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COMBINED USE OF ULTRASONOGRAPHY AND RIPASA SCORE IN ACUTE APPENDICITIS TO REDUCE NEGATIVE APPENDICECTOMY RATE

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ABSTRACT

Introduction: Acute appendicitis is one of the most common acute abdominal surgical emergencies; the diagnosis of which is often challenging. If there is a delay in the diagnosis and prompt action is not taken, it may lead to perforation and other complications. Many scoring systems have been devised for the diagnosis of appendicitis. USG also has gained importance in recent years. **Aims & Objectives:** The aim of this study is to evaluate the use of RIPASA score and USG in the diagnosis to bring down the rate of negative appendicectomies. **Materials & methods:** This is a cross sectional study and was done in 100 patients admitted in Gauhati Medical College & Hospital for a period of 6months. Patients were evaluated using RIPASA score and USG. Decision for surgery was made independent of the score and USG findings and the diagnosis was confirmed by intraoperative and histopathological findings. The results were confirmed by chi square test. A negative appendicectomy was considered when a non-inflamed appendix was removed. **Results:** In our study out of 100 patients, who were operated, 80 patients had appendicitis and 20 were normal according to intraoperative and histopathological findings. RIPASA score >7.5 had a sensitivity and specificity of 81.2% and 60% respectively whereas USG had a sensitivity and specificity of 73% and 55% respectively. **Conclusion:** From this study we conclude that inclusion of USG as a parameter in RIPASA scoring system will be more accurate in the diagnosis of acute appendicitis and in reducing the negative appendicectomy rate.

KEYWORDS: Acute appendicitis, RIPASA score, USG, negative appendicectomy.

INTRODUCTION

Acute appendicitis is one of the most common acute abdominal surgical emergengies which can rapidly progress to gangrenous appendicitis associated with increased morbidity and mortality. Therefore, surgeons resort to an early surgical intervention even when the diagnosis is in doubt. Acute appendicitis is essentially a clinical diagnosis, often which is challenging.

Various investigations are used to assist in the diagnosis including Ultrasonography, scoring systems, computed tomography. USG has been reported to have an accuracy of 71% to 95% but doubts have been raised about the influence of ultrasonography on patient outcomes.

Furthermore, findings at USG should not supercede clinical judgement in patients with a high probability of appendicitis. In 2010, a new scoring system for appendicitis was proposed by the dept. of general surgery in Raja Isteri Pengiran Anak Saleha(RIPAS) Hospital, comprising 14 parameters. This scoring system showed a sensitivity and specificity of 97.5% and 81.8% respectively.

This study aims to compare the accuracy of RIPASA scoring system and ultrasound in the diagnosis of Acute Appendicitis and to compare sensitivity, specificity, positive predictive value, negative predictive value of RIPASA scoring system and USG in the diagnosis of acute appendicitis to reduce negative appendicectomy rate.

MATERIALS AND METHODS

This is a hospital based cross sectional study conducted among 100 patients with a provisional diagnosis of acute appendicitis admitted in surgery department of Gauhati Medical College & Hospital for a period of 6 months. The primary end point of this study was to test the sensitivity, specificity, positive predicitve value and negative predictive value of the RIPASA score and

ultrasound in diagnosing acute appendicitis. Written and informed consent was obtained from all patients prior to inclusion in the study. Inclusion criteria being any patient irrespective of sex with age more than 18 years who presented with right iliac fossa pain suspected to be acute appendicitis. Exclusion criteria included those patients with age less than 18 years, right iliac fossa mass, previous history of urolithiasis, pelvic inflammatory disease.

The algorithm of RIPASA, USG AND HPE was made to decrease the NAR. It was focussed on RIPASA score and its interpretation, imaging findings and diagnosis, histopathological final diagnosis being the gold standard. RIPASA score was calculated from demographic details, clinical symptoms, examination signs and investigations and divided into four categories of score <5, 5-7, 7.5-11 and >12.

Transabdominal USG was performed and appendix was visualised using controlled bowel compression method

and findings were recorded under criteria of luminal diameter, peri-appendiceal inflammation(echogenic fat or bowel wall edema), presence of free fluid, appendicolith and lymphadenopathy. All the post surgical appendicectomy specimens were sent for histopathological examination.

STATISTICAL ANALYSIS
Data was analyzed by descriptive statistics using Statistical Package for Social Sciences (SPSS) 16.0 version. Chi-square test ($\chi2$), Fischer exact test were applied to determine the most accurate imaging factor for diagnosis with estimation of sensitivity, specificity and positive and negative predictive values. The assumed significance level was *P<0.05*. Percentage frequency distribution was also used. ROC curve was applied to assess the cut off value of appendix luminal diameter and RIPASA score to acquire least NAR. McNemar test was used for paired data to establish differences in accuracies among various modalities.

