



“A COMPARATIVE STUDY OF RIPASA SCORE AND ALVARADO SCORE IN THE DIAGNOSIS OF ACUTE APPENDICITIS”

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ABSTRACT

Acute appendicitis is the most common condition encountered in the Emergency department. Alvarado and Modified Alvarado scores are the most commonly used scoring system used for diagnosing acute appendicitis, but its performance has been found to be poor in certain population. Hence our aim was to compare the diagnostic accuracy of RIPASA and ALVARADO Scoring system and study and compare sensitivity, specificity and predictive values of these scoring systems. The study was conducted in Government district hospital Nandyal. We enrolled 176 patients who presented with RIF pain. Both RIPASA and ALVARADO were applied to them. Final diagnosis was confirmed either by CT scan, intra operative finding or post operative HPE report. Sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy was calculated both for RIPASA and ALVARADO.

It was found that sensitivity and specificity of the RIPASA score in our study are 98.7% and 83.3%, respectively. PPV and NPV were 98.1% and 88.2% and sensitivity and specificity of the Alvarado score in our study are 94.3% and 83.3%, respectively. PPV and NPV were 98% and 62.5%. Diagnostic accuracy of RIPASA score and Alvarado score are 97% and 93% respectively. RIPASA is a more specific and accurate scoring system in our local population when compared to ALVARADO. It reduces the number of missed appendicitis cases and also convincingly filters out the group of patients that would need a CT scan for diagnosis (score 5-7.5).

BACKGROUND: Acute appendicitis is one of the most commonly dealt surgical emergencies, with a lifetime prevalence rate of approximately one in seven.¹ The incidence is 1.5–1.9 per 1,000 in the male and female population, and is approximately 1.4 times greater in men than in women. Despite being a common problem, it remains a difficult diagnosis to establish, particularly among the young, the elderly and females of reproductive age, where a host of other genitourinary and gynaecological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis.²

A delay in performing an appendectomy in order to improve its diagnostic accuracy increases the risk of appendicular perforation and peritonitis, which in turn increases morbidity and mortality.

A variable combination of clinical signs and symptoms has been used together with laboratory findings in several scoring systems proposed for suggesting the probability of Acute Appendicitis and the possible subsequent management pathway.

The Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) and ALVARADO score are new diagnostic scoring systems developed for the diagnosis of Acute Appendicitis and has been shown to have significantly higher sensitivity, specificity and diagnostic accuracy.

AIMS AND OBJECTIVES

PRIMARY OBJECT

1. To compare RIPASA Scoring system and ALVARADO Scoring system in terms of diagnostic accuracy in Acute Appendicitis.
2. To study and compare sensitivity, specificity and predictive values of above scoring systems.

SECONDARY OBJECT

1. To study the rate of negative appendectomy based on above scoring systems.

CONCLUSION: The RIPASA score is a simple scoring system with high sensitivity and specificity for the diagnosis of acute appendicitis. The 14 clinical parameters are all present in a good clinical history and examination and can be easily and quickly applied. Therefore, a decision on the management can be made early. Although the RIPASA score was developed for the local population of Brunei, we believe that it should be applicable to other regions. The RIPASA score presents greater Diagnostic accuracy and Sensitivity and equal specificity as a diagnostic test compared to the Alvarado score and is helpful in making appropriate therapeutic decisions. In hospitals like ours, the diagnosis of AA relies greatly on the clinical evaluation performed by surgeons. An adequate clinical scoring system would avoid diagnostic errors, maintaining a satisfactory low rate of negative appendectomies by adequate patient stratification, while limiting patient exposure to ionizing radiation, since there is an increased risk of developing cancer with computed tomography, particularly for the paediatric age group.²¹

KEYWORDS : Appendicitis, RIPASA, ALVARAD

INTRODUCTION

Acute appendicitis is one of the most commonly dealt surgical emergencies, with a lifetime prevalence rate of approximately one in seven.¹ The incidence is 1.5–1.9 per 1,000 in the male and female population, and is approximately 1.4 times greater in men than in women. Despite being a common problem, it remains a difficult diagnosis to establish, particularly among the young, the elderly and females of reproductive age, where a host of other genitourinary and gynaecological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis.²

A delay in performing an appendectomy in order to improve its diagnostic accuracy increases the risk of appendicular perforation and peritonitis, which in turn increases morbidity and mortality.

