COMPARISON OF RIPASA AND ALVARADO SCORING SYSTEM IN ACUTE APPENDICITIS- A DESCRIPTIVE STUDY

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ABSTRACT

BACKGROUND

Acute appendicitis is the most common cause of an acute abdomen requiring surgery with a lifetime risk of about 7%. Even with recent advances in imaging modalities, considerable morbidity continues to be associated with appendicitis. Diagnostic delay leads to perforation and other complications increasing the morbidity. Scoring systems were introduced to reduce the rate of negative appendicectomy. Alvarado designed a 10-point clinical scoring system, where a score of ≥ 7 warrants appendicectomy. Recently, RIPASA scoring system was implemented to overcome the problems with Alvarado scoring system based on 14 fixed clinical parameters, where a score of ≥ 7.5 warrants a surgical intervention.

Our study compares the Alvarado and RIPASA scoring system in diagnosing acute appendicitis and correlate with histopathological findings.

MATERIALS AND METHODS

The descriptive study with patients who presented to our Emergency/ General Surgery Department from January 2016 to October 2016 with right iliac fossa pain and who were suspected of acute appendicitis were considered for the study. Of them, hundred patients who satisfied our inclusion criteria were enrolled in our study. A detailed history, clinical examination and laboratory investigations were done for all. Scores were obtained for all the patients using both the Alvarado and RIPASA scoring systems. All the patients underwent appendicectomy. Histopathological diagnosis was considered as gold standard. Sensitivity, specificity, positive predictive value and negative predictive value for both these scorings were calculated and analysed comparatively with a Chi-square test.

RESULTS

Out of 100 patients, 57 were male and 43 were female. Both the scoring system were obtained and correlated with histopathological findings. As per Alvarado scoring, 58 patients had a score of ≥ 7 and 42 patients had a score of < 7. On applying the RIPASA scoring system, 73 patients had a score of ≥ 7.5 and 27 patients had a score of < 7.5. The specimens of all the hundred patients were examined, of which 74 showed features of acute appendicitis histopathologically. The sensitivity of Alvarado and RIPASA was 68.92% and 91.89% respectively. The diagnostic accuracy was 70% by Alvarado compared to 89% by RIPASA. The negative appendectomy rate by Alvarado scoring was 12.06% and 6.85% by RIPASA.

CONCLUSION

Our study concluded that RIPASA score is a simple and rapid system with higher sensitivity compared to the Alvarado score. The NPV (Negative Predictive Value) and diagnostic accuracy was also higher with RIPASA scoring system in our study population. Hence, RIPASA scoring system is better than Alvarado scoring system in establishing the diagnosis of acute appendicitis.

KEYWORDS

Acute Appendicitis - Alvarado Scoring System - RIPASA Scoring System.

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BACKGROUND

Appendix is a diverticulum arising from the caecum approximately 2 cm below the ileocaecal junction. The length varies from 2 to 20 cm with an average length of 9 cm. The most common position is retrocaecal (65%).[1] Acute appendicitis is the most common cause of an acute abdomen requiring surgery with a lifetime risk of about 7%.[2] It is also the most common indication in emergency abdominal surgery comprising about 10%.[3] Appendicitis is most common in the second decade of life and is slightly more common in males than in females.[4] The incidence is 1.4 times increased in men than in women.[5]

The diagnosis of acute appendicitis depends mostly on the presenting symptoms and clinical examination findings. The confirmative diagnosis of appendicitis is done only by histopathological examination, which is impossible before surgery. So, it is very important to diagnose acute appendicitis at the time of presentation to reduce the post-operative morbidity and mortality.

