Comparison of Tzanakis and Alvarado Scoring System in Diagnosis of Acute Appendicitis, with Histopathology as Gold Standard

Muhammad Zafar Iqbal[1], Malik Irfan Ahmed[2], Naveed Akhtar Malik[3], Ali Kamran[4], Muhammad Umar Qaiser[5], Samra Riaz[6]

[1] Assistant Professor, Department of Surgery, Rawalpindi Medical University, Rawalpindi.

[3] Professor, Department of Surgery, Rawalpindi Medical University, Rawalpindi.

[2,4,5,6] Senior Registrar, Department of Surgery, DHQ Teaching Hospital, Rawalpindi.

Author's Contribution

[3,4] *Conception of study*
[2,4,6] *Experimentation/Study conduction*
[1,2,5] *Analysis/Interpretation/Discussion*
[1,2,4,5,6] *Manuscript Writing*
[3] *Critical Review*
[1] *Facilitation and Material analysis*

Corresponding Author

Dr. Malik Irfan Ahmed,
Senior Registrar,
Surgery,
DHQ Teaching Hospital,
Rawalpindi
Email: Rockblaster80@yahoo.co.uk

Abstract

Objective: To determine the diagnostic accuracy of Tzanakis and Alvarado's score for the diagnosis of acute appendicitis taking histopathology as the gold standard.

Materials & Methods: It was a Cross-sectional validation study. This study was carried out at the emergency department of RMC allied hospital Rawalpindi. The study was completed in eighteen months from 1st May 2020 till 30th Nov 2020. Alvarado score and Tzanakis score were calculated (as per operational definition) at the time of admission of the patients. All the data was entered by the researcher who will collect all the data by himself.

Results: The mean age of patients in this study was 20.15±7.13 years with 218 (51.9%) males and 202 (48.1%) females. The mean Alvardo score was recorded as 7.22±1.58 with the mean Tzanakis score being 9.64±3.13.

Conclusion: The sensitivity of the Tzanakis score was high when compared to the Alvarado score. And specificity was high in the Alvarado score when compared to the Tzanakis score. Moreover, the overall diagnostic accuracy of the Tzanakis score was high when compared to the Alvarado score. So Tzanakis score can be utilized to predict appendix and in the future, we can avoid negative appendectomies.

Keywords: Alvarado score, Appendicitis, Tzanakis score.

Introduction

Appendicitis is a common surgical emergency requiring surgery.[1] It has a lifetime prevalence of 8%.[2] Therefore, its diagnosis is a continuous surgical challenge. The final diagnosis is usually made at surgery or sometime after Histopathology.[2,3] Its diagnosis is made after a carefully taken history and clinical examination, aided by some important laboratory investigations.[2,4] Despite all these, a negative appendectomy rate of 15 to 40% is reported in the literature.[2] To outcome this, different scoring systems are available like Alvarado, Tzanakis, RIPASA, and Ohman.[5,6] Due to its simplicity, the Alvarado scoring system is widely used to reduce the rise in the negative appendectomy rate.[2] The Tzanakis scoring combines clinical examination, USG, and leucocyte count.[7] A recent article has reported that Tzanakis scoring has a sensitivity of 86.0% and specificity of 75.5%, a positive predictive value of 33.3%, a negative predictive value of 33.3% whereas the Alvarado scoring system has a sensitivity of 76.0%, specificity of 75.0%, positive predictivity 97.2%, and negative predictivity of 21.3%.[7]

The diagnosis of acute appendicitis in young females of their reproductive age is very tricky. Gynecological and Obstetrical diseases can mimic acute appendicitis[13], for example, PID, Tubal Pregnancy, Ovarian cyst, etc. The advent of USG has greatly helped in correctly diagnosing acute appendicitis in these female patients.[14] Similarly, acute appendicitis diagnosis is quite challenging in elderly patients.

