International Surgery Journal
Lamture YR et al. Int Surg J. 2017 Aug;4(8):2556-2564
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20173211

Original Research Article

Clinico sonological and laboratory co-relation with histopathology of acute appendicitis to develop new diagnostic scoring system (Yash scoring system)

Yashwant R. Lamture[1]*, Harshal Ramteke[1], R. K. Shinde[1], Vinay V. Shahapurkar[1], Varsha P. Gajbhiye[2]

[1]Department of Surgery, Jawaharlal Nehru Medical College Sawangi Meghe, Wardha, Maharashtra, India
[2]Department of Pharmacology, Jawaharlal Nehru Medical College Sawangi Meghe, Wardha, Maharashtra, India

Received: 10 July 2017
Accepted: 13 July 2017

***Correspondence:**
Dr. Yashwant R. Lamture,
E-mail: dryrlamture@yahoo.co.in

ABSTRACT

Background: Of the many scoring systems currently available, the modified Alvarado scoring system (MASS) is the most widely employed, because of its ability to reduce negative appendectomy rate (NAR). Unfortunately, this system is more accurate in western population. In spite of the advances in the diagnostic and imaging techniques NAR have not decreased much. This clearly indicates the need of development of new diagnostic scoring system so we have developed new diagnostic scoring system (Yash Score). The objective of this study was to develop and study diagnostic accuracy of new diagnostic scoring system (Yash scoring system) for acute appendicitis.
Methods: A prospective comparison YSS and MASS was done on 418 patients. Depending on clinical judgement appendicectomy was done. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy for YSS and MASS were calculated using SPSS 17.0 statistical software for statistical analysis and compared using Chi-square test.
Results: The sensitivity and specificity of YSS was found to be 99.48 per cent and 92.86 percent respectively. The sensitivity and specify of MASS was 52.05 per cent and 100 per cent respectively. The positive predictive value and negative predictive value of YSS was 99.48 per cent and 92.86 per cent respectively. Negative and positive predictive values of MASS were 13.02% and 100% respectively.
Conclusions: Comparison in between YSS and MASS in the present study shows significant statistical difference.

Keywords: CRP, Histopathology, MASS, YSS

INTRODUCTION

The classical signs and symptoms of acute appendicitis were first reported by Reginald Haber Fitz (America) in 1886. Since then it has remained the most common diagnosis for hospital admission requiring laparotomies. Approximately 6% of the population will suffer from acute appendicitis during their lifetime; therefore, much effort has been directed toward early diagnosis and intervention. The diagnosis of appendicitis can be difficult, occasionally taxing the diagnostic skills of even for the most experienced surgeon. Equivocal cases usually require inpatient observation. This delay in diagnosis may increase the morbidity and costs.[1] Different techniques have been devised to assist in equivocal cases in attempts to decrease negative appendectomy rates (NAR). A number of scoring systems have been used for aiding in early diagnosis and management of acute appendicitis. Prior to surgery the diagnostic accuracy of acute appendicitis remains

unsatisfactory, ranging from 25 to 90% and being worse in females than in males. Also, a NAR of 20-40% has been documented and many surgeons would accept a rate of 30% as inevitable. Removing a normal appendix is an economic burden on both the patients and health resources. Misdiagnosis and delay in surgery can lead to complications like perforation and finally peritonitis. Difficulties in diagnosis often arise in very young, elderly and female patients of reproductive age because they usually have an atypical presentation. Many conditions may also mimic acute appendicitis. In spite of their shortcomings, scoring systems are invaluable in discriminating acute appendicitis from non-specific abdominal pain. Of the many scoring systems currently available, the Alvarado scoring system is the most widely employed.[2]

A study done by Baidya N et al, reveal Alvarado score is found to be helpful in acute appendicitis.[3] Vandakudri AB et al suggests use of modified Alvarado score can reduce NAR.[4] However, these scoring systems were developed in western countries, and several studies have reported very low sensitivity and specificity in Asian countries.[5,6] Thus, new diagnostic appendicitis scoring system that is more effective is required to develop.

Another one study was carried by Lone NH et al from India.[7] Alvarado score works well in men but not in female with more than seven score.

Although typical cases of acute appendicitis are easy to diagnose but in atypical presentation, it is a difficult job.[8] In spite of the advances in the diagnostic and imaging techniques, NAR have not decreased much. Clinical judgment is still the most important factor in the management of patients with suspected acute appendicitis. The routine use of CT scan or diagnostic laparoscopy for all patients is neither cost-effective nor safe. However, the use of these two diagnostic procedures in selected controversial cases can enhance the accuracy of diagnosis; reduce the cost and NAR.[9]

The author Birchley D, concluded that: 'elements of the disease history, clinical findings and results of laboratory tests are weak individual discriminators of appendicitis.[10] However, in combination, they provide high discriminatory power.' Laboratory tests like white cell count and C-reactive protein are more effective when combined.

