MODIFIED ALVARADO SCORING IN ACUTE APPENDICITIS

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ABSTRACT

BACKGROUND

Acute appendicitis is one of the most common surgical emergencies with a lifetime presentation of approximately 1 in 7. Its incidence is 1.5-1.9/1000 in males and females. Surgery for acute appendicitis is based on history, clinical examination and laboratory investigations (e.g. WBC count). Imaging techniques add very little to the efficacy in the diagnosis of appendix. A negative appendicectomy rate of 20-40% has been reported in literature. A difficulty in diagnosis is experienced in very young patients and females of reproductive age. The diagnostic accuracy in assessing acute appendicitis has not improved in spite of rapid advances in management.

MATERIALS AND METHODS

The modified Alvarado score was applied and assessed for its accuracy in preparation diagnosis of acute appendicitis in 50 patients. The aim of our study is to understand the various presentations of acute appendicitis including the age and gender incidence and the application of the modified Alvarado scoring system in our hospital setup and assessment of the efficacy of the score.

RESULTS

Our study shows that most involved age group is 3rd decade with male preponderance. On application of Alvarado score, nausea and vomiting present in 50% and anorexia in 30%, leucocytosis was found in 75% of cases. Sensitivity and specificity of our study were 65% and 40% respectively with positive predictive value of 85% and negative predictive value of 15%.

CONCLUSION

This study showed that clinical scoring like the Alvarado score can be a cheap and quick tool to apply in emergency departments to rule out acute appendicitis. The implementation of modified Alvarado score is simple and cost effective.

KEYWORDS

Acute Appendicitis, Alvarado Score, Scoring System, Negative Appendicectomy.

BACKGROUND

One of the commonest clinical presentation that requires emergency surgery is acute appendicitis.[1,2] It is rare in infancy and among the elderly, but is common in children, teenagers and young adults.[3] Patients history and physical examination is very important for proper diagnosis.[4] Diagnosis of appendicitis has an considerable rate of negative appendicectomy varying from 20-40% and associated morbidity of around 10%.[5] The classical signs and symptoms of acute appendicitis were first reported by Fitz in 1886. Since then, it has remained the most common diagnosis for hospital admission requiring laparotomy.[1,2] The diagnosis of appendicitis can be difficult occasionally taxing the diagnostic skills of even most experienced surgeon. Attempts to increase the diagnostic accuracy of acute appendicitis has included computer-aided diagnosis, imaging by USG, laparoscopy and even radioactive isotope imaging.[6,7,8,9] Various scoring systems has been devised to aid diagnosis. The Alvarado score was described in 1886.[10] Our study is based on application of modified Alvarado score in evaluation of acute appendicitis.

AIM OF STUDY

1. To understand the various presentations of acute appendicitis including the age and gender incidence.
2. The application of the modified Alvarado scoring system in our hospital setup and assessment of the efficacy of the score.
3. To recognise the sensitivity and specificity of the scoring system.
4. To compare our evaluation with the available national and international standards.
5. The scoring was designed to decrease the negative appendicectomy rate thereby reducing the mortality.

MATERIALS AND METHODS

A total of 50 patients who were admitted on emergency basis were analysed for this prospective study conducted from 2014 to 2016 at K.A.P.V. Medical College Hospital, Tiruchirappalli.

Inclusion Criteria

Patients with provisional clinical diagnosis of acute appendicitis.

Exclusion Criteria

1. Paediatric age group.
2. Pregnancy.
3. Elderly above 70 years of age.

ALVARADO SCORING SYSTEM

The scoring system was introduced as an adjunct to the diagnosis in order to correct the previous high false positive rate based on three symptoms, three signs and two laboratory findings.[10] All the patients included in the study whose specimen were sent for HPE was recorded. The patients were reviewed up in the Alvarado Score. Each of the preoperative signs and symptoms and postoperative lab findings were awarded points in the Alvarado scoring system.

Symptoms	Scores
Migratory RIF pain	1
Anorexia	1
Nausea/vomiting	1
Signs	
Tenderness RIF	2
Rebound tenderness RIF	1
Increase in body temperature	1
Lab Finding	
Leucocytosis	2
Shift to left neutrophils	1
Total	**10**
Alvarado Score[10]	

Score	Inference
1-4	Not likely to have appendicitis
5-6	To have findings compatible with appendicitis, but not convincing to warrant surgery
7-8	To have probable acute appendicitis
8-10	Almost definite diagnosis of acute appendicitis
Inference	

The Alvarado score may increase or decrease on reassessment of patients, which were considered under review category (score 5-6).

We used a slightly modified version of Alvarado score by excluding one laboratory finding 'shift to left of Neutrophil Maturation' (Score 1). This was done because of non-availability of this test in emergency situations. Hence, patients calculated out of 9 than 10 score.

   6-9   - Subjected for appendectomy.

   <6   - Were not considered and were taken in review category for observation.

