JOURNAL OF
CONTEMPORARY MEDICINE

DOI:10.16899/jcm.1496012
J Contemp Med 2024;14(4):189-192

Original Article / Orijinal Araştırma

Pediatric Modification for Alvarado Score: Appearance of Patients with Apandisitis

Alvarado Skoru için Pediatrik Modifikasyon: Apandisitli Hastaların Görünümü

Burhan Beger[1], Cihan Etgül[1], Metin Simsek[2], Sevgi Ulusoy Tangul[3], Bülent Sönmez[4]

[1]Van Yuzuncuyil University, Pediatric Surgery Department, Van, Turkey
[2]Van Training and research Hospital, Pediatric Surgery Department, Van, Turkey
[3]Yozgat Bozok University, Pediatric Surgery Department, Yozgat, Turkey
[4]Van Yuzuncuyil University, Pediatry Department, Van, Turkey

Abstract

Aim: For decreasing the morbidity rate in emergency pediatric surgery clinics, this study evaluated the reliability of an acute appendicitis diagnosis score defined by us as "appearance of the patient with appendicitis (APA)", a new modification of Alvarado Score (AS).

Material and Method: One hundred eighty patients, that admitted to Van Training and Research Hospital between February 2018 and June 2018 and were consulted to pediatric surgery with acute appendicitis suspicion; were analyzed as a randomized prospective study. In the new scoring system which we define as APA, instead of a left shift of neutrophils – a state of the patients lying still in the bed, reluctant to speak, with dry lips, with tired eyes, upset and with a troubled expression at the face is placed. For all the patients, AS (AS 1-4, AS 5-6 and AS 7-10) and APA (APA 1-4, APA 5-6 and APA 7-10) scores were independently calculated as three groups and were compared to each other.

Results: 180 children (108 males – 72 female) with an average age of 11 (range, 6 – 15) were included in the study. Distribution of patients in the three groups of AS was determined as 1-4: 90 (50%), AS 5-7: 48 (26.7%) and AS 8-10: 42 (23.3%) respectively. Distribution of patients with respect to APA score were as APA 1-4: 72 (40%), APA 5-7: 69 (38.3%) and APA 8-10: 39 (21.7%). Appendectomy was performed on 3 patients from the AS 1-4 group, on 15 patients from AS 5-6 group and on 33 patients from AS 7-10 group. Whereas none of the patients from the APA 1-4 group had an appendectomy, 18 patients from APA 5-6 group and 33 patients from APA 7-10 group had an appendectomy.

Conclusion: By means of APA which we define as a combination of AS and clinical judgment (CJ), the number of pediatric cases with appendicitis suspicion to be kept under observation was increased and unnecessary – too early or too late- surgical intervention incidence was decreased. Our study shows CJ and scoring systems are not alternative methods for each other and collective use of both can decrease morbidity and mortality in acute appendicitis treatment.

Keywords: Alvarado score, appendicitis, pediatrics

Öz

Amaç: Bu çalışmada, acil çocuk cerrahisi kliniklerinde morbidite oranının azaltılması amacıyla Alvarado'nun yeni bir modifikasyonu olan ve "apandisitli hastanın görünümü (APA)" olarak tanımladığımız akut apandisit tanı skorunun güvenilirliği değerlendirilmektedir. Puan (AS).

Gereç ve Yöntem: Şubat 2018 ile Haziran 2018 tarihleri arasında Van Eğitim ve Araştırma Hastanesi'ne başvuran ve akut apandisit şüphesiyle çocuk cerrahisine başvuran 180 hasta; randomize prospektif bir çalışma olarak analiz edildi. APA olarak tanımladığımız yeni puanlama sisteminde nötrofillerin sola kayması yerine hastaların yatakta hareketsiz yatması, konuşmak istememesi, dudakları kuru, gözleri yorgun, üzgün ve yüzünde sıkıntılı bir ifade olması durumu. yüz yerleştirilir. Tüm hastaların AS (AS 1-4, AS 5-6 ve AS 7-10) ve APA (APA 1-4, APA 5-6 ve APA 7-10) skorları üç grup halinde bağımsız olarak hesaplandı ve karşılaştırıldı. birbirlerine.