A variable combination of clinical signs and symptoms has been used together with laboratory findings in several scoring systems proposed for suggesting the probability of Acute Appendicitis and the possible subsequent management pathway.

ALVARADO score are new diagnostic scoring systems developed for the diagnosis of Acute Appendicitis and has been shown to have significantly higher sensitivity, specificity and diagnostic accuracy.

The ALVARADO score is a clinical scoring system used in the diagnosis of appendicitis.³ Score < 5 : Appendicitis unlikely, Score 5-6 : Appendicitis possible, Score 7-8 : Appendicitis likely, Score 9-10 : Definitive Appendicitis.

The original Alvarado score describes a possible total of 10 points, but those medical facilities unable to perform a differential white blood cell count, are using a **Modified Alvarado Score**⁴ with a total of 9 points which could be not as accurate as the original score.

The RIPASA score⁵ is a useful for diagnosis of acute appendicitis, as it contains simple parameters. Thus, the operating surgeon can make a quick decision upon seeing patients with right iliac fossa pain, by RIPASA scoring system with a score > 7.5 to be operated, while patients with a RIPASA score < 7.0 can either be observed in the unit's day ward or discharged with an early clinic review appointment. The role of diagnostic imaging such as ultrasound, CT abdomen, MRI.

The Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) and

Since surgeons started performing appendectomies in the nineteenth century, surgery has been the most widely accepted treatment, with more than 300,000 appendectomies performed annually in the USA. Current evidence shows that laproscopic appendectomy to be the most effective surgical treatment.

Review Of Literature

The Appendix (or vermiform appendix) is a blind ended tube connected to the caecum, from which it develops in the embryo. The caecum is a pouch-like structure of the colon, located at the junction of the small and large intestine. The human appendix length is approximately 9 cm in length but can range from 2 to 20 cm. The appendix receives its arterial supply from the appendicular branch of the ileocolic artery. The venous drainage of the appendix is by one or more appendicular veins. These drain into the posterior caecal or ileocolic vein, which in turn drains into the superior mesenteric vein.

Acute appendicitis

Appendicitis is an inflammation of the appendix and is believed to occur as a result of appendiceal luminal obstruction and is most commonly caused by a fecolith, enlarged lymphoid follicles associated with viral infections (e.g., measles), inspissated barium, worms (e.g., pinworms, Ascaris, and Taenia), and tumors (e.g., carcinoid or carcinoma) may also obstruct the lumen. Fecaliths and calculi are found in 40% of cases of simple acute appendicitis. In 65% of cases of gangrenous appendicitis without rupture, and in nearly 90% of cases of gangrenous appendicitis with rupture.⁷ The proximal obstruction of the appendiceal lumen produces a closed-loop obstruction, and continuing normal secretion by the appendiceal mucosa rapidly produces distension. Distension of the appendix stimulates the nerve endings of visceral afferent stretch fibers, producing vague, dull, diffuse pain in the mid-abdomen or lower epigastrium.

Distension increases from continued mucosal secretion and from rapid multiplication of the resident bacteria of the appendix. This causes reflex nausea and vomiting, and the visceral pain increases. As pressure in the organ increases, venous pressure is exceeded. Capillaries and venules are occluded but arterial inflow continues, resulting in engorgement and vascular congestion.

The inflammatory process soon involves the serosa of the appendix and in turn the parietal peritoneum. This produces the characteristic shift in pain to the right lower quadrant.

Symptoms

Pain is the predominant symptom, starting with periumbilical and diffuse pain that eventually localizes to the right lower quadrant (sensitivity, 81%; specificity, 53%).⁸

There can be atypical presentations of pain in the abdomen and these are usually associated with the variable anatomical positions. In the retrocaecal position of the appendix, the patient complains of pain either in the flank or back, in the pelvic appendix, the patient may have pain in the suprapubic region and in the retroileal appendix, the patient may have testicular pain due to irritation of the spermatic artery and the ureter.

Appendicitis is also associated with gastrointestinal symptoms like nausea, vomiting, anorexia. Gastrointestinal symptoms that develop before the onset of pain suggest a different etiology such as gastroenteritis.

