ORIGINAL RESEARCH PAPER
Volume-8 | Issue-12 | December - 2019 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

DETERMINATION OF SENSITIVITY AND SPECIFICITY OF MODIFIED ALVARADO SCORE AND ULTRASONOGRAPHY IN PATIENTS WITH ACUTE APPENDICITIS

General Surgery

Pal Sanjay Kumar Department Of General Surgery, SMS&R, Sharda University Greater Noida, India.

Karthik P* Department Of General Surgery, SMS&R, Sharda University Greater Noida, India. *Corresponding Author

Rawat Karan R Department Of General Surgery, SMS&R, Sharda University Greater Noida, India.

ABSTRACT

Background: In spite of improvement in modern diagnostic technology, diagnosis of appendicitis based on clinical suspicion, leads to removal of normal appendix. Sometimes, Modified Alvardo Score system is helpful in minimizing the same.
Aim: To evaluate the sensitivity and specificity ofModifiedAlvarado Score(MAS)andUltrasonography (USG).
Material and Methods: 350patients suspectedof acuteappendicitiswereadmitted,investigatedandtreated.Theywereevaluated using Modified Alvarado Scoring and allcaseswere subjectedto ultrasonography.Thesensitivityand specificity of Modified Alvarado Scoreand Ultrasonography were correlated with histopathological findings.
Results: ModifiedAlvarado score >7 was seen in158 patientsin whom 151(95.60%) had histopathologicallyproved acuteappendicitis and 7 (4.43%) patients were histopathologically negative. Modified Alvarado score <7 was observed in 192 patients among whom 81 (42.19%) were histopathologically proved acute appendicitis and 111 (57.81%) patients were histopathologically negative. Among 158 with Modified Alvarado Score > 7, 152 (96.2%) were ultrasonographically diagnosed as acute appendicitis and 6(3.8%) patients were ultrasonography negative. Among 192 patients those with Modified Alvarado Score <7, 97 (50.52%) were ultrasonographically diagnosed as acute appendicitis and 111 (57.8%) patients were histopathologically negative.
Conclusion: An application of Modified Alvarado Scoring system and USG preoperatively as a protocol in patients with suspected appendicitis, the sensitivity is 98.44% for MAS and 98.33% for USG and specificity is 94.4% for Modified Alvarado Scoring and 90% for USG. In acute appendicitis, MAS is a good diagnostic indicator, and it is highly sensitive in diagnosis of appendicitis. Combined use of MAS and USG is very effective in diagnosis of appendicitis and it helps in reducing number of negative appendicectomy.

KEYWORDS

INTRODUCTION:

There are many pathological conditions involving appendix among which acute appendicitis is commonest [1], it is one of the commonest surgical emergencies worldwide, with an incidence of 1.17 per 1000 and life time risk of 8.6% among males and 6.7% in females [2]. Theincidence ishighest inadolescents and young adults butincidence ofcomplicated acuteappendicitisshowslittlevariation betweenage groups[3]. In1886 Reginald Heber Fits described the classical signs and symptoms of acute appendicitis as the disease entity [4]. Typical cases present classically with para-umbilical pain migrating to right lower quadrant of abdomen. Pain usually is associated with nausea, vomiting, and low gradefever. Variation in position of appendix, age ofthe patient, degree of inflammation makes theclinical presentation of appendicitis inconsistent[1], despite extra-ordinary advances in modernradiography imaging and diagnostic laboratoryinvestigations. The accurate pre-operativediagnosis of acute appendicitis remains anenigmatic challenge [5]. Nowadays commonlyused diagnostic aids for appendicitis are CECTabdomen, laparoscopy, diagnostic scores andultrasonography [5]. It has been claimed that ultrasonography dramatically reducesthenumber of appendectomies in patients withoutappendicitis. It is especially useful in children and young thin adults and in females it will allow exclusion of gynaecological causes mimicking appendicitis leading to diagnostic accuracy inexcess of 90% [6]. A scoring systemfor earlydiagnosisof acute appendic it is was developed byAlvarado in1986, based on clinicalsigns, symptomsand different ialleucocytecount with left shift of neutrophil maturation yielding ascore of 10, is known asAlvarado Score. Kalanet al omitted left shift of neutrophil maturation parameter and produced Modified Alvarado Score, it is 9 point scoring system thathelpsin increasing accuracy of preoperative diagnosis and thus reducing negative appendicectomy rate. Score of 7 or more has been recommended for surgery [7].The aim of present study has been to evaluate sensitivity and specificity of Modified AlvaradoScoring system and Ultrasonography.

