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Original Research Paper

Surgery

MODIFIED ALVARDO SCORE AND ITS APPLICATION IN THE DIAGNOSIS OF ACUTE APPENDICITIS

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ABSTRACT Acute appendicitis is one of the most common surgical emergencies. The diagnosis of acute appendicitis is most commonly based on clinical history and examination along with elevated total leukocyte count. Modified Alvarado score is simple to use , easy to apply and is dynamic since its relies on history, clinical examination and basic laboratory investigations. The purpose of our study was to evaluate the diagnostic effectiveness of the Modified Alvarado scoring system for diagnosis of acute appendicitis by correlating the score with operative and histopathological findings.

KEYWORDS : acute appendicitis, MAS , RIPASA, appendicectomy

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies. The incidence of acute appendicitis ranges from 8.6 to 11 cases per 10,000 person-years[1,2]. The lifetime risk of developing appendicitis is 8.6% for males and 6.7% for females , with highest incidence in the second and third decades[1]. The most common age group to be affected is 10 to 19 years[3].

Appendicitis , though described in 1886, by Reginald Heber Fitz, even after so many years, is still considered a diagnostic challenge for surgeons[4].

Failure to diagnose acute appendicitis at an early stage leads to complications like perforation, abscess and peritonitis which is associated with higher morbidity and mortality. Its complications are more in young children and elderly[5].The diagnosis of acute appendicitis is most commonly based on clinical history and examination along with elevated total leukocyte count. Though the diagnostic accuracy can be further improved through the use of ultrasonography (USG) and computer tomography (CT), but because of accessibility and affordability issue mostly at remote areas, their use are limited. Also, making arrangements for these diagnostic modalities may lead to further delays in diagnosis and surgery. Different scoring systems are there in use to diagnose appendicitis. Like - Alvarado scoring system, Modified Alvarado scoring (MAS) system, Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) scoring system.[6,7,8] These diagnostic scoring systems has been developed in an attempt to improve the diagnostic accuracy of acute appendicitis.

The most prominent of scoring system developed by Alfredo Alvarado in 1986 [6] He introduced a criterion for the diagnosis of acute appendicitis, was based on a retrospective analysis of 305 patients with abdominal pain suspicious of appendicitis.

Alvarado score has six clinical variables and two laboratory parameter with a total of ten points. The scoring includes elements from the patient's history, the physical examination and from laboratory tests.

1. Migratory right iliac fossa pain .
2. Anorexia
3. Nausea or vomiting
4. Tenderness in right iliac fossa
5. Rebound tenderness
6. Fever
7. Leukocytosis
8. Shift to left .

Tenderness in the right iliac fossa and leukocytosis are the two most important factors and are assigned two points each and six other factors are assigned one point each, for a total score of 10 points. A score of 1-4 indicates very unlikely appendicitis, 5-7 probable appendicitis and 8-10 highly probable appendicitis. The classical Alvarado score included a left shift of neutrophil maturation along with other parameters for assessment.

In 1994 ,The Alvarado score was modified by M. Kalan, D. Talbat, W.J. Cunliffe and A.J. Righ.11 The Modified Alvarado score[7] excludes, the left shift of neutrophil maturation (% of segmented immature neutrophils with normal total WBC count). This laboratory parameter was excluded as it was not available in an emergency basis in many laboratories. The patient were therefore scored out of 9 rather than 10 points.

We also omitted this parameter which was not routinely available in our emergency laboratory and used a Modified scoring system for the diagnosis of acute appendicitis.

The purpose of our study was to evaluate the diagnostic effectiveness of the Modified Alvarado scoring system for diagnosis of acute appendicitis by correlating the score with operative and histopathological findings.

MATERIAL AND METHODS :

The Cross sectional analytical study was conducted at Department of General Surgery at IGMC Shimla under unit 2 over a period of one year from July 2015 to July 2016. The study population comprised of all patients with suspected acute appendicitis presenting to emergency department under surgery unit 2 w.e.f. JULY 2015 to JULY 2016 thus making final sample size to be 100.

INCLUSION CRITERIA-

1) Patients of all age groups with clinical suspicion of acute appendicitis-

EXCLUSION CRITERIA-

1) Pregnant women
2) Right iliac fossa mass
3) Patients with previous history of renal calculi
4) Pelvic inflammatory disease
5) Who had been admitted previously for other complaints but who subsequently developed RIF pain during their admission episodes.