A delay in the diagnosis of acute appendicitis may lead to complications like appendicular perforation, which increases the morbidity and mortality especially in infants and

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elderly.[4] Although, the overall mortality is less than 1%, the incidence ranges between 5% and 15% in elderly and infants respectively.[6]

Symptoms of appendicitis overlap with a number of other conditions making diagnosis a challenge, particularly in children.[7] Clinical conditions that mimic appendicitis may delay the diagnosis. The incidence of misdiagnosis rates were higher in females than males.[8] In females pelvic inflammatory disease, torsion ovarian cyst and sometimes ectopic pregnancy may mimic appendicitis.

So a definite systematic evaluation for diagnosing a patient with acute appendicitis is required. Alvarado designed a 10-point clinical scoring system with the pneumonic MANTRELS for the diagnosis of acute appendicitis in 1986 [Table 1]. It was based on symptoms, clinical signs and laboratory values in patients presenting with the suspicion of acute appendicitis.[9] Although used for more than two decades, this scoring system is not completely reliable.

A recent clinical policy documented from the American College of Emergency Physicians review states that the Alvarado score can be used to 'rule out' appendicitis at a score below five points (sensitivity 94% to 99%), but not as a 'rule in' for appendicitis.[10]

In 2010, RIPASA scoring system was introduced [Table 2]. The Raja Isteri Pengiran Anak Saleha Appendicitis [RIPASA] score is a simple qualitative scoring system based on a 14 fixed clinical parameters (two demographics, five clinical symptoms, five clinical signs and two clinical investigations) and one additional parameter (foreign national identity).[3] RIPASA score showed a sensitivity and specificity of 88% and 67% with a diagnostic accuracy of 81%.[11] The sensitivity and specificity of RIPASA score in diagnosing acute appendicitis was equivalent to that achieved with CT scan of abdomen.[12] Hence, RIPASA scoring system reduced the number of CT scans done for appendicitis.

The RIPASA score is simple and easy to calculate. The 14 clinical parameters can be easily obtained with a detailed clinical history and a good clinical examination. Urine analysis included in the scoring system can also be obtained easily. So the final score can be calculated quickly and a rapid diagnosis of acute appendicitis can be made without the need for other investigations and when a score of > 7.5 is obtained we can proceed with surgical intervention. The 14 fixed clinical parameters are general to all populations and hence the RIPASA score can be applied in any country.[3]

The aim of study was to compare RIPASA and Alvarado scoring in diagnosing acute appendicitis and also to correlate with intraoperative and histopathological findings.

MATERIALS AND METHODS

The descriptive study with patients who presented to our Emergency/ General Surgery Department from January 2016 to October 2016 with right iliac fossa pain and who were suspected of acute appendicitis were considered for the study. Patients of all age groups admitted with complaints of right iliac fossa pain with clinical suspicion of acute appendicitis were included. Patients with pain in the right iliac fossa for more than 5 days who were suspected to have appendicular mass, patients with features of generalised peritonitis, patients with previous history of renal or ureteric stones and patients with pelvic inflammatory disease were excluded.

Hundred patients with clinical suspicion of acute appendicitis were enrolled into the study. Once the patient satisfies the inclusion criteria, a detailed history, clinical examination and laboratory investigations were done, which included routine haematological investigations, urine routine, x-ray KUB and USG abdomen and pelvis was done in for all.

Proforma for the two scoring systems were filled in for each patient. One proforma had general information about the patient with the eight variables of the Alvarado scoring system and the other proforma had similar patient details with the fourteen variables of RIPASA scoring system. The Alvarado score and RIPASA score were noted independently. After obtaining a proper informed and written consent for surgery, all the patients underwent appendicectomy.

The diagnosis of acute appendicitis was confirmed by intraoperative findings and also by histopathological assessment of the appendicectomy specimen. The presence of polymorphonuclear leucocytes throughout the thickness of the appendicular wall was the ultimate criteria for the final diagnosis of acute appendicitis histopathologically. Sensitivity, specificity, positive predictive value and negative predictive value for both these scorings were calculated and analysed comparatively with a Chi-square test (SPSS Software v 17.0).

