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Comparison between modified Alvarado scoring systems and RIPASA scoring systems as diagnostic tool of acute appendicitis

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Abstract
Background: Early detection of acute appendicitis in emergency department is essential in saving lives. Diagnosis of acute appendicitis is difficult needing many screening tests in appropriate validity findings to help the physicians in quick surgical intervention and to avoid false positive cases useless surgical operations.
Aim of study: To compare the validity findings of Modified Alvarado score with validity findings of RIPASA score in diagnosis of acute appendicitis.
Patients and Methods: A prospective cross sectional study conducted in Rozhhalat Emergency Hospital in Erbil city through a period of nine months from 1st of May 2019 to 1st of February 2020 on a sample of 100 acute appendicitis patients. Ultrasonography-fine needle aspiration. All the suspected cases were subjected to a questionnaire which was derived from both Modified Alvarado score and the Raja Isteri Pengiran Anak Saleha Appendicitis score systems simultaneously.
Results: The validity results of Raja Isteri Pengiran Anak Saleha Appendicitis score in comparison to histopathology findings for diagnosis of acute appendicitis were sensitivity (92.2%), specificity (65.2%), positive predictive value (89.9%), negative predictive value (71.4%) and accuracy (86%), while validity findings of Modified Alvarado score comparison to histopathology findings for diagnosis of acute appendicitis were sensitivity (67.5%), specificity (65.2%), positive predictive value (86.7%), negative predictive value (37.5%) and accuracy (67%).
Conclusions: The Raja Isteri Pengiran Anak Saleha Appendicitis score is better than Modified Alvarado score in screening and diagnosis of acute appendicitis in emergency department.

Keywords: acute appendicitis, raja isteri pengiran anak saleha appendicitis score, modified alvarado score

1. Introduction

The acute appendicitis is the most common cause of surgical emergency globally [1]. Acute appendicitis is the first cause of acute abdomen in young adults with life chance of 7% [2] and the appendectomy is the frequent abdominal surgical operation [1, 2]. In spite of this importance of acute appendicitis recently, the exact etiology of acute appendicitis is fully understood till now. The clinical presentations of acute appendicitis are various ranging from simple clinical features to generalized peritonitis [3].

Acute appendicitis diagnosis represented a big outstanding obstacle for physicians in emergency department (ED) as about half of cases are accompanied with atypical symptoms [4]. The histopathology is regarded as the golden diagnostic test for acute appendicitis [5]. Acute appendicitis diagnosis in ED is dependent on clinical history and examination in addition to investigations. The false positive rates of appendectomy all over the world were within range of 20–30% which is acceptable [6]. Delayed surgical treatment increased the validity of diagnosis for acute appendicitis but unfortunately increased rates of many complications such as perforation and sepsis with higher death rates reaching to 0.5-5% [4, 5]. On other hand, late decision regarding appendectomy is accompanied with surgical complications and economic burden [5]. For that, different scoring systems were designed and implemented in ED for early detection of acute appendicitis. The common acute appendicitis scores are Alvarado score, modified Alvarado score, Appendicitis Inflammatory Response score, Pediatric Appendicitis Score and Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score [7].

Alvarado score was firstly designed at 1986 [8]. and it included three components; symptoms, three clinical signs and two laboratory investigations. Modified Alvarado score (MAS) [9]. is the simple version of Alvarado score by exclusion of neutrophil count. The MAS is the common scoring system adopted by physicians in EDs nowadays as it is accompanied by sensitivity in diagnosis of acute appendicitis ranged from 68-82% and specificity of 75-87.9% [4, 10]. The RIPASA score was firstly designed at 2008 for peoples living in Asia and Middle East [4, 11]. RIPASA included fourteen components [12]. It has good sensitivity of 98% and an acceptable specificity of 83%[4,13]. Many authors preferred RIPASA scoring in comparison to Alvarado scoring in EDs [11, 14, 15].

Overcrowding in emergency departments, lack of some laboratory facilities and absence of imaging techniques of Erbil hospitals and need to develop a highly accurate scoring system for early detection of acute appendicitis in emergency department, all of these argued us to develop this study which

aimed to compare the validity findings of Modified Alvarado score with validity findings of RIPASA score in diagnosis of acute appendicitis.

