nausea / vomiting	1			
	Anorexia	1			
Ciana	Right iliac fossa pain and tenderness	2			
Signs	Fever ≥37.30° C				
Rebound tenderness in right iliac					
	fossa	1			
Laboratory	Leucocytosis (\geq 10,000 x 10 ⁹ / L)	2			
tests	Neurtophilic shift to the left ≥75%	1			
Scores ≤ 4	4 : Exclusion; 5-6 : Conservative;				
\geq 7 : Operation					

Table 2: The Izbicki scoring system for appendicitis (Total Score 7).

Gender	Male	1	Female	0
White cell count	≥11,000 x 10 ⁹ / L	1	<11,000	0
Guarding	Present	1	Absent	0
Rebound pain	Present	1	Absent	0
Migration of pain to Right lower quadrant	Present	1	Absent	0
Duration of pain	≤24 hours	1	\geq 24 hours	0
Type of pain	Intermittent	1	Other	0
Scores $\leq 2:1$	Monitoring;	\geq	2 : Operatio	n

Table 3: The Christian scoring system for appendicitis (Total Score 5).

Abdominal pain	< 48 hours	1	Other	0
Vomiting	Yes	1	No	0
Tenderness	Right lower quadrant	1	Other	0
Low grade fever	≤38.8° C	1	>38.8° C	0
White cell count (>75% polymorphs)	≥10,000 x 10 ⁹ / L	1	<11,000	0
Scores ≤3: N	Monitoring;	≥4 :	Operation	

The performance of various scoring systems was evaluated by computing following rates.

1. Negative appendectomy rate

It means the proportion of patients without acute appendicitis assigned to the operation group. In a group it should be $\leq 15\%$.

No. of patients with negative histopathology report assigned to the operation group

Total number of patients in the operation group

2. Potential perforation rate

It means proportion of patients with acute appendicitis not assigned to the operation group. It should be \leq 35%.

No. of patients with positive histopathology report not assigned to the operation group

Total number of patients with acute appendicitis

3. Missed perforation rate

It means proportion of patients with perforated appendicitis not assigned to the operation group. It should be <15%.

No. of patients with perforated appendicitis not assigned to the operation group

Total number of patients with perforated appendicitis

RESULTS

Table 4: Age and gender distribution among study population (N=48).

Age (in years)	Male	Females	Total	Percentage (%)
10-19	11	3	14	29.17
20-29	13	3	16	33.33
30-39	9	2	11	22.19
40-49	2	1	3	06.25
>50	1	3	4	08.33
Total	36	12.	48	100

The total numbers of 63 case records were analyzed. All had undergone appendicectomy except 15 cases who were managed conservatively and thus were excluded out of the study. The mean age for study population consisting of 48 case records was 30.12years (SD 13.27); Range 10-55 years). About three fourth were male (75%) while one- fourth was female (25%). Majority of cases (83%) were below 40 years of age with one third (33%) falling in the age group of 20-29 years (Table 4).

In our series, pain in right iliac fossa (97%), nausea / vomiting (94%) and fever (69%) were common presenting symptoms. The study subjects were classified into various groups of different scoring system as per the symptoms and calculated total scores (Table 5).

Table 5: Distribution of cases according to the three scoring systems and symptoms at presentation (N=48).

Scoring system	m / Group	No. of cases	Right iliac fossa pain (47 cases)	Nausea / vomiting (45 cases)	Anorexia (27 cases)	Fever (33 cases)
Alvarado	< 7	11	11	11	5	4
Aivarado	≥ 7	37	36	34	22	29
Izbiolzi	≤ 2	5	5	-	-	-
Izbicki	>2	43	42	-	-	-
Christian	≤ 3	16	15	15	-	1
	>4	32	32	30	-	32

Table 6: Distribution of cases according to the three scoring systems and signs at presentation (N=48).