RIPASA SCORE		SCORE	RIPASA SCORING	INTERPRETATION
PATIENT DEMOGRAPHICS	FEMALE	0.5		
	MALE	1	<5	UNLIKELY
	AGE < 39.9 YEARS	1	5 – 7.4	LESS PROBABLE
	AGE > 40 YEARS	0.5	7.5 - 11	HIGHLY PROBABLE
SYMPTOMS	RIF PAIN	0.5	> = 11	DIAGNOSTIC
	PAIN MIGRATION TO RIF	0.5	**B**	
	ANOREXIA	1	HISTOPATHOLOGY CRITERIA	INTERPRETATION
	NAUSEA AND VOMITING	1		
	DURATION OF SYMPTOMS < 48 HOURS	1	REACTIVE LYMPHOID HYPERPLASIA	NORMAL
	DURATION OF SYMPTOMS > 48 HOURS	0.5		
SIGNS	TENDERNESS	1		
	GUARDING	2	RESOLVIONG APPENDIX	CONSERVATIVE MANAGEMENT
	REBOUND TENDERNESS	1		
	ROVSING'S SIGN	2	ACUTE APPENDICITIS	SURGERY
	FEVER > 37 DEGREES CELSIUS	1		
INVESTIGATIONS	LEUCOCYTOSIS	1	ACUTE SUPPURATIVE APPENDICITIS	SURGERY
	NEGATIVE URINE ANALYSIS	1		
A			**C**	

Table-1: (a) – RIPASA score (b) – Its interpretation and (c) – Histopathological categories and interpretation

| Comparing parameter	P Value	Significance
Ripasa score	0.000	High
Luminal diameter	0.000	High
Periappendiceal inflammation	0.000	High
Free fluid	0.024	Yes
Appendiculolith	0.055	No
Complications on imaging	0.010	Yes

RESULTS AND OBSERVATIONS
In our study, 100 cases of acute appendicitis were diagnosed using RIPASA SCORE and ultrasonography and operated. 37 patients were found in the age group of

<20 yrs(37%), 58 patients were found in the age group of 21-40 years(58%), 5 patients were found in the age group of 41 -50 years(5%). In this study 53 patients were male and 47 female.
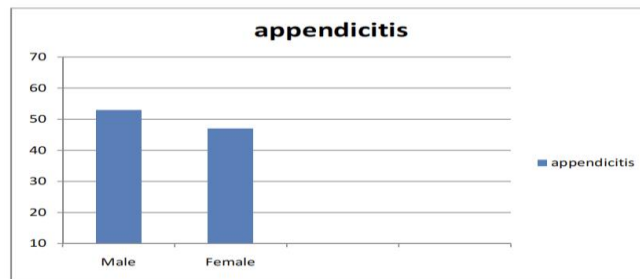
AGE INCIDENCE		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< = 20 YEARS	37	37.0	37.0	37.0
	21 - 40 YEARS	58	58.0	58.0	95.0

41 - 60 YEARS	5	5.0	5.0	100.0
Total	100	100.0	100.0	
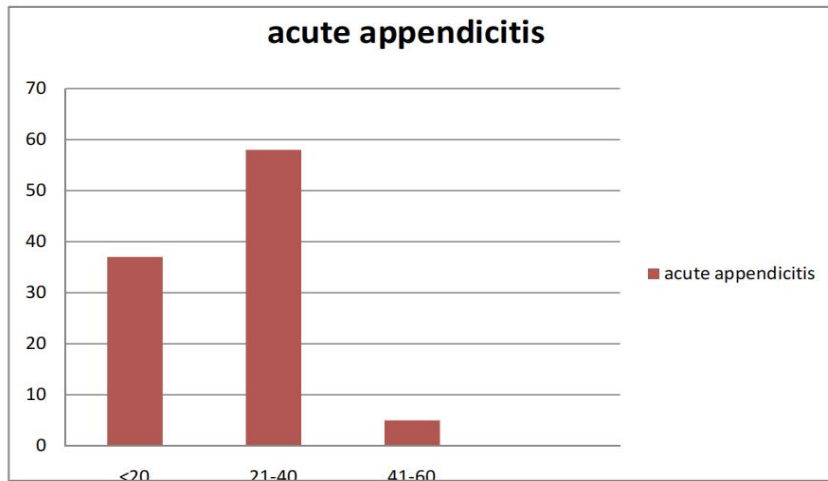
Sex incidence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MALE	53	53.0	53.0	53.0
	FEMALE	47	47.0	47.0	100.0
	Total	100	100.0	100.0	

In this study 53 patients were male and 47 patients were female

According to RIPASA score, out of 100 patients, 73 were diagnosed as having appendicitis and 27 patients were found to be normal and according to Ultrasonography 68 patients were diagnosed as appendicitis and 32 were normal. Histopathological examination showed that out of 100 patients who were diagnosed from RIPASA score and ultrasound, 80 patients were diagnosed as having appendicitis.