Establishing the diagnosis of inflammation of appendicitis can be a real challenge. The delay in the treatment of acute appendicitis can lead to very serious consequences and increase both morbidity and mortality in some cases due to the perforation of an inflamed appendix. These facts lead to justifying high rates of negative appendectomy which range from 14 to 75%.[23] Therefore, many clinical scoring systems have been devised to diagnose acute appendicitis. These use symptoms, signs, and laboratory values to diagnose acute appendicitis. The most widely cited system had been Alvarado Scoring System.[23] Similarly Pediatric appendicitis score or Samuel Score is used most of the time for children.[24]

Objective: To determine the diagnostic accuracy of Tzanakis and Alvarado's score for the diagnosis of acute appendicitis taking histopathology as the gold standard.

Materials and Methods

This cross-sectional validation study was conducted at the emergency department of Rawalpindi Medical University allied hospital Rawalpindi. The study was completed in eighteen months from dated 1st May 2020 to 30th November 2020. The sample size was estimated as 420 from WHO calculators.

Non-probably consecutive sampling Patients aged 10 to 40 years of either gender presented with suspicion of acute appendicitis within seven days of onset of symptoms.

Excluded Patients include those with suspected appendicular perforation, appendicular mass, appendicular abscess, and any patient who had given analgesia or sedation before clinical evaluation of acute appendicitis. After getting approval from the ethical committee of Rawalpindi medical university, 420 patients, fulfilling the inclusion criteria, were included in the study after getting their written informed consent. The demographic profile of patients was taken on a proforma and their Alvarado and Tzanakis score was calculated at the time of hospital induction. An appendicular specimen was sent for histopathology in the hospital laboratory. The final decision on acute appendicitis was based on histopathologist findings. All the data was entered into the software and different calculations were obtained.

Data Analysis: SPSS version 20 was used to analyse data. And variables like age, Alvarado, and Tzanakis score were measured as frequency and percentages. 2x2 tables were constructed to calculate the diagnostic accuracy of the Alvarado and Tzanakis score. Likelihood ratio and ROC were measured. The diagnostic accuracy of both of these scoring systems was compared by the chi-square test. P value ≤ 0.05 was significant.

Results

Out of the total of 420 patients, 51.9% were males and the mean age of patients was 20.15±7.13 years with minimum and maximum ages of 10 years and 39 years respectively. The mean Alvarado score was recorded as 7.22±1.58 with the lowest and highest scores of 1.00 and 10.00 respectively. (Table 1)

Table 1: Descriptive Statistics of Alvarado score

	Alvarado Score
Mean	7.22
S.D	1.58
Range	9.00
Minimum	1.00
Maximum	10.00

The Alvarado score of 76.9% (323) patients were observed to be 7 or more and 23.1% (97) patients had a score less than 7.

The mean Tzanakis score observed was 9.64+-3.13 with minimum and maximum scores of 1.00 and 15.00 respectively (table -2).

Table 2: Descriptive Statistics of Tzanakis score

	Tzanakis Score
Mean	9.64
S.D	3.13
Range	14.00
Minimum	1.00
Maximum	15.00

79% (332) of patients had a Tzanakis score of 8 or more and 21% (88) patients had a score of less than 8. (Table 3)

Table 3: Diagnosis of appendicitis on Tzanakis score

		Frequency	*Percent*
Tzanakis Score	8 or more	332	79
	less than 8	88	21
	Total	420	100.0

In 87.4% (367) of the patients, the histopathology was positive for appendicitis, and 12.6% (53) patients had negative histopathology.

The sensitivity of Alvarado's score for diagnosing appendicitis, keeping histopathology as a gold standard, was 86.92%, whereas the specificity was 92.45%. The positive predictive value was 98.76% and the negative predictive value was found to be 50.52%. The overall diagnostic accuracy was 86.62%. (Table 4)

Table 4: Comparison of Alvarado score and histological findings

		Histopathology		*Total*
		Positive	Negative	
Alvarado Score	7 or more	319	4	323
	less than 7	48	49	97
Total		367	53	420

Sensitivity	86.92%
Specificity	92.45%
Positive Predictive Value	98.76%
Negative Predictive Value	50.52%
Diagnostic Accuracy	87.62%