Consent- consent was taken from ethical committee

Sensitivity, specificity, PPV, NPV of the scoring system will be estimated by comparing the threshold level of score with surgical findings and histopathological findings. ROC will be used for delineating threshold score levels.

RESULTS

The youngest case was 4 years old and oldest was 62 years of age.In our study, 73% cases were male and 27% cases were female. In our study, no. of cases with MAS > 7 were 56, in score between 5 and 6, patients were 33 and in score < 4, 11 cases were there. Maximum no. of cases were in score more than 7. (table-1)

Table: 1-showing Modified Alvarado score and no. of cases

MAS		No. of patients(n-100)	Percentage %
	<4	n-11	11.0
	5 & 6	n-33	33.0
	>7	n-56	56.0
	Total	100	100.0

Symptoms, Signs and Lab findings

In our study , we observed that migratory pain was present in 64% cases with history of pain around the umbilical region initially which later shifted to RIF. Anorexia was present in 81% of cases. Nausea/vomiting was present in 83% of cases. Elevated temperature was present in 21% of cases. Rebound tenderness was present in 73% of cases. Tenderness RIF was present in 97% of cases. Leukocytosis was seen in 70% of cases. (table 2 Fig. 1)

Table:2-showing symptoms, signs and lab findings

	No. of patients(n-100)	Percentage(%)
Symptoms		
Migratory pain	64	64%
Anorexia	81	81%
Nausea/vomiting	83	83%
Signs		
Tenderness in RIF	97	97%
Rebound tenderness	73	73%
Elevated temperature	21	21%
Leucocytosis	70	70%

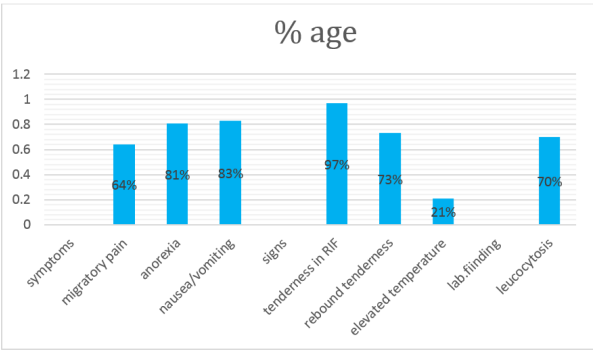

Fig. 1

HISTOPATHOLOGICAL EXAMINATION :

On histopathological examination of appendix removed during surgery, acute appendicitis was present in 75 patients, chronic was present in 9, acute on chronic was in 2 patients and acute suppurative was only in 1 patient. In 13 patients appendix removed during surgery was found to be normal on H.P.E. (table-3,Fig.2)

Table:3- showing histology report and percentage

Histology	No. of patients(n-100)	Percentage
Normal	13	13.0
Acute Appendicitis	75	75.0
Chronic Appendicitis	9	9.0
Acute on Chronic appendicitis	2	2.0
Acute Suppurative appendicitis	1	1.0
Total	100	100.0

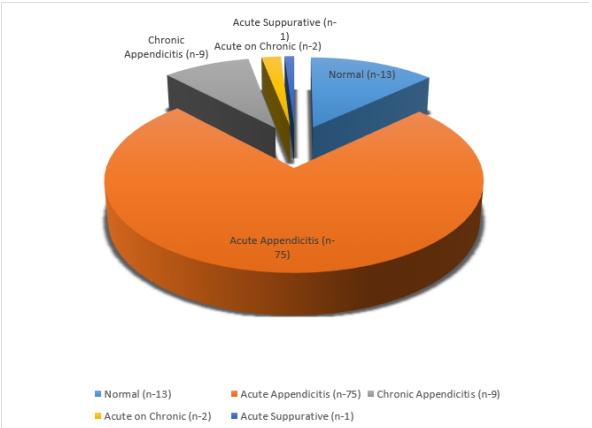

Fig. 2

Out of 100 patients undergone surgery , 78 patients had positive appendicectomy and 22 patients had negative appendicectomy.(table-4, Fig.3).

