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Diagnosis of Acute Appendicitis in a Tertiary Care Hospital Using Predictive Scoring Systems

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Abstract: ***Background (Introduction): Acute appendicitis is defined as inflammation of the appendix. Acute appendicitis is one of the most common surgical emergencies, with a prevalence of one in seven in lifetime. It is approximately 1.4 times greater in men than in women. A quick and correct diagnosis of acute appendicitis is based on clinical history, presentation, abdominal examination and laboratory investigations with subsequent early appendectomy can avoid complications arising from perforation. Ultrasonogram is continuity of clinical examination in this condition[1]. Appendectomy is the most commonly performed emergency operation and can mimic other acute conditions of the abdomen known to cause right iliac fossa pain particularly among the young, the elderly and females of reproductive age. Although appendicitis is a common problem presenting to surgical department, its diagnosis remains difficult and is mainly clinical helped by a few laboratory investigations such as white blood cells. Further aids for making diagnosis are USG and CT of Abdomen and Pelvis which have high sensitivity and specificity but burdens the common man's pockets and delays the treatment. To overcome this and to reduce the cost burden, many scorings systems are developed based on routine blood investigations we perform to diagnose this condition[2]. Raja IsteriPengiranAnakSaleha Appendicitis (RIPASA) [6], Alvarado[8], Acute Inflammatory Response (AIR) [7] are most commonly used scoring systems in tertiary hospital setup. The aim of this study is to compare the accuracy of all the three scores in diagnosing acute appendicitis by comparing them with the gold standard of histopathologically confirmed appendicitis. Objectives: The objective was to compare the predictive accuracy of the Raja IsteriPengiranAnakSaleha Appendicitis (RIPASA), Alvarado, Acute Inflammatory Response (AIR) scores in patients with right lower quadrant pain for the diagnosis of acute appendicitis. Materials & Methods: a) Design of study-Retrospective descriptive b) Total number of study subjects-100. C) Mode of selection of subjects-All patients treated at the RLJ Hospital for acute appendicitis between January 2019 and December 2020. Patients were identified through a computer-generated search through the Medical Records Department for all patients diagnosed with acute appendicitis. Data were extracted retrospectively from hospital records. All patients were evaluated and graded using Raja IsteriPengiranAnakSaleha Appendicitis (RIPASA), Alvarado, Acute Inflammatory Response (AIR) scores. Conclusion: The RIPASA (Raja IsteriPengiranAnakSaleha Appendicitis) scoring system looked promising when applied to our settings, and had a better sensitivity and specificity than the Alvarado score and AIR (Acute Inflammatory Response) score when applied to Asian populations. A significant reduction in the negative appendicectomy rate was also predicted.***

Keywords: RIPASA score, ALVARADO score, AIR score, Acute appendicitis

1. Introduction

Acute appendicitis is defined as inflammation of the appendix. Acute appendicitis is one of the most common surgical emergencies, with a prevalence of one in seven in lifetime. It is approximately 1.4 times greater in men than in women. A quick and correct diagnosis of acute appendicitis is based on clinical history, presentation, abdominal examination and laboratory investigations with subsequent early appendectomy can avoid complications arising from perforation. Ultrasonogram is continuity of clinical examination in this condition[1].

Appendectomy is the most commonly performed emergency operation and can mimic other acute conditions of the abdomen known to cause right iliac fossa pain particularly among the young, the elderly and females of reproductive age. Although appendicitis is a common problem presenting to surgical department, its diagnosis remains difficult and is mainly clinical helped by a few laboratory investigations such as white blood cells. Further aids for making diagnosis are USG and CT of Abdomen and Pelvis which have high sensitivity and specificity but burdens the common man's pockets and delays the treatment.

This delay in performing an appendectomy in order to improve the accuracy of diagnosis increases the risk of perforation of appendix and sepsis, which leads to increase in morbidity and mortality of the patient [2]. The incidence of perforation is more in younger age group and older age groups. Most common cause in younger age groups is lymphatic obstruction and in older age groups is low levels of immunity.

To overcome this and to reduce the cost burden, many scoring systems are developed based on routine blood investigations we perform to diagnose this condition[3]. Raja IsteriPengiranAnakSaleha Appendicitis (RIPASA), Alvarado, Acute Inflammatory Response (AIR) are most commonly used scoring systems in tertiary hospital setup[6, 7, 8].