A clinical decision to operate leads to the removal of a normal appendix in 15% to 30% of cases. Reductions in the number of "unnecessary" operations should not, however, be achieved at the expense of an increase in the number of perforations.[11]

This clearly indicates the need of new diagnostic scoring system. It is possible to reinforce MASS by adding imaging parameter like USG and inflammatory marker(CRP) and one sign hyperesthesia in Sherren`s triangle to develop new diagnostic scoring system.

METHODS

Prospective observational study conducted in Acharya Vinoba Bhave Rural Hospital Sawangi Meghe, Wardha, (AVBRH), India. Duration of this study January 2012 to January 2017. The source of data for our study is the patients coming to AVBRH

Numbers of cases studied were 418. The inclusion and exclusion criteria were as follows:

Inclusion criteria

- Patients between 15-60 age groups clinically suspected of Acute Appendicitis. All patients were operated by open method (Figure 1).

Exclusion criteria

- Pregnant women
- Patients with right iliac fossa mass
- Patients with previous history of urolithiasis and pelvic inflammatory disease.

The data collected included the patient`s demographics, age and gender, the presenting symptoms (the migration of pain to the RIF, nausea and vomiting, anorexia), clinical signs (RIF tenderness, rebound tenderness, hyperaesthesia in Sherren's triangle and fever), laboratory investigations (white cell count more than 10000 and CRP more than 15mg/dl) and ultrasonography. The inclusion of these 10 parameters was agreed upon by guide and scholar. Parameters of MASS and three more parameters are added to develop new diagnostic scoring system, Yash scoring system (YSS). The probability and odds ratio calculated to allocate scores. Confirmation of acute appendicitis as the final diagnosis was obtained from pathological examination of resected appendix at the department of pathology at AVBRH. The probability and odds ratio for each parameter were derived using logistic regression analysis. The receiver operating curve (ROC) at the optimal cut-off threshold score for YSS and MASS were derived using SPSS 17.0 statistical software. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy at the optimal cut-off threshold score was also derived from the ROC of Yash score (Figure 3 and Table 2). Principal component factor analysis was done. Around 10 sign and symptoms of acute appendicitis fully studied and correlated with histopathology. Weightage of additional parameters was given as per odds ratio, probability, and diagnostic accuracy. Parameters common in both scores have weightage as per MASS.

Ethical approval for the study was obtained from the Ethics Committee Review Board of DMIMS University.

RESULTS

The sensitivity and specificity of Yash score was found to be 99.48 percent and 92.86 percent respectively. The sensitivity and specify of MASS was 52.05 percent and 100 percent respectively. The positive predictive value and negative predictive value of Yash score was 99.48 percent and 92.86 percent respectively. Negative and positive predictive values of MASS were 13.02% and 100% respectively.

Figure 1: Open appendectomy.

Figure shows e/o caecum, appendix and its mesoappendix through the operated wound.

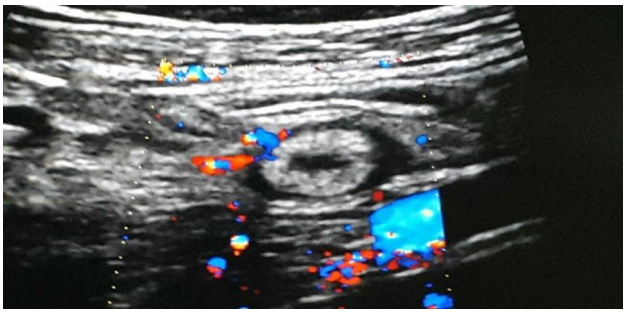

Figure 2: USG transverse section of appendix with Doppler effect.

Doppler effect clearly shows increase vascularity s/o inflammatory process.

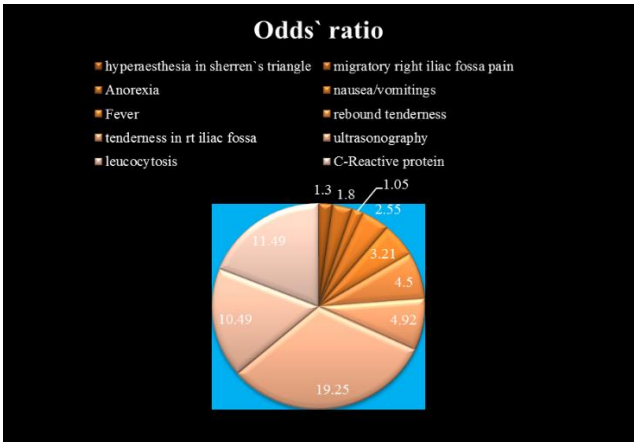

Figure 3: Parameters of Yash score and odds ratio.

USG gives maximum odds ratio followed by CRP and leucocytosis.

