Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

The Prospective Study to Evaluate the Efficacy of ALVARADO Score and RIPASA Score in Diagnosis of Acute Appendicitis and Correlation with Histo-Pathological Findings.

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Received: February 2018
Accepted: March 2018

ABSTRACT

Background: Acute abdomen is one of the most common surgical emergencies with the life time risk of 7%. The diagnosis of appendicitis is challenging due to overlapping of symptoms with other diseases and variable accuracy of clinical examination. The present study was carried out to diagnose acute appendicitis and its complications, to compare ALVARADO and RIPASA scoring systems and correlating these with intra-operative and histopathological findings. **Methods:** This prospective study of 100 patients was conducted in Department of Surgery admitted in Muzaffarnagar Medical College and Hospital, Muzaffarnagar. Any patients irrespective of sex admitted with age more than 13 yrs presented with right iliac fossa pain suspected to be acute appendicitis and underwent appendectomy. Diagnosis of acute appendicitis was confirmed by operative findings and histological assessment of the appendectomy specimen. In every clinically diagnosed case, ALVARADO and RIPASA scoring systems were applied. Patients were monitored following admission, surgery and till discharge from the hospital. Intra-operative findings such as length of appendix, site of appendix, presence of gangrene or nor, free fluid present or not, presence of fecolith or not, base of caecum evaluated. Histopathologic findings of operated case were collected and correlated with either scores. **Results:** Out of 100 patients 64% were males and 36% were females. When Alvarado score applied in the study group; 55 patients were in > 7 group and 45 patients in < 7 group. When correlate with histopathology, 90% patients fall into acute appendicitis group and 10% in nonappendicitis group. RIPASA score revealed that there were 89% patients in high probability of acute appendicitis, while 11% were in low probability. When correlate with histopathology 90% fall into appendicitis group and 10% in non-appendicitis group. **Conclusion:** In the study we conclude that for the diagnosis of appendicitis both ALVARADO and RIPASA scoring systems were equally good. However, RIPASA score is a useful rapid diagnostic tool for establishing a quick decision in patients with RIF pain. Moreover, it also reduces the cost of expensive radiological investigations and thus making a more cost effective approach for patients belonging to lower socioeconomic group.

Keywords: ALVARADO score, RIPASA, Acute appendicitis, Histo-pathological findings.

INTRODUCTION

Acute abdomen is one of the most common surgical emergencies faced by general surgeons worldwide. It is one of the most common causes of abdominal pain requiring emergency surgery with the life time risk of 7%.[1] The peak incidence occurring between 10-30 years.[2] It is 1.5-1.9 per 100 in male and female population and approximately 1.4 times more common in male than in female.[3]

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Though it is a common problem, surgeons and radiologists remain in dilemma particularly among young, elderly and females in reproductive age due to nonspecific symptoms, duration of symptoms and exact position of appendix in abdomen.

The diagnosis of appendicitis is based on clinical history, examination and elevated WBC count.[4] Accuracy of clinical examination ranged from 71% to 97% due to nonspecific symptoms and overlap with various other diseases.[5] Opinion varies as to whether imaging modalities should be performed in all patients with selected patients with atypical or confusing clinical presentation.[6]

Diagnostic accuracy specially in patients with atypical symptoms can be improved by

ultrasonography and computed tomography imaging. Graded compression sonography has been shown to be useful examination because of techniques safety and high accuracy (approximately 90%) but it is non-sensitive for perforated appendix.[7] CT scan has 99% specificity and sensitivity.

However, these modalities are costly and may not be easily available all the time when it is required. Making arrangements for these diagnostic modalities may had to further delays in diagnosis and surgery. A delay more than 36 hours in performing appendectomy increases the risk of perforation and sepsis higher 65%,[8] which in turn increases the morbidity and mortality.

Therefore several scoring systems have been developed to aid in early diagnosis of acute appendicitis so that the rate of negative appendectomies can be reduced to 0-5%.[9] Alvarado scoring system9 developed in 1986 comprising of 8 parameters.

