Original Research Article

DIAGNOSTIC ACCURACY OF RIPASA SCORE FOR DIAGNOSING ACUTE APPENDICITIS KEEPING HISTOPATHOLOGY AS GOLD STANDARD

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Abstract: *The objective of the study was to determine the diagnostic accuracy of the RIPASA score in diagnosing acute appendicitis using histopathology as the gold standard. The cross-sectional study was conducted at the General Surgery Department of Lady Reading Hospital, Peshawar, between 17-03-2020 and 16-092020. A total of 171 patients were enrolled in the study. Each patient underwent the RIPASA score, followed by an appendectomy. The appendix specimen obtained during the appendectomy was sent to the laboratory for histopathology. After receiving the histopathology study's objective, which was to determine the report, the results of histopathology, RIPASA score, and other information, including name, age, gender, and age group, were recorded. The age distribution in the sample varied from 15-65 years, with a mean age of 25.8±11.0 years. There were 114 males (66.7%) and 57 females (33.3%). The RIPASA score had a sensitivity of 94.9%, specificity of 64.2%, PPV of 96.7%, NPV of 52.9%, and accuracy of 92.4%. Stratification was also carried out for age and gender. Age 15-25 showed a sensitivity of 94%, specificity of 57.1%, PPV of 97.3%, NPV of 36.3%, and accuracy of 91.9%. Similarly, the age 26-65 group revealed a sensitivity of 97.5%, specificity of 71.4%, PPV of 65.1%, NPV of 83.3%, and accuracy of 93.6%. Stratification by gender showed a sensitivity of 94.2%, specificity of 66.6%, PPV of 97%, NPV of 50%, and accuracy of 92.1% for males, while for females, the sensitivity was 96.1%, specificity was 60%, PPV was 96.1%, NPV was 60%, and accuracy was 92.9%. In conclusion, the study suggests that the RIPASA scoring system is a good choice for doctors in the emergency department to aid in diagnosing acute appendicitis with good sensitivity, albeit with a slightly high profile and specificity, albeit with a bit low profile.*

Keywords: RIPASA Score, Acute Appendicitis, Histopathology

Introduction

General surgeons view the vermiform appendix as a mystery organ since they are unsure of its purpose. Its propensity for inflammation, which causes the clinical illness known as "acute appendicitis," makes it essential in surgery. Fifty percent of the population has acute appendicitis, making it one of the most prevalent surgical emergencies (Butt et al., 2014; Kagwad and Karuppasamy, 2019).

Acute appendicitis (AA) is the most common diagnosis for emergency surgeons globally, accounting for up to 20% of all surgical procedures. It is linked to 10% morbidity and 0.24%–4.0% fatality rates. An acute episode of appendicitis is more commonly linked to people in their second and fourth decades of life (Arroyo-Rangel et al., 2018; Bhangu et al., 2015).

Even though acute appendicitis is a common health issue, it may sometimes be challenging to diagnose, particularly in young people, the elderly, and fertile women. Numerous inflammatory genitourinary and gynecologic disorders can manifest with symptoms like those of acute appendicitis (Sammalkorpi et al., 2014). The clinical history, physical examination, and laboratory tests—such as leukocytosis—are always used to make the diagnosis. (Butt et al., 2014) To obtain a definitive diagnosis, a late appendectomy raises the risk of appendicular perforation and sepsis, which in turn raises morbidity and mortality (perforation 5–40%, abscesses 2-6%, sepsis and death 0.5–5%). In contrast, (Díaz-Barrientos et al., 2018; Sammalkorpi et al., 2014) a

delayed diagnosis of appendicitis leads to harmful or needless appendectomies, which occurs in 20–40% of patients (Sammalkorpi et al., 2014). Although tomographic and ultrasonography imaging are diagnostic tools, not all healthcare institutions have access to them, and they come at a high cost.

Numerous noninvasive, simple-to-use, and replicable scoring methods are available to improve the diagnosis accuracy of appendicitis (Díaz-Barrientos et al., 2018). In addition to laboratory results (leukocytosis), they are employing numerical values for various appendicitis signs and symptoms, such as fever, evidence of peritoneal irritation, nausea, vomiting, and pain localization and migration. Six

Chong CF et al. revealed that the RIPASA score, which was newly established to fit the needs of the Asian population, has a sensitivity of 88% and a specificity of 67% (Chong et al., 2010).