Scoring sy /Group	stem	No. of cases	Tenderness right iliac fossa (43 cases)	Rebound tenderness right iliac fossa (26 cases)	Guarding (40 cases)	Raised Total WBC count
Alvarado	<7	11	10	2	-	3
	≥7	37	33	24	-	32
Izbicki	≤2	5	-	-	2	-
	>2	43	-	26	38	22
Christian	≤3	16	12	-	-	3
	>4	32	31	-	-	32

Table 7: Comparison between different scoring systems and final outcomes (N=48).

Score Group)	No. of cases	Negative appendectomy rate	Missed perforation rate	Potential perforation rate	
Alvarado	<7	11	- 18.9	0	31.4	
≥7		37	10.5	· ·	31.4	
Izbicki	≤2	5	- 27.9	8.3	14.3	
IZUICKI	>2	43	21.9	0.3	14.3	
Christian	≤3	16	- 25	8.3	45.7	
Christian	>4	32	_ 23	0.3	43.7	
Significance			$Z_{A/I} = 0.96 \text{ (p} > 0.05) Z_{A/C}$ = 0.61 (p> 0.05) $Z_{C/I} =$ 0.28 (p> 0.05)	$\begin{split} Z_{A/I} &= 1.04 \ (\ p {>}\ 0.05) \\ Z_{A/C} &= 1.04 \ (\ p {>}\ 0.05) \\ Z_{C/I} &= No \ difference \end{split}$	$Z_{A/I} = 1.74 \text{ (p> 0.05)}$ $Z_{A/C} = 1.24 \text{ (p> 0.05)}$ $Z_{C/I} = 3.05 \text{ (p< 0.005)*}$	

Significant

Shift of tenderness to right lower quadrant (90%), guarding (83%) and rebound tenderness (54%) were common clinical findings in our study while leukocytosis ($>10,000 \times 109/L$) was noted in about 73% of cases and neutrophilia (PMNs >75%) in about 71% of study subjects (Table 6).

We applied three scoring systems and compared the results in terms of negative appendectomy rate, missed perforation rate and potential perforation rates after correlating the operative findings with final histopathology reports (Table 7).

DISCUSSION

Almost every surgeon faces a diagnostic dilemma at some time or other while dealing with a case of acute abdomen and suspected appendicitis. The dilemma exists pinpointing the diagnosis, planning management and to avoid unnecessary appendicectomies. The need for urgent and timely treatment in the perplexing clinical scenario makes improved diagnostic accuracy and stratification of risk desirable in all such cases. Although wide array of investigation modalities are available, clinical diagnostic scoring systems have been proposed as being rapid, non-invasive, more economical and accurate tool without requiring any special equipments. In the present study, we calculated and compared different clinical scores (Alvarado, Christian and Izbicki) in 48 cases who underwent surgery for appendicitis at our centre.

We observed that in our study appendicitis was more frequent in the age group 10-29 years (29.17%) Ashley in their study also noted it to be more frequent between 15-20 years with peak affection at the age of 18 years. ¹⁰ Others also had similar observations. ^{11,12} In our study, males (75%) were more frequently affected than females (25%) which was similarly observed by Lewis. ¹¹

The clinical presentation of acute appendicitis varies widely owing to variable degree of involvement by inflammatory process, different positions of appendix and varying age of the patient. The inconsistent clinical presentation often leads to misdiagnoses of acute appendicitis in 1 out of 5 cases and negative appendicectomy rates in the range of 15-40%. Adding up to the dilemma, the classic symptoms of anorexia and periumbilical pain followed by nausea, right lower quadrant (RLQ) pain, vomiting occurs may be seen in only 50% of cases. The trivial symptoms like anorexia and nausea may equally be seen in other cases of acute abdomen with different etiologies. The most common presentation of appendicitis is abdominal pain. In a typical presentation, it begins as periumbilical or epigastric pain migrating to the right lower quadrant of the abdomen. This pain migration is the most discriminating feature of appendicitis, with a sensitivity