Bulgular: Araştırmaya yaş ortalaması 11 (6-15 yaş aralığı) olan 180 çocuk (108 erkek – 72 kız) dahil edildi. AS'nin üç gruba göre dağılımı sırasıyla 1-4: 90 (%50), AS 5-7: 48 (%26,7) ve AS 8-10: 42 (%23,3) olarak belirlendi. Hastaların APA skoruna göre dağılımı APA 1-4:72 (%40), APA 5-7:69 (%38,3) ve APA 8-10:39 (%21,7) şeklindeydi. AS 1-4 grubundan 3 hastaya, AS 5-6 grubundan 15 hastaya ve AS 7-10 grubundan 33 hastaya apendektomi yapıldı. APA 1-4 grubundaki hastaların hiçbirinde apendektomi yapılmazken, APA 5-6 grubunda 18, APA 7-10 grubunda ise 33 hastaya apendektomi uygulandı.

Sonuç: AS ve klinik yargının (CJ) birleşimi olarak tanımladığımız APA sayesinde, apandisit şüphesi ile gözlem altında tutulması gereken pediatrik olguların sayısı artırılmış ve gereksiz -çok erken veya çok geç- cerrahi müdahale sıklığı azaltılmıştır. azaldı. Çalışmamız CJ ve skorlama sistemlerinin birbirine alternatif yöntemler olmadığını ve her ikisinin birlikte kullanımının akut apandisit tedavisinde morbidite ve mortaliteyi azaltabileceğini göstermektedir.

Anahtar Kelimeler: Alvarado skoru, apandisit, pediatri

Corresponding *(İletişim)*: Burhan Beger, Van Yuzuncuyil University, Pediatric Surgery Department, Van, Turkey
E-mail *(E-posta)*: burhanbeger@hotmail.com
Received *(Geliş Tarihi)*: 24.06.2024 **Accepted *(Kabul Tarihi)*:** 19.07.2024

INTRODUCTION

Alvarado score (AS) is a well-tested and commonly used clinical scoring system for acute appendicitis diagnosis.[1] Prospective studies reported that just AS could be used as a diagnostic method.[2] Apart from utility and cost effectiveness of AS, its insufficiency may also be in question.[3] Thus, it should be supported with additional parameters in pediatric cases. Some surgeons remark that acute appendicitis can be clinically diagnosed without routine imaging.[4] In studies in where clinical judgment (CJ) and AS were compared, no superiority of AS over CJ could be proved.[5] Objective redefinition of CJ and its incorporation into AS as a parameter may increase the diagnostic value and practical use of AS.

This study intended to evaluate the reliability of CJ, which defined by us as "appearance of patient with appendicitis" (APA). We used APA as a new parameter in AS to develop a new pediatric modified system. We named this modification as "Appearance of Patient with Appendicitis-modified Alvarado Score" (APA m-AS).

MATERIAL AND METHOD

The study was carried out with the permission of Van Training and Research Hospital Ethics Committee (Date: 03.05.2018, Decision No: 2018/08). This work was carried out in accordance with the Helsinki Declaration principles.

This prospective case control study was conducted in Van Training and Research Hospital as a public institution. One hundred eighty patients that admitted to our clinic between February-June 2018 were included in the work. Our clinic is a reference center for appendicitis surgery. The rates of appendicitis are high, since patients examined by other clinicians (e.g., pediatricians) are directed to our clinic. All patients admitted to the hospital with a right lower quadrant pain were identified with an initial diagnosis of appendicitis, after being assessed using scoring systems. None of the patients were given painkillers during the observation. Patients were divided into three groups regarding to AS score: 1-4 point (discharge), 5-6 point (observation with scoring repeated in 12h), and 7-10 point (urgent surgery).

Instead of a left shift of neutrophils, we preferred to use APA in our newly defined APA m-AS score system included a state of the patients: a) lying still in the bed, b) reluctant to speak, c) dry lips, d) tired looking eyes, and e) upset and troubled expression at the face. These are most common findings about general appearance in acute appendicitis. According to APA m-AS, at least existence of three out of five signs was considered as 1 point.