Another scoring system RIPASA 10 developed in 2008 comprising of 15 parameters is a new system designed by Raja Isteri Pengiran Anak Saleha Hospital, Bander Seri Begawan, Brunei Darussalam and has been shown to have significant higher sensitivity, specificity and diagnostic accuracy particularly when applied to Asian population.[10]

Based on these background information, this prospective study has been carried out in our hospital to diagnose acute appendicitis and its complications, to compare both scoring systems and correlating these with intra-operative and histopathological findings, also to decrease the negative appendectomy rate in Western UP population.

MATERIALS AND METHODS

This prospective study of 100 patients, who were suspected of acute appendicitis, attending in OPD, emergency department and admitted in surgery wards, was carried out in the Department of Surgery, Muzaffarnagar Medical College & Hospital, Muzaffarnagar (UP) from March 2016 to August 2017. Institutional ethical clearance was obtained prior to the commencement of study. Informed consent was obtained from all the patients.

Inclusion criteria

Any patients irrespective of sex admitted with age more than 13 yrs presented with right iliac fossa pain suspected to be acute appendicitis and underwent appendectomy.

Exclusion criteria

- Children below 13 years of age.
- Patients with Right iliac fossa mass.
- Patients with previous history of urolithiasis.
- Patients with pelvic inflammatory disease.
- Patients who had undergone other emergency laparotomy when appendectomy was also performed as a part of procedure.
- Patients undergoing interval appendectomies after conservative management.
- Pregnant females.

The formula for sample size for value mean is (1.96 X SD/D)2
SD- Standard deviation-2
D- Allowable error-1
Mean score-7
On calculation- sample size = (1.96 X 1.96 X2/1X1)2=64.

Alvarado score

CHARACTERISTICS	SCORE
M= Migration of pain to the right lower quadrant	1
A= anorexia	1
N= Nausea	1
T= Tenderness in the right lower quadrant	2
R= Rebound tenderness	1
E= Elevated temperature	1
L= Leucocytosis	2
S= Shift of WBC to the left	1
TOTAL	10

Interpretation of Alvarado score

SCORE	INTERPRETATION
1-4	Very unlikely, keep under observation
5-6	Acute appendicitis, may be, for regular observation
7-8	Acute appendicitis probable, operate
9-10	Acute appendicitis definite, operate

RIPASA score

Parameter	Score
Sex : Male	1.0
Female	0.5
Age : <39.9 years	1.0
>40 years	0.5
RIF pain	0.5
Migration of RLQ pain	0.5
Anorexia	1.0
Nausea and vomiting	1.0
Duration of symptoms <48 hrs	1.0
>48hrs	0.5
RIF tenderness	1.0
RIF guarding	2.0
Rebound tenderness	1.0
Rovsing's sign	2.0
Fever	1.0
Raised WBC	1.0
Negative urinalysis	1.0
Foreign NRIC	1.0

A thorough clinical history of pain in right lower quadrant or periumbilical region with nausea, vomiting, fever more than 38°C was taken. Physical examination was done tenderness and guarding on RIF were noted. Baseline investigations like Hb,TLC, Shift of WBC's to left, blood urea with serum creatinine, serum electrolytes, urine pregnancy test for females in reproductive age group, ultrasound abdomen, abdomen X ray erect

and supine films, urine analysis were done. Application of ALVARADO and RIPASA scoring done in every clinically diagnosed case.

Alvarado score contained eight parameters whereas RIPASA score contained 15 parameters. Patients were monitored following admission, surgery and till discharge from the hospital. Intra-operative findings such as length of appendix, site of appendix, presence of gangrene or nor, free fluid present or not, presence of fecolith or not, base of caecum evaluated. Histopathologic findings of operated case were collected and correlated with either scores.

RESULTS

A total of 112 patients attending surgical emergency OPD, ward were included. Out of these 12 patients did not give consent and were excluded from the study.

Out of 100 patients, 64 patients were < 40 years of age and 36 patients were ≥ 40 years. The mean age of subjects in study was 32.71 years ranging from 13-76 years. SD was 15.80.