FREQUENCY TABLE:

RIPASA SCORE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	> 7.5	73	73.0	73.0	73.0
	< = 7.5	27	27.0	27.0	100.0
	Total	100	100.0	100.0	

ULTRASONOGRAPHY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	APPENDICITIS	68	68.0	68.0	68.0
	NORMAL	32	32.0	32.0	100.0
	Total	100	100.0	100.0	

HISTOPATHOLOGY

|		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	APPENDICITIS	80	80.0	80.0	80.0
	NORMAL	20	20.0	20.0	100.0
	Total	100	100.0	100.0	
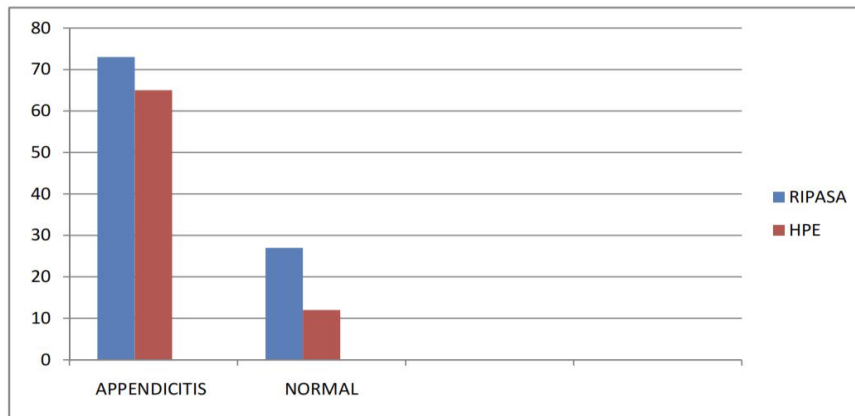
According to this table, 65 % of the patients who are diagnosed to have appendicitis by RIPASA score truly had appendicitis by HPE and 8% of the patients who were diagnosed to have appendicitis by RIPASA score were normal by HPE. This accounted for 89% and 11% of total patients respectively.

USG WITH HPE FINDINGS

			HPE		
			APPENDICITIS	NORMAL	Total
USG	APPENDICITIS	Count	59	9	68
		% within USG	86.8%	13.2%	100.0%
	NORMAL	Count	21	11	32
		% within USG	65.6%	34.4%	100.0%
Total		Count	80	20	100
		% within USG	80.0%	20.0%	100.0%
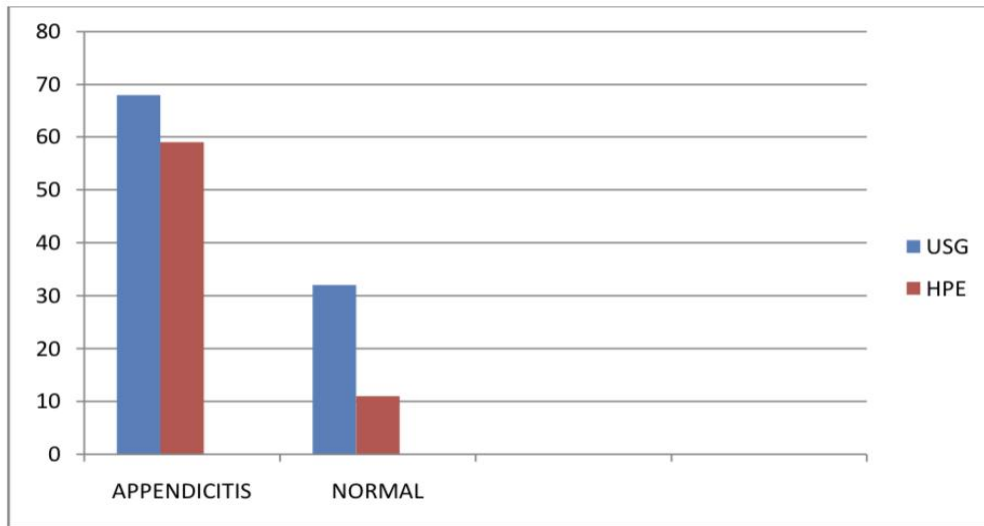
In our study 59 % of the patients who were diagnosed to have appendicitis by USG truly had appendicitis by HPE and 9% of the patients who were diagnosed to have appendicitis in USG were found to be normal in HPE examination. This accounted for 86.8% and 13.2% of total patients respectively.