MATERIALAND METHODS:

This prospective study was carried out in schoolof medical science and research ShardaUniversity, Greater Noida during August 2018 toAugust 2019,onadmittedpatients of rightlowerquadrantabdominal pain suspected ofappendicitis. Evaluation of patientwas done bycomprehensive history, clinico pathological examination, investigations and Modified Alvarado Score.

Inclusion Criteria :

All patients of age more than15 years and less than 50 years with acuteabdominalpaininrightiliacfossawerepresumedtobeofappendicular origin.Exclusion Criteria: Patientswith age less than15 years or more than 50 yearswith palpablemass on abdominal examinationor with signs ofgeneralizedperitonitis,patientswho are notwilling for appendicectomy.

Informed consent was taken from all enrolledpatients after detailed counselling The contentsof the consent were read out to the patient in his/her language. Patients with a score of 1-4 whowerenot consideredlikelytohaveacuteappendicitisand were observed and not operatedunless forcompelling reasons, they had to beoperated.Those with scores between 5-6 whowould beconsidered to have possible diagnosisof acute appendicitis, but not convincing enoughto warrantimmediatesurgery. These patientsweremonitored at 4hourly intervalsand ifwithin24 hoursofobservation theirscorebecome >7ortheirclinicalfeatures wereconvincing enoughto warrant surgery, and thenirrespectiveoftheirscores, appendicectomy would be performed. 222

Modified Alvarado Score

Symptoms/ Signs/ Investigations	Score	
Symptoms	Yes	No
Migration of pain to right iliac fossa	1	0
Anorexia	1	0
Nausea/ vomiting	1	0
Signs		
Tenderness over right iliac fossa	2	
Rebound tenderness over right iliac fossa	1	
Temperature > 37.3°C	1	0
Investigations		
Leucocytosis > 10 x 10 $_9$/L	2	0
Scoring system: 1-4: Appendicitis unlikely, 5–6: Appendicitis possible, 7-	*9 Appendicitis*	*definitive*
Total score		0

All patients with scores 7 to 9 were consideredto have either probable or definite diagnosis ofacute appendicitis and were considered forappendicectomy in the first instance [5].Ultrasonography of every patient was performedwith 5 MHZ or 7.5 MHZ linear array transducer to diagnose appendicitis and with 3.5 MHZ convex transducer to rule out any other abdominal pathology. An ultrasonography criterion for diagnosis of acute appendicitis was maximumdiameter of 6 mm or more or wallthickness of 3 mm or more or increased peri-appendicularechogenicity [5]. Confirmation ofdiagnosisofacute appendicitis was done by histopathological examination of appendix in all operated cases.

Statistical Method:
Data was collected using a pre-tested codedquestionnaire and analysed using SPSS satiatedcomputer software.

RESULTS:
In our study, patients ranged in age from 15- 50 years (The mean age being 17.5years).The highest occurrence was seen in 187(53%) of the patients as seen in age group of 21-30 years In our study the total number of male patients were 189 (54%) and female patients were 161 (46%) and M:F Ratio was 1.17:1. Maximum patients were in the range of 7-9 years i.e. 158.

Table 1: Symptoms and Signs Distribution with Sensitivity and Specificity of Modified Alvarado Scoring

Symptoms and signs	No of cases with score(1-4)	No of cases with score(5-6)	No of cases with score(7-9)	Total	Percentage	Sensitivity	Specificity
Migration of pain to right iliac fossa	82	75	149	306	87	64.2%	98.4%
Anorexia	2	44	108	154	44	79%	79%
Nausea and vomiting	33	101	119	253	72	54%	71%
Tenderness in right iliac fossa	73	119	158	350	100	10%	0.00%
Rebound tenderness	12	54	96	162	46	60%	69%
Elevated temperature	20	72	110	202	58	57%	70%
Leukocytosis	9	64	157	230	66	76%	95%

was 189. In females, 39 patients were in the range of 1-4, and 36 patients were in the range of 5-6 years, and 86 patients were in the range of 7-9 years, and the total was 161. Maximum patients were in the range of 7-9 years i.e. 158.

In our study score ≥ 7 (158) patients, there were (4.43%). In our study score < 7 (192) patients whom histopathologically positive were 81 (42.19%), while 111 patients were having normal appendix (57.81%). So, overall negative appendicectomy rate in our study regardless of Modified Alvarado Score was 33.71%

Table 2: Gender Distribution Of Results Of Histopathology For Patients With Modified Alvarado Score.