Out of 100 patients 64% were males and 36% were females is shown in [Table 1].

Table 1: Age Distribution

Age (yrs)	Number of patients	Percentage
< 40 yrs	64	64%
≥40 yrs	36	36%
Total	100	100%

Table 2: Sex Distribution.

Age (yrs)	Number of patients	Percentage
Male	64	64%
Female	36	36%
Total	100	100%

Clinical parameters collected shows right iliac fossa pain 100 (100%), Anorexia 82 (82%), nausea and vomiting 74 (74%), fever in 45 (45%), tenderness in RIF 95 (95%), rebound tenderness in 71(71%), guarding in 57 (57%) and rovsing sign 34(34%).

When Alvarado score applied in the study group 55 patients were in > 7 group and 45 patients in < 7 group as shown in table III. So according to this system 55% patients had high probability of acute appendicitis.

When correlate with histopathology, 90% patients fall into acute appendicitis group and 10% in nonappendicitis group as shown in [Table 4].

Table 3: Alvarado Score Groups Frequency Distribution.

Alvarado Score	Number Of Patients	Percentage
≥ 7	55	55%
< 7	45	45%
Total	100	100%

Table 4: Correlation of AS With Histopathology.

Test	Acute Appendicitis (Histopathologically)	Non Appendicitis (Histopathologically)	Total
AS≥7	58 (64.4%)	0 (0%)	Chi square=15.344 DF=1 P<0.001(S)
AS < 7	32(35.6%)	10 (100%)	
Total	90 (100%)	10 (100%)	

RIPASA score when applied to all patients in our study as shown in [Table 5]. So according to this system, there were 89% patients in high probability of acute appendicitis, while 11% were in low probability.

When correlate with histopathology 90% fall into appendicitis group and 10% in non-appendicitis group.

Table 5: RIPASA score groups frequency distribution.

RIPASA score	Number of patients	Percentage
≥7.5	89	89%
<7.5	11	11%
Total	100	100%

Table 6: Correlation of RIPASA Score with Histopathology

	Acute Appendicitis (Histopathology)	Non Appendicitis (Histopathology)	Total
RIPASA Score ≥7.5	87 (96.7%)	4 (40%)	Chi square=35.287 DF=1 P<0.001 (S)
RIPASA Score <7.5	3 (3.3%)	6 (60%)	
Total	90 (100%)	10 (100%)	

Table 7: Comparison of ALVARADO SCORE and RIPASA Score

	ALVARADO SCORE	RIPASA Score
Sensitivity	64.4%	96.7%
Specificity	100%	60%
PPV	100%	95.6%
NPV	23.8%	66.7%
Accuracy	68.0%	93.0%

Table 8: Histopathology Correlation of AS at cut off 6

	Acute Appendicitis (Histopathology)	Non Appendicitis (Histopathology)	Total
AS ≥ 6	78 (86.7%)	1 (10%)	Chi square=31.887
AS< 6	12 (13.3%)	9 (90%)	DF=1
Total	90 (100%)	10 (100%)	P<0.0001 (S)

Table 9: Histopathology Correlation of RIPASA at cut off 8

	Acute Appendicitis (Histopathology)	Non Appendicitis (Histopathology)	Total
RIPASA≥ 8	86 (95.6%)	3 (30%)	Chi square=39.507
RIPASA< 8	4 (4.4%)	7 (70%)	DF=1
Total	90 (100%)	10 (100%)	P<0.0001 (S)

DISCUSSION

Acute appendicitis is one of the most common surgical emergencies worldwide. Though it is common problem it is difficult to diagnosis and delay in diagnosis may lead to increase morbidity and mortality, whereas with reduced diagnostic accuracy, the negative or unnecessary appendectomy rate is increased and this is reported to be approximately 20-40%.[11] Antel et al also considered higher negative appendectomy rate acceptable in order to minimize the incidence of perforation.[12] In our study, negative appendectomy rate for female was 17.64% while for male it was 6.06%. Over all 10% patients had normal appendix.