Alvarado scoring system, which was first described in 1986, has remained the most popular scoring system in acute appendicitis for many decades. The scoring system remains popular as this scoring system has been proven to have very good sensitivity and specificity.

RIPASA score is another new diagnostic scoring system developed in 2008 at the Department of Surgery, Raja IsteriPengiranAnakSaleha Hospital, Darussalam, Brunei.

The Appendicitis inflammatory response (AIR) score is a newer scoring system used in suspected appendicitis, first reported in 2008.

The three scoring systems, though different in having different maximum scores, have some overlapping parameters[4].

The aim of this study is to compare the accuracy of all the three scores in diagnosing acute appendicitis by comparing them with the gold standard of histopathologically confirmed appendicitis.

2. Objectives of Study

The objective of this study is to compare all the scores used in diagnosis of acute appendicitis and to evaluate the most accurate scoring system among these three by comparing with histological report in tertiary care centre**.**

3. Materials and Methods

a) Design of study-Retrospective descriptive
b) Total number of study subjects-100
c) Mode of selection of subjects

It is a retrospective descriptive study consisting of 100 patients who presented to surgical department of RLJ Hospital, with acute abdomen and diagnosed as Acute Appendicitis for which they have undergone open appendectomy between January 2019 to December 2020 who were identified from the operation records of the Department of Surgery, RLJ Hospital, Tamaka, Kolar.

All patients who underwent laparoscopic/open appendectomy were evaluated and graded using Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA), Alvarado, Acute Inflammatory Response (AIR) scores.

Table 1: RIPASA score

Characteristics	Score
Female	0.5
Male	1.0
Age <39.9 years	1.0
Age >40 years	0.5
Rif Pain	0.5
Pain migration to RIF	0.5
Anorexia	1.0
Nausea and vomiting	1.0
Duration of symptoms < 48 hours	1.0
Duration of symptoms > 48 hours	0.5
RIF tenderness	1.0
RIF guarding	2.0
Rebound tenderness	1.0
Rovsing Sign	2.0
Fever >37^0C- < 39^0C	1.0
Investigation	
Raised WBC	1.0
Negative urine analysis	1.0
Foreign nationality	1.0
Total Score	17.5

Table 2: ALVARADO score

Clinical symptoms signs/ blood tests	Score
Migration of Pain	1
Anorexia	1
Nausea and vomiting	1
Tenderness at the right iliac fossa	2
Rebound tenderness	1
Raised temperature >37.5^0C	1
Leukocytosis (≥10x 10^9/L)	2
Presence of neutrophils ≥ 70%	1
Total	10

Table 3: Acute inflammatory response score (AIR)

	Score
Vomiting	1
Pain in right lower quadrant	1
Muscular /defence	
Light	1
Medium	2
Strong	3
Body Temperature >38.5^0C	1
Polymorphonucleur leucocytes	
70- 84%	1
Equal or more than 85%	2
WBC	
10000- 14999 Cell/ cumm	1
Equal or more than 15000 Cell/ cumm	2
CRP estimation	
10- 49mg/l	1
Equal or more than 50mg/l	2

Inclusion Criteria
Patients who underwent emergency appendectomy for suspected appendicitis with acute complaints (lasting less than 4 days), non traumatic right iliac fossa pain consistent with a diagnosis of appendicitis (pain associated with nausea, anorexia, vomiting and fever along with clinical signs as tenderness and rebound tenderness in right iliac fossa, with or without ultrasound findings suggestive of appendicitis) were included.

Exclusion Criteria
Pregnant women, those with appendicular mass and features of peritonitis, patients with a previous history of urolithiasis or pelvic inflammatory disease, and children below 12 years of age were excluded from the study.

4. Analysis & Statistical Methods

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. **Chi-square test** was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation.

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram, Pie diagram.

p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

5. Results

Total number of patients involved in this study are 100 (N=100).
Using Alvarodo score, patients were distributed into two groups based on their scores as <8 and >8.46 subjects i. e 46% falls under <8 group and 54 subjects i. e 54% falls under >8 group (Table 4).

