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The Diagnostic Accuracy of Alvarado Score and to Compare it with Fenyo-Lindberg Score in the Diagnosis of Acute Appendicitis

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ABSTRACT
Appendicitis diagnosis relies heavily on the patient's medical history, physical examination, and laboratory tests such as elevated white blood cell count. Although appendicitis is a frequently encountered surgical issue, diagnosing it can be challenging in certain cases, particularly in very young or elderly patients and women of childbearing age, due to overlapping symptoms with other genitourinary and gynaecological conditions. The medical history was collected through direct interviews with both the patients and their accompanying relatives. A comprehensive clinical history and examination were performed on all patients, and both clinical and scoring assessments were calculated. After evaluating the hemodynamic stability of each patient, resuscitation was administered if necessary, and blood investigations were conducted. Among the 70 cases analysed, 47 cases were positive according to both systems (>7 for Alvarado, >7.5 for Fenyo-Lindberg), indicating significant overlap. However, discrepancies occurred where the Alvarado score was positive (>7), but Fenyo-Lindberg was negative (<7.5) in 18 cases and vice versa in 5 cases.

INTRODUCTION

Acute appendicitis (AA) is a frequently encountered surgical emergency in medical settings, necessitating the highest level of expertise and attention from the surgeon, in addition to thorough clinical assessment[1]. The estimated lifetime occurrence of acute appendicitis is around 1 in 7 individuals, with an estimated incidence of approximately 1.5-1.9 cases per 1000 people. Men are affected about 1.4 times more often than women. Diagnosing acute appendicitis can be challenging and may even test the abilities of the most experienced surgeons. As a result, various efforts have been made to achieve early diagnosis and immediate intervention[2].

Appendicitis diagnosis relies heavily on the patient's medical history, physical examination and laboratory tests such as elevated white blood cell count. Although appendicitis is a frequently encountered surgical issue, diagnosing it can be challenging in certain cases, particularly in very young or elderly patients and women of childbearing age, due to overlapping symptoms with other genitourinary and gynaecological conditions[3].

Negative appendectomy rates ranging from 25% to 35% are quite common, and the morbidity rates for negative appendectomy are often similar to those for surgery to treat acute appendicitis. Conversely, a delay in diagnosis is connected with a higher likelihood of perforation[4].

To improve the accuracy of diagnosing appendicitis, multiple methods have been tested, such as ultrasonography, computed tomography and radioisotope imaging. However, no single investigation has been demonstrated to be superior.

Several scoring systems have been created to aid in the quick and cost-effective diagnosis of acute appendicitis. The most commonly used system is the 'Alvarado score'. Its sensitivity and specificity range from 53%-88% and 75%-80% respectively. It's important to note that while the Alvarado score was developed for the western population, its sensitivity and specificity may decrease when applied to different ethnic groups.

MATERIALS AND METHODS

Source of Data: All patients with acute appendicitis admitted to The Department of General Surgery.

Study Design: Observational study.

Study Period: August 2022 to January 2024.

Inclusion Criteria:

- Patients above 18 years of age.
- Patients willing to give informed consent.
- Patients undergoing appendicectomy after being diagnosed with acute appendicitis based on the clinical features, routine blood investigations and ultrasonography of abdomen AND pelvis.

Exclusion Criteria:

- Patients under 18 years of age.
- Patients not willing to give informed consent.
- Patients not willing to have surgery.

The medical history was collected through direct interviews with both the patients and their accompanying relatives. A comprehensive clinical history and examination were performed on all patients, and both clinical and scoring assessments were calculated. After evaluating the hemodynamic stability of each patient, resuscitation was administered if necessary and blood investigations were conducted. Additional diagnostic procedures, including chest X-ray, abdominal X-ray and abdominal and pelvic ultrasound, were carried out based on the patient's hemodynamic stability. The decision to proceed with surgery was made based on the clinical history, total leucocyte count, and ultrasound findings. Appendicectomy was performed following a detailed discussion of the potential complications and the acquisition of written informed consent. During the intraoperative phase, the appendix was examined for signs of inflammation and sent for histopathological evaluation.

RESULTS AND DISCUSSIONS

Table 1: Clinical diagnosis using Fenyo-Lindberg scores and Alvarado Scores

Scores	Positive	Negative
Fenyo-Lindberg	63	7
Alvarado	44	25

According to the findings, the Fenyo-Lindberg score identified 63 cases as positive and 7 as negative, indicating a higher sensitivity but possibly lower specificity compared to the Alvarado score, which classified 44 cases as positive and 25 as negative Table 1.

According to the data, the Fenyo-Lindberg score categorized 63 cases, with 61 confirmed as appendicitis and 2 misdiagnosed cases (positive but not confirmed). Conversely, 7 cases were classified as negative, including 4 correctly identified and 3 misclassified (negative but confirmed as appendicitis). In comparison, the Alvarado score classified 70 cases, with 44 correctly identified as appendicitis and 1 misclassified case (positive but not confirmed). Additionally, 25 cases were deemed negative, with 22 correctly identified and 3 misclassified (negative but confirmed as appendicitis). Table 2

Among the 70 cases analysed, 47 cases were positive according to both systems (>7 for Alvarado, >7.5 for Fenyo-Lindberg), indicating significant overlap. ive<7.5 However, discrepancies occurred where the Alvarado score was positive (>7), but Fenyo-Lindberg was

