Alvarado Scoring in Acute Appendicitis—A Clinicopathological Correlation

Subhajeet Dey · Pradip K. Mohanta · Anil K. Baruah ·
Bikram Kharga · Kincho L. Bhutia · Varun K. Singh

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Abstract Acute appendicitis is a clinical diagnosis, so it's impossible to have a definitive diagnosis by gold standard (histopathology) pre operatively. The treatment being surgical, negative appendectomy rates are high. Present study was conducted to evaluate Alvarado scoring system for diagnosis of acute appendicitis and its co relation by histopathology. Retrospective study of consecutive patients admitted with suspected acute appendicitis during the period March 2005 to March 2007. The Alvarado scoring system was computed from admission notes and records and correlated with the histopathology reports. Out of 155 patients, 92 underwent appendectomy with the intention to treat appendicitis and diagnosis was confirmed in 80 patients. Reliability of scoring system was assessed by calculating negative appendectomy rate and positive predictive value. The normal appendectomy frequency was 13% and positive predictive value was 86%. Alvarado scoring system is easy, simple, cheap, useful tool in pre operative diagnosis of acute appendicitis and can work effectively in routine practice.

Keywords Alvarado scoring · Acute appendicitis · Histopathology

Introduction

Acute appendicitis is traditionally understood to be a clinical diagnosis. About 6% of population is expected to

have appendicitis in their lifetime [1]. Routine history and physical examination still remain most practical diagnostic modalities [2]. Absolute diagnosis of course is only possible at operation and histopathologic examination of the specimen [3]. For this reason it is impractical to have a definitive preoperative diagnosis by gold standard, histopathology, which leads to an appreciable rate of negative appendectomy as reported in the world literature varying from 20–40% with its associated morbidity of around 10%, some surgeons even accept a negative appendectomy rate of 20% [4]. In order to reduce the negative appendectomy rates various scoring systems have been developed for supporting the diagnosis of acute appendicitis [5]. Alvarado scoring system is one of them and is purely based on history, clinical examination and few laboratory tests and is very easy to apply [6]. The aim of the study was to evaluate the reliability of Alvarado scoring system for diagnosis of acute appendicitis and correlate it with the gold standard and absolute diagnostic modality, histopathology

Patients and Methods

This retrospective study was conducted in the Department of Surgery of a Medical College Hospital in Gangtok for the period March 2005 to March 2007. All consecutive patients admitted in that period with pain in the right lower abdomen were considered. Patients of all age groups and both genders admitted were included in the study. Patients with urological, gynecological or surgical problems other than appendicitis and especially patients with mass in right iliac fossa or those patients with incomplete documentations in the case sheets were excluded from the study. The admission records and notes were reviewed and Alvarado scoring computed and patients were categorized into three

S. Dey (✉) · P. K. Mohanta · A. K. Baruah · B. Kharga ·
K. L. Bhutia · V. K. Singh
Sikkim Manipal Institute of Medical Sciences,
Sikkim, India
e-mail: subhajeetd@gmail.com

Table 1 Showing distribution of patients

Score	Male		Female	
	No.	%	No.	%
1–4	14	63.6	8	36.3
5–6	37	52.8	33	47.1
7–10	32	50.7	31	49.2
Total	83		72	

groups, score ≥ 7 , ≤ 6 and ≤ 4 : as it standard to label those patients with a score ≥ 7 as diagnostic of appendicitis, score ≤ 6 as doubtful but potential candidates suffering from the disease and scores ≤ 4 unlikely to suffer from the condition. This was correlated and analyzed with operative notes and histopathologic examination of the specimen. And finally we tried to find out the negative appendectomy rate, the positive predictive value, negative predictive value, sensitivity and specificity in order to assess the reliability of Alvarado scoring system.

Results

A total of 155 patients were included in the study, which comprised of 83 male (53.5%) and 72 females (46.5%). Mean age was 25.8 years in a range of 09–57 years with a median of 22.5 years.

22 (14.1%) patients were placed within the 1–4 score range, 70 (45.1%) were categorized as within 5–6 and 63 (40.6%) fitted in to the last score range of 7–10. The sex distribution was 14 (63.6%) males and 8 (36.3%) females within 1–4 range, 37 (52.8%) males and 33 (47.1%) females in the group score range of 5–6, 32 (50.7%) males and 31 (49.2%) females in the last group. Distribution of patients according to scoring pattern in both male and females is shown in Tables 1 and 2 shows detailed distribution of patients according to scores. Further retrospective analysis of the datas revealed that all the 63 (32 male and 31 females) patients categorized to be in the score range of ≥ 7 underwent appendicectomy within 20 hours of admission (range of 6–20 hours). Histopathological examination of the specimens confirmed acute appendicitis in 60 patients. There were 04 perforated appendix (Male 3 and Female 1) in the group and 06 (Male 3 and Female 3) had gangrenous appendicitis. 3 males had negative appendicectomy, no pathology was detected in one and two had Meckel's diverticulitis.

