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Original Article

Ultrasound and the Alvarado Score for Diagnosing Acute Appendicitis

Sumia T Dra

Surgical Department, Faculty of Medicine, University of Zawia, Libya.

Corresponding Author: Dr. Sumia Dra, email: s.draa@zu.edu.ly

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ABSTRACT

Purpose: the signs and symptoms associated with acute appendicitis are determined by the Alvarado score with a numerical value. The Alvarado score is practically equivalent to the clinical suspicion score. On the other hand, ultrasound is often used to help diagnose acute appendicitis. The aim of this study is to study the sensitivity of the Alvarado Scoring System and Ultrasonography in diagnosing appendicitis in Zawia Medical Center.

Methods: In this study 146 patients were included with provisional diagnosis of acute appendicitis and admitted and operated in the Department of General Surgery, Zawia Medical Center from July 2018 to July 2019. Alvarado score was applied and ultra sound abdomen was done pre operatively. The study population was divided into two groups regarding the Modified Alvarado scoring ≥ 7 and ≤ 7. The sensitivity, specificity, positive and negative predictive values of both clinical scores and ultrasound were compared.

Results: Our study indicated overall sensitivity of the Alvarado system; score ≥ 7 was (65% for male, 68% for female) while for score ≤ 7 the sensitivity was (52% for male and 66% for female). While the sensitivity of ultrasonography, was (76.9% foe male and 71.4% for female (score ≥ 7), and (81.8% for male, 66.6% for female (score ≤ 7).

Conclusions: From our study, we can conclude that both the Alvarado score approach and ultrasonography are effective diagnostic methods for acute appendicitis, with the sensitivity of ultrasonography reaching 81%.

Keywords: Acute appendicitis, Alvarado score, ultrasonography, sensitivity.

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INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies, with a lifetime prevalence of approximately 1 in 7.[1] It is estimated that as much as 6% to 7% of the general population will develop appendicitis during their lifetime, with the incidence peaking in the second decade of life.[2] Diagnostic aids have been shown to significantly reduce the number of surgical interventions, perforations, and hospitalizations in patients without the disease.[1] The Alvarado scoring system and ultrasonography are helpful in diagnosing acute appendicitis due to their ease of use, low cost, and lack of radiation.[3] The Alvarado Scoring System is a clinical scoring system that predicts the incidence of acute appendicitis and identifies people who need immediate medical intervention or surgery to prevent complications that increase mortality and morbidity.[4,5] However, most of them are difficult and unworkable during an emergency.[6,7]

Although modern radiographic imaging has improved diagnostic accuracy, diagnosing appendicitis remains a clinical challenge that requires observation, clinical expertise, and surgical knowledge. It serves as a reminder of the importance of surgical diagnosis.

The diagnostic methods for acute appendicitis include ultrasound,[8] Scoring Systems,9,10 Computed Tomography,[11] Magnetic Resonance Imaging,[12] and Laparoscopy.[13] The Ultrasonography is the least expensive and intrusive of the imaging modalities, with a sensitivity ranging from 78% to 83% as reported by many studies.[14,15]

The following study was conducted at Zawia Medical Center to study the sensitivity of the Alvarado Scoring System and Ultrasonography in diagnosing acute appendicitis.

MATERIALS AND METHODS

The 146 patients in this study were hospitalized in the Department of General Surgery at Zawia Medical Center between July 2018 and July 2019 with a preliminary diagnosis of acute appendicitis. The abdomen was ultrasonographed before surgery, and the Alvarado score was used. Independent of the score and ultrasonography results, the decision to proceed with surgery was taken. Table 1 presents the Alvarado scoring criteria for acute appendicitis.[16]

Criteria for acute appendicitis by ultra sound

When an aberrant appendix is observed sonographically as a tubular, blind-ending, aperistaltic intestinal loop that is non-compressible and has a diameter of at least 7 mm in the antero-posterior direction, discomfort on graded compression of the affected area is suggestive of appendicitis. An indirect indicator was fecolith, or the predominance of periappendicular fat. When the appendix was absent, normal, or revealed non-appendicular disease, ultrasonography was deemed negative.[17]

Table 1. Criteria for acute appendicitis by Modified Alvarado score.

Alvarado scoring system	
Symptoms	**Score**
Migratory right iliac fossa pain	1
Nausea/ vomiting	1
Anorexia	1
Signs	**Score**
Tenderness in right iliac fossa	2
Rebound tenderness in right iliac fossa	1
Elevated temperature	1
Laboratory Findings	**Score**
Leukocytosis	2
Shift to the left of neutrophils	1
Total	10

•Score of 7 to 9- Probable acute appendicitis.
•Score of 5 to 6- Possible diagnosis of acute appendicitis.
•Score of 1 to 4-Unlikely to have appendicitis.