CHI SQUARE TESTS FOR RIPASA SCORE & USG
In this study analysis of chi square tests of both RIPASA score and USG were at significant level,(p=0.000 and 0.014 respectively).

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	13.813[a]	1	.000		
Continuity Correction[b]	11.799	1	.001		
Likelihood Ratio	12.519	1	.000		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	13.675	1	.000		
N of Valid Cases	100				

|	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.078[a]	1	.014		
Continuity Correction[b]	4.828	1	.028		
Likelihood Ratio	5.743	1	.017		
Fisher's Exact Test				.030	.016
Linear-by-Linear Association	6.017	1	.014		
N of Valid Cases	100				

In this study the **sensitivity** of RIPASA score and USG were **81.25** and **73.75** respectively and **specificity** of RIPASA score and USG were **60%** and **55%** respectively.

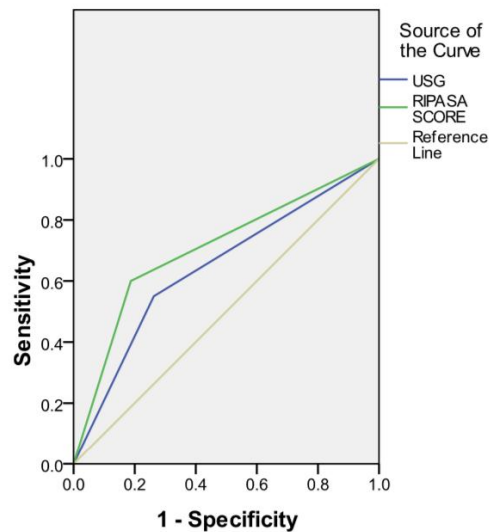|	Sensitivity	Specificity
RIPASA	81.25	60
USG	73.75	55
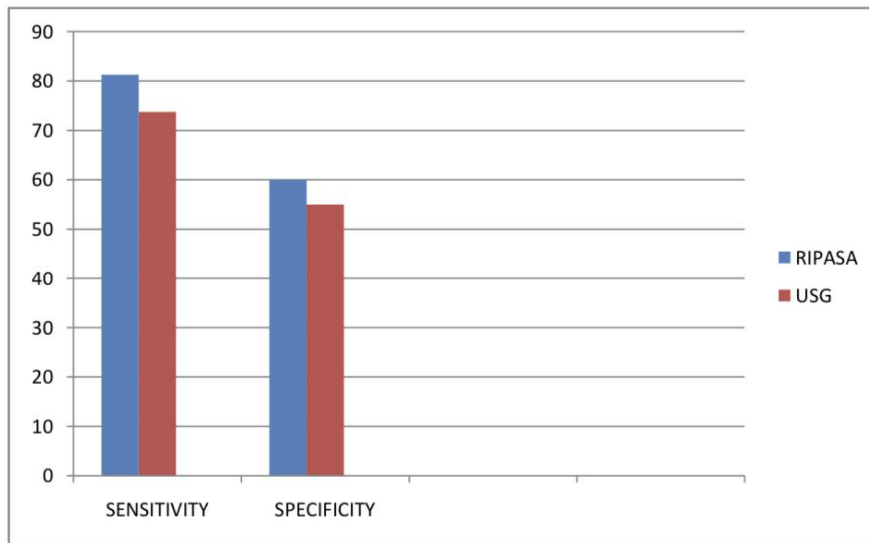
In this study the **PPV** for RIPASA score and USG were **89%** and **86.8%** respectively. **NPV** for RIPASA score and USG were **44.4%** and **34.4%** respectively.

	PPV	NPV
RIPASA SCORE	89%	44.4%
USG	86.8%	34.4%
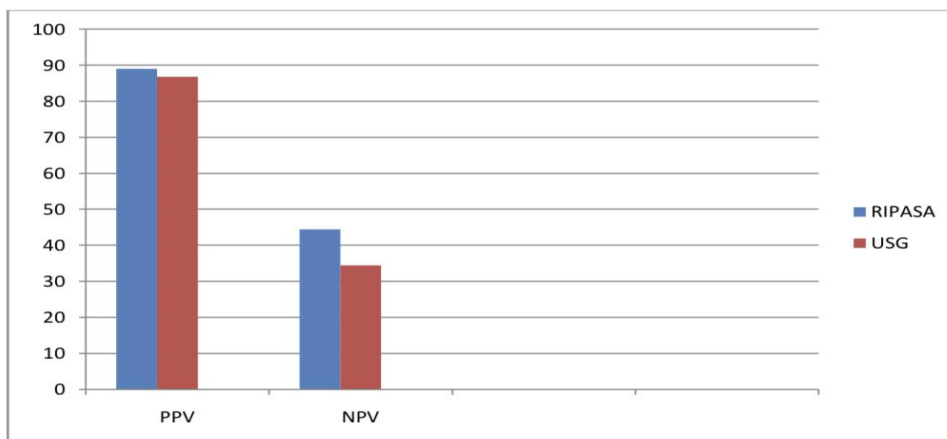
SENSITIVITY & SPECIFICITY OF RIPASA & USG.

