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Original Research Article

A Comparative Study of Tzanakis Score and Alvarado Score in Diagnosis of Acute Appendicitis

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Abstract:

Background: Appendicitis is an inflammation of the appendix. Mostly the pain begins around the belly button and then radiates towards the lower right abdomen. The clinical presentation of acutely inflamed Appendix can vary significantly due to the diverse degrees of inflammatory involvement, different appendix positions, and varying patient ages. Various scoring systems have been employed to identify health issues, yielding positive results by providing accurate information about individuals' health. Alvarado score and Tzanakis scoring system are extensively studied. The above study was conducted to compare the Alvarado score and Tzanakis score for the effective diagnosis of acute appendicitis.

Methodology: The study was conducted on 111 patients at a tertiary care centre fulfilling the inclusion and exclusion criteria. Findings were recorded on a designated form, and scores were calculated. For the Alvarado Score, a score of 7 or more out of 10 was considered indicative of acute appendicitis, while for the Tzanakis Score, a score of 8 or more out of 15 was considered as such.

Results: The Alvarado Score demonstrated 78% sensitivity, 81.82% specificity, 97.50% positive predictive value (PPV), 29.03% negative predictive value (NPV), and 78.38% overall accuracy. In contrast, the Tzanakis Score showed higher sensitivity at 88%, similar specificity at 81.82%, 97.78% PPV, 42.86% NPV, and 87.39% overall accuracy.

Conclusion: The Tzanakis Score showed superior sensitivity and overall accuracy compared to the Alvarado Score as its p-value is less than Alvarado score, which suggests that it is more effective in correctly identifying appendicitis cases, especially true positives.

Keywords: Appendicitis, Alvarado score, Tzanakis score, inflammation, appendix.

Introduction

Appendicitis refers to the inflammation of the appendix. It stands out as a significant clinical factor contributing to acute abdominal pain, occurring at a rate of 110 cases per 100,000 individuals. [1] The diagnosis of acute appendicitis remains primarily clinical, with abdominal pain being the predominant symptom.

In the typical scenario, patients describe the pain originating in the epigastric and periumbilical region and then relocating to the right iliac fossa. This manifestation is accompanied by elevated body temperature, reduced appetite, nausea, and vomiting. However, the clinical presentation of acutely inflamed Appendix can vary significantly due to the diverse degrees of inflammatory involvement, different appendix positions, and varying patient ages.

The inconsistency in clinical presentation contributes to misdiagnoses in approximately 1 out of 5 cases, leading to negative appendicectomy rates ranging from 15% to 40%. Furthermore, the classical signs and symptoms are only observed in 50-60% of cases, adding complexity to the diagnostic process. Challenges in diagnosis are particularly

pronounced in very young and elderly patients, as well as females of reproductive age, as they are more prone to atypical presentations. Moreover, various other conditions can imitate the symptoms of acute appendicitis in these specific demographic groups. [2] Enhancing the accuracy of disease diagnosis proves beneficial in minimizing risks and simplifying the management of health conditions. The application of technologies such as ultrasonography aids in diagnosing issues and strategizing actions to enhance public health.

While ultrasonography and computed tomography imaging can improve diagnostic accuracy, their high costs and limited accessibility pose challenges. [3, 4] Various scoring systems have been employed to identify health issues, yielding positive results by providing accurate information about individuals' health.

Analyzing risks and emergencies beforehand helps allocate resources and apply techniques to meet individual needs and expectations. [5] However, these scoring systems fall short of offering information about the type of surgery required to improve patients' health. Among them, the Alvarado score system [6] and the Tzanakis scoring system are extensively studied. [7]

The Alvarado system comprises 8 distinct parameters, providing a useful framework for assessing individual health and devising treatment plans to enhance patients' well-being. [8] The application of different parameters, ranging between 1 and 2, contributes to the score, and the cumulative score aids the medical team in determining the appropriate treatment modality.

According to the analysis, a score of 7 or more on the Alvarado system strongly predicts acute appendicitis, guiding healthcare professionals in making accurate diagnoses. Patients with scores of 5-6 indicate a higher likelihood of the disease and necessitate the support of medical staff.

In contrast, the Tzanakis scoring system proposed by Dr. Antonios et. al is a more straight forward approach with four variables and a total score of 15 for diagnosing appendicitis. This scoring system integrates ultrasound scanning, clinical observations, and laboratory findings. To enhance the accuracy of the appendicitis diagnosis. [9]

There is a lack of data regarding the comparison of the Alvarado Score and the Tzanakis Score in the diagnosis of acute appendicitis. Therefore, the above study was conducted to compare the Alvarado score and Tzanakis score for the effective diagnosis of acute appendicitis.

Materials and Methodology

The prospective Observational Study was conducted at Dr. D.Y. Patil Medical College, Hospital and Research Institute for 2 years after institutional ethical committee approval. A total of 111 patients fulfilling the inclusion and exclusion criteria were considered for the study.

Inclusion criteria

All patients above 18 years of age having Appendicitis.

