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# A Comparative Study of Raja Isteri Pengiran Anak Saleha and Alvarado Scores to Diagnose Acute Appendicitis

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## ABSTRACT

**Background:** Acute Appendicitis is a clinical diagnosis with atypical presentation in young, elderly, females, genitourinary and gynecological conditions. Delayed appendectomy increases the risk of appendicular perforation, sepsis morbidity and mortality. Literature reports as high as 20-40% negative appendectomy. Raja Isteri Pengiran Anak Saleha score has come with higher sensitivity and diagnostic accuracy than Alvarado score in Asian population. This study aims to compare RIPASA and Alvarado score for diagnostic accuracy.

**Methods:** Appendectomy patients at Patan Hospital from April to September 2014 were compared on raja isteri pengiran anak saleha (cut-off value 7.5 out of 15) and Alvarado score (cut-off value 7 out of 10). Final diagnosis was histopathology based. Microsoft Excel and SPSS 17 were used for analysing sensitivity, specificity and diagnostic accuracy of both scores. The study included patients who underwent appendectomy with histopathology report and excluded those with conservative management, generalized peritonitis, appendicular lump and abscess.

**Results:** There were 88 appendectomy patients with median age 26 (18.25, 35) years, and male 52 (59.1%). Negative appendectomy was 10 (11.36%). Sensitivity and specificity of Raja Isteri Pengiran Anak Saleha 98.71% and 80.00% respectively, and for Alvarado 52.56% and 70%. The Raja Isteri Pengiran Anak Saleha score had statistically significant sensitivity ( $p=0.000$ ). Positive Predictive value, Negative Predictive Value and diagnostic accuracy were 97.46%, 88.89% and 96.6% for RIPASA and 93.18%, 15.19% and 54.4% for Alvarado respectively.

**Conclusions:** The Raja Isteri Pengiran Anak Saleha score had better diagnostic accuracy compared to Alvarado score for diagnosis of Acute Appendicitis.

**Keywords:** Acute appendicitis; alvarado score; RIPASA score

## INTRODUCTION

Acute appendicitis (AA) accounts for common emergency abdominal surgeries.<sup>1</sup> Lifetime risk of having appendectomy is 6.7%-8.6%.<sup>2</sup> AA is a clinical diagnosis with atypical presentation in young, elderly, females, genitourinary and gynecological conditions.<sup>3</sup> Diagnostic accuracy can be improved by ultrasonography or computed tomography.<sup>4</sup> Delayed appendectomy risks perforation, sepsis, morbidity and mortality; while negative appendectomy is reported in 20-40%.<sup>5,6</sup> Scoring systems help clinical diagnosis of AA. 'Alvarado score' has sensitivity and specificity ranging from 53-88% and 75-80% but has reported low sensitivity and specificity among population with different ethnic origin.<sup>4,6-9</sup> New

diagnostic scoring system developed to diagnose AA, Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score has shown higher sensitivity, specificity and diagnostic accuracy than Alvarado score, when applied in Asian or oriental population like ours.<sup>10,11</sup> Only few studies have compared them in Asian population.<sup>12-14</sup> This study compared clinical diagnosis of AA using Alvarado and RIPASA Scores.

## METHODS

This was a cross-sectional prospective study done in Patan Hospital, Patan Academy of Health Sciences (PAHS), Lalitpur, Nepal. All patients who underwent appendectomy for clinically suspected AA attending

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department of emergency and admitted in surgery ward were the study population. Patients with conservative management for AA, generalized peritonitis, appendicular lump, appendicular abscess and histopathological report not available were excluded from the study.