	SENSITIVITY	SPECIFICITY
RIPASA+USG	97.4%	88.1%

DISCUSSION

The routine protocol for evaluation of acute appendicitis should begin with RIPASA scoring, assessment of USG findings, combination of clinical radiologic scoring to decide for the management by surgery or non-surgical methods. This leads to the best outcome for the patient. Clinical examination with RIPASA score ≥12, when used alone, was able to diagnose acute appendicitis with 100% accuracy, confirmed by HPE but the rate of complications was high in this group.

In cases with RIPASA score 7-11.5, was the situation where USG criteria when used as an adjunct for diagnosis of appendicitis could accurately diagnose 96.5% of cases that required timely surgery. These two modalities together had a high specificity (88.1%) and sensitivity (97.4%) and a high positive predictive value (90%).

A cross sectional diameter >7 mm, was a reliable indicator for acute appendicitis according to our algorithm with a NAR of 3.1% and without increasing the rate of complications.

In a study by Sachar Sudhir et al[10], the main USG features for diagnosing acute appendicitis were an incompressible appendix with a transverse outer diameter of >7mm. According to the study by Hasan Erdem et al[11], 7mm luminal diameter of appendix with non compressibility and periappendiceal inflammation was the most accurate feature for diagnosis. They also concluded that RIPASA and USG in combination were able to diagnose 88% of the cases showing high diagnostic accuracy. In our study, similar results were obtained with the luminal diameter cut off value for acute appendicitis being 7mm and the diagnostic accuracy of clinicoradiological scoring being 91.5%.

Kessler et al[12], in their study of evaluation US, Doppler US and Laboratory Findings in appendicitis concluded that the most accurate periappendiceal finding of appendicitis was the presence of inflammatory fat changes, with an NPV of 91% and a PPV of 76%. Our study proved similar results with high specificity of 100%.

A study by Mardan et al[13] assessing the role of USG in the management of acute appendicitis showed that the addition of ultrasonography in clinical assessment for acute appendicitis decreases the sensitivity but significantly increases the specificity of the protocol thereby reducing the false positive rate translating into decreased NAR. In the study by Subedi et al[14] who analyzed the NAR by combining RIPASA and USG scoring system came out to be 1.2%. In our study, similar scoring system resulted in NAR of 3.1%. In the study by Chong et al[15], the presence of appendicolith is a surgical indication irrespective of luminal diameter, however in our study presence of appendicolith was not as statistically significant as that of luminal diameter as a prerequisite criteria for surgery.

In the study by Flum et al[16], the USG alone showed a NPV of 91% and a PPV of 76% in diagnosis of acute appendicitis. In our study, using HRUSG alone, the NPV was 92.5% and PPV of 100% in evaluation of acute appendicitis, thereby emphasizing the role of imaging.

Limitations

All suspected cases on USG might not show appendix due to poor acoustic window or non co-operability of patient. USG is an adjunct to clinical and laboratory findings in making decisions regarding surgical or medical management of the patient. Thus positive USG only must not be a pre- requisite for surgery due to false negative results.

Strengths of the study
This study has assessed the specificity, sensitivity, predictive values and accuracy of USG and RIPASA score individually and in combination for diagnosis of acute appendicitis.

This study has used RIPASA scoring system rather than Alvarado or modified Alvarado score as RIPASA has higher diagnostic accuracy for acute appendicitis especially in Asian population.

CONCLUSION
Combination of USG and clinical RIPASA score in the management of acute appendicitis has a major role in reducing negative appendicectomy rate to minimum, reducing complications and better patient outcome. USG has a diagnostic role as well as prognostic role in following up patients on conservative management to assess progression or resolution of disease. It also excludes other conditions as well as appendicitis itself by visualising a normal appearing appendix. It establishes the severity of the disease as well as existing complications like abscess or perforation or mass formation that hinder immediate surgical intervention and call for higher investigation.

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