Similar to AS groups, patients were divided into three groups: APA m-AS 1-4 (discharge), APA m-AS 5-6 (observation with scoring repeated in 12h) and APA m-AS 7-10 (urgent surgery).

AS and APA m-AS scores were compared. Discharged group was followed with phone calls by pediatric surgery nurses. All observed groups were re-evaluated after 12 hours. These patients were either discharged or admitted to the pediatric surgery clinic. This study did not contain pathological results.

Statistical Analysis

Statistical assessment was performed using SPSS Inc., Chicago, IL, USA (version 15). Normality controls were done using Shapiro–Wilk test. Groups were compared in terms of appendectomy rate, negative pathology rate and hospitalization periods, using independent sample t-test. The statistical significance level was set at $P < 0.05$.

RESULTS

One hundred eighty patients were included in the work. Average age of the patients was 11 years (range, 6-15 years). Children under six-year-old were excluded from the study because of the difficulty in clinical observation. 108 out of 180 patients (60%) were male and 72 were female. Distribution of patients relative to AS scores was as follows: AS 1-4: 90 (50%), AS 5-6: 48 (26.7%), and AS 7-10: 42 (23.3%). Distribution of patients according to APA m-AS scores was as follows: APA m-AS 1-4: 72 (40%), APA m-AS 5-6: 69 (38.3%), and APA m-AS 7-10: 39 (21.7%). AS and Comparison of AS and APA m-AS scores was exhibited in Figure 1. Appendectomy was performed in 51 of 180 patients (28.3%). Appendectomy was performed in 3 patients from group AS 1-4, 15 patients from group AS 5-6, and 33 patients from group AS 7-10. None of the patients from group APA m-AS 1-4 underwent appendectomy, but 18 patients from group APA m-AS 5-6 and 33 patients from group APA m-AS 7-10 underwent appendectomy. 6 patients in AS 1-4 group were transferred to APA m-AS 5-6 group, and also 6 patients in AS 7-10 group were transferred to APA m-AS 5-6 group without operation.

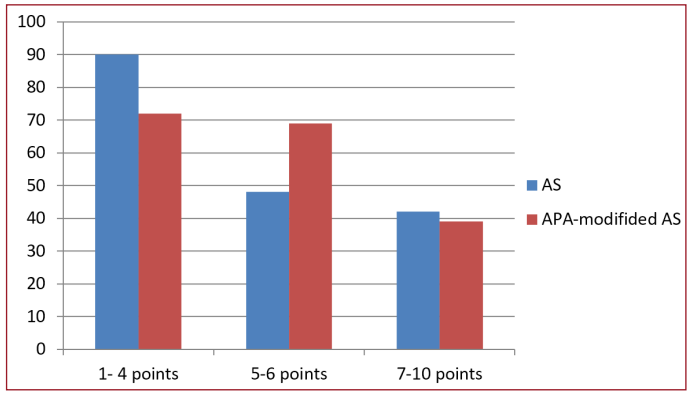

Figure 1. Comparison of AS and APA-Modified AS

There was no significant difference between AS group and APA m-AS group in terms of negative pathology and laparotomy rates ($p>0.05$). In the APA m-AS group, we determined that the suspected group (APA m-AS 5-6 points) increased ($p<0.05$). APA was correlated with leukocytosis ($p<0.05$). APA m-AS reduced significantly perforated appendicitis and hospitalization periods ($p<0.05$).

DISCUSSION

Acute appendicitis is the most frequently performed emergency surgical intervention in all age groups, including children.6 However, due to the mimicking of other diseases, difficulties may be encountered in acute appendicitis diagnosis in children.[7-9] In one of every three pediatric cases examined by clinicians, appendicitis is missed.[10] Due to negative appendectomies with misdiagnosis or too late operations, perforations may occur and thus this lead to an increase of morbidity and mortality.[4,10] Negative appendectomy incidence is reported between 6-32% in previous studies.[11-13] Perforation incidence is almost 100% in infants under a certain age, but it decreases with age and is 65% in children under 4-year-old.[14] Thus, we consider that especially in pediatric surgery clinics, diagnostic methods employed for acute appendicitis should be improved.