With prevalence of 17% negative appendectomy rate (tolerable error 10% at 95% confidence interval (CI) and 10% non-response rate), sample size of 88 was taken.<sup>15</sup> Data was collected for six months, from April 1<sup>st</sup> to September 30, 2014. In order to maintain randomness in selection of the patients, first case was randomly taken among the patients admitted in surgery ward for clinically suspected acute appendicitis and every alternate case being admitted to surgery ward and fulfilling inclusion criteria were taken till calculated sample size was obtained. Checklist proforma adopting RIPASA and ALVARADO Scores were applied to each patient and scores obtained were recorded. In Alvarado Score, "migration of pain, anorexia, nausea or vomiting, tenderness and rebound tenderness in right iliac fossa, fever, leukocyte count and shift to left of leukocyte count" were included. In addition to above parameters, RIPASA score consisted of age, sex, duration of symptoms, Rovsing's sign, guarding in right iliac fossa and negative urine analysis (no pus cells in urine).

Histopathology report of appendix with acute inflammation of mucosa with neutrophilic infiltration of appendix wall was considered AA. The researcher gave orientation of one day to the surgery residents and house officers on filling the proforma to cover the eligible patients when researcher was not on duty in the hospital. The ethical clearance was taken from IRB, NAMS and written informed consent was taken from participants aged 18 years or above and for those under 18 years informed assent was taken from the participants and consent was taken from their guardians.

Data was analysed using Microsoft Excel 2007 and Statistical Package for Social Sciences (SPSS) version 17.0. Mean, median, standard deviation (SD) and interquartile range (Q1, Q3) were calculated and total scores computed for both RIPASA and ALVARADO. Sensitivity, specificity, positive predictive value, negative predictive value, likelihood ratio and diagnostic accuracy of the scoring system were estimated by comparing the threshold level of scores (Alvarado Score being 7 and RIPASA Score being 7.5) with surgical findings from the patients' operation note and histopathology findings. The RIPASA and ALVARADO score were compared using McNemar's Test, with p-value less than 0.05 being

statistical significant.

## RESULTS

Among 88 patients who underwent appendectomy, histopathology report revealed true appendicitis in 78 (88.6%) and negative appendectomy in 10 (11.4%). Among negative appendectomy, six (60%) were normal appendix, two (20%) were mesenteric lymphadenitis, one (10%) was carcinoid tumor and one (10%) had Chron's disease. Among five female who had normal appendix, surgical findings showed that two of them had twisted ovarian cyst and one had ectopic pregnancy.

Majority of the patients (71 (80.7%)) were less than 40 years with median (Q1, Q3) age 26 (18.25, 35) years and more than half (52 (59.1%)) of the patients were male.

Majority of the patients (73 (83%)) presented to emergency within 48 hours of onset of the pain. The total number of true appendicitis who underwent appendectomy were 90% out of 73 who presented within 48 hours and the total number of true appendicitis who presented at 48 hours and after, who underwent appendectomy were 80% out of 15 cases.

The positive predictive value and negative predictive value were 97.46% (95% CI:90.31-99.56) and 88.89% (50.67-99.41) for RIPASA score at cut off value 7.5 and the positive predictive value and negative predictive value for Alvarado score at cut off value 7 were 93.18% (80.29-98.22) and 15.91% (7.15-30.67) respectively. The likelihood ratio for RIPASA score at cut off value 7.5 and Alvarado score at cut off value 7 were 4.93 (1.42-17.05) and 1.752 (0.66-4.6) respectively. The positive likelihood ratio for both RIPASA and Alvarado scores above 1 but more convincing likelihood to have true Acute Appendicitis who is positive for Acute Appendicitis has been shown by RIPASA score at cut off value 7.5 as compared to Alvarado score at cut off value 7. The negative likelihood ratio for RIPASA score less than 7.5 and Alvarado score less than 7 cut-off values were 0.016 (0.002-0.117) and 0.677 (0.493-0.931). So, patients with RIPASA score less than 7.5 compared to Alvarado score less than 7 will have less likely to have acute appendicitis.

The sensitivity and specificity were 98.71% and 80.00% respectively for RIPASA; and 52.56% and 70.00% for Alvarado score. The sensitivity of RIPASA to diagnose AA was significantly high (McNemar's test; p-value: 0.000) compared to Alvarado score (Table 1).

Table 1. Sensitivity and Specificity of RIPASA Score and Alvarado Score for diagnosis of Acute Appendicitis.