The sensitivity of the Tzanakis score for diagnosing acute appendicitis, keeping histopathology as the gold standard was 88.83% whereas its specificity was 88.6%. Tzanakis positive predictive value was 98.19% and the negative predictive value was 53.41%. Tzanakis overall diagnostic accuracy was 88.81%. (Table 5)

Table 5: Comparison of Tzanakis score and histopathology findings

		Histopathology		*Total*
		Positive	Negative	
Tzanakis Score	8 or more	326	6	332
	less than 8	41	47	88
Total		367	53	420

Sensitivity	88.83%
Specificity	88.68%
Positive Predictive Value	98.19%
Negative Predictive Value	53.41%
Diagnostic Accuracy	88.81%

There was a significant association between the Alvarado score and Tzanakis score for diagnosing acute appendicitis (p-value<0.001). (Table 6)

Table 6: Comparison of Alvarado score and Tzanakis score

		Alvarado Score		*Total*
		7 or more	less than 7	
Tzanakis Score	8 or more	278	54	332
	less than 8	45	43	88
Total		323	97	420

Chi-square = 41.62
p-value< 0.001

The area under curve for Tzanakis score = 0.969 (p-value <0.001)
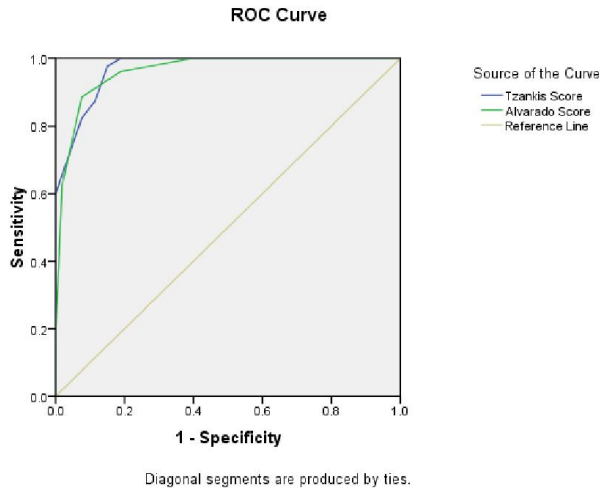Area under curve for Alvarado score = 0.962 (p-value <0.001). (Figure 1)

Figure 1: ROC analysis

Using ROC, we found the optimum cut-off value for Alvarado Score as 6.5, whereas we obtained sensitivity and specificity of 88.6% and 92.5% respectively. Moreover for Tzanakis Score, the optimum cut of value is 8.5 which results in higher sensitivity and specificity of 82.3% and 92.5% respectively.

Discussion

An appendix is a hollow muscular tube at the junction of the ileum and caecum. The inflammation of this apparently vestigial structure is called appendicitis which is a very common cause of acute abdomen in our daily life in the accident and emergency department, and a significant number of such patients require surgery.[28] The patients suffering from right lower quadrant abdominal pain have a wide spectrum of symptoms and sometimes diagnosis of acute appendicitis can be a really difficult task even by a senior surgeon.[29] A prompt diagnosis of the condition is very important to reduce the morbidity and mortality associated with this condtion[28] due to associated perforation. Over the years, certain non-invasive scoring systems like Alvarado and Tzanakis scoring system have evolved which help in making a diagnosis and thus preventing unnecessary operations in these patients. Of the two, the Alvarado scoring system is most commonly used worldwide although it has certain weaknesses. On the other hand, the Tzanakis scoring system is considered better than Alvarado's as it combines clinical examination, assisted by the laboratory as well as ultrasonography in making a final diagnosis of acute appendicitis.[30]

Male dominance in the study population in our study is comparable to other studies.[31] Mean age of our patients was 20.15 years with a standard deviation of ±7.13 years, this is also comparable with international literature.[32]

According to one study[33] sensitivity, specificity, and overall diagnostic accuracy of Tzanakis scoring were 91.48%, 66.66%, and 90% respectively which is like our study but the specificity of our study is higher than this study. Another study[34] reported sensitivity, specificity, and positive and negative predictive values of the Tzanakis scoring system as 86.9%, 75.0%, 97.5%, and 33.3% respectively which is quite similar to our study. In the current study, we have calculated the sensitivity, specificity, and positive and negative predictive values as 88.83%, 88.60%, 98.19%, and 59.41% respectively. While the overall diagnostic accuracy of Tzanakis score was 88.81%. Therefore, our results prove that the Tzanakis scoring system is better than the Alvarado scoring system in the diagnostic accuracy of acute appendicitis.