Ultrasonography and CRP are more reliable due to high accuracy, odds ratio and probability of USG, C-reactive protein in a present study, score of 4 and 3 were given respectively.

Table 1: Probability in relation with odds ratio.

Probability	Odds ratio
0.001	0.001001
0.01	0.010101
0.15	0.1764706
0.2	0.25
0.25	0.3333333
0.3	0.4285714
0.35	0.5384616
0.4	0.6666667
0.45	0.8181818
0.5	1
0.55	1.222222
0.6	1.5
0.65	1.857143
0.7	2.333333
0.75	3
0.8	4
0.85	5.666667
0.9	9
0.999	999
0.9999	9999

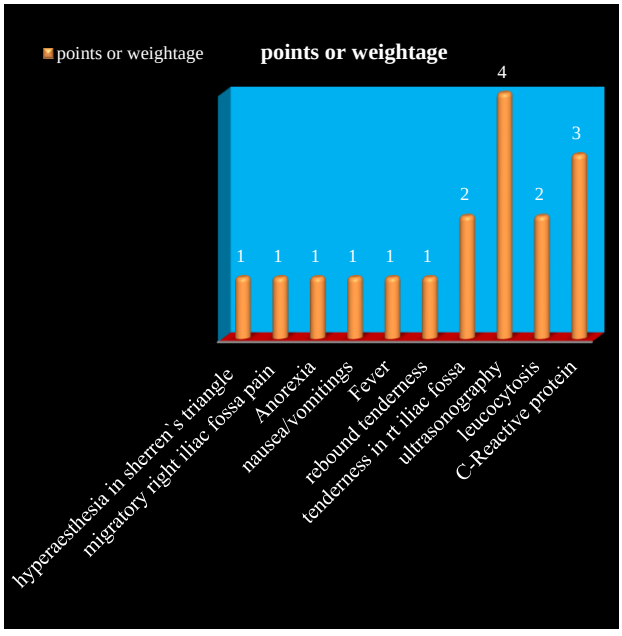

Figure 4: Parameters of YASH score with weightage individual parameter.

USG had given maximum score of 4 followed by CRP 3, Leucocytosis and tenderness in right iliac fossa of 2 each, rest parameters got 1.

Table 2: Cut points of YASH score.

Cut of value	Sensitivity	Specificity
>=3	100.00%	0.00%
>=4	100.00%	17.86%
>=5	98.72%	35.71%
>=6	97.44%	82.14%
>=7	96.67%	100.00%
>=8	93.85%	100.00%
>=9	88.21%	100.00%
>=10	83.59%	100.00%
>=11	78.97%	100.00%
>=12	71.03%	100.00%
>=13	59.23%	100.00%
>=14	46.92%	100.00%
>=15	36.92%	100.00%
>=16	15.90%	100.00%
>=17	01.03%	100.00%
>17	0.00%	100.00%

Here cut point of 7 gives highest sensitivity and specificity of 96.67 % and 100.00% respectively. So, YASH score of 7 or more suggestive of acute appendicitis.

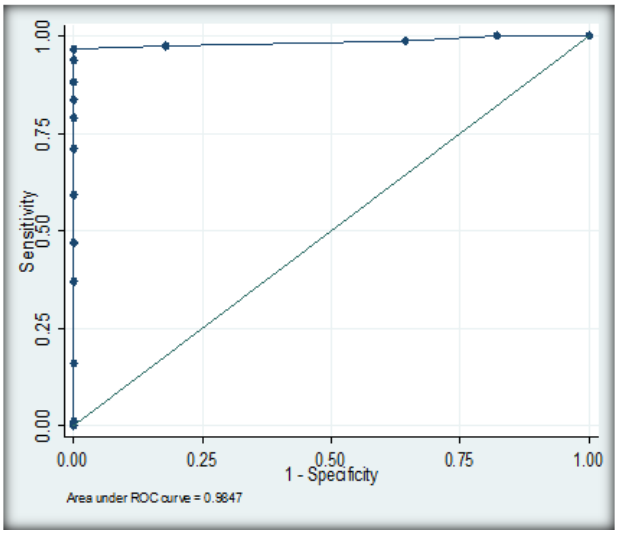

Figure 5: ROC of YASH score.

Receiver operating curves (ROCs) at the optimal cut-off threshold score of 7 for the YASH score and modified Alvarado score were derived using SPASS 17.0 statistical software.

Table 3: Sensitivity, specificity, PPV, NPV and accuracy of all parameters.