Murphy's Triad is constituted by Pain, Vomiting and Fever.
SIGNS

Mc Burney's Sign :

On abdominal palpation, there is tenderness with a maximum at or near McBurney's point.⁹ It lies at the junction between the medial 2/3rd and the lateral 1/3rd along the imaginary line that joins the umbilicus and the right anterior superior iliac spine.

Blumberg Sign:

A hand is placed on the right iliac fossa and progressively pressed with each movement of expiration. It is then released suddenly. If the sign is positive, the patient will wince or cry with pain. This indicates inflammation of the parietal peritoneum.

Rovsing's Sign

When pressure is applied on the abdomen in the left iliac fossa, it causes pain in the right iliac fossa.

Cope's Sign

Pain in the right hypogastrium on flexion and internal rotation of the right thigh, also known as Obturator Internus test. Inflamed appendix overlying the obturator internus and iliacus, causes spasm in these muscles and stretching of these muscles by flexion/internal rotation of the hip causes pain.

Psoas Sign -

Pain elicited upon extension of the right thigh, due to irritation of the psoas muscle, as seen in retrocaecal appendicitis.

Hyperaesthesia In Sherrren's Triangle

Sherrren's triangle is bounded by lines joining the umbilicus, the right anterior superior iliac spine and the pubic symphysis. Skin overlying this triangle is gently struck and on comparing to the opposite side, hyperaesthesia is elicited.

Rectal Examination

It is a must in all cases of appendicitis. Tenderness on the right lateral wall, especially when compared to the posterior and left lateral wall is a significant sign.

Lab Investigations

Mild leukocytosis is often present in patients with acute, uncomplicated appendicitis and is usually accompanied by a polymorphonuclear predominance. The white blood cell count is $>18,000$ cells/mm³ in complicated appendicitis. Counts above this level raise the possibility of a perforated appendix with or without an abscess.

An increased C-reactive protein (CRP) concentration is a strong indicator of appendicitis, especially for complicated appendicitis.¹⁰

Imaging systems :

Plain abdominal x-ray can show the presence of fecolith associated with appendicitis but is rarely helpful in the diagnosis of appendicitis.

Usg :

Graded compression USG is the most commonly used imaging test in patients with abdominal pain, particularly in the evaluation of possible appendicitis. Ultrasonography has a sensitivity of about 88% and specificity of 93% for diagnosing appendicitis.

Computerized Tomography:

With high-resolution helical CT, the inflamed appendix appears dilated (>5 mm), and the wall is thickened. There is often evidence of inflammation, which can include periappendiceal fat stranding, thickened mesoappendix, periappendiceal phlegmon, and free fluid.

Ripasa scoring system

Patients:	Score
Female	0.5
Male	1
Age < 39.9 years	1
Age > 40 years	0.5
Symptoms	
Right iliac fossa Pain	0.5
Pain Migration to Right iliac fossa	0.5
Anorexia	1
Nausea & Vomiting	1
Duration of Symptoms < 48 hrs	1
Duration of Symptoms > 48 hrs	0.5
Signs	
Right iliac fossa Tenderness	1
Guarding	2
Rebound Tenderness	1
Rovsing Sign	2
Fever > 37° C < 39° C	1
Investigation	
Raised WBC	1
Negative Urine Analysis	1
Additional Score	
Foreign NRIC	1
Total score	17.5

ALVARADO scoring system

Symptoms	score
Migration to right iliac fossa	1
Anorexia	1
Nausea	1
Signs	
Tenderness in Right iliac fossa	2
Rebound pain	1
Elevated temperature	1
Investigation	
Leucocytosis	2
Shift of neutrophils to the left	1
Total score	10

Score <5 Appendicitis unlikely

Score 5-6 Appendicitis possible

Score 7-8 Appendicitis likely

Score 9-10 Definitive Appendicitis <7 monitoring >7.5 operation

Materials And Methods

Study Area: Government District General Hospital, Nandyal, Kurnool District, Andhra Pradesh

Study population: The study population included all patients attending emergency department with right iliac fossa pain in Government District General Hospital, Nandyal.

Study design: Prospective observational study.

Sample size: 176

Patients, between the age group of 10 and 60 years of both sexes attending emergency department with right iliac fossa pain in Government District General Hospital Nandyal was selected in a consecutive manner from **January 2017 to November 2108**.

Inclusion Criteria:

The study population included all patients attending emergency department with right iliac fossa pain in Government District General Hospital, Nandyal.

