

Original Research Article

Cross sectional study to evaluate modified Alvarado score in the diagnosis of acute appendicitis

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ABSTRACT

Background: Appendectomy is one of the most commonly performed emergency operation. The diagnosis requires distinguishing from other causes of pain in that region of the abdomen like acute ureteric colic, right sided salphingoophoritis. Presently ultrasonogram and contrast enhanced CT scan are the diagnostic modalities of choice. Although these facilities are readily available in urban areas but rural areas still suffer from lack of timely diagnosis and negative appendectomy, enhancing the need for a reliable scoring system for diagnosis of acute appendicitis. Here we will evaluate modified Alvarado scoring system in diagnosis of acute appendicitis.

Methods: This is an observational cross-sectional hospital-based study at KPC medical college, Kolkata with 92 consecutive cases of suspected acute appendicitis, who were admitted, investigated and treated during 1st February 2022 to 31st January, 2023. Modified Alvarado score is calculated of each patient and compared with the histopathological findings of operated appendix.

Results: The above study shows that modified Alvarado score 7-9 has high sensitivity of 93.10% in men and in female sensitivity is 77.78%. Overall sensitivity of modified Alvarado score of 7-9 came out to be 83.63%.

Conclusions: It can be concluded that modified Alvarado score of 7-9 can be used as a potent diagnostic tool in male. But in females due to lower sensitivity and significant number of negative appendectomy, it can be used an diagnostic aid in addition to imaging studies for diagnosis

Keywords: Alvarado score, Acute appendicitis, Appendectomy

INTRODUCTION

Acute appendicitis is a common gastrointestinal disease affecting 5.7-57/per 100 individuals each year with the highest incidence in children and adolescents. The variation of incidence is due to variations in ethnicity, sex, age, obesity and season of the year.¹

Acute appendicitis is one of the most common acute surgical conditions of the abdomen, encompassing a life time risk of 8.6% for males and 6.7% for females. In general population, it has an incidence of 86 per 100,000 populations per year. After the first appendectomy done on December 6, 1735 by French Surgeon Claudius

Amyand at St. George's hospital in London, the disease characteristics have come to be better known and more accurate diagnostic tools have been developed.² Reports have shown that preoperative radiographic evaluation has helped to decrease negative appendectomy rates from 20% to as low as 5%.³ However, such facilities are mainly available in urban areas, rural hospitals and remote areas still lack such technologies. This results in rise of significant number of delayed diagnosis or negative appendectomy. To bridge this gap various scoring system such as modified Alvarado score, appendicitis Inflammatory Response score etc.⁴ have been devised to assist, along with the clinical characteristics and the usual laboratory analysis for accurate diagnosis of acute appendicitis.

In 1986, Alvarado presented a clinical scoring system on the basis of eight predictive clinical factors to improve the accuracy of physicians' clinical assessments in diagnosing acute appendicitis. This scoring system produces a maximum total score of 10 points and includes clinical symptoms (nausea and anorexia), signs (fever, shifting pain, right lower quadrant pain, and rebound tenderness), and laboratory findings (leucocytosis and neutrophilia). Right lower quadrant pain and leucocytosis contribute 2 points each while the rest contributes 1 point.

The objective of this study is to evaluate modified Alvarado score (Table 1) in diagnosis of acute appendicitis to reduce negative appendectomy rate.⁴

Table 1: Modified Alvarado score.

Variables	Score
Symptoms	
Migratory right iliac fossa pain	1
Anorexia	1
Nausea/ vomiting	1
Sign	
Tenderness right lower quadrant	2
Rebound tenderness in right iliac fossa	1
Elevated temperature > 37 degree C	1
Investigations	
Leukocytosis	2
Total score	9

Modified Alvarado score of 1-4 excludes the diagnosis of acute appendicitis. Score of 7-9 highly favors the diagnosis of acute appendicitis and score of 5-6 depicts a possibility of diagnosis of acute appendicitis.

METHODS

Study area

Study conducted at KPC Medical College and Hospital.

Inclusion criteria

All the patient attended in KPCMCH with complaints of acute pain in right iliac fossa and umbilical region and treated with provisional diagnosis as acute appendicitis during the period 1st February, 2022 to 31st January, 2023 were included in the study.

Study population

A total of 92 consecutive cases of suspected acute appendicitis, who were admitted, investigated and treated during the above-mentioned period and met the inclusions criteria.

Study period

Study conducted for 12 months (From 1st February, 2022 to 31st January, 2023).

Study design

The study design was of institution based, observational and cross-sectional study.

Sample size

The 92 patients presenting with pain in the right lower quadrant of abdomen, lasting fewer than 7 days who after clinical examination and radiological examination were provisionally diagnosed to have acute appendicitis.

Exclusion criteria

Patients below 18 years, patients above 70 years, patient not giving consent for study, generalized peritonitis due to appendicular perforation, appendicular mass, other disease mimicking acute appendicitis. Patients declared unfit for surgery by anaesthesiologist due to comorbidities were excluded.

All the patients who were provisionally diagnosed having acute appendicitis underwent ultrasonography of abdomen primarily to rule out other conditions mimicking acute appendicitis. Modified Alvarado score is calculated pre operatively on each of the 92 patients who were provisionally diagnosed having acute appendicitis. Patients with score from 7-9 were considered for appendectomy. Scores Of 1-4 were treated conservatively. scores between 5-6 were observed for 24 hours with intravenous antibiotics and reassessed after 24 hours. If score become ≥ 7 they are subjected to appendectomy, whereas with decreasing of the score, conservative management was continued. All the specimens of appendix were sent for histopathological confirmation of acute appendix in the department of pathology, KPCMCH. Final correlation was made to derive the results. All the data are compiled in Microsoft excel sheet and were analyzed by SPSS software. Chi-square test was used for assessment of level of significance.