RESULTS

Of the hundred patients included in the study, the age of the patients varied from minimum of 13 years to a maximum of 71 years [Table 3]. More number of patients were in the age group of 20 to 40 years of age with a mean age of 32.16. Among the 100 patients, 57 were male and 43 were female with a male-to-female ratio of 1.33: 1.

Based on symptoms, all the 100 patients had right iliac fossa pain. Anorexia was the next predominant symptom present in about 81 patients. Fever was present in 52 patients. Nausea and vomiting was present in 63 patients and migratory pain to the right iliac fossa was present in 56 patients only. 40 patients presented to us within 48 hours of onset of symptoms [Table 4].

Regarding signs, right iliac fossa tenderness was present in all the patients with rebound tenderness in 76 patients, guarding in 47 patients and a positive Rovsing's sign only in 24 patients. Elevated white blood cell count was observed in 51 patients and a normal urine microscopy was present in 87 patients [Table 5].

As per Alvarado scoring, 58 patients had a score of ≥ 7 and 42 patients had a score of < 7. On applying the RIPASA scoring system 73 patients had a score of ≥ 7.5 and 27 patients had a score of < 7.5. The intra-operative details were noted which showed an inflamed appendix in 89 patients, perforated appendix and gangrenous appendix in 8 and 3 patients respectively. The mean hospital stay was 4.3 ± 2 days.

The specimens of all the hundred patients were examined, of which 74 showed features of acute appendicitis and 26 were found to be normal histopathologically.

According to Alvarado scoring system, 58 patients were diagnosed to have acute appendicitis. Of these 51 patients had histological evidence of acute appendicitis. Seven patients who had an Alvarado score of more than 7 had no

evidence of appendicitis histologically. Of the 42 patients with Alvarado score less than 7, twenty three patients who had features of acute appendicitis in the specimen were missed by this scoring system [Table 6]. The sensitivity of this scoring system in the study was 68.92% (57.1% - 79.17%), specificity was 73.08% (52.21% - 88.43%). The positive predictive value was 87.93% (79.16% - 93.32%) and the negative predictive value was 45.25% (35.37% - 55.5%). The diagnostic accuracy was 70% (60.02% - 78.76%). The negative appendicectomy rate was 12.06%.

According to RIPASA scoring system, 73 patients were diagnosed to have acute appendicitis. Of these 68 patients had histological evidence of acute appendicitis [Table 7]. Five patients with a RIPASA score of more than or equal to 7.5 had a histologically normal appendix. Of the 27 patients with RIPASA score less than 7.5, only six patients who had histological evidence of acute appendicitis in the specimen were missed by this scoring system. The sensitivity of this scoring system in the study was 91.89% (83.18% - 96.97%), specificity was 80.77% (60.65% - 93.45%). The positive predictive value was 93.15% (86.05% - 96.77%) and the negative predictive value was 77.78% (61.38% - 88.52%). The diagnostic accuracy was 89% (81.17% - 94.38%). The negative appendicectomy rate was 6.85%.

On analysing the Cross Table 8 by Fisher's exact test, there is a definitive agreement that the two scoring systems are correlating positively with each other with respect to the diagnosis of the disease with p-value of 0.0031.

Symptoms	Score
M= Migratory RIF pain	1
A= Anorexia	1
N= Nausea, vomiting	1
T= RIF tenderness	2
R= Rebound tenderness	1
E= Elevated temperature	1
L= Leucocytosis	2
S= Shift to left (neutrophilia)	1
Total	**10**

Table 1. Alvarado Scoring System

Parameter		Score
Gender	Male	1.0
	Female	0.5
Age	< 39.9 years	1.0
	> 40.0 years	0.5
RIF pain		0.5
Migratory RIF pain		0.5
Anorexia		1.0
Nausea and vomiting		1.0
Duration of Symptoms	< 48 hours	1.0
	< 48 hours	0.5
RIF Tenderness		1.0
Guarding		2.0
Rebound Tenderness		1.0
Rovsing's Sign		2.0
Fever		1.0
Raised WBC Count		1.0
Negative Urine Analysis		1.0
Foreign NRIC		1.0

