



## A Comparative Study of Ultrasonography and Different Scoring Systems in Diagnosing Cases of Acute Appendicitis

Authors

**Digbijay Kumar Singh<sup>1</sup>, Binit Prasad<sup>2\*</sup>, Ashwini Kumar<sup>3</sup>**

<sup>1</sup>Senior Resident, Department of General Surgery, Indira Gandhi Institute of Medical Sciences, Patna, India

<sup>2</sup>Senior Resident, Department of Neuro Surgery, Indira Gandhi Institute of Medical Sciences, Patna, India

<sup>3</sup>Senior Resident, Department of General Surgery, Indira Gandhi Institute of Medical Sciences, Patna, India

\*Corresponding Author

**Binit Prasad**

### Abstract

**Background:** *Accurate diagnosis of acute appendicitis is still challenging task in some patient's despite of wide availability of diagnostic methods. The purpose of this study to identify the accurate diagnostic tool for acute appendicitis.*

**Research Design and Methods:** *The study was conducted on 50 patients of age group 14 to 60 years, who had diagnosed as a case of acute appendicitis clinically. Data was collected as RIPASA, Lintula, Alvarado score and ultrasonography findings. Statistical analysis was done and results of all four scoring systems were compared with ultrasonography for diagnostic accuracy. Histopathological finding of resected specimens was considered as a final diagnosis.*

**Results:** *RIPASA score we found sensitivity of 86.84%, specificity of 66.60% and diagnostic accuracy of 82%, Alvarado score we found sensitivity of 86.84%, specificity of 58.66%, and diagnostic accuracy of 80%, Lintula score we observed sensitivity of 81.57%, specificity of 58.33% and diagnostic accuracy of 76%. We observed that ultrasonography had sensitivity of 89.47%, specificity of 83.33%, and diagnostic accuracy of 88%.*

**Conclusions:** *The present study concluded that ultrasonography is the most accurate diagnostic method among the above scoring systems in diagnosing case of acute appendicitis.*

### Introduction

Acute appendicitis is defined as acute inflammation of appendix. Acute appendicitis is one of the commonest surgical emergencies encountered by the surgeons all over world and appendectomy is one of the commonest emergency abdominal surgeries<sup>1</sup>. Early diagnosis of appendicitis is important as delay in diagnosis leads to perforation, intra-abdominal abscess and significant increase in morbidity and mortality. Various type of approaches for diagnosis has been

developed like clinical examination, ultrasonography and various scoring systems, diagnostic laparoscopy but gold standard modality for accurate diagnosis is still in search. Many type of scoring systems have been developed based on clinical examination, history, routine investigation. Definite points are given for each variable and if sum of all variables are greater than a definite cut-off value, the case is diagnosed as acute appendicitis according to that scoring system.

High resolution ultrasonography has been suggested as an accurate way to establish the diagnosis of appendicitis<sup>2</sup>. The technique is inexpensive, can be performed rapidly does not require a contrast medium and can be used even in pregnant women<sup>3</sup>.

RIPASA scoring system was developed at Raja Isteri Pengiran Anaka Saleha Hospital, Singapore. It is considered better than some previous scoring systems. It is based on history, clinical examination and routine laboratory investigations<sup>4</sup>.

Alvarado scoring system was introduced by Alvarado in 1986.9 Later on it was modified by Kalan by excluding the criteria of left shift of neutrophils. This scoring system based on simple history clinical and laboratory examination has proved to be highly sensitive and specific in diagnosing acute appendicitis<sup>5</sup>.

Lintula scoring system is another clinical based data scoring system developed by Lintula et al in Finland. In scoring system there is no laboratory investigation required<sup>6</sup>.

### Research Design and Methods

The study was conducted in the department of surgery, in collaboration with the department of radio diagnosis and the department of pathology in Nalanda Medical College and Hospital, Agamkuan, Patna. Minimum of 50 patients was included in study within period of 1.5yrs.

All patients of age group >13 and <60 having clinical suspicion of acute appendicitis were included in the study. Patients having previous history of any abdominal surgery, patients of paediatric age group, patients who had received treatment prior to admission, those patients who had undergone elective appendicectomy, patients simultaneously having other diseases like liver disease, renal disease, tuberculosis, diabetes mellitus, cardiac diseases etc, female patients with urine pregnancy test positive, patients having any other known pelvic pathology and patient with appendicular lump were excluded from study.

All patients having clinical signs and symptoms of acute appendicitis (vomiting, right iliac fossa pain, right iliac fossa tenderness, rebound tenderness, localized guarding,) presented to the emergency were admitted and put on iv fluid and antibiotics, all necessary investigation were done, scores according to different scoring system were calculated and then patients send for ultrasonography. As per different scoring systems Alverado score of 7 or more RIPASA score of 7.5 or more Lintula score of 21 or more were diagnosed as a patient of acute appendicitis. Ultrasonography examination were performed in all patients. If there was presence of periappendiceal fluid or thickening of appendiceal wall or presence of non-compressible appendix > 6 mm in antero-posterior diameter or presence of appendicolith was consider as a positive scan result for appendicitis. Non-visualized appendix cases in ultrasound were excluded from study. Emergency appendicectomy was done in cases clinically proven appendicitis along with suggested by various scoring systems or ultrasonography. Specimen sent for histopathology for proven signs of inflammation. If there were no histopathological signs of inflammation in the specimen, the patients were said to have underwent a negative appendicectomy. Statistical analysis done and result was concluded.