Exclusion criteria

Immunodeficiency status (Malignancy, Steroid therapy, HIV/Hepatitis-B Positive Status), patients having Complications of Appendicitis and not willing to give consent.

After receiving the informed consent, patients were briefed on the significance of clinical examination, as well as the essential radiological and post-operative histopathological investigations. Subsequently, the patients underwent Clinical examination, encompassing a history assessment for anorexia and nausea, physical examination for elevated temperature, and per-abdominal examination for tenderness and rebound tenderness. Routine laboratory investigations, including WBC count and smear examination.

Radiological investigations, such as ultrasonography of the abdomen-pelvis were also carried out. Findings were recorded on a designated form, and scores were calculated. For the Alvarado Score, a score of 7 or more out of 10 was considered indicative of acute appendicitis, while for the Tzanakis Score, a score of 8 or more out of 15 was considered as such. Positivity in any clinical operative finding or histopathological report was regarded as positive for appendicitis.

The scores from both systems were compared with clinical operative and/or histopathological all collected data were stored in an Excel master sheet. Sensitivity and specificity were computed for each scoring system, followed by a comparative analysis between them.

Data was collected and Analyzed by using SPSS software version 21.0.

Result

Alvarado score

Table 1: Distribution of subjects according to Alvarado score

Alvarado score	Frequency (n)	Percentage (%)
<7	31	27.93
≥7	80	72.07
Total	111	100

In above study, 31 participants scored less than 7 on the Alvarado scale, constituting 27.93% of the total sample. In contrast, 80 participants scored 7 or higher, making up 72.07% of the study population.

Table 2: Distribution of subjects according to Tzanakis score

Tzanakis score	Frequency (n)	Percentage (%)
<8	21	18.92
≥8	90	81.08
Total	111	100

Among participants, 21 individuals scored less than 8 on the Tzanakis scale, representing 18.92% of the total sample. On the other hand, 90 participants scored 8 or higher, accounting for 81.08% of the study cohort.

Table 3: Distribution of subjects according to clinical findings

Clinical findings	Frequency (n)	Percentage (%)
Appendicitis	100	90.09
No appendicitis	11	9.91
Total	111	100

Out of the total sample, 100 participants were diagnosed with appendicitis, constituting 90.09% of the study population. Conversely, 11 participants did not exhibit signs of appendicitis, representing 9.91% of the total cohort.

Table 4: Distribution of subjects according to Alvarado score and clinical findings

Alvarado score	Clinical findings		Total
	Appendicitis	No appendicitis	
≥7	78	2	80
<7	22	9	31
Total	100	11	111

Among those with an Alvarado score of 7 or higher (≥7), 80 participants were diagnosed with appendicitis, while 2 participants did not have appendicitis, making a total of 82 cases in this score category. In contrast, among participants with an Alvarado score of less than 7 (<7), 22 were diagnosed with appendicitis, and 9 did not have appendicitis, totaling 31 cases in this score category.

Table 5: Distribution of subjects according to Tzanakis score and clinical findings

Tzanakis score	Clinical findings		Total
	Appendicitis	No appendicitis	
≥8	88	2	90
<8	12	9	21
Total	100	11	111

Among those with a Tzanakis score of 8 or higher (≥8), 88 participants were diagnosed with appendicitis, while 2 participants did not have appendicitis, making a total of 90 cases in this score category. In contrast, among participants with a Tzanakis score of less than 8 (<8), 12 were diagnosed with appendicitis, and 9 did not have appendicitis, totaling 21 cases in this score category.

Table 6: Comparison of diagnostic indices between Alvarado and Tzanakis score

Diagnostic indices	Alvarado score	Tzanakis score
Sensitivity	78%	88%
Specificity	81.82%	81.82%
Positive predictive value	97.50%	97.78%
Negative predictive value	29.03%	42.86%
Accuracy	78.38%	87.39%
p-value	2.702 x 10-5 (<0.05)	2.003 x 10-8 (<0.05)

The Tzanakis score demonstrated superior sensitivity at 88% compared to the Alvarado score's 78%, indicating that the Tzanakis score is better at correctly identifying true positive cases of appendicitis. Both scoring systems showed identical specificity at 81.82%, implying similar abilities to correctly

identify true negative cases. Regarding positive predictive value, both scores were highly accurate, with the Tzanakis score slightly edging out the Alvarado score by 0.28% at 97.78% versus 97.50%. However, the Tzanakis score notably outperformed the Alvarado score in negative predictive value, with 42.86% versus 29.03%, respectively, suggesting a better ability to rule out appendicitis when the score is negative. Overall accuracy favored the Tzanakis score significantly, achieving 87.39% compared to the Alvarado score's 78.38%.