Table 2. Alvarado score distribution among patients.

Alvarado score	**Number of cases**			
	Male	**Female**	**Children**	**Total**
≥ 7	22	15	10	47
≤ 7	19	15	10	44

RESEULTS

During the study period, 146 individuals with a provisional diagnosis of acute appendicitis underwent surgery. From Table 3, there are 41 male patients (28%), 44 female patients (30 %) and 61 patients are children (42%).

Table 3. Patient distribution.

	Number of patients	Percentage
Male	41	28%
Female	44	30%
Children	61	42%
Total NO.	146	100%

From the Table 5, the sensitivity of the Alvarado score system (score ≥ 7) was (65%for male, 68% for female and 90% for children), while the sensitivity of ultrasound was (76.9% for male, 71.4% for female and 73.7% for children). The sensitivity of the Alvarado score system (score ≤ 7) was (52% for male, 66% for female and 40% for children), while the sensitivity of ultrasound was (81.8% for male, 66.6% for female and 42.9% for children).

From the above data, we can infer that the abdominal ultrasound has higher sensitivity 76.9% (in male) and 71.4 % (in female) when compared to Alvarado score in the diagnosis of acute appendicitis for patients with score ≥ 7. In contrast to, Alvarado score has higher sensitivity (90%) when compared to the abdominal ultrasound in children as show in Table 6.

Table 4. Sensitivity of Alvarado score system.

Sex	Total number of patients	Patients with score ≥ 7	Appendicitis	Sensitivity	Patients with Score ≤ 7	Appendicitis	Sensitivity
Male	41	22	17	65%	19	10	52%
Female	44	29	21	68%	15	10	66%
Children	61	51	36	90%	10	4	40%

Table 5. Sensitivity of Ultrasonography.

Sex	Total number of patients	Patients with Score ≥ 7	Appendicitis	Sensitivity	Patients with Score ≤ 7	Appendicitis	Sensitivity
Male	41	22	17	76.9%	19	10	81.8%
Female	44	29	21	71.4%	15	10	66.6%
Children	61	51	36	73.7%	10	4	42.9%

DISCUSSION

Appendicitis is the leading cause of emergency abdominal surgery all over the world.This condition involves inflammation of the vermiform appendix. Despite the many strategies that have been studied to lessen the removal of a normal appendix without raising the risk of perforation, appendicitis remains a challenging diagnosis for emergency physicians and surgeons.[18]

To improve diagnostic accuracy, various scoring systems and radiological procedures, including ultrasonography and computed tomography, are used.[19] The best-known scores are the Alvarado score, the modified Alvarado score, the Pediatric Appendicitis Score, the Appendicitis Inflammatory Response score, and the RIPASA score.[20,21] The Alvarado score was described in 1986. The Alvarado score is one such simple system based on

a few symptoms, signs, and a basic laboratory investigation.[22] While, Ultrasound is often used as the initial diagnostic imaging in which cases the clinical diagnosis is equivocal. However, a negative ultrasound or lack of appendix visualization does not rule out acute appendicitis. Ultrasonography is noninvasive, rapidly available and avoids radiation exposure.[23,24] It is the first modality recommended by the European Association for Endoscopic Surgery (EAES) for patients with suspected appendicitis.[25,26]

In our study, 47 patients (male and female) proved to have acute appendicitis by the Alvarado system (score ≥ 7) with a sensitivity of (65% for males, 68 % for female), while, those patients with score ≤ 7 (44 male and female with a sensitivity of (52% for males, 66% for female) which was similar to Mohannad Al-Tarakji et al. study which demonstrated that sensitivity of the Alvarado system were 66.4%,[27] and was lower as compared to the Gujar et al., study (sensitivity = 98.44%),[28] and the Nautiyal et al., and Tandi et al. studies, which demonstrated that sensitivity of the Alvarado system 77%.[29,30] On other hand the sensitivity of ultrasonography (score ≥ 7) was (76.9% for males, 71.4%for female), which was similar to that reported by Seda Ozkan et al. study which demonstrated that sensitivity of the ultrasonography were 71.2%,[31] but it was lower than this obtained by the Gujar et al. and Nautiyal and his colleague studies, which demonstrated a sensitivity of (98.44%, 97.14%) chronologically.[32,33] While, those patients with score ≤ 7 the sensitivity of the ultrasonography was (81.8%for males, 66.6% for female) which was similar to that in Sixto Javier Genzor Ríos et al study,[34] and it was lower as compared to the Ashraf Ali et al. study which demonstrated that sensitivity of the ultrasonography were 86.2%.[35]

CONCLUSIONS

We conclude that both the Alvarado score approach and ultrasonography are effective diagnostic tools for acute appendicitis, with the sensitivity of ultrasonography reaching 81%.