Methodology

In this prospective study, all the cases suspected to have (AA) have been admitted to the Rozhhalat Emergency Hospital in Erbil city, to which all surgical emergencies are referred in the city, all the cases were subjected thoroughly to history taking, clinical examination, laboratory investigations (white blood cell "total and differential") and abdominal ultrasound examination, appendectomy (if needed and decided by the general surgeon), and sending the removed appendix specimens to histopathology.

The collection of these data was achieved over a period of ten months from 1st of May 2019 to 1st of February 2020. The study design was cross sectional (survey) and the sampling method was of convenience type. During the current study, all the cases who were admitted being suspected to have AA, but the patients whose symptoms were relieved medically (without surgery) were excluded from the study. Patients who were diagnosed and operated on for pathology other than AA, then intraoperative findings pointed to inflamed appendix, were discarded from the study. All the suspected cases were subjected to a questionnaire which was derived from both MAS and the RIPASA systems simultaneously. The exclusion criteria were patient less than 18 year old and those who refused to participate in this study.

The ultrasound device was of 5 MHz linear transducers. The radiologist was not informed about results of physical examination and leukocyte count of the cases. The ultrasound criteria only subjected to differentiate the AA from normal cases (or to diagnose other pathology which must be excluded).

All the appendicectomized specimens were labeled by the patient's name with a brief clinical history, fixed in 10% formaldehyde. Analysis of the statistics achieved using Statistical Package for the Social Sciences Software, version 25 (IBM SPSS Statistics, IBM Company, USA). The validity and power of diagnosis of the MAS system and the TZS system was estimated by calculating the sensitivity, specificity, positive predictive value (PPV), and negative predictive values (NPVs). Statistical significance for the difference between the two scoring systems was accepted at the 5% level. This study was submitted to and approved by the Ethics and Scientific committees of Emergency Medicine Council at the Kurdistan Board of Medical Specialties, in addition to formal approval from Rozhhalat Emergency Hospital. An informed form of consent and agreement from all patients has been taken verbally and in written, those patient disagree the consent are excluded from the study. The form of consent will reserve the confidentiality of the patients. The MASS score is having a total score of 9 while the total RIPASA scoring is not consistent and depends on gender and age of the patients. The details of both systems are Shown below:

Table 1: MAS scoring system.

Elements	Score
Migratory right ileac fossa pain	1
Anorexia	1
Nausea and vomiting	1
Tenderness in the right ileac fossa	1
Duration of symptom < 48hrs.	0
Duration of symptom > 48hrs.	0
Rebound tenderness	2
Elevated temperature	1
Leukocytosis	2
Rovsing sign	0
Negative urine analysis	0
Guarding	0
RIF tenderness	0
Total	9

Table 2: RIPASA scoring system.

Elements	**Score**
Age < 40 years	1
Age ≥ 40 years	0.5
Sex, Male	1
Sex, Female	0.5
Migratory right ileac fossa pain	0.5
Anorexia	1
Nausea and vomiting	1
Tenderness in the right ileac fossa	2
Duration of symptom < 48hrs.	1
Duration of symptom > 48hrs.	0.5
Rebound tenderness	1
Elevated temperature	1
Leukocytosis	1
Rovsing sign	2
Negative urine analysis	1
Guarding	1
RIF tenderness	1
Total	16

A score of 7.5 in RIPASA scoring system was considered significant for the diagnosis of acute appendicitis and a score of 7 in MAS scoring system was considered significant.

Results

A. Descriptive data of participants.

In general 100 suspected patients with acute appendicitis included in this study with mean ± S.D age of 31.4 ± 10.97 years. Fifty-three of them were male and the rest 47 of them were females. Among the cases, 73% of them had vomiting, 45% had fever, 67% had anorexia and majority (94%) of them was suffering from RIF pain. Upon examination of the patients by RIPASA method, 79% of the cases were positive in reverse to 60% by MAS technique. The histopathology which is regarded as the golden and confirmatory test revealed 77 positive cases (Table 1).

Table 3: Descriptive data of participants.

Variables	Categories	No. (%)
Gender	Male	53
	Female	47
Vomiting	Yes	73
	No	27
Fever	Yes	45
	No	55
Anorexia	Yes	67
	No	33
RIF pain	Yes	94
	No	6
RIPASA	Positive	79
	Negative	21
MAS	Positive	60
	Negative	40
Histopathology	Positive	77
	Negative	23
Total		100

B. Validity of RIPASA and MAS

The results of Table 2 indicate that RIPASA used as screening test in comparison to histopathology which is the gold standard test. The screening test had sensitivity of 92.2%, specificity of 65.2%, positive predictive value (PPV) of 89.9%, Negative predictive value (NPV) of 71.4% and accuracy rate of 86%.

