



**Accuracy Score on Raja Isteri Pengiran Anak Saleha (RIPASA) and Pediatric Appendicitis (PAS) for Diagnosing Acute Appendicitis in Children**

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**Abstract**

**Introduction.** Acute appendicitis is the most common case of acute abdomen. Diagnosis of acute appendicitis is still difficult and is one of the problems in the surgical field. The Clinical Scoring System (CSS) has been developed to help doctors classify risk categories. PAS has been widely evaluated in the pediatric population. In another study it was found that RIPASA had better sensitivity, specificity, and accuracy than PAS in pediatric patients.

**Methods.** This study is a cross sectional study to assess the level of concordance between RIPASA and PAS scores in diagnosing acute appendicitis, with the gold standard of Histopathological examination. Samples were taken by consecutive method, in 30 patients aged <18 years for 1 year.

**Results.** This study had an average age of  $10.10 \pm 3.745$  years. Histopathologically early acute appendicitis 3.3%, acute suppurative appendicitis as much as 20%, acute gangrenous appendicitis 73.3% and others 3.3%. Using a cut-off point value of 9.5 for RIPASA and 7 for PAS, the sensitivity, Specificity, Accuracy of 82.75%, 100%, 80% for RIPASA, and 75.8%, 100%, 73.3% for PAS.

**Conclusion.** The RIPASA score on the cut-off threshold 9.5 has better sensitivity and accuracy than PAS in diagnosing acute appendicitis in pediatric patients and can be used as CSS to assist in making decisions regarding the diagnosis of acute appendicitis in children.

**Keyword:** acute appendicitis, pediatric, surgery, accuracy.

## 1. Introduction

Acute appendicitis is the most common case of acute abdomen, 1% of all surgical cases, very rare in infants, the incidence increases with age, with a peak at the age of 10-30 years, the ratio of males compared to females in adolescents is 3:2 and to 1:1 after the age of 25 years.<sup>1</sup> Acute appendicitis is one of the most common surgical emergencies in emergency departments with an incidence of 1.5-1.9 per 1000 population.<sup>2</sup> In children, this incidence is reported to increase at an average rate of 0.5 cases / 100.000 population / year, with a lifetime cumulative incidence of 9.0%.<sup>3</sup> More than 80% of patients undergoing emergency appendectomy are under 40 years of age and more than half are included in the age group of children.<sup>4</sup>

The diagnosis of acute appendicitis is still difficult and is one of the problems in the field of surgery, negative appendectomy rates range from 20 - 35%.<sup>5</sup> So far, acute appendicitis is based on history, physical examination and laboratory examination, namely leukocyte count  $>10,000 / \text{mm}^3$ . And calculate the type of leukocytes with a shift to the left that is an increase in the percentage of neutrophils.<sup>1,6</sup> However, one third of cases (mainly elderly) leukocytes and leukocytes count are within normal limits or elevation of leukocytes and the percentage of neutrophils do not compare directly with the severity of appendicitis.<sup>1,5</sup>

The *Clinical Scoring System* (CSS) has been developed to assist doctors in grouping patients into low, medium or high risk groups for acute appendicitis and to provide appropriate management strategies based on their risk categories. Of these, Alvarado scores and Pediatric Appendicitis (PAS) scores have been widely evaluated in the pediatric population with sensitivity and specificity ranging from 70-100% and 60-90% depending on the chosen cut-off threshold value.<sup>7,8</sup> The RIPASA Score, also known as the Appendicitis Score of the King of Pengiran's Child Saleha's, named after the hospital where it was developed, is the latest CSS. The RIPASA score is reported to have sensitivity, specificity and accuracy of 98%, 81.3% and 91.8%, respectively,

evaluated in populations with an average age of 25 years.<sup>4</sup> In another study it was found that RIPASA had better sensitivity, specificity, and accuracy than Alvarado and pediatric appendicitis scores in pediatric patients under the age of 18 at 96.7%, 84.4%, and 90.9% .<sup>9</sup> even for the negative rate of RIPASA appendectomy had a lower value of 14.7% compared to Alvarado 19.2% and PAS 27.5% .<sup>9</sup>