Table 4: Alvarodo score distribution

Score	Number (N=100)	Percentage
<8	46	46%
>8	54	54%

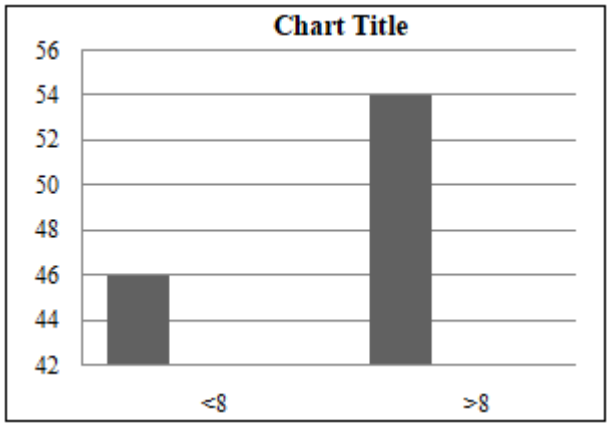

Figure 1: Alvarodo score distributuion

Using RIPASA score, patients were distributed into two groups based on their scores as <7.5 and >7.5.12 subjects i. e 12% falls under <7.5 group and 88 subjects i. e 88% falls under >7.5 group (Table 5).

Table 5: RIPASA score wise distribution

Score	Number (N=100)	Percentage
<7.5	12	12%
>7.5	88	88%

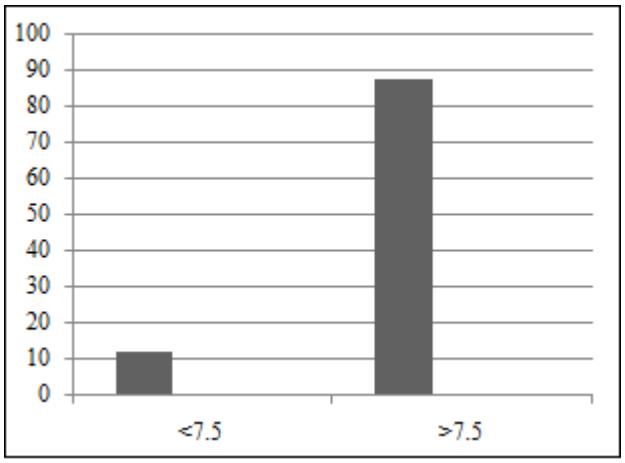

Figure 2: RIPASA score wise distribution

Using AIR score, patients were distributed into two groups based on their scores as <5 and >5.32 subjects i. e 32% falls under <5 group and 68 subjects i.e 68% falls under >5 group (Table 6).

Table 6: AIR score wise distribution

Score	Number (N=100)	Percentage
<5	32	32%
>5	68	68%

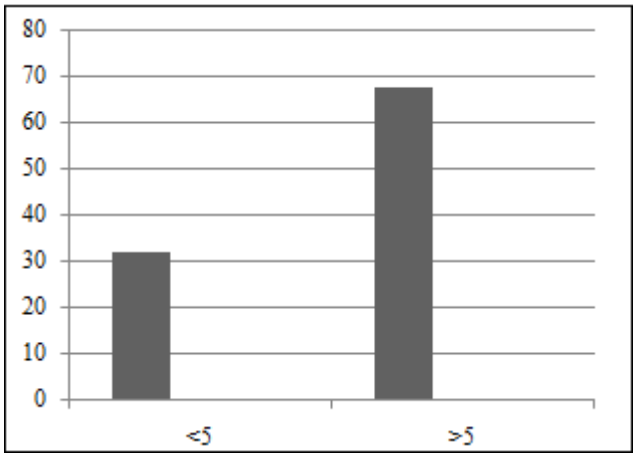

Figure 3: AIR Score wise distribution

Comparing histopathology reports of the patients included in this study and ALVARADO Score, total 46 patients are grouped under <8 group out of which 38 cases had positive HPR of appendix and 8 cases had negative HPR of appendix and 54 patients are grouped under >8 group out of which 49 cases had positive HPR of appendix and 5 had negative HPR of appendix (Table.7).