Of the 70 patients with in the score of 5–6, 27 i.e. 38.5% (15 males and 12 females) underwent appendicectomy within 36 hours of admission after reassessment. It was noted that those patients who underwent delayed appendicectomies were either due to increased severity of symp-

Table 2 Showing frequency of patient distribution according to Alvarado score

Score	No. of patients	%
1	0	0
2	2	1.2
3	8	5.1
4	12	7.7
5	29	18.7
6	41	26.4
7	20	12.9
8	12	7.7
9	18	11.6
10	13	8.3

toms and clinical deterioration or on revised computation of the scoring they were fitting into the next group, ≥ 7 . In this group there were 9 patients (Male 6 and Female 3) in whom histology showed removed appendix was normal. Of the 6 male patients no pathology was detected in 4 patients, 1 had mesenteric lymphadenitis and 1 had ileo ceecal tuberculo-sis. No pathology was detected in 1 female and 1 each had salpingitis and twisted ovarian cyst (Table 3).

The first group of patients with the range of 1–4 score had 22 (14 Male and 8 Female) patients and all of these patients were discharged with 48 hours of admission. 2 male patients from this group were readmitted within 24 hours of discharge with complaints of increased severity of symptoms and underwent appendicectomy. They were found to have a score more than >7 on readmission. Histopathology confirmed acute appendicitis in both the patients.

On statistical analysis of the collected data, it was found that there were 49 males and 43 females who underwent appendicectomy; appendicitis was confirmed in 40 males and 40 females giving a negative appendicectomy rate of 18.3% in males and 6.9% in females with an overall

Table 3 Showing HPE and operative findings

Findings	No. of patients	%
Appendix inflamed		
Acute Appendicitis	70	76
Gangrenous Appendicitis	06	6.5
Perforated Appendicitis	04	4.3
Normal Appendix		
Meckel's Diverticulitis	02	2.1
Mesenteric Lymphadenitis	01	1.1
IC TB	01	1.1
Twisted Ovarian Cyst	01	1.1
Salpingitis	01	1.1
Pathology not found	06	6.5
Total Operated Patients	92	

negative appendectomy rate of 13%. Operative note findings and histology reports confirmed appendicitis in 80 out of 92 patients undergoing appendectomy (86.9%).

In males the sensitivity and specificity were 89% and 62.8% where as the positive and negative predictive values were 81.6% and 62.8%. Females had a positive predictive value of 93% and sensitivity of 89% where as the negative predictive value and specificity were 30.9%. The overall positive predictive value of Alvarado score was 86.9%, negative predictive value of 69.8% and sensitivity and specificity of 94.2 and 70% respectively.

There were 6 patients with gangrenous appendicitis, 4 had perforated appendicitis in the series and they all were within the score range of 7–10. All these patients underwent surgery and were not missed out.

Overall there was a positive diagnostic likelihood ratio of 9.5 and a negative diagnostic likelihood ratio of 0.24.

Discussion

Decision making in cases of acute appendicitis poses a clinical challenge especially in developing countries where advanced radiological investigations do not appear cost effective and so clinical parameters remain the mainstay of diagnosis [7]. Through history and clinical examination still remains the mainstay for the diagnosis, but misdiagnosis and negative appendectomy still do occur at quite a high rate. It is the surgeon who has to decide the best management and at a cost effective manner. The decision to operate or not is very important as surgical intervention in acute appendicitis is not without the risk of morbidity and mortality. Even though, a negative appendectomy has a negligible mortality and morbidity of around 10% [8]. Various scoring systems are being used to aid the diagnosis of acute appendicitis and bring down the negative appendectomy rates. In 1986 A. Alvarado published 8 predictive factors, which he found to be useful in making the diagnosis of acute appendicitis [6]. Since then there have been various studies, trying to validate the utility and usefulness of this simple scoring system.

The results of our study are comparable with the relevant literature. Our study shows a positive predictive value of 86.9% comparable with literature reports of 97% [7], 97.6% [9], 83.5% [10].

We had a negative appendectomy rate of 13% (Males-18.3% and Females-6.9%). Similar results were reported in literature; 21% [9], 15.6% [10], 7% [7]. There are even opinions and evidences that if negative appendectomy rates are below 10–15%, the surgeon is operating on too few patients thus increasing the risk of complications [11].

Negative predictive value of our series was 69.8% as compared to 77% [9].

Despite the availability of radiological (US/CT) investigative modalities, a recent population-based study in USA indicated that there was essentially no change in the frequency of negative appendectomy [12]. Similar results were also reported, where the authors found Ultrasonography did not have any additional benefit over Alvarado score and were of the opinion that Ultrasonography is unnecessary in diagnosis of acute appendicitis [8].

This is a simple scoring system which can easily be interpreted by non surgical emergency residents [13].

Even though the scoring system may be effective in the adults, the authors in this study agree with the opinion that it is not effective and reliable in younger children. Probably because it does not contain variables that allow for differentiating appendicitis from the numerous other conditions mimicking it in the pediatric population. The clinician remains the best judge of the acute abdomen in the pediatric age group [14].

Conclusion

Alvarado scoring system is easy, simple, cheap, useful tool in pre operative diagnosis of acute appendicitis and can work effectively in routine practice. Scores more than 7 definitely warrant a virtual confirmed diagnosis of acute appendicitis and early operation is indicated to avoid complications like perforation. Patients with in the score range of 5–6 require admission and need re-evaluation for possible deterioration of clinical condition and earliest possible intervention. The application of Alvarado scoring system definitely improves diagnostic accuracy and possibly reduces the complication rates.

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