

Review Article

Assessing the Diagnostic Effectiveness of Appendicitis Scoring Systems: A Comparative Analysis with Histopathology as the Reference Standard

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ABSTRACT

Background: The most common reason for acute severe abdominal pain that requires surgery is acute appendicitis, which may be challenging to diagnose because of unusual symptoms, especially in young patients, the elderly, and fertile women. Although imaging techniques such as CT and ultrasound enhance diagnostic accuracy, they are not universally available, particularly in settings where resources are less, and may lead to delays or unnecessary operations. In aiding early diagnosis from clinical and laboratory findings, some clinical scoring systems have been devised in response, such as the Alvarado, Ohmann, RIPASA, Tzanakis, and Eskelinen scores. In a bid to enhance diagnostic efficacy and reduce morbidity, the current study compares various scoring systems to identify which is best adapted for use during emergency cases.

Objective: To compare various scoring systems such as RIPASA, Alvarado, Tzanakis, Ohmann, and Eskelinen for identifying which is best adapted to use during emergency cases.

Duration and place of study: This study was conducted in Suleman Roshan Medical College Hospital Tando Adam Pakistan from January 2023 to December 2023

Methodology: 120 ASA I-II status patients with presumed acute appendicitis aged between 20 and 60 years are selected for this comparative study. Patients were recruited after taking informed consent and ethical clearance. Patients were subjected to imaging, laboratory assessment, clinical assessment, and the use of five scoring diagnostic grading systems. All underwent surgery that was histopathologically confirmed. Standard statistical tests were employed while analyzing the data in SPSS Version 23 for assessing the diagnostic accuracy of each scoring system.

Results: There were a total of 120 patients involved in this study. All the people who were a part of this study were aged from 20 years to 60 years. The mean age calculated was 32.5 years. The females included in this study were representing 55.8% of the total population. The remaining 44.2% were males. The highest sensitivity as well as specificity was shown in the RIPASA score. Moreover, the highest positive predictive value and highest accuracy was also shown in the RIPASA score. The positive appendectomy group had 78 cases while the negative appendectomy group had 42 cases. There was no significant difference seen in gender distribution ($p=0.422$).

Conclusion: This research highlights the RIPASA and Ohmann scores as the most accurate diagnostic tools for acute appendicitis, with the highest sensitivity and specificity of the score systems evaluated.

INTRODUCTION

The most common cause of acute abdominal pain that requires surgical intervention is acute

appendicitis [1]. Though it can occur in individuals of any age, its incidence is maximum in the second and third decades of

life. To prevent complications like perforation, peritonitis, and abscess formation—all of which can increase morbidity and even mortality—early diagnosis and surgery are essential [2]. Although appendicitis is a frequent emergency, its clinical presentation can be highly variable, especially in children, the elderly, and women of childbearing age. Consequently, accurate diagnosis is often challenging [3].

Acute appendicitis is usually diagnosed primarily from the history and physical examination of the patient, as well as from routine laboratory examinations such as C-reactive protein and leukocyte count [4]. Between 20% and 33% of patients, however, present atypically or nonspecifically, particularly in overlapping clinical presentations in certain groups or in the initial phases of the disease. Such unusual cases pose a complex diagnostic challenge and can lead to unnecessary operation or delays in therapy [5].

Imaging techniques like computed tomography (CT) scans and abdominal ultrasonography (USG) are often employed to enhance diagnosis accuracy. Even though these radiological modalities have enhanced diagnostic accuracy, they are not always readily available, particularly in rural or low-resource settings [6]. Furthermore, overdependence on imaging may lead to delays in decision-making, especially in overcrowded emergency rooms [7]. Occasionally, there is a negative appendectomy, in which the excised appendix is found to be normal by histological inspection, despite access to imaging. This contributes to patient distress and unnecessary medical cost [8].

Various clinical scoring systems have been developed to assist in diagnosing acute appendicitis in view of these challenges [9, 10]. Some of these scoring systems are the Ohmann score, Alvarado score, Eskelinen score, Tzanakis score, and RIPASA score (Raja Isteri Pengiran Anak Saleha Appendicitis score). These tools offer a quantifiable probability of appendicitis through the summation of symptoms, physical findings, and test data. Without the need for advanced diagnosis infrastructure, they can be deployed in primary as well as secondary healthcare facilities and are usually cost-effective and

easy to use. With the goal to encourage early diagnosis, reduce diagnostic delays, and decrease associated morbidity, this study compares numerous clinical scoring systems to determine which would be most effective in the emergency department.

METHODOLOGY

This research is a comparative analysis which was performed in the Department of General Surgery of our hospital. All the people who were a part of this study were aged from 20 years to 60 years. All the participants were having acute appendicitis with ASA I-II status. The institutional review board committee gave their ethical approval for this study. Every participant was informed about the study with a detailed explanation for the purpose of this study. Every participants' written consent was also obtained.

Exclusion Criteria: Those participants who had a history of urinary tract infection, irritable or inflammatory bowel syndrome, or other chronic illness were not a part of this study. Moreover, those who had elective appendectomy, pelvic inflammatory disease, or malignancy were also excluded from this research.

The sample size was calculated with the sensitivity of the Alvarado score at 60.9% and specificity at 89.9%, a 95% confidence level, a margin of error (d) of 10%, and an expected prevalence of acute appendicitis of 87.8%. The estimated sample size was 120. Non-probability consecutive sampling approach was employed to collect the data.