## **2. Method**

This study is a cross sectional study to assess the level of concordance between RIPASA score and PAS score in diagnosing acute appendicitis, with the gold standard of Histopathological examination. The study population was patients who went for surgery to the Palembang General Hospital Dr. Mohammad Hoesin Palembang and clinically diagnosed with acute appendicitis and undergoing emergency appendectomy surgery. The RIPASA Score research variable was composed of 14 parameters on symptoms and signs, and 1 additional unique parameter in the form of demographic data from patients. Gender, age, symptoms (nausea and vomiting, anorexia, migration pain, RIF pain, duration), signs (RIF tenderness, guarding, rebound tenderness, Roving sign, fever 37-39°C, laboratory results (increased WBC, negative urine analysis). The research variable PAS score is composed of 6 clinical components and 2 laboratory components. (Migration pain, Anorexia, nausea / vomiting, RIF-tenderness, cough / hopping pain, Fever > 38°C, leukocytosis, and shift from neutrophil to the left).

Inclusion Criteria are Children under the age range of 18 years (Law no.35 of 2014, WHO). Patients who present with a diagnosis of acute appendicitis and have a clinical, laboratory and ultrasound examination and undergo appendectomy surgery. Patients are prepared to undergo emergency appendectomy surgery and approve and sign informed consent. Exclusion Criteria are Patients with appendix tissue who did not undergo Histopathological examination for any reason. This research was conducted at the Dr. Mohammad Hoesin Palembang, during the May 2019 - April 2020 Period. Sampling is taken by *consecutive* method by taking all samples that meet the inclusion criteria until the number of samples is met. RIPASA score and PAS score in the form of ordinal data with a score of 0-16 for the RIPASA score and a score of 0-10 for the PAS score,

using SPSS 20 which is then determined by the cut-off point using *ROC analysis*, and this is used as a positive and negative nominal limit for acute appendicitis.

### 3. Results

This study was to assess the suitability of the RIPASA score and the Pediatric Appendicitis Score to diagnose acute appendicitis with the gold standard of Histopathological examination in the Pediatric and Digestive section of the Palembang General Hospital Dr. Mohammad Hoesin Palembang. Research has been carried out from June 2019 to March 2020 in the Emergency Room of Muhammad Hoesin Hospital's sub-section of Pediatric surgery and Digestive Surgery Department of Palembang General Hospital Dr. Mohammad Hoesin Palembang with 30 patients

Patient data collection was performed to calculate RIPASA score and *Pediatric Appendicitis Score* including: History of disease, physical examination, supporting examination then Histopathological examination of appendix tissue of patients undergoing appendectomy

The characteristics of the sex and age of the study sample are shown in Table 1 of 30 respondents found 22 people (73.3%) were male and 8 were female (26.7%).

**Table 1.** Characteristics of pediatric appendicitis patients in the Pediatric Surgery and Digestive Department of Palembang General Hospital Mohammad Hoesin Palembang in 2019-2020.

| <b>Gender</b> | <b>Total</b> | <b>Percentage</b> |
|---------------|--------------|-------------------|
| Male          | 22           | 73.3              |
| Female        | 8            | 26.7              |
| <b>Total</b>  | <b>30</b>    | <b>100.0</b>      |

Based on age, the sample has an age range of 4-17 years, with an average age of  $10.10 \pm 3.745$  years. Most sufferers at the age of 7 years.

To assess whether the RIPASA scoring system can be used as a good tool to predict acute appendicitis, a suitability level test (Kappa value) is performed with a comparison of the Pediatric Appendicitis Score scoring system.

**Table 2.** Compliance level (Kappa score) RIPASA score compared to Pediatric Appendicitis Score.

| <b>Variable</b>                | <b>Pediatric Appendicitis Score <math>\geq 7</math></b> | <b>Pediatric Appendicitis Score <math>&lt; 7</math></b> | <b>Total</b> |
|--------------------------------|---|---|--------------|
| <i>RIPASA</i> Score $\geq 9.5$ | 20  | 4   | 24           |
| <i>RIPASA</i> Score $< 9.5$    | 2   | 4   | 6            |
| <b>Total</b>                   | <b>22</b>   | <b>8</b>  | <b>30</b>    |

The analysis results obtained: Kappa value of 0.444. The results of calculating the level of appropriateness of the Kappa score between the RIPASA score and the Pediatric Appendicitis Score were 0.444 and categorized as Good.