	TP	FP	FN	TN	Sensitivity	Specificity	PPV	NPV	Accuracy
Factor 1 Rebound tenderness	234	7	156	21	60%	75%	97.10%	11.86%	61.00%
Factor 2 migratory right iliac fossa pain	221	10	169	18	56.67%	64.29%	95.67%	9.62%	57.18%
Factor 3 anorexia	312	16	78	12	80%	42.86%	95.12%	13.33%	77.51%
Factor 4 nausea vomiting	270	15	120	13	69.23%	46.43%	94.74%	9.77%	67.70%
Factor 5 tenderness in right iliac fossa	365	27	25	1	93.59%	3.57%	93.11%	3.84%	87.56%
Factor 6 fever	250	10	140	18	64.10%	64.29%	96.15%	11.39%	64.11%
Factor 7 Leucocytosis	226	1	164	27	57.95%	96.43%	99.56%	14.14%	60.53%
Factor 8 USG	332	0	58	28	85.13%	100%	100%	32.56%	86.12%
Factor 9 CRP	317	2	73	26	81.28%	92.86%	99.37%	26.26%	82.06%
Factor 10 Hyperesthesia in Sherren`s triangle	186	16	204	12	47.69%	42.86%	92.08%	5.55%	47.37%

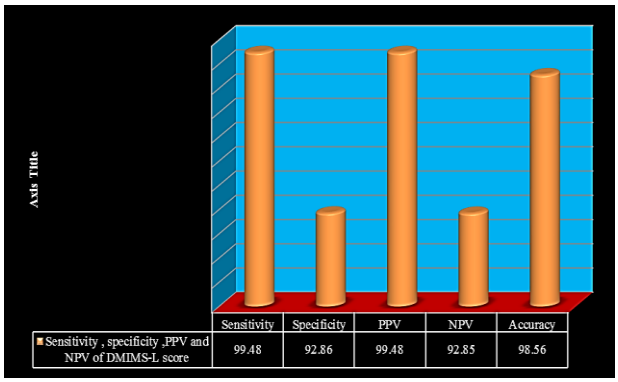

Figure 6: Sensitivity and specificity, negative, positive predictive value and accuracy of Yash score.

Sherren`s triangle hyperesthesia is a first parameter included in the new score. We offered score of 1 in Yash scoring system as per its probability, diagnostic accuracy and odds ratio. In the present study migratory right iliac fossa pain was selected as a second parameter for Yash scoring system. Given score one as per its MASS.

Presence of anorexia increases probability of appendicitis but its absence cannot rule out diagnosis of acute appendicitis as specificity and NPV are less. We had given score of 1 to anorexia to broaden the diagnostic kit (YSS).

For the parameters, fever and nausea/ vomiting, a score of 1 each given in Yash scoring system.

Rebound tenderness represents pain from layer of peritoneum by stretching or moving. We offer a score of 1 to this valuable sign in Yash scoring system.

For Leucocytosis and tenderness in right iliac fossa, we offer score of 2 as per MASS. Due to high accuracy, odds ratio and probability of USG, C-reactive protein in a present study, score of 4 and 3 were given respectively.

The Kaiser-Meyer-Olkin value is 0.606, which is higher than the minimum acceptable 0.6. This indicates that the sample was adequate.

Bartlett's test of sphericity was highly significant at 552.134 degrees of freedom and the estimated 'p' value is 0.0001 which is ideal for any distribution to accept the test value; the KMO value in this case. The $p<0.05$ also indicates that Factor Analysis is valid for further analysis of the data.

Table 4: Correlation of modified alvarado score and Yash score.

		Total YASH Score		Total	ϰ2-value
		Negative	Positive		
Total Alvarado Score	Negative	30 (7.18%)	185 (44.26%)	215	30.51 p=0.0001, S
	Positive	0 (0%)	203 (48.56%)	203	
Total		30 (7.18%)	388 (92.82%)	418	

Table 5: Correlation of modified Alvarado score and YASH score.

	TP	FP	FN	TN	Sensitivity	Specificity	PPV	NPV	Accuracy
Alvarado Score	203	0	187	28	52.05%	100%	100%	13.02%	55.26%
YASH Score	386	2	2	26	99.48%	92.86%	99.48%	92.85%	98.56%

Table 6: KMO and Bartlett's Test.

Kaiser-Meyer-Olkin measure of sampling adequacy		0.606
Bartlett's test of sphericity	Approx. Chi-Square	552.134
	df	55
	Sig.	0.0001, S

Table 7: Component Matrix.

	Component				
	1	2	3	4	5
VAR00001	0.183	-0.689	-	-	-
VAR00002	0.282	0.337	0.708	-	-0.177
VAR00003	0.293	0.113	-0.660	-	0.395
VAR00004	0.301	0.624	-0.252	-0.232	-
VAR00005	-	0.626	0.139	0.320	0.215
VAR00006	0.508	-	-	-0.651	0.158
VAR00007	0.620	-0.148	0.271	-0.349	0.176
VAR00008	0.659	-	-	0.320	-0.357
VAR00009	0.598	-	-	0.277	0.257
VAR00010	-0.242	-0.114	0.367	0.231	0.735
VAR00011	0.743	-0.161	-	0.425	-

Extraction Method: Principal Component Analysis; a. 5 components extracted.