According to a histopathological (HPE) report, 133 of the 144 patients in Kagwad SS et al.'s research had an acute appendicitis diagnosis. The RIPASA scoring system's sensitivity, specificity, PPV, and NPV were determined to be 96.2%, 57.1%, 97.7%, and 44.4%, respectively. The RIPASA score's diagnostic accuracy was 94.3 (Kagwad and Karuppasamy, 2019).

Analytical and observational research was carried out at the Hospital Universitario de Puebla from July 2012 to February 2014. It includes individuals who had surgery at

the Hospital Universitario de Puebla with a suspected diagnosis of acute appendicitis. The ROC curve (area 595), sensitivity (93.3%), specificity (8.3%), PPV (91.8%), and NPV (10.1%) were obtained when the RIPASA score of 8.5 was determined to be the ideal cutoff value (Díaz-Barrientos et al., 2018).

The accuracy of the RIPASA scoring system in diagnosing acute appendicitis was the subject of a recent study. The study aimed to evaluate whether the RIPASA score could be considered a reliable clinical diagnostic tool for this condition, given its various sensitivities and specificities.

Methodology

Following clearance by the hospital's ethical and research committee, patients admitted to the emergency room of Lady Reading Hospital in Peshawar between March 17, 2020, and September 16, 2020, participated in this study.
Both male and female patients in this study, participants with significant right iliac pain ranging in age from 15 to 65 were included.

Patients presenting to the hospital with abdominal discomfort and distension (based on full ultrasound scans); pregnant women (based on medical history); any mass seen in each abdomen (based on ultrasonography) Patients who, based on their medical history, had a history of any pelvic inflammatory illness were excluded from the study. They gave their informed written agreement to be included in the research and to have an appendectomy.

Every patient had a check-up for acute appendicitis, and tests such as an abdominal ultrasound, complete blood count, HBS, HCV, and urinalysis were performed. Each patient had an appendectomy after receiving a RIPASA score. The specimen of the appendix taken during the appendectomy was sent to a lab for histology. Following the receipt of the histology report, all relevant data, such as

name, age, gender, and age group, were entered into a pre-made proforma along with the findings of the Histopathology and RIPASA score. Strict adherence to the exclusion criteria prevented bias in the study's findings.

The statistical program SPSS was used to enter and analyze all the data (version 22) for categorical variables, including age group, RIPASA score, histology, frequency, and %, which were computed. For continuous variables like age and RIPASA score, mean±SD was computed. Histopathology was used as the gold standard to calculate the following metrics: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy using 2x2 tables.

The post-stratification 2x2 table was utilized to compute the diagnostic accuracy, PPV, NPV, sensitivity, and specificity.

Results

The age distribution in the study sample varied from 15-65 years, with a mean age of 25.8±11.0 years. There were 114 males (66.7%) and 57 females (33.3%) (Table 1).

Table 1: Distribution of age and gender of the patients

Parameter	Age (years)	Frequency	Percentage
Age	15-40	76	44.4%
	41-65	95	55.6%
Gender	Male	114	66.7%
	Female	57	33.3%

Table 2: Distribution of patients by RIPASA score

RIPASA score	Number	Percentage
≤ 7	16	09.4
> 7	155	90.6
Total	**171**	**100.0**

Table 3: Diagnostic accuracy of RIPASA score for diagnosing acute appendicitis keeping Histopathology as gold standard

RIPASA Score	Histopathology (Gold Standard)		Total
	Positive	**Negative**	
Positive	149 (TP) a	5 (FP) b	154
Negative	8 (FN) c	9 (TN) d	17
Total	157 a+c	14 b+d	**171**
Sensitivity:	a/a+c x 100		94.9%
Specificity:	d/d+b x 100		64.2%
Positive Predictive Value	a/a+b x 100		96.7%
Negative Predictive Value:	d/c+d x 100		52.9%
Diagnostic accuracy	a+d/a+d+b+c x 100		92.4%

Table 4: Stratification with regard to Age and Gender

Age (Year)	RIPASA score	Histopathology Findings		*P value
		Positive	**Negative**	
15-25	Positive	110	3	P<0.001
	Negative	7	4	
26-65	Positive	39	2	P<0.001
	Negative	01	5	
Gender				
Male	Positive	99	03	P<0.001
	Negative	06	06	
Female	Positive	50	02	
	Negative	02	03	P<0.001
*Chi-square test applied				