#### 4. Discussion

This study was to assess the suitability of the RIPASA score and *Pediatric Appendicitis* Score to diagnose acute appendicitis with the gold standard of Histopathological examination in the anatomical pathology department at the general central Hospital Dr. Mohammad Hoesin Palembang

Based on the characteristics of the study sample, From 30 respondents found 22 people (73.3%) were male and 8 were female (26.7%). This is not in accordance with the literature of the incidence of appendicitis under 18 years with a ratio of 54.15% for men and 45.85% for women.<sup>10.11.12</sup>

Based on age, the sample has an age range of 4-17 years, with an average age of  $10.10 \pm 3.745$  years. Most sufferers at the age of 7 years, this is in accordance with the highest incidence

literature at age 7-13 years of 56.77% in 7037 patients aged up to 17 years diagnosed with acute appendicitis.<sup>13,14</sup>

Based on RIPASA Score and Pediatric Appendicitis Score, Of the 30 study subjects assessed with RIPASA score, there were 24 patients (80%) RIPASA score  $\geq 9.5$  and RIPASA score  $<9.5$  as many as 6 patients (20%). Assessed based on Pediatric Appendicitis Score, out of 30 study subjects, 22 patients (73.3%) Pediatric Appendicitis Score  $\geq 7$  and Pediatric Appendicitis Score  $<7$  were 8 patients (26.7%).<sup>15,16</sup>

From 30 research subjects who underwent appendectomy surgery, then Histopathological examination obtained early acute appendicitis in only 1 case (3.3%), acute suppurative appendicitis in 6 patients (20%), acute gangrenous appendicitis in 22 patients (73.3 %) and active chronic Ileitis with extensive inflammation in 1 patient (3.3%). This is the same as the study conducted April Hidayat in Mohammad Hoesin Hospital 2014.<sup>17,18,19</sup> and different from the research conducted by Maryam et al. Where the most acute suppurative appendicitis is.<sup>20,21</sup> This can be because patients who come to Mohammad Hoesin Hospital have received treatment in other places beforehand and treatment time is too late.

Based on RIPASA score on the Histopathological results obtained a sensitivity of 82.75%, specificity 100%, accuracy of 80% with a positive predictive value of 100% and a negative predictive value of 16.7%, while based on *the Pediatric Appendicitis Score* on the Histopathological results obtained a sensitivity of 75.8%, 100% specificity, 73.3% accuracy with a positive guess value of 100% and negative predictive value 12.5%.<sup>22,23,25</sup> Based on this study the RIPASA score has better sensitivity and accuracy than the *Pediatric Appendicitis Score* in the appropriateness of the diagnosis of acute appendicitis.<sup>28</sup> This is in accordance with the research of Chong et al.<sup>29</sup>

The level of concordance between RIPASA and *Pediatric Appendicitis Score* obtained 0.444 means that it is a good fit, which means that in predicting acute appendicitis the RIPASA score can be used as well as the Pediatric Appendicitis Score.<sup>30</sup>

This study still has many limitations where the number of samples is limited. A larger number of studies are needed, involving several hospitals and increasing sample criteria in patients suspected of having acute appendicitis early but not undergoing surgery to get better results.

The limitation of the sample is also caused by the fact that this research was conducted at Dr. Mohammad Hoesin General Hospital, a national referral hospital in the southern Sumatra region, so that patients with pediatric appendicitis who are seeking treatment, are pediatric appendicitis patients who cannot be treated in network hospitals, or patients who live around hospitals.

This research is in the form of screening as well as other Clinical Scoring Systems in helping surgeons assess their diagnosis of acute appendicitis.

## **5. Conclusion**

The RIPASA score has better sensitivity and accuracy than PAS in diagnosing acute appendicitis in pediatric patients and can be used as a clinical scoring system to assist in making decisions regarding the diagnosis of acute appendicitis in children.

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