Exclusion Criteria:

1. Children below 10 years.
2. Pregnant women
3. Patients with previous history of urolithiasis, urinary tract infections and pelvic inflammatory disease.
4. Patient presenting with a right iliac fossa mass.
5. Previously diagnosed case of acute appendicitis.
6. Immunocompromised patients.
7. Patients who were managed exclusively by conservative management and did not undergo appendicectomy.

All cases satisfying inclusion and exclusion criteria had undergone thorough history and detailed clinical examination at the time of admission as part of routine management. Complete blood picture, total and differential white blood cell counts, urinary analysis and ultrasonography were ordered for all as per institutional protocol.

A score of 7 was taken as high probability of acute appendicitis for Alvarado scoring system and a score of 7.5 for RIPASA scoring system. A patients with low probability score 5-6 for alavarado and 5-7.5 for RIPASA were reassessed by surgeon. The decision on appendicectomy was solely based on the surgeon's clinical judgment after taking into consideration all the findings of clinical, laboratory and radiological investigations. Ultrasound (USG) of abdomen and pelvis was done within 6 hours in all clinically suspected cases. Findings of USG were recorded and compared with the Alvarado and RIPASA scores.

Patients who were managed exclusively by conservative management and did not undergo appendicectomy were excluded out of the study.

All patients clinically diagnosed as appendicitis and who were having a significant RIPASA scores were operated for appendicectomy (either by the open method or by the laparoscopic technique) and the specimens of appendix were sent for histo-pathological examination (HPE) and compared with Alvarado score.

Clinical score were compared with histopathology of specimen for all

those who underwent appendicectomy.

A descriptive statistical analysis of the demographic data of the population was completed, as well as the analysis of diagnostic tests, using the pathology report as a gold standard. Sensitivity, specificity, positive predictive value [PPV], negative predictive value [NPV] and diagnostic accuracy are compared.

Statistical analysis was performed with SPSS version 24 software. P value of < 0.05 was considered statistically significant. Pearson's Chi-square test was used. With these data, ROC curves were generated to compare both scores

Results**Age distribution**

In our study the most susceptible age group is found between 25 and 35 years (31.3%) and least susceptible age group is found between 55 and 60 years (0.6%).

Sex distribution

In our study male population were more 56.8% in comparison with female population (43.8%).

As per Alvarado criteria ,

In our study 26% of patients had history of pain migration to Right iliac fossa. 75 % of patients were having history of anorexia. All patients had either or vomiting and tenderness in the right iliac fossa indicating predominating feature. 24% of patients in our study showed a sign of rebound tenderness. 88.6 % of population of our study were having elevated temperature and 11.4% of patients had normal recorded temperature. 93.2 % of population of our study showed elevated leukocyte count. 60.2 % of population of our study showed lab investigation of Neutrophil count > 75%. In our study population with Alvarado score of 5, 6, 7, 8, 9 were 11.9, 1.7, 37.5, 31.8 and percentage respectively. In the study p value is 0.001 (< 0.05) which is statistically significant. Sensitivity, specificity, true predictive value and false predictive value of Alvarado scoring with histopathological examination set as gold standard are 94.3%, 83.3%, 98% and 62.5% respectively.

As per RIPASA criteria,

63.6% of the population of our study were less than 39 years of age and are susceptible to appendicitis when compared to age more than 39 years.

63.1 % of population in our study presented to emergency department less than 48 hours of onset of symptoms and 36.9 % of population presented more than 48 hours of onset of symptoms probably due to less awareness of symptoms, lack of awareness of healthy life style. 54% of population of our study showed soft abdomen on per abdomen examination probable indication of uncomplicated appendicitis. Rovsign sign a palpation of left lower quadrant of abdomen increases the pain felt in right lower quadrant were absent in 93.8% of population of our study. 93% of population in our study showed negative for urine analysis and probably eliminating conditions which mimics appendicitis like simple urinary tract infection.