Moreover, the optimum cut-off value for the Tzanakis scoring system is 8.5 which gives higher sensitivity and specificity as 82.3% and 92.5%. Therefore, after using the combination of both scoring systems, a negative appendicectomy rate that is reportedly high (15 to 40%), can be minimized in the future.

Conclusion

The sensitivity of the Tzanakis score was high when compared to the Alvarado score. And specificity was high in the Alvarado score when compared to the Tzanakis score. Moreover, the overall diagnostic accuracy of the Tzanakis score was high when compared to the Alvarado score. So Tzanakis score can be utilized to predict appendix and in the future, we can avoid negative appendectomies.

References

1.   Omari AH, Khammash MR, Qasaimeh GR, Shammari AK, Yaseen MKB, Hammori SK. Acute appendicitis in the elderly: risk factors for perforation. World Journal of Emergency Surgery 2014;9(1):1.
2.   Olakolu S, Lloyd C, Day G, Wellington P. Diagnosis Of Acute Appendicitis At Mandeville Regional Hospital (MRH): Clinical Judgment Versus Alvarado Score. The Internet Journal of Surgery 2010;27(1).
3.   Alnjadat I, Abdallah B. Alvarado versus RIPASA score in diagnosing acute appendicitis. Rawal Medical Journal 2013;38(2):147-51.
4.   Arbab R, Khan MI, Mehmood M, Marri MM, Khan JA. Diagnostic accuracy of modified Alvarado score in the prediction of acute appendicitis. Pak J Surg 2013;29(4):272-7.
5.   Nanjundaiah N, Mohammed A, Shanbhag V, Ashfaque K, Priya S. A comparative study of RIPASA score and ALVARADO

score in the diagnosis of acute appendicitis. Journal of clinical and diagnostic research: JCDR 2014;8(11):NC03.

6. Chong C, Thien A, Mackie A, Tin A, Tripathi S, Ahmad M, et al. Comparison of RIPASA and Alvarado scores for the diagnosis of acute appendicitis. Singapore medical journal 2011;52(5):340-5.

7. Malla B, Batajoo H. Comparison of Tzanakis Score vs Alvarado Score in the Effective diagnosis of acute Appendicitis. Kathmandu University Medical Journal 2015;12(1):48-50.

8. Ohle R, O'Reilly F, O'Brien KK, Fahey T, Dimitrov BD. The Alvarado score for predicting acute appendicitis: a systematic review. BMC medicine 2011;9(1):1.

9. Seal A. Appendicitis: a historical review. Canadian journal of surgery Journal canadien de chirurgie 1981;24(4):427-33.

10. Smith DC. Appendicitis, appendectomy, and the surgeon. Bulletin of the History of Medicine 1996;70(3):414-41.

11. Körner H, Söndenaa K, Söreide JA, Andersen E, Nysted A, Lende TH, et al. Incidence of acute nonperforated and perforated appendicitis: age-specific and sex-specific analysis. World journal of surgery 1997;21(3):313-7.

12. Körner H, Söndenaa K, Söreide JA, Andersen E, Nysted A, Lende TH, et al. Incidence of acute nonperforated and perforated appendicitis: age-specific and sex-specific analysis. World journal of surgery 1997;21(3):313-7.

13. Morishita K, Gushimiyagi M, Hashiguchi M, Stein GH, Tokuda Y. Clinical prediction rule to distinguish pelvic inflammatory disease from acute appendicitis in women of childbearing age. The American journal of emergency medicine 2007;25(2):152-7.