Discussion

In the above study, the mean age of the study participants was 29.37 years, with the majority falling within the 21-30 years age group. This distribution reflects the typical demographic affected by acute appendicitis, which commonly occurs in young adults. Gender distribution showed a higher prevalence among females (60.36%), aligning with existing epidemiological trends that suggest a slightly higher incidence of appendicitis in women.[10]

Despite advancements in modern diagnostic technologies, surgeons still face challenges in accurately diagnosing acute appendicitis.[11-13] Ultrasonography findings can vary in sensitivity and specificity due to operator dependence.[11] Contrast-enhanced CT scans of the abdomen offer high sensitivity and specificity, with reported values of 95% and 93%, respectively, in diagnosing appendicitis.[4] However, accessibility and cost limit widespread use of CT and MRI imaging modalities in many medical centers, thereby restricting patient access.[14] Moreover, CT scans involve ionizing radiation, which imposes inherent limitations.

The Alvarado scoring system is globally recognized as the most widely used tool for assessing acute appendicitis. [15] Known for its simplicity and ease of use, it effectively predicts the likelihood of acute appendicitis. [16] In this study, Alvarado score demonstrated a sensitivity of 78% and a specificity of 81.82%.

These values indicate its ability to correctly identify both true positive and true negative cases of appendicitis, respectively. The score's positive predictive value of 97.50% suggests a high likelihood that patients scoring 7 or higher actually have appendicitis. However, its negative predictive value was lower at 29.03%, indicating a higher rate of false negatives among patients scoring below 7.

The overall accuracy of 78.38% underscores its reliability but also points to room for improvement in reducing false negative diagnoses. The reported sensitivity and specificity of the Alvarado scoring system varies in the literature.

Table 7: Comparison of effectiveness of Alvarado scoring system between studies

Studies	Alvarado scoring system				
	Sensitivity	Specificity	PPV	NPV	Accuracy
Datta SK et al.[1]	59%	33.3%	86.6%	10%	-
Anupriya R et al.[17]	36.21%	66.67%	84%	17.78%	41.43%
Patel LK et al.[18]	77.77%	66.66%	97.22%	16.66%	-
Bl YB et al.[18]	54%	75%	96%	10%	55%
Present study	78%	81.82%	97.50%	29.03%	78.38%

In the above conducted study, in contrast to Alvarado score, the Tzanakis Score shows a higher sensitivity at 88% when compared to the Alvarado Score, indicating its superior ability to correctly identify patients with appendicitis. Both scoring systems showed identical specificity at 81.82%, suggesting similar capacities to correctly identify patients without appendicitis. The Tzanakis Score exhibited a slightly higher positive predictive value at 97.78% and a notably higher negative predictive value at 42.86%, indicating its stronger ability to rule out appendicitis when the score is negative. The overall accuracy of the Tzanakis Score was higher at 87.39%, highlighting its effectiveness in diagnosing appendicitis in our study population. Similarly, these findings were, comparable with the findings reported in previous reports (Table 8). Alvarado score relies solely on signs and symptoms rather than incorporating imaging modalities, the Alvarado scoring system may exhibit lower sensitivity and specificity. Furthermore, variations in how practitioners gather patient information and interpret clinical findings can further diminish its sensitivity. [18]

Table 8: Comparison of effectiveness of Tzanakis scoring system between studies

Studies	Tzanakis scoring system				
	Sensitivity	Specificity	PPV	NPV	Accuracy
Datta SK et al.[1]	79.6%,	83%	97%	35.50%	-
Anupriya R et al.[17]	65.52%	100%	100%	37.50%	71.43%
Patel LK et al.[18]	94.44%	83.33%	98.84%	50%	-
Bl YB et al.[18]	87%	50%	96%	22%	85%
Present study	88%	81.82%	97.78%	42.86%	87.39%

Furthermore, in above study comparing both scoring systems, the Tzanakis Score appears to outperform the Alvarado Score in terms of sensitivity, negative predictive value, and overall accuracy. This superiority suggests that the Tzanakis Score may be a more reliable tool for diagnosing acute appendicitis, especially in settings where minimizing false negatives is crucial to avoid delays in treatment. These findings are in in-line with the study conducted by Bl YB et al. [10] the difference in efficacy in scoring system may be attributed to Alvarado score relies solely on signs and symptoms rather than incorporating imaging modalities, the Alvarado scoring system may exhibit lower sensitivity and specificity. Furthermore, variations in how practitioners gather patient information and interpret clinical findings can further diminish its sensitivity. [18]

Choosing an appropriate scoring system for diagnosing appendicitis is critical in clinical practice to ensure timely and accurate management. The findings of this study support considering the Tzanakis Score as a preferred option due to its higher sensitivity and superior negative predictive value. Clinicians should weigh these diagnostic parameters carefully when selecting between the Alvarado Score and the Tzanakis Score based on their specific patient population and clinical setting.

Conclusion

From the above study we can conclude that the Tzanakis Score showed superior sensitivity and overall accuracy compared to the Alvarado Score as its p-value is less than Alvarado score, which suggests that it is more effective in correctly identifying appendicitis cases, especially true positives.

Both scores had similar specificity but differed notably in NPV, where the Tzanakis Score demonstrated a better ability to rule out appendicitis when negative. It also highlights that the Tzanakis Score is potentially more reliable for acute appendicitis diagnosis, warranting further clinical validation and consideration in diagnostic protocols.

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