Table 8: A) Sensitivity and specificity of rebound tenderness to appendicular perforation; B) Negative and positive predictive value of rebound tenderness to appendicular perforation.

Sensitivity	92%
Specificity	43%
Positive predictive value	5%
Negative predictive value	99%

Table 9: Comparison with other studies

Name of study	NAR	Sen	Spec	PPV	NPV	Name of study
S. Olakolu et al[34]	30.2%. 35.8%	82.4%,	52.6%	75.7%,	62.5%	ASS Clinical
Harsha B. K et [32]	7.6%.	98.8%	89.3	93.3	83.3	MASS
Syed waris Ali Shah[25]	28%	88.9%	71.4%	-	-	MASS
Ahmed M. Al-Hashemy et al[1]	27.3%	88.3%	94.5%	-	-	MASS
Chong CF, et al[5]	6.9%,	88.46%	66.67%	93.00%	53.00%,	RIPASA
Ambreen Jawaid[28]	13%	78%	89%	97%	-	-
Emmanuel S Kanumba et al Tanzania[29]	33.1%	94.1%	90.4%	95.2%	88.4%	MASS
The Ohman et al [30]	14.3%	0.63	0.93	0.77	0.86	Ohman
Kailash et al[32]	16.21%	-	-	83.79%	-	ASS
Hsien-Wei Ting and et al[30]	-	0.945	0.805	-	-	ASS
Chong C.F. et al[5]	13.5	98%	81.3%	85.3%	97.4%	Ripasa
Shashikala et al[40]	-	79% 61.9%	62% 50%	83.3% 86.6%	97.72% 15%	Tzanakis score ASS
Madan Samuel[31]	-	100%	92%	96%	99%	Samuel Score
Faruquzzaman et al[37]	-	91%	82%	91%	77%	New appendicular
Sammalkori HE et al[39]	-	95.9%	54.2	-	-	New adult appendicitis score

Table 10: NAR.

Name of study	NAR
S. Olakolu et al[23] Clinical Alvarado score	35.8% 30.2%
Sara Ijaz Gilani and et al[26]	27%
Harsha B. K et al[34]	7.6%
Dr. Syed waris Ali Shah[25]	28%
Ahmed M. Al-Hashemy et al[1]	27.3%
M,M,Wani et al[2]	32.3%
Chong C F, et al[5]	6.9%,
Nazir Ahmad Lone[7]	17%
Khairy G et al[9]	9.2%
Rajab Ali, [27] laparoscopic group Rajab Ali,[27]open group	17% 10%
Ambreen Jawaid [28]	13%
Emmanuel S Kanumba et al[29]	33.1%
The ohman al [30]	14.3%
Kailash et al[32]	16.21%
Ali S. Raja et al[36]	1.7%
Fatemeh Nabipour[6]	34.2%

DISCUSSION

Sherren`s triangle hyperesthesia is an area of skin hyperesthesia bounded by lines joining anterior superior iliac spine, the pubic symphysis and umbilicus. It was described by the English surgeon James Sherren.[12,13]

Hyperesthesia in Sherren's triangle was the first parameter included to broaden the diagnostic kit (Table 3). This sign was having good sensitivity (47.69%) and PPV (92.08%). We offered score of 1 in YSS as per its probability and odds ratio (Table 1 and Figure 5).

In the present study, Migratory right iliac fossa pain was selected as a second parameter for YSS. Score of all parameters of MASS were not changed hence a score of one was given to it. This sign was present in 231 (55.26%) cases with sensitivity and specificity of 56.67% and 64.29% respectively. PPV was 95.67% and NPV was 9.62 % (Table 3). In a study done by P. D. Gaurav et al most common presentation was pain in right iliac fossa and most common presenting sign was tenderness in right iliac fossa.[14]

Acute appendicitis has many clinical symptoms such as anorexia, abdominal pain, nausea, vomiting, urinary symptoms etc. Anorexia is an important and prevalent symptom in acute appendicitis. If a patient has abdominal pain but he or she doesn't have anorexia, the diagnosis of appendicitis becomes doubtful. In present study, we found that in patients with acute appendicitis, 78.47% (328) had anorexia. The sensitivity of anorexia was 80% and PPV was 95.12 with specificity and NPV was 42.86% and 13.33% respectively (Table 3). These results of our study are comparable with the study done by Salari AA et al.[15] In this series out of a total of 465 cases, 400 (86%) cases were confirmed of appendicitis. Three hundred thirty-five (83.75%) had anorexia. Sensitivity was 83.75% and specificity was 24.61%. PPV was 87.2% and NPV was 19.8%. We had given score of 1 to it to YSS.

In this study nausea and vomiting were present in 285 cases out of 418(68.18%). Sensitivity, specificity, PPV

and NPV were (69.23%, 46.43%, 94.74% and 9.77) respectively. Score of 1 was given (Table 3).