AS, first suggested by Alvarado in 19861, is a scoring system, rating the clinical and laboratory findings of patients with possible appendicitis. It is denoted that AS is the best prediction method available for appendicitis diagnosis.2 However, true diagnosis incidence of AS alone is reported as 70%.[3] For this reason, many modified scoring systems have been developed to increase the success rate of AS.[15-17] However, instead of introducing an unaccustomed, many parameters, brand new scoring systems, we consider that AS is more appropriate to improve with modifications since it is the most commonly used and adapted scoring system. Techniques as ultrasonography and computed tomography are referred as well in appendicitis diagnosis.[3,15-18] Such complementary techniques along with AS increase the success rate of AS; however, there are some disadvantages as follows: a) ultrasonography is noticeably dependent to the experience of the physician and b) computed tomography is not available in all the emergency rooms owing to its cost.[17-19] CJ can be considered as another technique in diagnosis.5 Man denoted that CJ was more reliable than AS.[5] Zakaria reported that negative appendectomy reduced in studies used CJ and ultrasonography together, and they defined this method as "modified clinical practice grading score".[20,21] However, Man remarked that especially in clinics without an emergency surgeon, and for less experienced surgeons, AS was more useful.[5]

In our study, with the purpose of increasing the success rate of AS, we developed APA m-AS scoring system. We designed the system as a combination of AS and CJ. Most important disadvantage of CJ is its subjectivity by including the clinical experiences of a surgeon. There is a necessity to eliminate the subjectivity of CJ and make it easier to comprehend for non-surgeon physicians and for less experienced surgeons. In this study, we defined CJ as a state of the patients (lying still in the bed, reluctant to speak, with dry lips, with tired looking eyes, and with upset and troubled expression at the face). Because some symptoms such as anorexia and nausea, which are placed between AS parameters are commonly seen in any other inflammatory disease. Judgment formation is a puzzle. We believe that togetherness of all these subjective parameters are the pieces of this puzzle.

We removed the left shift of neutrophils from AS, and included the patient state into the system. Thus, we defined a newly modified system (APA m-AS). This allowed us, without too much change in the assessment system of AS, to combine CJ and AS. By means of APA m-AS, no appendectomy was performed for patients in discharge group. Transfer of patients that not required appendectomy from AS urgent surgery group to APA m-AS observation group is achieved. Re-evaluation may reduce potential complications with the advantage of early intervention before clinical deterioration.[21,22] Foremost advantage of APA m-AS versus AS is increasing the number of patients in observation group and thus prevent unnecessary–too early or too late- surgical interventions. This method may perhaps reduce morbidity and mortality.

This study reduced the number of misdiagnosed patients and thus increased the number of patients to be kept under observation. We didn't interfere to do decision of surgeon on the call and we didn't give any information about data of patients in any step of management. With this method, the number of patients under observation group increases. Thus, the length of hospital stay associated with complicated surgeries decreases.