and specificity of approximately 80%, a positive likelihood ratio of 3.18, and a negative likelihood ratio of 0.5.¹⁴ In our series, pain in right iliac fossa (97%), nausea/vomiting (94%) and fever (69%) were common presenting symptoms. The results are comparable with the observations of F R Lewis, who noted pain in right lower abdomen as most frequent symptom followed by vomiting and fever.¹¹ Shift of tenderness to right lower quadrant (90%), guarding (83%) and rebound tenderness (54%) were common clinical findings in our study. Golledge J and Anderson RE concluded in their study that vomiting, tenderness in right iliac fossa and rebound tenderness are more common pointers of appendicitis.¹⁵

Studies have consistently proven that majority of patients with appendicitis have an elevated white blood cell counts with neutrophilia (polymorphs >75%). Dueholm et al calculated likelihood of appendicitis for defined intervals of the WBC count.¹⁶ In our series, leucocytosis $(>10,000 \times 10^9/ L)$ was present in about 73% of cases while neutrophilia (pmns >75%) was seen in about 71% of study subjects. Pieper et al observed that 67% of cases had leucocyte count above 11,000 x 10⁹/ L.¹⁷ Although the WBC test is widely available, inexpensive and rapid it may have limitations in certain subsets of population (children. elderly, pregnancy) where normal physiological response to infection may be truncated or misleading.

The ideal support tool for clinical diagnosis should help clinicians in avoiding unnecessary surgeries (Negative appendectomy rate should be <15%) and missing out on actual cases of appendiceal perforations (Missed perforation rate should be <15%) at the same time keeping the possibility of perforation to minimum (potential perforation rate should be <35%) in cases managed conservatively. We applied three scoring systems and compared the results in terms of negative appendectomy rate, missed perforation rate and potential perforation rates after correlating the operative findings with final histopathology reports. The Negative appendicectomy Rates for the three scoring systems Alvarado, Izbicki and Christian were 18.9%, 27.9% and 25% respectively. Although all three failed to meet the desired cut-off of 15%, only Alvarado scoring system did fair with minimum rate of 18.9%. Similarly, the Missed perforation rates for three were 0, 8.3%, and 8.3% respectively. Here, all three fulfilled the criteria of <15% but Alvarado performed better by keeping it at nil level. Although perforation in certain proportion of cases cannot be avoided it should be kept minimum to keep the complications secondary to missed perforation at lowest. The potential perforation rates in our series were observed as 31.4%, 14.3% and 45.7% for Alvarado, Izbicki and Christian respectively. Izbicki followed by Alvarado faired better in avoiding potential perforations by meeting the criteria of <35%. Numerous studies have examined the Alvarado Score. Bond et al prospectively studied 187 children aged 2-17 years with suspected appendicitis. Using the Alvarado's cutoff score of 7, the authors found a sensitivity and specificity of 90% and 72% respectively, with a negative appendectomy rate of 17%. Lower cutoff scores (5 or 6) demonstrated improved sensitivity, but corresponding reductions in specificity. Hsiao et al carried out a retrospective study of children under 14 years of age and stated that RLQ tenderness and a left shift were the most prevalent signs in those with pathologically proven appendicitis. Children with Alvarado Scores ≥7 were statistically more likely to have appendicitis than controls. Overall sensitivity and specificity for an Alvarado Scores ≥7 were 60% and 61% respectively. 19

CONCLUSION

Appendicitis continues to perplex the treating surgeons. Although, a spectrum of diagnostic methods is available, careful use of clinical scoring systems may supplement as a tool in taking management decisions. This study shows that the Alvarado score fairly predicts appendicitis by minimizing negative appendicectomies. Patients presenting as emergency in resource limited settings, could benefit from Alvarado score. Although all three scores failed to meet the desired cutoff, Alvarado score appears to be more accurate, simple, rapid, reliable, economic diagnostic modality helping in clinical decision making.

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institutional ethics committee

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