Fever suggest onset of bacteremia, in a present study around 260 (62%) patients were suffering from fever with sensitivity and specificity of 64.10% and 64.29% respectively.[16] The PPV and NPV were 96.15% and 11.39%, as per MASS a score of 1 was given (Table 3).

Rebound tenderness was positive in 241 (57.66) patients. Sensitivity was 60% and specificity was 75% with PPV and NPV were 97.10% and 11.86% (Table 3) respectively.[17] There are 13 cases of perforation observed in the study out of 418 (3.11%), 8 were females and 5 were males, out of 13 only 1 patient was having no rebound tenderness, rest in all 12-patient rebound tenderness was elicited.

Sensitivity and specificity of this sign towards appendicular perforation were 92% and 43% respectively, the positive and negative predictive (NPV) value were 5% and 99 %respectively. Here 99% NPV means that if rebound tenderness test is negative, you have a 99% chance of not having perforation. 5% PPV means that if rebound tenderness positive, you have a 5% chance of actually having the perforation. This clearly indicates that rebound tenderness is very important to rule out complications like perforation or peritonitis but to diagnose perforation it had less significance (Table 8).

Study continue a score of 1 to this valuable sign in YSS.

Tenderness in right iliac fossa was present in 392 (93.77%) subjects and absent in 6.22% in the present study. These 6.22% patients present with vague pain around umbilicus, epigastrium or whole abdomen (visceral pain). Sensitivity and specificity of tenderness in right iliac fossa was 93.59% and 3.57%. Positive predictive value and NPV of tenderness in right iliac fossa were 93.11% and 3.84% respectively (Table 3). It suggests its value in diagnosing appendicitis but having less value to rule out it. We continue score of 2 as per MASS.

Puylaert et al, described graded compression ultrasonographic technique for the diagnosis of acute appendicitis (Figure 2).[11]

USG abdomen in our study shows sensitivity of 85.13% and specificity 100% with PPV and NPV were 100% and 32.56%, reports were s/o acute appendicitis in 337 patients and normal in 82 subjects (Table 3). This is comparable with study performed by Ibrahim M et al in Kuwait.[11]

USG abdomen gives highest odds ratio; diagnostic accuracy and probability (Table 1 and 3, Figure 6, Figure 4). Hence, we offer a score of 4 in YSS.

Two inflammatory markers one is total leucocyte count and other is C-reactive protein included in the study. If Leucocytosis is normal, patient should be further investigated by ultrasonography or diagnostic laparoscopy.[17-20]

In this study leucocytosis was found in 227 (62.20%) out of 418 patients. Sensitivity and specificity of Leucocytosis (more than 10000) 21 was 57.95% and 96.43% with positive and negative predictive values were 99.6 and 14.1% respectively (Table 3). As per MASS a weightage of 2 is given to YSS. These results were comparable to the study done by IP Mahato (Nepal) where leucocytosis (>10,000) was found in 83.1%.[21] The conclusion of the study conducted by Stefanutti G et al suggests that if both WBC and CRP levels are normal in a child with a high suspicion of appendicitis, the presence of an inflamed appendix is extremely unlikely and re-evaluating the patient over time is perhaps a better option than proceeding to operation.[22]

In the present study, we found sensitivity and specificity of C-reactive protein was 81.28% and 92.86% with negative and positive predictive values were 26.26% and 99.37% respectively (Table 3). Due these high values and good odds ratio and probability a score of 3 is given to this inflammatory marker.

Sensitivity and specificity of MASS was 52.05% and 100%. Negative and positive predictive value of mass were 13.02% and 100% respectively. Diagnostic accuracy was 55.26 % (Table 3).

The Yash score was sensitivity of 99.48% and specificity of 92.86% with positive predictive value and negative predictive value of 99.48% and 92.85% respectively (Figure 6). Diagnostic accuracy was 98.56%. Cut point of 7 gives highest sensitivity and specificity of 96.67% and 100.00% respectively. Hence Yash score of 7 or more out of 17 considered suggestive of acute appendicitis (Table 2, Figure 5).

Comparison in-between YSS and MASS shows superior results of YSS (Table 4 and 5).

Factor analysis was carried out to establish adequacy of the sample and to establish the construct validity of Yash score. Principal component analysis was used as a method of extraction. The Kaiser-Meyer-Olkin value is 0.606, which is higher than the minimum acceptable 0.6. This indicates that the sample was adequate. Bartlett's test of sphericity was highly significant at 552.134 degrees of freedom and the estimated 'p' value is 0.0001 which is ideal for any distribution to accept the test value; the KMO value in this case. The $p<0.05$ also indicates that Factor Analysis is valid for further analysis of the data (Table 6 and 7).