The distribution of patients by RIPASA score is shown in table 2. RIPASA score had a sensitivity of 94.9%, specificity of 64.2%, PPV of 96.7%, NPV of 52.9%, and accuracy of 92.4% (Table 3). Stratification for age and gender was also carried out. Age 15-25 showed a sensitivity of 94%, specificity of 57.1%, PPV of 97.3%, NPV of 36.3%, and accuracy of 91.9%. Similarly, age 26-65 revealed a sensitivity of 97.5%, specificity of 71.4%, PPV of 65.1%, NPV of 83.3%, and accuracy of 93.6% (table 4). Stratification for males showed a sensitivity of 94.2%, specificity of 66.6%, PPV of 97%, NPV of 50%, and accuracy of 92.1%, while in females, sensitivity of 96.1%, specificity of 60%, PPV 96.1%, NPV 60% and accuracy 92.9% (Table 5).

Table 5: Diagnostic accuracy of age and gender

Diagnostic accuracy	Age Group		Gender	
	15-25	**26-65**	**Male**	**Female**
Sensitivity	94.0%	97.5%	94.2%	96.1%
Specificity	57.1%	71.4%	66.6%	60.0%
PPV	97.3%	95.1%	97.0Z%	96.1%
NPV	36.3%	83.3%	50.0%	60.0%
Accuracy	91.9%	93.6%	92.1%	92.9%

Discussion

Delayed appendectomy and diagnostic imprecision can make it difficult for surgeons to treat acute appendicitis. This can lead to an increased risk of an appendicular inflammatory mass or appendicular perforation if an appendectomy is not performed in time. Unfortunately, 20% to 30% of appendectomies yield poor results, which is considered unacceptable by many studies (Díaz-Barrientos et al., 2018; Gilmore et al., 1975).

To reduce the negative appendectomy rate and improve diagnostic accuracy, various diagnostic studies, such as computed tomography (CT) and ultrasonography, have been employed at an increased cost. Additionally, diagnostic grading systems such as the Alvarado score and the modified Alvarado score have been created (Antevil et al., 2006). These scoring schemes have strong sensitivity and specificity when used in Western populations, but their accuracy is lower for Asian people. As a result, a more effective scoring system called RIPASA has been developed for Asian populations (Nanjundaiah et al., 2014; Owen et al., 1992).

The RIPASA scoring system consists of 14 fixed criteria that are used to identify acute appendicitis. A thorough medical history, clinical examination, and laboratory tests are used to obtain these clinical data. Each clinical parameter is allocated a score between 0.5 and 2.0, which represents its likelihood of correctly identifying acute appendicitis (Alvarado, 1986; Sammalkorpi et al., 2014).

Our investigation found that the RIPASA score has a sensitivity of 94.9%, specificity of 64.2%, positive predictive value (PPV) of 96.7%, negative predictive value (NPV) of 52.9%, and diagnostic accuracy of 92.4% (Owen et al., 1992). These findings are consistent with studies conducted by Shuaib et al. in 2014 and Chong et al. in 2017. Rathod et al. (Chong et al., 2010) generated a sensitivity of 82.61%, specificity of 88.89%, PPV of 96.61%, NPV of 57.14%, and diagnostic accuracy of 83.91% using the RIPASA score. Additionally, Butt et al., 2014 reported a 96.7% sensitivity, 93.0% specificity, and 95.1% diagnostic accuracy with the RIPASA score (Butt et al., 2014).

Our investigation revealed that 33.3% of cases of acute appendicitis occurred in women, and 66.7% of cases occurred in men.

The main limitation of this study was the smaller sample size. Further studies on a large sample, sex, and age-standardized study population, including long-term follow-up, would emphasize the diagnostic accuracy of RIPASA score for diagnosing acute appendicitis in patients presenting with acute appendicitis in the emergency department of surgery.

Conclusion

Based on the study and its results, we can conclude that the RIPASA scoring system is the best choice for doctors in the Emergency Department when diagnosing acute appendicitis. The system has good sensitivity, although it may lead to some false positives, and its specificity may be slightly lower than desired.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
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Conflict of interest

The authors declared the absence of conflict of interest.

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