REFERENCES

1. Kardong, K.V. Vertebrates: Comparative anatomy, function, evolution. Third edition. McGraw-Hill: New York, NY, 2002:513-115.
2. Douglas CD, Macpherson NE, Davidson PM. Randomized controlled trial of ultrasonography in diagnosis of acute appendicitis, incorporating the Alvarado score. Brit Med J. 2000; 321:1-7.
3. Chitnavis N, Jagtap D, Parthiban A and Shojai. AR. Comparison of ultrasound and the alvarado score in the diagnosis of acute appendicitis: a prospective comparative study in a tertiary care centre in western maharashtra. Int. J. Adv. Res, 2023; 11(01), 1159-1166.
4. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Annals of Emergency Medicine. 1986;15(5):557–564
5. Karaman K, Ercan M, Demir H, Yalkın Ö, Uzunoğlu Y, Gündoğdu K, Zengin İ, Aksoy YE, Bostancı EB. The Karaman score: A new diagnostic score for acute appendicitis. Ulus Travma Acil Cerrahi Derg. 2018; 24(6):545-551.
6. Karami M. Y., Niakan H., Zadebagheri N., Mardani P., Shayan Z., Deilami I. Which one is better? Comparison of the acute inflammatory response, raja isteri pengiran anak saleha appendicitis and alvarado scoring systems. Annals of Coloproctology . 2017; 33(6):22 7–231.
7. Alvarado A. Current Issues in the Diagnostics and Treatment of Acute Appendicitis. London, UK: Intech Open; 2018. Diagnostic
8. Puylaert JB. Acute appendicitis: US evaluation using graded compression. Radiology. 1986; 158:355-60.
9. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med. 1986; 15:557-64.
10. Lone NA, Shah M, Wani KA, Peer GQ. Modified Alvarado Score in Diagnosis of Acute Appendicitis. Indian Journalfor the Practising Doctor. 2006; 3:17.
11. Terasawa T, Blackmore CC, Bent S, Kohlwes RJ. Systematic review: Computed tomography and ultrasonography to detect acute appendicitis in adults and adolescents. Ann Intern Med. 2004; 141:537-46.
12. Duke E, Kalb B, Arif-Tiwari et al. A systematic review and meta- analysis of diagnostic performance of MRI for evaluation of acute appendicitis. American Journal of Roentgenology. 2016; 206(3).
13. Fitzgibbons RJ, Ulualp K. Laparoscopic appendicectomy. In Baker RJ and Fischer JE (eds): Mastery of Surgery, 4th ed, Lippincott Williams & Wilkins, 2001, 1472.