Gender	Positive HPR	Percentage	Negative HPR	Percentage
Modified Alvarado score >7				
Female N=88	85	56.29	3	42.86
Male N=70	66	43.71	4	57.14
Total N=158	151	95.60	7	4.43
Modified Alvarado score < 7				
Female N=85	33	40.74	52	46.85
Male N=107	48	59.26	59	53.15
Total N=192	81	42.19	111	57.81
For all Patients				
Female N=173	118	40.86	55	46.61
Male N=177	114	49.14	63	53.39
Total N=350	232	66.29	118	33.71

In our study,158 patients with score > 7 range, Males with positive histopathology reportingwere 66 (43.71%) and negative histopathology reporting were 4 (57.14%), females with positive histopathology reporting were 85(56.29%) and negative histopathology reporting were3 (42.86%). Out of the 192 patients with Modified Alvarado Score <7, 81 patients had histopathologically positive acute appendicitis while 111 patients had histopathologically normalappendix. Outof107 male patients, 48 (59.26%) patients were histopathologically positive; while out of 85 female 33 (40.74%) patients were histopathologically positive. In our study 81 patients with confirmed appendicitis by histopathology, 33 (40.74%) were females and 48 (59.26%) were male. On other hand 111 patients with non-appendicitis, 52 (46.85%) were females and 59 (53.15%) were males. In our study, number of males in the Modified Alvarado Score range of >7 were 70 patients in which, number of ultrasonography positive were 68 (97.14%) and number of confirmed appendicitis were 70 (100%).

In our study the over all, sensitivity and specificity of histopathology were 98.44% and 94.44% respectively. Ultrasonography sensitivity = 98.33%, Specificity = 90.0% and Modified Alvarado score Sensitivity = 65.62% Specificity 91.67%.

Table 3: Comparison of Findings of Modified Alvarado Score, USG and Histopathology

Sex	No. of Cases	USG Positive	Confirmed by histopathology
Modified Alvarado Score >7			
Male	70	68 (97.14%)	70 (100%)
Female	88	84 (95.45%)	85 (96.59%)
Total	158	152	155
Modified Alvarado Score < 7			
Male	112	61 (54.46%)	64 (57.14%)
Female	80	36 (45%)	38 (47.50%)
Total	192	97	102

30 years [7], while Talukder *et al* showed high incidence in third decade [8]. In our study the total number of male patients was 89 (54%) and number of female patients was 161 (46%) and M: F Ratio was 1.17:1. Male: female ratio was 3:2 [7], while Thabit *et al* showed high incidence in females about (57%) [9].In males the patients in the range of 1-4 was 34, in 5-6 range was 83 and in 7-9 range was 72 patients and total was 189. In females, the patients in the range of 1-4 was 39, in 5-6 range was 36 and in 7-9 range was 86 patients and total was 161. Maximum patients were in the age range of 7-9 years i.e. 158. In our study the distribution of patients according to Modified Alvarado Score in ≥7 range was 158 and <7 was 192.

Migration pain to right iliac fossa was present in 306 (87%) patients with sensitivity of 64.2% and specificity of 98.4%.

In our study for Modified Alvarado Score ≥7(158) patients in which histopathologically positive were (151) patients (95.60%), 7 patients were having normal appendix so negative appendicectomy rate was (4.43%).

In our study, 158 patients with score ≥ 7 range, males with positive histopathology reporting were 66 (43.71%) and negative histopathology reporting present in 4 (57.14%), femaleswith positivehistopathology reportingwere 85(56.29%) andnegative histopathologyreportingwereare3(42.86%). Similar study was done by Thabit *et al*[9].

In his study out of these (87) patients with score ≥ 7, (80) patients had histopathologically proven acute appendicitis, while (7) patients had histopathologically normal appendix. Patients with positive histopathology, (45) of them (56.25%) were females, while (35) patients (43.75%) were males. Patients having negative histopathology, (5) of them (71.5%) were females while (2) patients (28.5%) were males, Negative appendectomy rate for patients with Modified Alvarado Score ≥ 7 were 8.1%. Similar study was done by Thabit *et al* [9], out of (86) patients, regardless of their Modified Alvarado Score, with confirmed appendicitis by histopathology, (52.4%) were females, and (47.6%) were males. On the other hand, out of (14) patients with non-appendicitis, (85.7%) were females and (14.3%) were males. Accordingly, the negative appendectomy rate in female patients was (21.05%) while in male patients was (4.65%). In our study, number of males in the Modified Alvarado Score range of ≥7 were 70 patients in which, number of ultrasonography positive were 68 (97.14%) and number of confirmed appendicitis were 70 (100%), number of females in the Modified Alvarado Score range ≥7 were 88 patients in which ultrasonography positive were84 (95.45%) and number of confirmed appendicitis were 85 (96.59%). Inour study, number of males in the Modified Alvarado Scorerange of <7 were 112 patientswhich, number of ultrasonography positivewere 61 (54.46%) and number. of confirmed appendicitis were 64 (57.14%), Number of females in the Modified Alvarado Score range<7 were80 patients in which ultrasonography positive were36 (45%)and number of confirmed appendicitis are 38(47.50%). Inour study, in the diagnosis of appendicitis, true positive caseswere 228 and false negative case were 4 and innon-appendicitis, false positive cases were 8andtrue negative cases were 110. In our studythediagnostic approach for over all, Sensitivity =98.44%, Specificity = 94.44%