Comparison in between Yash score and modified Alvarado score in the present study shows significant

statistical difference 2א-value =30.51 (p=0.0001) (Table 4 and 5).

Even after elapse of more than 120 years since its first description this common surgical disease continues to remain a diagnostic problem. Delay in diagnosis definitely increases the morbidity, mortality and cost of treatment. In equivocal cases, however, aggressive surgical approach "when in doubt take it out" has resulted in increased negative laparotomies. Presentation of acute appendicitis can mimic variety of acute medical and surgical abdomino-thoracic conditions. Early diagnosis is a primary goal to prevent morbidity and mortality in acute appendicitis. In spite of advancements in medical diagnostics, its diagnosis is mainly clinical one. Over the last two decades different protocols have been introduced and tested by different researchers which include Lidverg, Fenyo, Christian, Ohman and Alvarado scoring system to make an early diagnosis of this sometimes very elusive disease.[24-34]

In the present study found 13 (3.11%) cases of perforated appendix. The study done by S Salati, A Rather, and S Wani in kashmir shows higher rate of perforation.[35]

If we compare it with previous studies in other scoring systems, results of present study were much higher (Table 9).[25-32]

Histopathology is considered as a gold standard for diagnosis of acute appendicitis. In a present study (6.69%) patients were have normal on histopathological examination. This value of NAR is significantly lower than other studies (Table 10).[36-39]

In a view of this above said scenario, the new Yash score has a promising post in place in a diagnosis of acute appendicitis. It differs from previous scoring systems by taking into account the important combined effects of CRP, TLC, USG and clinical data. The new diagnostic score is fast and more reliable in diagnosing cases of suspected appendicitis. Yash score may be aimed at that direction as a future tool for the surgeons in clinical practice.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Al-Hashemy AM, Seleem MI. Appraisal of the modified Alvarado Score for acute appendicitis in adults. Saudi Med J. 2004;25(9):1229-31.
2. Wani MM, Yousaf MN, Khan MA, Abdul AB, Durrani M, Wani MM, et al. Usefulness of the alvarado scoring system with respect to age, sex and time of presentation, with regression analysis of individual parameters. Int J Surg. 2007;11(2):139.
3. Baidya N, Rodrigues G, Rao A, Khan SA. Evaluation of alvarado score in acute appendicitis: a prospective study. Int J Surg. 2007;9(1):1-3.
4. Vandakudri AB. Evaluation of modified Alvarado score in the diagnosis of acute appendicitis. Int J Res Med Sci. 2016;4(1):84-8.
5. Chong CF, Adi MIW, Thien A, Suyoi A, Mackie A J, et al. Development of the RIPASA score: a new appendicitis scoring system for the diagnosis of acute appendicitis. Singapore Med J. 2010;51(3):220.
6. Nabipour F. Histopathological feature of acute appendicitis in Kerman-Iran from 1997 to 2003. Am J Environmental Sci. 2005;1(2):130-2.
7. Lone NA, Shah M, Wani KA, Peer GQ. Modified Alvarado score in diagnosis of acute appendicitis. Indian J Pract Doct. 2006;3(2):1-4.
8. Mohamed A, Bhat N. Acute appendicitis dilemma of diagnosis and management. Int J Surg. 2010;23(2):66-70.
9. Khairy G. Acute appendicitis: Is removal of a normal appendix still existing and can we reduce its rate?. Saudi J Gastroenterol. 2009;15:167-70.
10. Birchley D. Patients with clinical acute appendicitis should have pre-operative full blood count and c-reactive protein assays, Ann R Coll Surg Engl. 2006;88:27-32.
11. Ibrahim M, Sak M, Kreshnan TR, Sharma R, Abdel-Shaheed AA, Habib MA. Ultrasonography in the diagnosis of clinically equivocal acute appendicitis: a prospective study. Kuwait Med J. 2003;35(3):271-4.
12. Gurav PD. Evaluation of right iliac fossa pain with reference to Alvardo score- can we prevent unnecessary appendicectomies? JKIMSU. 2013;2(2):24-32.
13. Irvin TT. Abdominal pain: a surgical audit of 1190 emergency admissions. Br J Surg.1989;76:1121-5.
14. Gurav PD, Hombalkar NN, Dhandore P, Hamid M. Evaluation of right iliac fossa pain with reference to alvarado score can we prevent unnecessary appendicectomies? JKIMSU. 2013;2(2):25-9.
15. Salari AA, Binesh F. Diagnostic value of anorexia in acute appendicitis. Pak J Med Sci. 2007;23(1):68-70.
16. Juric I, Primorac D, Zagar Z, Biocić M, Pavić S, Furlan D. Frequency of portal and systemic bacteremia in acute appendicitis. Padiatre. 2001;43(2):152-6.
17. Liddington MI, Thomson WHF. Rebound tenderness test. Br J Surg. 199178:795-6.
Bundy DG, Byerley JS, Liles EA, Perrin EM, Katznelson J, Rice HE. Does this child have appendicitis?. JAMA. 2007;298(4):438-51.
18. Agrawal A, Govil A, Lakdawala M. Unusual case of right iliac fossa pain: A case report. J Mahatma Gandhi Inst Med Sci. 2015;20:94-6.
19. Lateef AU, Arshad AR, Misbah J, Hamayun M. Role of leucocyte count in the diagnosis of acute appendicitis. J Med Sci. 2009;7(2):140-2.