9.7 % of the population were having RIPASA score < 7.5 and 90.3 % of the population were calculated a score above 7.5. In our study p value is 0.003 (< 0.05) which is statistically significant. Sensitivity and specificity of RIPASA score in our study in the diagnosis of acute appendicitis are 98.7% and 83.3% respectively. Out of 176 patients who underwent appendicectomy, histopathological examination was negative for appendicitis in 10.2% of population in our study. In our study 35.2% of population underwent emergency open appendicectomy that is within 6 hours of presentation to emergency department, 47.7% underwent open appendicectomy after 6 hours of observation and 17% of the population were taken for laparoscopic appendicectomy. Negative appendicectomy rate in our study is 10%. In ROC curve Area under curve is more for RIPASA score hence it is of more diagnostic accuracy in comparison with Alvarado score.

Comparison Between Ripasa And Alvarado Score

PARAMETER	RIPASA SCORE	ALVARADO SCORE
Sensitivity	98.7%	94.3%
Specificity	83.3%	83.3%
Positive Predictive Value	98.1%	98%
Negative Predictive Value	88.2%	62.5%
Diagnostic Accuracy	97%	93%

Significance

Specificity of both RIPASA and Alvarado score are comparable but there seems to be a definite upgrade in sensitivity, diagnostic accuracy and to certain amount in positive predictive value as well in RIPASA scoring over ALVARADO scoring.

DISCUSSION

Acute appendicitis is one of the most commonly encountered surgical emergency. The evaluation is mainly based on history and clinical findings and basic lab investigation which are an important parameter in reaching a diagnosis of acute appendicitis. Recent reports have suggested that the indiscriminate use of CT scan may lead to the detection of early low-grade appendicitis and these patients may then be subjected to unnecessary Appendectomy, in a condition that would otherwise have resolved spontaneously with antibiotics therapy.¹¹ Several scoring systems such as the Alvarado and the modified Alvarado scoring system had been introduced since 1986 to help with clinical decision-making process in achieving an accurate diagnosis of acute appendicitis in the fastest and cheapest way.

Despite good sensitivity and specificity when applied to a Western population, both these scoring systems have been shown to achieve low sensitivity and specificity, ranging from 50% to 59% and 23% to 94%, respectively, when applied to Middle Eastern, Asian, or Oriental populations.^{12,13,14}

Because of the poor sensitivity and specificity of both the Alvarado and the modified Alvarado scoring systems, the RIPASA score was developed, which was more applicable to our Asian population, given the nature of diet and high prevalence of parasitic infestation.¹⁵

Recently, a new scoring system called, "appendicitis inflammatory response score" was introduced by Andersson in 2008. This scoring system had a sensitivity of only 96% and a specificity of 73% for a cut-off threshold set at >4 or a sensitivity of 37% and specificity of 99%.

- The sensitivity and specificity of the RIPASA score in our study are 98.7% and 83.3%, respectively. PPV and NPV were 98.1% and 88.2%.
- The sensitivity and specificity of the Alvarado score in our study are 94.3% and 83.3%, respectively. PPV and NPV were 98% and 62.5%.
- Diagnostic accuracy of RIPASA score and Alvarado score are 97% and 93% respectively.

The number of patients in our study had males more than females, which is similar to a study done by Canavosso et al. in which the incidence of acute appendicitis was more in males than in females.¹⁶

In our study, the PPV of RIPASA score was 98.1%, whereas a study done by Singh et al. found PPV of 83.79%, which suggests that the RIPASA score is superior to Alvarado score.¹⁷

Our study suggests that RIPASA score can be considered a superior score than the commonly used Alvarado score in terms of higher sensitivity and high PPV in diagnosis of appendicitis

The rate of negative appendectomies reported in our study was 10.2%, similar to reports in the international literature.^{18,19,20}

CONCLUSION

The RIPASA score is a simple scoring system with high sensitivity and specificity for the diagnosis of acute appendicitis. The 14 clinical parameters are all present in a good clinical history and examination and can be easily and quickly applied. Therefore, a decision on the management can be made early. Although the RIPASA score was developed for the local population of Brunei, we believe that it should be applicable to other regions. The RIPASA score presents greater Diagnostic accuracy and Sensitivity and equal specificity as a diagnostic test compared to the Alvarado score and is helpful in making appropriate therapeutic decisions. In hospitals like ours, the diagnosis of AA relies greatly on the clinical evaluation performed by surgeons. An adequate clinical scoring system would avoid diagnostic errors, maintaining a satisfactory low rate of negative appendectomies by adequate patient stratification, while limiting patient exposure to ionizing radiation, since there is an increased risk of developing cancer with computed tomography, particularly for the paediatric age group.²¹

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