Table 7: Histopathology and ALVARADO

Alvarado	Histopathology		Total
	Positive	Negative	
<8	38	8	46
>	49	5	54
Total	87	13	100

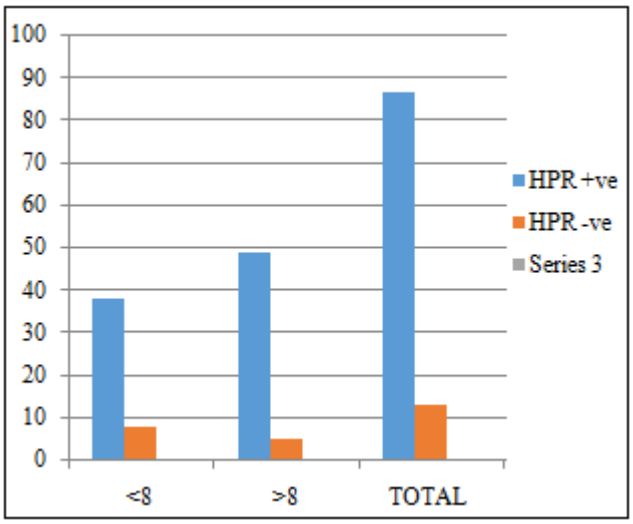

Figure 4: Histopathology and ALVARADO

Comparing histopathology reports of the patients included in this study and RIPASA Score, total 12 patients are grouped under <7.5 group out of which 8 cases had positive HPR of appendix and 4 cases had negative HPR of appendix and 88 patients are grouped under >7.5 group out of which 85 cases had positive HPR of appendix and 3 had negative HPR of appendix (Table.8).

Table 8: Histopathology and RIPASA

Ripasa	Histopathology		Total
	Positive	Negative	
<7.5	8	4	12
>7.5	85	3	88
Total	93	7	100

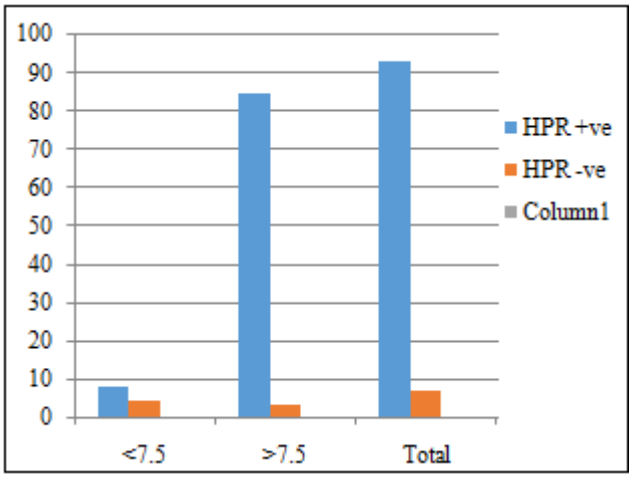

Figure 5: Histopathology and RIPASA

Comparing histopathology reports of the patients included in this study and AIR Score, total 32patients are grouped under <5group out of which 27 cases had positive HPR of appendix and 5 cases had negative HPR of appendix and 68 patients are grouped under >5 group out of which 60 cases had positive HPR of appendix and 8 had negative HPR of appendix (Table.9).

Table 9: Histopathology and AIR Score

AIR	Histopathology		Total
	Positive	Negative	
<5	27	5	32
>5	60	8	68
Total	87	13	100

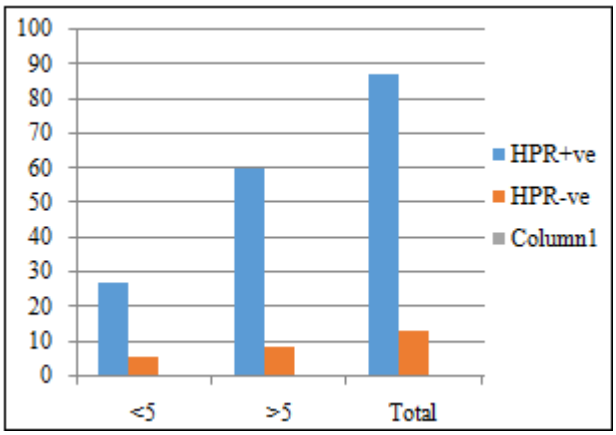

Figure 6: Histopathology and AIR Score

6. Discussion

Appendicitis is one of the most common presentations to emergency. It is one of the most common procedures performed in by department of general surgery[5]. Patients present with symptoms such as nausea and vomiting associated with pain abdomens which are common in many abdomen conditions.

Appendicitis is generally diagnosed based on clinical and laboratory findings, including the results of imaging analysis. However, the presence of numerous gynecological pathologies in female patients makes it challenging to diagnose acute appendicitis, particularly in pregnant patients

Radiological examination has high diagnostic value for acute appendicitis. However, the main disadvantages of computed tomography are its teratogenic effect and high cost.