CONCLUSION

By means of APA m-AS, a combination of AS and CJ, number of pediatric cases with appendicitis suspicion to be kept under observation was increased. This study shows that CJ and AS are not alternative methods for each other, and collective use of both can decrease morbidity and mortality in acute appendicitis treatment. Foremost advantage of APA m-AS is retaining the assessment system of well-comprehended, commonly used and cost-effective AS. We consider that APA m-AS will be useful for non-surgeon doctors and less experienced surgeons.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Van Training and Research Hospital Ethics Committee (Date: 03.05.2018, Decision No: 2018/08).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The Work was developed at Van Training and Research Hospital, Van, Turkey.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med. 1986;15.5:557-64.
2. Kollar D, McCartan DP, Bourke M, Cross KS, Dowdall J. Predicting acute appendicitis? A comparison of the Alvarado score, the appendicitis inflammatory response score and clinical assessment. World J Surg. 2015;39(1):104-9.
3. Inan M, Tulay SH, Besim H, Karakaya J. The value of ultrasonography and its comparison with Alvarado scoring system in acute appendicitis. Ulus Cerrahi Derg. 2011;27:149-53.
4. Castro S, Unlu C, Steller E, Van Wagensveld BE, Vrouenraets BC. Evaluation of the appendicitis inflammatory response score for patients with acute appendicitis. World J Surg. 2012;36(7):1540-5.
5. Man E, Simonka Z, Varga A, Rárosi F, Lazar G. Impact of the Alvarado score on the diagnosis of acute appendicitis: comparing clinical judgment, Alvarado score and a new modified score in suspected appendicitis: a prospective, randomized clinical trial. Surg Endosc. 2014;28(8):2398-405.
6. Kirkil C, Karabulut K, Aygen E, et al. Appendicitis scores may be useful in reducing the costs of treatment for right lower quadrant pain. Ulus Travma Acil Cerrahi Derg. 2013;19(1):13-9.
7. Blob E, Kohlhober U, Tillawi S. Advancements in the diagnosis of acute appendicitis in children and adolescents. Eur J Pediatr Surg. 2004;14:404-9.
8. Scholer SJ, Pituch K, Orr DP, Dittus RS. Clinical outcomes of children with acute abdominal pain. Pediatrics. 1996;20:680-5.
9. Rotrock SG, Skeoch G, Rush JJ, Johnson NE. Clinical features of misdiagnose appendicitisin children. Ann Emerg Med. 1991;20:45-50.
10. Bhatt M, Joseph L, Ducharme FM, Dougherty G, McGillivray D. Prospective validation of the pediatric appendicitis score in a Canadian pediatric emergency department. Acad Emerg Med. 2009;16.7:591-596.
11. Douglas CD, Macpherson NE, Davidson PM, Gani JS. Randomised controlled trial of ultrasonography in diagnosis of acute appendicitis, incorporating the Alvarado score. BMJ. 2000;321:919-22.
12. Mentes O, Eryilmaz M, Harlak A, Ozturk E, Tufan T. The value of serum fibrinogen level in the diagnosis of acute appendicitis. Ulus Travma Acil Cerrahi Derg. 2012;18:384-8.
13. Jo YH, Kim K, Rhee JE, et al. The accuracy of emergency medicine and surgical residents in the diagnosis of acute appendicitis. Am J Emerg Med. 2010;28:766-70.
14. Smink DS, FishmanSJ, Kleinman K, Finkelstein JA. Effects of race insurance status and hospital volume on perforated appendicitis in children. Pediatrics. 2005;115(4):920-5.
15. Stephens PL, Mazzucco JJ. Comparison of ultrasound and the Alvarado score for the diagnosis of acute appensicitis. Conn Med. 1999;63(3):137-40.
16. Borushok KF, Jeffrey RB Jr, Laing FC. Sonografic diagnosis of perforation in patients with acute appendicitis. AJR Am J Roentgenol. 1990;154(2):275-8.
17. Skaane P, Amland PF, Nordshus T, Solheim K. Ultrasonography in patients with suspected acute appendicitis: a prospective study. Br J Radiol. 1990;63(754):787-93
18. Leite PN, Pereira JM, Cunha R, Pinto P, Sirlin C. Computed tomography evaluation of appendicitis and its complications: Imaging techniques and key diagnostic findings. Am J Roentgenol. 2005;185:406-17.
19. 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.
20. Zakaria O, Sultan TA, Khalil TH, Wahba T. Role of clinical judgment and tissue harmonic imaging ultrasonography in diagnosis of paediatric acute appendicitis. World J Emerg Surg. 2011;6(1):39.
21. Baltrak YA, Söğüt SE, Varlıklı O. An Effective Method for Diagnosing Appendicitis in Children: Appendicitis Scoring System. The Anat J of Famil Med. 2020;3(2):158-62.
22. Dey S, Mohanta PK, Baruah AK, Kharga B, Bhutia KL, Singh SK. Alvarado scoring in acute appendicitis—a clinicopathological correlation. Indian J Surg. 2010;72(4):290-3.