14. Bernard M, Jaffe, Berger DH. The Appendix. In Schwartz′s Principles of Surgery. Brunicardi FC, Anderson DK, Billiar TR, Dunn DL, Hunter JG, Pollock RE, 8th ED. USA: The McGraw-Hill, 2005, 1119-1137.
15. Zhang Q, Agyekum EA, Zhu L, Yan L, Zhang L, Wang X, Yin L, Qian X. Clinical Value of Three Combined Ultrasonography Modalities in Predicting the Risk of Metastasis to Axillary Lymph Nodes in Breast Invasive Ductal Carcinoma. Front Oncol. 2021 Sep 22; 11:715097. doi: 10.3389/fonc.2021.715097. PMID: 34631542; PMCID: PMC8493283.
16. McKay R, Shepherd J. The use of the clinical scoring system by Alvarado in the decision to perform computed tomography for acute appendicitis in the ED. Am J Emerg Med. 2007; 25:489-93.
17. Karul M, Berliner C, Keller S, Tsui TY, Yamamura J. Imaging of appendicitis in adults. Rofo. 2014; 186:551–8.
18. Moris D, Paulson EK and Pappas TN. Diagnosis and management of acute appendicitis in adults: a review. JAMA 2021; 326: 2299-2311.
19. Depetris MA, Martínez Chamorro E, Ibáñez Sanz L, Albillos Merino JC, Rodríguez Cuellar E and Borruel Nacenta S. The usefulness and positive predictive value of ultrasonography and computed tomography in the diagnosis of acute appendicitis in adults: a retrospective study. Radiologia (Engl Ed) 2022; 64: 506- 515.
20. Andersson M., Andersson R.E. The appendicitis inflammatory response score: a tool for the diagnosis of acute appendicitis that outperforms the Alvarado score. World J. Surg. 2008; 32:1843–1849. doi: 10.1007/s00268-008-9649-y.
21. Sammalkorpi H.E., Mentula P., Leppäniemi A. A new adult appendicitis score improves diagnostic accuracy of acute appendicitis - a prospective study. BMC Gastroenterol. 2014; 14:114. doi: 10.1186/1471-230X-14-114.
22. Alvarado A. A practical score for the early diagnostic of acute appendicitis. Annals of Emergency Medicine. 1986; 15(5):557-564.
23. Podda M, Pisanu A, Sartelli M, Coccolini F, Damaskos D, Augustin G, Khan M, Pata F, De Simone B, Ansaloni L, Catena F and Di Saverio S. Diagnosis of acute appendicitis based on clinical scores: is it a myth or reality? Acta Biomed 2021; 92: e2021231.
24. Hussain S, Mubeen I, Ullah N, Shah SSUD, Khan BA, Zahoor M, Ullah R, Khan FA and Sultan MA. Modern diagnostic imaging technique applications and risk factors in the medical field: a review. Biomed Res Int 2022; 2022: 5164970
25. Kilkenny J, Greensmith T, Hameed W, Gill S and Hassan S. A case-based overview of the role of radiological imaging in emergency general surgery. Cureus 2022; 14: e21986.
26. Teng TZJ, Thong XR, Lau KY, Balasubramaniam S and Shelat VG. Acute appendicitis-advances and controversies. World J Gastrointest Surg 2021; 13: 1293-1314.
27. Al-Tarakji M, Zarour A, Singh R, Ghali MS. The Role of Alvarado Score in Predicting Acute Appendicitis and Its Severity in Correlation to Histopathology: A Retrospective Study in a Qatar Population. Cureus. 2022 Jul 15; 14(7):e26902. doi: 10.7759/cureus.26902. PMID: 35983388; PMCID: PMC9376215.
28. Gujar N, Mudhol S, Choudhari R, Sachin D (2015): Determination of sensitivity and specificity of modified Alvarado Score and ultrasonography in patients with acute appendicitis. J Krishna Inst Med Sci Univ., 4 (2): 89-99.
29. Nautiyal H, Ahmad S, Keshwani N, Awasthi D (2010): Combined use of modified Alvarado score and USG in decreasing negative appendicectomy rate. Indian J Surg., 72 (1): 46-52.
30. Tandi N, Pai S, Mulla S, Kini A (2019): Relevance of scoring systems in acute appendicitis. Int Surg J., 6 (7): 2475.
31. Ozkan S, Duman A, Durukan P, Yildirim A, Ozbakan O (2014): The accuracy rate of Alvarado score, ultrasonography, and computerized tomography scan in the diagnosis of acute appendicitis in our center. Niger J Clin Pract.,17 (4): 413-418
32. Gujar N, Mudhol S, Choudhari R, Sachin D (2015): Determination of sensitivity and specificity of modified Alvarado Score and ultrasonography in patients with acute appendicitis. J Krishna Inst Med Sci Univ., 4 (2): 89-99.
33. Nautiyal H, Ahmad S, Keshwani N, Awasthi D (2010): Combined use of modified Alvarado score and USG in decreasing negative appendicectomy rate. Indian J Surg., 72 (1): 46-52.
34. Genzor Ríos SJ, Rodríguez Artigas JM, Giménez Maurel T, Vallejo Bernad C, Aguirre Prat N, Miguelena Bobadilla JM. Ecografía y Escala de Alvarado en el diagnóstico de la apendicitis aguda. Impacto en la tasa de apendicectomía negativa [Ultrasonography and the Alvarado score in the diagnosis of acute appendicitis: impact on the negative appendectomy rate]. Emergencias. 2016 Dic; 28(6):396-399. Spanish. PMID: 29106084.
35. Ali A, Habib A, Abd Elrahman A. The Accuracy of Abdominal Ultrasound and the Modified Alvarado Score in the Diagnosis of Acute Appendicitis. The Egyptian Journal of Hospital Medicine, 2023; 93:7093- 7096.