Variables	Appendicitis		Sensitivity	Specificity
	Present	Absent		
RIPASA Score	Test Positive	77	98.71 (92.08-99.93)	80.00 (44.21-96.54)
	Test Negative	1		
Alvarado Score	Test Positive	41	52.56 (41.01-63.86)	70.00 (35.36-91.90)
	Test Negative	37		
McNemar test; p value:			0.000	1.000

Among 78 patients with true appendicitis, 41 (52.57%) were detected correctly by both the scores, 1 (1.28%) was missed by both and 36 patients (46.15%) detected by RIPASA were missed by Alvarado (Table 2). The diagnostic accuracy for RIPASA score was 96.6% (CI: 90.00-98.70) and for Alvarado was 54.54% (CI:47.00-59.50) (Table 3).

Table 2. Comparison of Missed Diagnosis of Acute Appendicitis by Alvarado Score Against RIPASA Score.

		Alvarado Score	
		Positive Appendicitis	Negative Appendicitis
RIPASA Score	Positive Appendicitis	41 (52.57%)	36 (46.15%)
	Negative Appendicitis	0 (0.00)	1 (1.28%)

Table 3. Diagnostic Accuracy for Acute Appendicitis by RIPASA Score and Alvarado Score.

Variables	Appendicitis		Diagnostic Accuracy
	Present	Absent	
RIPASA Score	Test Positive	77	96.6% (CI: 90.00-98.70)
	Test Negative	1	
Alvarado Score	Test Positive	41	54.54% (CI:47.00-59.50)
	Test Negative	37	

## DISCUSSION

The study was done in hospital setting to compare RIPASA and Alvarado scoring for clinical diagnosis of AA. RIPASA score was found to be better than Alvarado score in correctly diagnosing AA. The sensitivity and specificity were 98.71% and 80.00% for RIPASA score at cut-off value 7.5 respectively whereas the sensitivity and specificity were 52.56% and 70.00% respectively for Alvarado score at cut off value 7. The sensitivity of RIPASA score to diagnose Acute Appendicitis is significantly high (McNemar test p-value: 0.000).

In this study the total number of sample taken was 88.

Among them, 80.7 % were less than 40 years and 19.3% were 40 or above 40 years. The mean age in this study were 27.7±12.86 years including minimum age eight years and maximum age 60 years. These findings are consistent with other studies.<sup>12,14,15</sup> The similarities may be because no age is an exempt to appendicitis.

In this study, the patients who presented to ER within 48 hours were 83% and the rest 15% presented after 48 hours. This is a bit higher than the study done in Brunei.<sup>10</sup> This may be because this study is done in tertiary center with possibilities of peripheral referral on typical signs and symptoms of acute appendicitis. The true appendectomy rate was 90% among those presenting within 48 hours while it was 80% among those presenting after 48 hours. This may be because typical cases are more likely to present early to the hospitals.

The diagnostic accuracy for RIPASA score at cut off value at 7.5 is 96.6% and that for Alvarado score at cut off value 7 is 54.54% in this study which corroborates with other studies.<sup>12,14,16,17</sup> This may be due to the methodological similarities where histopathological report is taken as gold standard for the confirmation of the diagnosis and studies were done in Asian population. Also the findings are similar to the study done in general hospital at Mexico.<sup>18</sup> The similarities may be due to the similar mean age of the study population (<40 years). While these findings are contrast to the study done in Thailand where Alvarado score is reported better than RIPASA score.<sup>19</sup> This may be due to the difference in the study population as acute appendicitis with complication were not included in our study.

The limitation of the study was that it was a single centered study. Thus, the findings may not be generalizable to other setting.

## CONCLUSIONS

The RIPASA score has better sensitivity with more diagnostic accuracy compared to Alvarado score to clinically diagnose acute appendicitis. Thus, in resource limited setting like ours, RIPASA score is a useful tool for

clinical diagnosis of AA and has likely to have reduction of expenses in radiological investigations and has potential to reduce health care expenses.

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