Sensitivity and Specificity of Modified AlvaradoScore in our study was 98.44 and 94.44%respectively which is more as compared toNautiyal *et al* [5]; while Tiecher *et al* studyshowed sensitivity 48-77% and specificity 73-87% [11]. In another study conducted by Gurav*et al* showed 20.00% and 80.00% sensitivity andspecificity in case of acute appendicitis while28.57% and 78.83% sensitivity and specificity incase of non-acute appendicitis [12]. In our study,in the diagnosis of appendicitis, true positivecases were 207 and false negative cases were 4and in non-appendicitis, false positive cases were14 and true negative cases were 125.

Inourstudythediagnosticapproachforultrasonography ,Sensitivity=98.44%,Specificity=94.44%.

Inourstudy,inthediagnosisofappendicitis,truepositivecaseswere 155 and false negative cases were 76 andin non-appendicitis, false positivecases were 3and true negative cases were 116. Inour studythe diagnostic approach for Modified

Alvarado Score, Sensitivity = 65.62%, Specificity= 91.67% Nautiyal *et al* diagnostic sensitivity was 97.14% and 88.57%. in ultrasonography. It can only complement clinical scores or clinical judgment because in few cases inflamed appendix could not be visualized due to bowel gases.

CONCLUSION:

Thus applying Modified Alvarado Scoring system preoperatively as a protocol in patients with suspected appendicitis the sensitivity is 98.44% for MAS and 98.33% for USG and specificity is 94.4% for MAS and 90% for USG. In acute appendicitis, MAS is a good diagnostic indicator, and it is highly sensitive in diagnosis of appendicitis and when combined with USG, is very effective in diagnosis of appendicitis and it helps in reducing number of negative appendicectomy.

REFERENCES

1. SwagataBrahmachariet al. Alvardo score: A Valuable clinical tool for diagnosis of acute appendicitis-a retrospective study. J Med Allied Sci 2013; 3(2):63-66.
2. Addiss DG et al. The epidemiology of appendicitis and appendicectomy in the United States. Am J Epidemiol1990; 132(5):910-925.
3. Korner H et al. Incidence of acute nonperforated and perforated appendicitis: age-specific and sex-specific analysis. World J Surg 1997; 21(3):313-317.
4. Mohamed AA and Bhat NA. Acute appendicitis dilemma of diagnosis and management. The Internet Journal of Surgery 2010; 23(2).
5. HemantNautiyal, Shabi Ahmad, NK Keshwani and DN Awasthi. Combined use of modified Alvarado score and USG in decreasing negative appendisectomy rate. Indian Journal of Surgery 2010; 72 (1): 46-52.
6. Satyajeet Kumar Singh et al. Comparative study of Diagnostic Accuracy of Modified Alvarado Score and Ultrasonography in Acute appendicitis: IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 2014; 13 (1): 36-40.
7. Harsha. B Kodliwadamath et al. In Evaluation of Modified Alvardo Scoring in the diagnosis of acute appendicitis and its correlation with Ultra Sonography and Histopathology. J Clin Biomed Sci 2011:1(4)
8. Talukder DB and Siddiq AKMZ. Modified Alvarado scoring system in the diagnosis of acute appendicitis. JAFMC Bangladesh 2009; 5(1):18-20.
9. Maral F Thabit, Hani M Al Ansari, Bashar R Kamoona. In Evaluation of Modified Alvarado Score in the Diagnosis of Acute Appendicitis at Baghdad Teaching Hospital. The Iraqi Postgraduate Medical Journal 2012; 11 (Suppl): 675-683.
10. IP Mahato, R Bhandari, R Rajbhandari, S Kumari, AK Yadav. Sensitivity and specificity of clinical, featuresused in Alvarado scoring system. Health, Renaissance 2011; 9 (1):12-14.
11. Teicher I, Larida B, Cohen M et al. Scoring system to aid in diagnosis of appendicitis. Ann Surg 1983; 198: 753-759.
12. Gurav PD. Evaluation of Right Iliac Fossa Pain with Reference to Alvardo score-Can We prevent Unnecessary Appendicectomies? JKIMSU 2013; 2 (2):24-29.