Table 2: Histopathological diagnosis of Fenyo-Lindberg and Alvarado Scores

	Fenyo-Lindberg score			Alvarado score		
Histopathological diagnosis	Positive	Negative	Total	Positive	Negative	Total
Appendicitis	61	4	65	44	22	66
Not appendicitis	2	3	5	1	3	4
Total	63	7	70	45	25	70

Table 3: Fenyo-Lindberg scores and Alvarado Scores

	Fenyo-Lindberg score		
Alvarado score	Positive>7.5	Negative<7.5	Total
Positive > 7	47	0	47
Negative<7	18	5	23
Total	65	5	70

Table 4: Comparing parameters between Fenyo-Lindberg and Alvarado Scores

Parameter	Fenyo-Lindberg score	Alvarado score
Sensitivity	90.62%	65.63%
Specificity	58.36%	78.19%
Positive predictive value	95.27%	96.42%
Negative predictive value	35.29%	10.18%
Diagnostic accuracy	91.08%	66.29%

negative (<7.5) in 18 cases, and vice versa in 5 cases Table 3.

The Fenyo-Lindberg score demonstrated a higher sensitivity at 90.62% compared to the Alvarado score, which had a sensitivity of 65.63%. However, the Alvarado score exhibited higher specificity (78.19%) compared to the Fenyo-Lindberg score (58.36%). Both scoring systems showed high positive predictive values (Fenyo-Lindberg: 95.27%, Alvarado: 96.42%), indicating their effectiveness in correctly identifying true positives. In contrast, the Fenyo-Lindberg score had a higher negative predictive value (35.29%) than the Alvarado score (10.18%), suggesting its better ability to rule out disease in cases where it indicates a negative result. Overall diagnostic accuracy was notably higher with the Fenyo-Lindberg score (91.08%) compared to the Alvarado score (66.29%) Table 4.

In this study, the Fenyo-Lindberg score identified 63 cases as positive and 7 as negative, indicating a higher sensitivity but possibly lower specificity compared to the Alvarado score, which classified 44 cases as positive and 25 as negative. On comparison with the histopathological findings, the Fenyo-Lindberg score categorized 63 cases, with 61 confirmed as appendicitis and 2 misdiagnosed cases (positive but not confirmed). Conversely, 7 cases were classified as negative, including 4 correctly identified and 3 misclassified (negative but confirmed as appendicitis) and the Alvarado score classified 70 cases, with 44 correctly identified as appendicitis and 1 misclassified case (positive but not confirmed). Additionally, 25 cases were deemed negative, with 22 correctly identified and 3 misclassified (negative but confirmed as appendicitis).

Among the 70 cases analysed, 47 cases were positive according to both systems (>7 for Alvarado, >7.5 for Fenyo-Lindberg), indicating significant overlap. However, discrepancies occurred where the Alvarado score was positive (>7), but Fenyo-Lindberg was negative (<7.5) in 18 cases and vice versa in 5 cases.

In this study, the Fenyo-Lindberg score demonstrated higher sensitivity at 90.62% compared to the Alvarado score, which had a sensitivity of 65.63% and is consistent with findings of Uttej[5] with 72% sensitivity and 71% of specificity of the Fenyo-Lindberg score. This is in contrast to the findings of Xingye[6] 2018 who reported with a sensitivity of 92.7% for Alvarado scoring. In this study, the Alvarado score exhibited higher specificity (78.19%) compared to the Fenyo-Lindberg score (58.36%). This finding is consistent with the study by Kariman[7] sensitivity and specificity of Alvarado scoring system were found to be 37% and 95.5% respectively. The findings were in contrast with the study done by Gonullu[8] who reported with the 60% sensitivity and 65% specificity for Fenyo–Lindberg scoring system and 25% sensitivity and 81% specificity for Alvarado scoring systems.

Both Scoring Systems Showed High Positive Predictive Values (Fenyo-Lindberg: 95.27%, Alvarado: 96.42%), indicating their effectiveness in correctly identifying true positives. In contrast, the Fenyo-Lindberg score had a higher negative predictive value (35.29%) than the Alvarado score (10.18%), suggesting its better ability to rule out disease in cases where it indicates a negative result. This is consistent with the findings of Uttej[5] who reported with PPV of 75%, and NPV of 68% in diagnosing acute appendicitis with Fenyo-Lindberg score, overall diagnostic accuracy was notably higher with the Fenyo-Lindberg score (91.08%) compared to the Alvarado score (66.29%).

Gonullu[8] suggested that the Fenyo-Lindberg score and Alvarado scoring systems were more accurate for predicting appendicitis than the others. Considering the physiological changes and chronic diseases occurring with advancing age, an applied scoring system may not produce the same score in similar patients in all age groups.

The present study proposes the use of Fenyo-Lindberg score as it an inexpensive clinical tool that may help the diagnosis of acute appendicitis. While marginally less specific than the Alvarado scoring system, the FL system emerges as a pragmatic diagnostic tool, emphasizing its potential in resource-limited settings. Despite the study's sensitivity and specificity aligning with prior research, the caveat of a relatively small sample size necessitates circumspect interpretation. Larger cohorts will be instrumental in yielding more robust data and enhancing its utility in diverse

populations and routine clinical practice for optimal patient care.

CONCLUSION

Appendicitis scoring systems help clinicians make a differential diagnosis in cases where imaging methods cannot be used or are insufficient. In this study, the most accurate scoring system for the differential diagnosis of appendicitis was Fenyo-Lindberg scoring system.

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