Table :4-showing no. of patients with appendicectomy

appendicectomy	No. of patients	Percentage
Negative Appendicectomy	22	22.0
Positive appendicectomy	78	78.0
Total	100	100.0

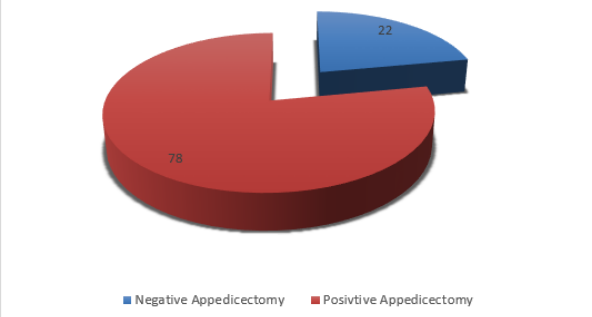

fig. 3

DISCUSSION

Acute appendicitis is one of the most common surgical emergency. Lifetime prevalence rate of approximately one in seven[8]. Despite being a common problem, it remains a difficult diagnosis to make, particularly among the young, elderly and females of reproductive age, where a genitourinary and gynecological conditions can present with signs and symptoms that are similar to those of acute appendicitis . A delay in performing an appendicectomy increases the risk of appendicular perforation and sepsis, which leads to increase in morbidity and mortality. Diagnostic accuracy can be further improved through the use of USG or CT scan. However, such routine practice may inflate the cost of health care substantially. Several scoring system such as the Alvarado[6] and the Modified Alvarado scoring system[7] had been introduced since 1986 to help in making accurate diagnosis of acute appendicitis in the fastest and cheapest way. Such scoring systems provide guidelines to help surgeon to select patients for either emergency appendicectomy or conservative management till radiological investigations arrived. Modified Alvarado score is simple to use , easy to

apply and is dynamic since its relies on history, clinical examination and basic laboratory investigations. In our study mean age of presentation was 28.71±13.595 years with male being 73% and female 27% .

In study conducted by Berry J and Malt RA(1984)[9], males were 60.2% and females were 39.8%. Another study conducted by Asfer S et al (2000)[10], males were 69.5% and females were 30.5%. Male preponderance as seen in our study was evidenced by various studies in the literature.[11-16](table 5)

Table 5: Sex distribution in different series

Sex	Berry J and Malt RA(1984) (n-246)	Asfer S et al (2000) (n-78)	Present study (2016)
Male	148(60.2%)	54(69.5%)	73%
Female	98(39.8%)	24(30.5%)	27%

In our study, maximum cases were in younger age group (55%) years which is similar to study conducted by Lewis FR et al (1974)[17](43.7%)years.(table 6)

Table 6: Age distribution in different series

Age (in years)	Lewis FR et al(1974) (n-774)	Present study (2016) (n-100)
0-20	41.0%	28%
21-40	43.7%	55%
>41	15.3%	17%

We compare sign and symptoms with other studies like from Lewis FR et al[17] and Berry J and Malt RA(1984)[9]. (table 7).

Table 7: Comparison of present study with other studies

variables	Lewis FR et al (1974) (n-772)	Berry J and Malt RA(1984) (n-246)	Present study (2016) (n-100)
Anorexia	92%	61%	81%
Nausea/vomiting	78%	67.5%	83%
Migrated pain	75%	80%	64%
Elevated temperature	13%	34.3%	21%
Tenderness	99%	95.9%	97%
Rebound tenderness	68%	69.5%	73%

Sensitivity, specificity, PPV and NPV of MAS > 7 were 70.50%,95.50%,98.20% and 47.70% respectively. The result of this study corroborated with other global studies in respect of percentage of sensitivity ,specificity and diagnostic accuracy (Table 8).

Table 8: comparative analysis of sensititvity ,specificity and diagnostic accuracy of MAS with other studies

STUDY	Sensitivity	Specificity	Diagnostic accuracy
Chong et al.2010[18]	68.32%	87.9%	86.5%
Alnjadat et al.[19]	73.7%	68.6%	74.3%
Erdem et al,2013[20]	82%	75%	80%
Reyes –Garcia et al.[21]	89.5%	69.2%	
Present study	**70.5%**	**95.5%**	**76.23%**

CONCLUSIONS –

Modified Alvarado scoring system is easy, simple, cheap. It is non invasive tool in preoperative diagnosis of acute appendicitis . Moreover it is repeatable at no cost. Thus the application of this scoring system improves diagnostic accuracy and reduces negative appendicectomy rate.

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