Table 2. RIPASA Scoring System

AGE (Years)	Total
< 20	14
21 – 40	63
41 – 60	18
> 60	5

Table 3. Age Distribution

Symptoms	Frequency	Percentage
Right iliac fossa pain	100	100
Anorexia	81	81
Fever	52	52
Nausea and vomiting	63	63
Migratory pain	56	56
Duration < 48 hours	40	40

Table 4. Symptom Distribution

Signs	Frequency	Percentage
RIF Tenderness	100	100
Rebound Tenderness	76	76
Guarding	42	42
Rovsing's Sign	24	24

Table 5. Signs Distribution

	Positive Histology	Negative Histology	Total
Alvarado > 7	51	7	58
Alvarado < 7	23	19	42
Total	**74**	**26**	**100**

Table 6. Alvarado Score and Histopathology

	Positive Histology	Negative Histology	Total
RIPASA > 7.5	68	5	73
RIPASA < 7.5	6	21	27
Total	74	26	**100**

Table 7. RIPASA Score and Histopathology

	RIPASA > 7.5	RIPASA < 7.5	Total
Alvarado > 7	49	9	58
Alvarado <7	24	18	42
Total	**73**	**27**	**100**

Table 8. Qualitative Analysis of both Scoring Systems

(P value- 0.0031)

Statistical Analysis	Alvarado	RIPASA
Sensitivity	68.92%	91.89%
Specificity	73.08%	80.77%
Positive predictive value	87.93%	93.15%
Negative predictive value	45.25%	77.78%
Diagnostic accuracy	70.00%	89.00%
Negative appendicectomy rate	12.06%	6.85%

Table 9. Comparison between Alvarado and RIPASA Scoring with Respect to Different Variables

DISCUSSION

Acute appendicitis is the most common surgical emergency encountered in call duties accounting for 10% of all emergency abdominal surgeries.[3] It is also the most common emergency surgical condition in the age group of less than 30 years in the world.[13] The diagnostic accuracy of clinical assessment of acute appendicitis varies from 50% - 80%.[14] In children, elderly and in women of reproductive age group

the clinical diagnosis is especially difficult. Hence, we have to rule out the conditions which mimic appendicitis.[7,8]

Radiological methods such as ultrasonography and computed tomography are methods that have been investigated. CECT scan of abdomen is an investigation, which has a high sensitivity and specificity in diagnosing acute appendicitis and its complications. But this investigation cannot be affordable and feasible for every patient with right iliac fossa pain in countries with limited resources.[15,16]

Appendicitis is still a diagnostic challenge for even experienced surgeons. Many investigations have been done in the past trying to reduce the removal of a normal appendix without increasing the rate of complications of appendicitis like perforation and abscess formation. Many diagnostic scores advocated earlier are complex and difficult to implement in a clinical scenario.

The Alvarado score is a simple scoring system first described in 1986. The Alvarado criterion for the diagnosis of acute appendicitis was later modified to accommodate additional parameters along with original Alvarado scoring system.[9] Since then, the modified Alvarado scoring system has been the most widely used scoring system for acute appendicitis. Studies done recently showed poor results in diagnostic accuracy of Alvarado scoring system in Asian populations when compared to western literature.

This led to the development of a newer scoring system in 2010 by Chong et al called RIPASA scoring that included 14 fixed parameters.[11] Data showed a significantly increased accuracy in diagnosing acute appendicitis and was claimed to have better outcomes in the Asian populations. Their study compared the Alvarado scoring with the newer RIPASA scoring in local population group with respect to correlation between the scores and histopathological findings.[11,17]

Our study group had 100 cases of acute appendicitis based on clinical suspicion alone with more number of patients in the age group of 20 to 40 years. There were 57 males and 43 females in the study population. All patients underwent surgery and the intra-operative parameters were noted. Histopathological examination was considered the gold standard for confirmation of the diagnosis. According to histopathological examination, 74 patients were in the appendicitis group and 26 were in the no appendicitis group.