### Results

Study results of all the parameters are as followed

#### Age Distribution of Patients Under Study

Age Groups	No. of Patients	Percentage
14 – 20	24	48
21 – 30	16	32
31 – 40	5	10
41 – 50	4	8
51 – 60	1	2
<b>Total</b>	<b>50</b>	<b>100</b>

#### Frequency distribution of ultrasonography scan result

Ultrasonography Result	No. of Patients
Positive	36
Negative	14
<b>Total</b>	<b>50</b>

**Results of RIPASA Scoring System**

RIPASA Score	No. of Patients
Positive (Score 7.5 or more)	37
Negative Score <7.5	13
<b>Total</b>	<b>50</b>

**Result of Alvarado Score**

Alvarado Score Result	No. of Patients
Positive (Score 7 or more)	38
Negative (Score <7)	12
<b>Total</b>	<b>50</b>

**Frequency distribution of result of Lintula Score result**

Lintula Score Result	No. of Patients
Positive	36
Negative	14
<b>Total</b>	<b>50</b>

**Histopathology findings results**

Findings	No. of Patients	Percentage
Inflamed appendix	38	76
Normal appendix	12	24
<b>Total</b>	<b>50</b>	<b>100</b>

**Comparison of Diagnostic Accuracy of Ultrasonography and all Scoring Systems Under Study****Sensitivity**

Parameter	Sensitivity
Ultrasonography	89.47
RIPASA scoring system	86.84
Alvarado scoring system	86.84
Lintula scoring system	81.57

**Specificity**

Parameters	Specificity
Ultrasonography	83.33
RIPASA scoring system	66.66
Alvarado scoring system	58.66
Lintula scoring system	58.33

**Positive Predictive Value**

Parameters	positive predictive value
Ultrasonography	94.44
RIPASA scoring system	89.18
Alvarado scoring system	86.84
Lintula scoring system	86.11

**Negative Predictive Value**

Parameters	Negative predictive value
Ultrasonography	71
RIPASA scoring system	61.53
Alvarado scoring system	58.66
Lintula scoring system	50

**Diagnostic Accuracy**

Parameters	Diagnostic accuracy
Ultrasonography	88
RIPASA scoring system	82
Alvarado scoring system	80
Lintula scoring system	76

**Discussion**

Acute appendicitis is a still a common disease all over the world although incidence is decreasing. Accurate diagnosis is very important to reduce negative appendectomy rate and morbidity. This study was conducted to compare ultrasonography with the different scoring systems for diagnosis of acute appendicitis. The study was conducted over 50 patients of age group 14 to 60 years of age. RIPASA, Alvarado, Modified Alvarado and Lintula score were compared with ultrasonography for diagnostic accuracy and histopathological report was taken as the standard. Maximum numbers of patients (48%) in this study belonged to age group of less than 20 years and about 32% belonged to the age group of 20-30 years.

All 50 patients in this study were subjected to ultrasonography. Among 50 patients, positive result was found 36 patients and 14 patients were found negative in ultrasonography scan. Among 36 positive patients 34 having diseases (true positive) and 2 patients was found not having disease (false positive). Out of 14 patients found negative by ultrasonography 4 having disease (false negative) and 10 are true negative. On the basis of above findings diagnostic accuracy of ultrasonography scan was calculated. USG showed sensitivity of 89.4 %, Specificity of 83.33%, positive predictive value of 94.44% negative predictive value of 71.42%, and diagnostic accuracy of 88%.

For RIPASA score value of 7.5 or more was taken as cutoff 74% of patients in this study had score above cutoff and 26% below cutoff. Our study

showed sensitivity of 86.84%, specificity of 66.6%, positive predictive value of 89.18%, negative predictive value of 61.5% and diagnostic accuracy of 82%. The study conducted by Chong et al (2011) had a sensitivity of 98%, specificity of 81.3%, positive predictive value of 85.3%, negative predictive value of 97.4% and diagnostic accuracy of 91.8%<sup>7</sup>. Our study having no such high accurate results.

Taking as cutoff value score of 7 or more, we found that Alvarado score had sensitivity of 86.84%, specificity of 58.66%, positive predictive value of 86.84%, negative predictive value of 58.66% and diagnostic accuracy of 80%. The original study conducted by Alvarado A (1986) was a retrospective study over 305 patients and they found sensitivity of 81%, specificity of 74%, positive predictive value of 93%, negative predictive value of 46% and diagnostic accuracy of 80%<sup>8</sup>. So the present study results are comparable to the original study.

For LINTULA scoring system in our study cutoff score was taken as 21 or more for diagnosing a case of acute appendicitis. As shown in the table, the present study had sensitivity of 81.57% specificity of 58.33%, positive predictive value of 86.11%, negative predictive value of 50%, and diagnostic accuracy of 76%.

When all four scoring systems were compared with each other RIPASA and Alvarado score were found to be equally sensitive (86.84%), while Lintula score has lowest sensitivity (81.57%). Specificity of RIPASA score was found to be highest (66.66%) and other 3 scoring systems were similar about (58%) specific. Positive predictive value of RIPASA was highest (89.18%) and lowest for Lintula score (86.11%). Negative predictive value of RIPASA was maximum (61.53%) and minimum for Lintula (50%). The diagnostic accuracy is maximum for RIPASA score (82%) and minimum for Litula score (76%).

In present study ultrasonography clearly shows better sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy than all the four scoring systems.

## Conclusion

Out of four scoring systems RIPASA score was found to be most accurate with a diagnostic accuracy of 82% and Lintula score was least accurate with only 76%.

Thus on concluding the results of our current study ultrasonography was found to be more accurate, more specific and more sensitive than all the four scoring systems in diagnosing a case of acute appendicitis.

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