The mean age in our study was 32.71 years which is slightly higher as compared to the 25.1 years in study by Chong FC et al.[10] Most common symptom in our study was pain in RIF (100%) which is same in other studies.[13,14]

Appendicular perforation was seen in 33 cases. Perforation can occur at any stage but it is usually associated with gangrene. The mean Alvarado score and RIPASA score in patients with appendicular perforation were 7.82 (with SD1.74) and 12.57 (with SD1.97) respectively. Thus the higher RIPASA score correlates with higher chances of perforation. According to Borushok KF et al,[4] eight patients with perforated appendicitis had a mean RIPASA score of 10.2±2.3.

In our study, sensitivity of RIPASA score was found to be more sensitive (96.7%) as compared to Alvarado score (64.4%), while Alvarado score is more specific (100%) as compared to RIPASA score (60%). The positive predictive value of Alvarado score was 100% as compared to RIPASA score which was 95.6%. Negative predictive value of RIPASA score was 66.7% as compared to Alvarado score (23.8%). Accuracy of RIPASA score was 93% as compared to Alvarado score which was 68%. This finding are also supported by many studies as shown in [Table 8 & 9].

Table 10: Showing sensitivity and specificity of Alvarado score.

Studies	Alvarado score sensitivity	Alvarado score specificity
Limpawattanariri C 2011[15]	87.14%	74.34%
Alnjadat et al 2013[16]	73.7%	68.6%
Chong et al 2011[17]	68.3%	87.9%
Schneider C et al 2017[18]	72%	81%
Present study cut off 7	64.4%	100%
Present study cut off 6	86.7%	90%

Table 11: Showing sensitivity and specificity of RIPASA score.

	RIPASA sensitivity	RIPASA specificity
Goel et al(2017)[19]	95.6%	50%
Dominik Aa et al(2015)[20]	88%	9%
M.K.Regar et al(2017)[21]	94.74%	60%
Chong et al(2011)[17]	98%	81.3%
Present study cut off 7.5	96.7%	60%

Table 12: Showing comparison of Alvarado and RIPASA score by other study and our study.

		Chong CF et al[10]	Alnjadat et al[16]	Erdem H et al[22]	REYES-GARCIA, Nallely et al[23]	Present study
Alvarado score	Sensitivity	68.3%	73.7%	82%	89.5%	64.4%
	Specificity	87.9%	68.6%	75%	69.2%	100%
	PPV	86.3%	92%	88%	92.7%	100%
	NPV	71.4%	34.8%	66%	60%	23.8%
	Accuracy	86.5%	74.3%	80%	89%	68%
RIPASA score	Sensitivity	98%	93.2%	100%	91.2%	96.7%
	Specificity	81.3%	61.8%	28%	84.6%	60%
	PPV	85.3%	92.2%	75%	96.3%	95.6%
	NPV	97.4%	64.9%	100%	68.8%	66.7%
	Accuracy	91.8%	91.5%	77%	93%	93%

CONCLUSION

Both the Alvarado and RIPASA scoring systems were equally good to diagnose appendicitis and significantly decrease the negative appendectomy rate. However, RIPASA score is useful rapid diagnostic tool in Asian population as it require only patient's demographics, good clinical history and examination can make a quick decision in patients with RIF pain, > 7.5 score for surgery and < 7.0 can either be observed. It can also help to reduce the use of expensive radiological investigations such as CT imaging and thus further help to reduce the healthcare cost which is necessary in developing countries as most of patients belong to low socioeconomic group.

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How to cite this article: Singla M, Gupta AK, Attarde N, Goel P, Arora N. The Prospective Study to Evaluate the Efficacy of ALVARADO Score and RIPASA Score in Diagnosis of Acute Appendicitis and Correlation with Histo-Pathological Findings. Ann. Int. Med. Den. Res. 2018; 4(3):SG29-SG33.

Source of Support: Nil, **Conflict of Interest:** None declared