On applying Alvarado scoring system in the study group, 58% of cases had a score of ≥ 7 and 42% had a score of < 7. On comparing with the histopathological analysis in this study, the sensitivity was 68.92%, specificity was 73.08% with a positive and negative predictive value of 87.93% and 45.25% respectively. The diagnostic accuracy was 70%. The negative appendicectomy rate was 12.06%. Regar MK et al reported a sensitivity and specificity of 67.37% and 80% respectively. The positive and negative predictive values of Alvarado score were 98.46% and 11.43%. Negative appendicectomy rate in that study was 1.54%.[18] The sensitivity in our study was 68.92% which was almost comparable with the quoted study, specificity being 7% lower in our study with the quoted study.

Jawaid et al, Dey S et al, Baidya et al and Chan et al concluded that the sensitivity, specificity, positive predictive value and negative predictive value of Alvarado scoring system ranged from 59% to 89%, 23% to 70%, 77% to 98% and 69.8% to 98% respectively.[19,20,21] When the RIPASA scoring system was applied, 73 patients had a score of ≥ 7.5 and 27 had a score of < 7.5. On histopathological analysis the sensitivity of our study was 91.89%, specificity was 80.77%, positive and negative predictive values were 93.15% and 77.78% respectively. Negative appendicectomy rate was 6.85% and diagnostic accuracy was 89%. Chong et al found a sensitivity and specificity of 88% and 67% respectively with a positive and negative predictive value of 93% and 53% respectively. A diagnostic accuracy of 81% was obtained.[11]

Thus, in our study the Alvarado score failed to diagnose 54.7% of patients (n= 23) with acute appendicitis and wrongly classified them in the low-probability group (Alvarado score < 7.0). The RIPASA score was more sensitive and specific compared to the Alvarado scoring system. The difference in diagnostic accuracy was 19% between the Alvarado score and RIPASA score, indicating that the RIPASA score is a much better diagnostic tool for diagnosing acute appendicitis in our patient population.

At the same time patients who were classified as low-probability of having acute appendicitis (i.e. true negative group with RIPASA score < 7.5 and Alvarado score < 7.0), the RIPASA score again outperformed the Alvarado score by correctly diagnosing 77.78% of patients who did not have acute appendicitis compared with the Alvarado score, which correctly diagnosed in only 45.25%.

The RIPASA score is a simple, good and rapid diagnostic tool in acute appendicitis, especially in the emergency situation as it requires only the patient's demographics (age, gender), a detailed clinical history (RIF pain, migratory pain to RIF, anorexia, nausea and vomiting), clinical examination (fever, RIF tenderness, guarding, rebound tenderness and Rovsing's sign) and two simple investigations (elevated white blood cell count and negative urine analysis).

Thus, a quick decision making can be made on examining the patients with right iliac fossa pain in the emergency setting. A RIPASA score of > 7.5 needs admission and further surgical intervention, while patients with a RIPASA score <7.5 can be put on conservative management and observed.

The RIPASA score has a high sensitivity (91.89%) and NPV (77.78%), which can reduce the unwarranted radiological investigations like a CT imaging which is also expensive.[22,23,24]

CONCLUSION

Our study concluded that RIPASA score is a simple and rapid system with higher sensitivity compared to the Alvarado score. The NPV and diagnostic accuracy was also higher in RIPASA scoring system in our study population. With a detailed history, clinical examination and two simple investigations, all the 14 fixed parameters can be easily obtained in any population. For medical professionals in a rural setup, RIPASA score can help in making a quick decision whether to proceed with surgery or to put on conservative management.

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