14. Wolfe JM, Henneman PL. Acute appendicitis. women 2013;1:2.

15. Pu D, Bedalov G, Fridrih S, Vu I, Banek T, Pasini J. Urinalysis, ultrasound analysis, and renal dynamic scintigraphy in acute appendicitis. Urology 1995;45(1):108-12.

16. Yang HR, Wang YC, Chung PK, Chen WK, Jeng LB, Chen RJ. Laboratory tests in patients with acute appendicitis. ANZ journal of surgery 2006;76(1-2):71-4.

17. Kojima, K., Fujita, T., Imanari, Y. et al.: Usefulness of ultrasonography in acute appendicitis. Nichi Rin Ge I Kaishi 1993; 54: 2524– 2528. (in Japanese)

18. Yamashita, Y., Nishino, Y. and Hirakawa, K.: Radiographic diagnosis of acute appendicitis, a disease commonly treated by emergency surgery. Establishment of the diagnosis depending on characteristic findings. Shokaki Geka (Intestinal Surgery) 2000; 23: 1903–1910. (in Japanese)

19. Rao PM, Rhea JT, Rao JA, Conn AK. Plain abdominal radiography in clinically suspected appendicitis: diagnostic yield, resource use, and comparison with CT. The American journal of emergency medicine 1999;17(4):325-8.

20. Rao P, Boland G. Imaging of acute right lower abdominal quadrant pain. Clinical radiology 1998;53(9):639-49.

21. Wolfe JM, Henneman PL. Acute appendicitis. women 2013;1:2.

22. Pouget-Baudry Y, Mucci S, Eyssartier E, Guesdon-Portes A, Lada P, Casa C, et al. The use of the Alvarado score in the management of right lower quadrant abdominal pain in the adult. Journal of visceral surgery 2010;147(2):e40-e4.

23. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Annals of emergency medicine 1986;15(5):557-64.

24. Samuel M. Pediatric appendicitis score. Journal of pediatric surgery 2002;37(6):877-81.

25. De Dombal F, Leaper D, Horrocks JC, Staniland JR, McCann A. Human and computer-aided diagnosis of abdominal pain: further report with emphasis on performance of clinicians. British medical journal 1974;1(5904):376.

26. Ohmann C, Yang Q, Franke C. Diagnostic scores for acute appendicitis. Abdominal Pain Study Group. The European journal of surgery= Acta chirurgica 1995;161(4):273-81.

27. Iqbal MM, Ahmed T, Khan I, Iftikhar A, Shah SH, Magsi AM et. al. Experience of Tzanakis Scoring System for Accurate Diagnosis of Acute Appendicitis in Jinnah Postgraduate Medical Centre, Karachi. Isra Med J. 2018; 10(1): 40-43

28. Brown JJ. Acute appendicitis: the radiologist's role. Radiology 1991;180(1):13-4.

29. Williams GR. Presidential Address: a history of appendicitis. With anecdotes illustrating its importance. Annals of surgery 1983;197(5):495-506.

30. Sahm M, Pross M, Lippert H. Acute appendicitis-changes in epidemiology, diagnosis and therapy. Zentralblatt fur Chirurgie 2011;136(1):18-24.

31. Malik A A, Mir M F, Khurshid S U, Wani I, Dagga R. Modified Alvarado Score Versus Tzanakis Score for Diagnosing Acute Appendicitis in Changing Clinical Practice. Int J Clin Muhammad Mansoor Iqbal et al. ISRA MEDICAL JOURNAL | Volume 10 - Issue 1 | Jan - Feb 2018 43 Exp Med. 2016;2(5):90-93.

32. Shashikala V, Hegde H, Victor AJ. Comparative study of Tzanakis score vs Alvarado score in the effective diagnosis of acute appendicitis. Int J of Biomed & Adv Res. 2016;7(9):418-20

33. Sigdel G, Lakhey P, Misra P. Tzanakis Score vs Alvarado in Acute Appendicitis. J Nepal Med Assoc 2010;49(178):96-9.

34. Malla B, Batajoo H. Comparison of Tzanakis Score vs Alvarado Score in the Effective diagnosis of acute Appendicitis. Kathmandu Univ Med J 2014;45(1):48-50.