Table 4: Sensitivity, specificity, PPV and NPV of RIPASA.

		Histopathology		Total
		Positive	Negative	
RIPASA	Positive	71	8	79
	Negative	6	15	21
Total		77	23	100

The findings of Table 3 reveal that MAS had a sensitivity of 67.5% and specificity of 65.2% only, in the same time it provided greater PPV (86.7%) yield than NPV (37.5%) result. It had accuracy rate of 67%.

Table 5: Sensitivity, specificity, PPV and NPV of MAS.

MAS	Histopathology		Total
	Positive	Negative	
Positive	52	8	60
Negative	25	15	40
Total	77	23	100

Discussion

Diagnosis of acute appendicitis is predominantly not easy to acquire due to lack of the pathognomonic signs or symptoms, low predictive values of investigative tests and different clinical presentations. Screening tests with high validity are required to help the clinicians in emergency department in early detection of acute appendicitis [16].

The present study showed that the validity results of RIPASA in diagnosing acute appendicitis in comparison to pathology are sensitivity (92.2%), specificity (65.2%), positive predictive value (89.9%), negative predictive value (71.4%) and accuracy (86%). These findings are close to results of previous Iraqi study [17] included 251 patients with right iliac fossa pain presented to emergency department of Al-Yrmouk Teaching hospital and reported validity findings of RIPASA in diagnosis of acute appendicitis in comparison to pathology as followings; sensitivity (95.8%), specificity (70.49%), positive predictive value (91%) and negative predictive value (84.3%). Karapolat study in Turkey revealed that RIPASA scoring system is accurate and fast diagnostic test of acute appendicitis helping also in prediction of pathological stages without need for computed tomography [18]. Validity results of RIPASA by our study were lower than results of Arroyo-Rangel *et al* [19]. study in Mexico which reported that RIPASA diagnostic validity findings were 98.8% sensitivity and specificity 71.4%. The differences in validity findings are small and might be attributed to variation in sample size between two studies. Despite good validity findings of RIPASA in detection of acute appendicitis, low specificity of this test was clear and this needs further investigations to confirm the diagnosis. This finding is similar to results of Singh *et al* [20]. study in India which revealed sensitivity of 95.8% and specificity of 75.9% for RIAPASA in diagnosis of acute appendicitis and documented need for other tests in confirmation. However, in remote areas, the RIPASA is considered as best tool in diagnosis of acute appendicitis [19, 20].

Current study showed validity findings for MAS in diagnosis of acute appendicitis in comparison to pathology are sensitivity (67.5%), specificity (65.2%), positive predictive value (86.7%), negative predictive value (37.5%) and accuracy (67%). These validity findings are lower than results of Mahomood and Garota study in Erbil[21] which found that MAS had sensitivity (94.1%), specificity (92.8%), positive predictive value (98.7%) and negative predictive value (72.35%). This difference in validity findings of RIAPASA between two studies might be attributed to variance of MAS interpretation by physicians in addition to difference of cases presented to ED from cases admitted to Surgical Wards in addition to fact that this previous study in Erbil compared thar MAS to Tzanakis score [21]. However, our study findings regarding MAS validity in diagnosis of acute appendicitis are also lower than results of Khola *et al* [22]. study in Egypt which revealed sensitivity of 93.3% and specificity of 52.9% for MAS in diagnosis of acute appendicitis.

The interesting finding of current study was the higher validity findings of RIPASA in comparison to validity findings of MAS in diagnosis of acute appendicitis in emergency department. This finding coincides with results of many literatures like Chong *et al* [12]. study in Brunei, Karami *et al* [23]. study in Iran and Díaz-Barrientos *et al* [15]. study in Mexico. Shuaib *et al* [14]. study in Kuwait stated that RIPASA score is more sensitive and specific than modified Alvarado score especially in Asian population. Another study conducted in India by Soundharya *et al* [24]. also found that RIPASA is better than MAS statistically and clinically in diagnosis of acute appendicitis.

In conclusion, the Raja Isteri Pengiran Anak Saleha Appendicitis score is better than Modified Alvarado score in screening and diagnosis of acute appendicitis in emergency department. Training workshops and seminars regarding RIPASA and MAS are needed to develop the skills of resident doctors in emergency department in addition to adding of these tests in curriculum of schools of Medicine.

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Conflict of interest
Declared none.

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