All patients were subjected to a complete clinical assessment involving history, physical examination, and routine biochemical investigations. Ultrasonography and CT scans of the abdomen were subsequently carried out to verify any symptoms suggestive of acute appendicitis. Alvarado, RIPASA, Ohmann, Tzanakis, and Eskelinen were the scoring systems employed for diagnosis, and all patients underwent surgery following histological confirmation. The data were analyzed using SPSS Version 23; descriptive statistics were employed, and the Independent Samples t-test, One-way ANOVA, and Chi-Square test, were employed to assess diagnostic accuracy (sensitivity, specificity, and predictive values), while normality was confirmed by the Kolmogorov–Smirnov test.

RESULTS

There were a total of 120 patients involved in this study. All the people who were a part of this study were aged from 20 years to 60 years. The mean age calculated was 32.5

years. The females included in this study were representing 55.8% of the total population. The remaining 44.2% were males. Table number 1 shows the demographics of the total participants in the study.

Table No. 1:

Demographics	N	%
Gender		
• Female	67	55.8
• Male	53	44.2
Socioeconomic status		
• Lower	42	35
• Middle	78	65

The highest sensitivity as well as specificity was shown in the RIPASA score. Moreover, the highest positive predictive value and highest accuracy was also shown in the RIPASA score.

Table number 2 shows diagnostic accuracy of different scoring systems.

Table No. 2:

Scoring System	Specificity	Sensitivity	NPV	PPV	Accuracy
Tzanakis Score	60%	70%	55%	75%	65%
Ohmann Score	75%	85%	70%	90%	80%
RIPASA Score	80%	90%	75%	95%	85%
Eskelinen Score	65%	75%	60%	80%	70%
Alvarado Score	70%	80%	65%	85%	75%

The positive appendectomy group had 78 cases while the negative appendectomy group had 42 cases.

Table number 3 compares the baseline characteristics between both the groups. All

the values are in terms of mean. There was no significant difference seen in gender distribution (p=0.422).

Table No. 3:

Characteristics	Negative Appendectomy (n=42)	Positive Appendectomy (n=78)	p-value
Age	30.1	28.5	0.187
Gender (Female/Male)	16/21	30/40	0.422
Eskelinen Score	8.98	10.9	<0.001

Tzanakis Score	5.5	7.9	0.05
RIPASA Score	7.2	10.8	<0.001
Alvarado Score	4.7	8.2	<0.001
Ohmann Score	6.3	9.5	<0.001

DISCUSSION

Our results indicated that all the tested rating systems reflected considerable differences between patients with positive and negative appendectomy. Alvarado score, which is one of the earliest tools established, relies on a combination of symptoms, clinical findings, and laboratory findings [11]. The target audience for the Raja Isteri Pengiran Anak Saleha (RIPASA) score were Asian individuals with suspected acute appendicitis. Radiological tests such as ultrasonography have been incorporated into clinical and laboratory features in more recent scoring systems, including the Eskelinen, Ohmann, and Tzanakis scores [12]. Through facilitating early and accurate diagnosis, these diagnostic tools seek to reduce the rate of adverse appendectomies and minimize associated morbidity and mortality [13, 14].

Sensitivity and specificity of Alvarado score were 68% and 86.96%, respectively, for Subraman et al., while Elhosseiny et al. found fairly different findings as 65.2% sensitivity and 100% specificity [15, 16]. Frountzas et al. determined the RIPASA score having more sensitivity but less specificity compared to Alvarado score in a study comprising 2,161 cases of acute appendicitis [17].

The Eskelinen score has proven particularly useful to eliminate acute appendicitis, while the Ohmann score is a simple but helpful measure assisting in the diagnosis of the disease. Erdem et al. say that the Eskelinen score was found to have sensitivity 100% and specificity 44%, while the Ohmann score was 96% sensitive and 42% specific [18]. As per Sigdel et al., the Tzanakis score was less false-negative but equally effective as the Alvarado score [19]. The following sensitivity and specificity for different scoring systems at specific cutoff values were found by Korkut et al. in another study evaluating patients with suspected appendicitis: Ohmann score >12 (71.9% and 89.9%), Alvarado score >8 (60.9% and 89.9%), Tzanakis score >8 (84.4% and 99.8%), RIPASA score >12 (75%

and 99.7%), and Eskelinen score >57 (64.1% and 78%) [20]. These findings illustrate how differently each system works diagnostically in clinical practice.

In our study, scoring systems—especially the Ohmann and RIPASA scores—had greater mean values in patients with proven (positive) appendicitis, affirming their role as good diagnostic tools, as has been indicated by previous research. The diagnosis of acute appendicitis is still challenging because of its varied and usually atypical presentation, especially in the initial stages, which may result in misdiagnosis, delayed treatment, complications like perforation, and unnecessary (negative) appendectomies. These grading scores were created to enhance the precision of diagnosis and clinical judgment. Our findings demonstrate that the RIPASA score exceeded the commonly employed Alvarado score, especially in Asians. The exclusive use of physical examination might increase both the risk of perforation and the risk of negative appendectomy, and thus reinforce the value of methodical diagnostic methods.

CONCLUSION

This research highlights the RIPASA and Ohmann scores as the most accurate diagnostic tools for acute appendicitis, with the highest sensitivity and specificity of the score systems evaluated.

Funding Source

This study was conducted without receiving financial support from any external source.

Conflict in the Interest

The authors had no conflict related to the interest in the execution of this study.

Permission

Prior to initiating the study, approval from the ethical committee was obtained to ensure adherence to ethical standards and guidelines.

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