Ethical consideration

Ethical committee approval was taken from concerned authorities.

RESULTS

From the Table 2, it is seen that majority of the study patients belonged to the age group of 21-30 years (37%).

Table 2 clearly depicts that majority of cases with score 1-4 belonged to age group of 21-30 years and score 5-6 also belonged to age group of 12. Whereas, majority of cases with score 7-9 belonged to age group 10-20 years.

In Table 3, total 24 patients scored of 5-6. Eight patients of them are operated due to clinical deterioration/ strong clinical suspicion of acute appendicitis. Rest 16 patients observed, conservatively managed and discharged.

Of the 9 patients, with score of 5-6 who were operated 6 were male and 2 were female.

In Table 4, out of 51 patients in the score group 7-9, 47 patients have undergone appendectomy. Of these 47 patients 29 are male and 18 are females.

In Table 4, 41 cases out of 47 cases had acute appendicitis. The sensitivity of modified Alvarado score ≥ 7 is 87.23%. The sensitivity in male is 93.10% and in

female 77.78%. Negative appendectomy rates are highest among females (25%). In males it is 17.24%.

In Table 5, 55 cases operated according to modified Alvarado score out of which 46 cases showed appendicitis in histopathology report.

Overall, sensitivity in male-88.57% and female 75%. Negative appendectomy rates is highest among females (25%). In males it is 11.43%.

Table 2: Age wise distribution of modified Alvarado score.

Age (years)	No. of cases with score 1-4	No. of cases with score 5-6	No. of cases with score 7-9	Total	Percentage (%)
10-20	3	6	20	29	32
21-30	8	12	14	34	37
31-40	6	4	10	20	21
41-50	0	2	5	7	7
>50	0	0	2	2	3
Total	17	24	51	92	100

Table 3: Distribution of cases according to modified Alvarado score (5-6).

Category of cases	No. of cases operated	No. of cases with hp appendicitis	No. of cases without hp appendicitis	Proportion of true positive (%)
Male (n=14)	6	4	2	67
Female (n=10)	2	1	1	50
Total (n=24)	8	5	3	62.5

Table 4: Distribution of cases according to modified Alvarado score (7-9).

Category of cases	No. of cases operated	No. of cases with hp appendicitis	No. of cases without hp appendicitis	Proportion of true positive (%)
Male (n=32)	29	27	2	93.1
Female (n=19)	18	14	4	77.78
Total (n=51)	47	41	6	87.23

Table 5: Relation between modified Alvarado score (5-9) and positive appendectomy rate.

Category of cases	No. of cases operated	No. of cases with hp appendicitis	No. of cases without hp appendicitis	Proportion of true positive (%)
Male (n=46)	35	31	4	88.57
Female (n=29)	20	15	5	75
Total (n=75)	55	46	9	83.63

DISCUSSION

Acute appendicitis is the very common cause of acute abdomen in all age groups.⁵

Diagnosis can be made with physical examination and laboratory findings. In suspicious cases, radiological methods are performed. However, they are not available under rural conditions and they are not cost-effective. To reduce the cost and prevent delay in diagnosis, various scoring systems such as Lintula, Madan, Ohmann, Eskelinen, De Dombal, and Alvarado were suggested. Common features of these scoring systems are that they

aimed to be practical, non-invasive, and do not require much expertise to use.⁶

Alvarado score helps to stratify the patients who should undergo further examination, follow-up, or operation.⁴

The above study shows that modified Alvarado score 7-9 has high sensitivity of 93.10% in men with negative appendectomy rates of 17.24%. In females, negative appendectomy of around 25% with sensitivity of 77.78%. Sensitivity of acute appendicitis 93.10% for males with modified Alvarado score of 7-9 correlates well with study results of Kalan et al (reported sensitivity of 93%),

Bhattacharjee et al (who reported 94.1%) and Ozsoy et al (reported sensitivity of 80.1%).⁷⁻⁹

Sensitivity for female with modified Alvarado score 7-9 is around 77.78% which corroborates with the sensitivity reported by other studies-Kalan et al (reported sensitivity is 67%) and Bhattacharjee et al (reported sensitivity 71.9%).

Overall sensitivity of modified Alvarado score of 7-9 came out to be 83.63% which correlates with studies by Kalan et al (reported sensitivity is 83.7%) and Bhattacharjee et al (reported sensitivity 82.7%).

Our result of study is also comparable with the study conducted by Talbot et al and Vandakuri et al.^{10,11}

According to our study, 55 cases operated according to modified Alvarado score out of which 46 cases showed Appendicitis in histopathology report. Overall, the sensitivity in male is 88.57% and in female 75%. Negative appendectomy rates are highest among females (25%). In males it is 11.43%. This result is very much comparable with the study of Jo et al.^{5,12}

Limitations

The sample size was small. Only 92 cases are not sufficient for this kind of study. The study has been done in a single centre. The study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

CONCLUSION

From the above studies and analysis, it is clear that scores of modified Alvarado score of 7-9 has significant diagnostic value for acute appendicitis especially in male. However, in females the sensitivity is lower than that of male because of multiple pathologies, which presented with signs and symptoms of acute appendicitis like pelvic inflammatory disease and ruptured ectopic pregnancy, etc. So, although modified Alvarado score can be used to diagnose and treat cases of acute appendicitis in male, in female the need of imaging for final diagnosis can be certainly felt to avoid negative appendectomy.

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