20. Mahato IP, Health Renaissance, sensitivity and specificity of alvarado scoring system. 2011;9(1);12.
21. Stefanutti G, Ghirardo V, Gamb P. Inflammatory markers for acute appendicitis in children:are they helpful? J Pediatr Surg. 2007;42:773-6.
22. Olakolu S, Lloyd C, Day G, Wellington P. Diagnosis of acute appendicitis at mandeville regional hospital (MRH): clinical judgment versus alvarado score. Int J Surg. 2011;27(1):1-6.
23. Talukder DB, Siddiq AKMZ. Modified Alvarado scoring system in the diagnosis of acute Appendicitis. JAFMC Bangladesh. 2006;5(1):18-20.
24. Shah SWL, Tarrar AM, Khan CA, Irtiza. Modified Alvarado score; accuracy in diagnosis of acute appendicitis in adult's professional. Med J. 2010;17(4):546-50.
25. Gilani SI, Ali S, Hyder O, Iqbal A, Mazhar T, Mir ST. Clinico-pathological correlation in 1016 appendicectomies performed at two tertiary care hospitals, Rawal Med J. 2008;34:11-3.
26. Ali R, Khan MR, Pishori T, Tayeb M. Laparoscopic appendectomy for acute appendicitis: Is this a feasible option for developing countries?. Saudi J Gastroenterol. 2010;16:25-9.
27. Jawaid A, Asad A, Motiei A, Munir A. Clinical scoring system: a valuable tool for decision making in cases of acute appendicitis JPMA. 1999;49:254.
28. Kanumba ES, Mabula JB, Rambau P, Chalya PL. Modified alvarado scoring system as a diagnostic tool for acute appendicitis. BMC Surg. 2011;11:4
29. Koppad SN, Vandakudri AB, Desai M, Kodliwadmath H. Evaluation of Ohmann score and correlation with ultrasound for diagnosing acute appendicitis. Int J Orthopaed Traumatol Surg Sci. 2016;2(1):234-8.
30. Samuel M. Pediatric appendicitis score. J Pediatr Surg. 2002;37(6):877-81.
31. Kailash S, Shyam G, Pinki P. Application of alvarado scoring system in diagnosis of acute appendicitis. JK Sci. 2008:10(2):84-6.
32. Ting HW, Wu JT, Chan CL, Lin SL, Chen MH. Decision model for acute appendicitis treatment with decision tree technology-a modification of the alvarado scoring system. J Chin Med Assoc. 2010;73(8):4016.
33. Harsha BK, Bhaskaran A, Prasad CSBR, Vasant Kumar W. Evaluatio of modified alvarado score in the diagnosis of acute appendicitis and its correlation with ultrasonography. J Clin Biomed Sci. 2011;1(4)149-57.
34. Salati S, Rather, Wani S. Perforated Appendicitis - an experience from a tertiary care center in Kashmir. Int J Surg. 2008;21(1):620-2.
35. Raja AS, Wright C, Zane RD, Schiff GD, Hanson R, Baeyens PF, et al. Negative appendectomy rate in the Era of CT. Radiol. 2010;256(2):460-5.
36. Faruquzzaman, Mazumder SK, Hoque MJ, Implementation of newly proposed appendicular scoring system (ASS) for diagnosis of acute appendicitis in surgical practice- a clinical study, Dinajpur. Med Col J. 2014;7(1):47-51.
37. Ünlüer EE, Urnal R, Eser U, Bilgin S, Hacıyanl M, Oyar O, et al. Application of scoring systems with point-of-care ultrasonography for bedside diagnosis of appendicitis. World J Emerg Med. 2016;7(2):124-9.
38. Sammalkorpi HE, Mentula P, Leppäniemi A. A new adult appendicitis score improves diagnostic accuracy of acute appendicitis - a prospective study. BMC Gastroenterol. 2014;14:114.
39. Shashikala V. Comparative study of Tzanakis score vs Alvarado score in the effective diagnosis of acute appendicitis. Int J Biomed Adv Res. 2016;7(9):418-20.

Cite this article as: Lamture YR, Ramteke H, Shinde RK, Shahapurkar VV, Gajbhiye VP. Clinico sonological and laboratory co-relation with histopathology of acute appendicitis to develop new diagnostic scoring system (Yash scoring system). Int Surg J 2017;4:2556-64.