To overcome this many scoring systems are developed. Using these scoring systems that combine clinical and imaging features, 95% of patients with uncomplicated appendicitis can be diagnosed correctly[9].

Delays in diagnosis and treatment of appendicitis may result in more complicated illness, chances of perforation, sepsis which are more lethal compromising morbidity of the patient which also leads too mortality[10].

Clinical scoring systems aim to diagnose appendicitis by assessing signs, symptoms, and laboratory results. RIPASA, Alvarado, Acute Inflammatory Response (AIR) are most commonly used scoring systems in general setup[6, 7, 8]. In our study, we assessed the above mentioned scoring systems that are commonly used to diagnose appendicitis and compared with histopathology reports and outcome of the patients.

Based on the results from the study, the RIPASA score had the highest predictive value, followed by the AIR and ALVARADO scores[11]. This scoring system did perform well considering the simple nature of its structure and application and also promotes early diagnosis; improve treatment and outcomes of the patient.

7. Conclusion

The RIPASA (Raja IsteriPengiranAnakSaleha Appendicitis) scoring system looked promising when applied to our settings, and had a better sensitivity and specificity than the Alvarado score and AIR (Acute Inflammatory Response) score when applied to Asian populations. A significant reduction in the negative appendectomy rate was also predicted.

References

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Proforma

PARTICULARS OF THE PATIENT

NAME:
AGE:
SEX:
UHID NUMBER:
OCCUPATION:
DATE OF ADMISSION:
DATE OF SURGERY:
DATE OF DISCHARGE:
CHIEF COMPLAINTS:

HISTORY OF PRESENTING ILLNESS:

PAST HISTORY:

GENERAL PHYSICAL EXAMINATION:

PULSE: BP: TEMP: RR:
PALLOR: ICTERUS: LYMPHADENOPATHY:
CYANOSIS:
CLUBBING: OEDEMA:

SYSTEMIC EXAMINATION

CVS:
RS:
P/A:
CNS:
Local Examination:

RIPASA SCORE

Parameter	Score
Age	1 pt (if <40yr) or 0.5pt (if >40yr)
Sex	1 pt (if M) or 0.5pt (if F)
Rif Pain	0.5 pt
Migration to RIF	0.5 pt
Nausea and vomiting	1 pt
Anorexia	1 pt
Duration of symptoms	1 pt (if <48hr) or 0.5pt (if >48yr)
RIF tenderness	1 pt
RIF Rebound tenderness	1 pt
RIF guarding	2 pt
Rovsing Sign	2 pt
Fever	1 pt
Raised WBC	1 pt
Negative urine analysis	1 pt
Maximum Score/ Min Score	15 pt/ 2 pt

The Alvarado score

Signs	Score
Right lower quadrant tenderness	2
Elevated Temperature (>99.1F)	1
Rebound tenderness	1
Symptoms	
Anoxeria	1
Nausea or Vomiting	1
Migration on pain to Right lower quadrant	1
Laboratory Values	
Leukocytosis (>10, 000 WBC)	2
Left Shift (> 75% neutrophils)	1

AIR Score	Score
Vomiting	1
Pain in right lower quadrant	1
Muscular /defence	
Light	1
Medium	2
Strong	3
Body Temperature >38.5^{0}C	1
Polymorphonucleur leucocytes	
70- 84%	1
Equal or more than 85%	2
WBC	
10000- 14999 Cell/ cumm	1
Equal or more than 15000 Cell/ cumm	2
CRP estimation	
10- 49mg/l	1
Equal or more than 50mg/l	2

1) RIPASA SCORE:
2) ALVARADO SCORE:
3) AIR SCORE:

Patient Information Sheet

Study Title:

"DIAGNOSIS OF ACUTE APPENDICITIS IN A TERITIARY CARE HOSPITAL USING PREDICTIVE SCORING SYSTEMS"

Study location: R L Jalappa Hospital and Research Centre attached to Sri DevarajUrs Medical College, Tamaka, Kolar.

Details-

Subject in this study will have to undergo investigations as necessary.

You can ask any question regarding the study. If you agree to participate in the study we will collect information (as per proforma) from you or a person responsible for you or both.

Relevant history will be taken. This information collected will be used only for educational purpose and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.
For further information contact

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