After subjecting the patients in review category to 24 hrs., observation regardless of score surgery was performed on patients who were thought on clinical grounds to require surgery.

RESULTS

Out of 60 cases, 50 cases were taken up for surgery. The remaining 10 cases with low scores and not convincing to warrant emergency surgery were excluded.

Age (Yrs.)	Number of Patients	Percentage
0-10	-	
11-20	12	24
21-30	18	36
31-40	12	24
41-50	5	10
51-60	1	2
61-70	2	4
Age Distribution		

In our analysis, it has been observed that the most involved age group is third decade of life followed by second decade of life.

Sex	Cases	Percentage
Male	35	70
Female	15	30
Sex Distribution		

In this study, number of male patients (35) were more than the number of female patients.

	Number of Patients	Percentage
Symptoms		
Migration of pain to RIF	50	100
Anorexia	30	60
Nausea/vomiting	35	70
Signs		
Tenderness over RIF	50	100
Rebound tenderness over RIF	22	44
Increased temperature	44	88
Laboratory investigations		
Leucocytosis	50	100
Clinical Features		

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Diagnosis	Cases
Acute appendicitis (not perforated)	30
Perforated appendix	8
Appendicular abscess	5
Ruptured ectopic	2
No pathology found	5
Diagnosis After Surgery	

Scores	Total Case	Appendicitis	Normal Appendix
<4	-	-	-
<5	-	-	-
6	5	-	5
>6	30	30	-
Total	35	30	5
Alvarado Score Correlated With Operative Findings in Males			

Scores	Total Case	Appendicitis	Normal Appendix
<4	-	-	
<5	-	-	
6	3	-	3
>6	12	12	-
Total	15	12	3
Alvarado Score Correlated With Operative Findings in Females			

Parameters	Number of Patients
Sensitivity	65%
Specificity	40%
Positive predictive value	85%
Negative predictive value	15%
% of false positive	6
% of false negative	5
Value of Alvarado Score	

The above results demonstrate quite effectively that the sensitivity for the test in male and female is about 65%. But, specificity is only 40% on discussion with the data submitted in literature with respect to our study 2014, the observations are presented here.

Author	Age in Years
Talukder DB (2009)[51]	20-30
Ramachandra (2013)	11-20
Nishikant Gujar et al (2015)	21-30
Rajashekar Jade (2016)	20-30
Study (2016)	20-30
Age	

In our study, the most frequently affected persons by appendicitis were in 3rd decade of life.

Year	Percentage	
	Male	Female
2009	58	42
2013	64	36
2015	46	54
2016	60	40
Our Study	70	30
Sex		

In our study, preponderance is higher for males when compared to females.

Author	Anorexia	Nausea/Vomiting
Ramachandra (2013)	39%	39%
Nishikant Gujar et al (2015)	44%	72%
Rajashekar et al (2016)	78%	74%
Our study	30%	50%
Clinical Features		

This shows that the percentage of cases observed in our study when compared to that of Ramachandra (2013).

Author	<10,000 cu/cm (%)	>10,000 cu/cm (%)
Ramachandra (2013)	40	60
Nishikant Gujar et al (2015)	44	66
Study (2016)	48	52
Leucocytosis		

It has been observed that leucocytosis is a predominant factor in 52% of cases and forms an useful modality of investigation in diagnosis of acute appendicitis.[28]

Author	Sensitivity	Specificity
Talukder DB et al (2009)	89%	68%
Nishikant Gujar et al (2015)	65.62%	91.67%
Our study	65%	40%
Sensitivity and Specificity		

Initial assessment can be improved by clinical scoring systems such as the Alvarado scoring system based on history, physical examination and laboratory investigations.[13,14] On a comparative basis, the sensitivity is high in males, but have a low specificity in females. The above findings depict that modified Alvarado scoring system is efficacious in males, thereby decreasing the morbidity. Traditionally surgeons may have a more liberal attitude towards laparotomy in young female patients because of the increased risk of infertility following perforated appendix, but the application of modified Alvarado score may be useful in important diagnostic accuracy. Ultrasonogram is considered resource consuming and therefore not useful as a general

diagnostic tool in all patients. Laparoscopy has recently gained more attention as having both diagnostic property and therapeutic possibility, which is promising, however, it is an invasive procedure performed under general anaesthesia and with regard to feasibility and cost utility, its place still remains to be shown with patients in suspected appendicitis. Recently, various examination tools including USG and CT diagnosis have been employed to improve diagnostic accuracy. Results of our study are comparable with literature. Negative appendicectomy rate in our study was 16%. Removal of some normal appendices is found to lower the rate of perforation and consequently mortality. Literature shows that negative appendicectomy rate is less than 10-15%, 16% in Talukder et al 2009, 12% in Rajashekar Jade et al 2016. Our study shows that the application of Alvarado scoring system in diagnosis of acute appendicitis can provide a high degree of patient's predictive value and thus diagnostic accuracy. Our study also revealed that Alvarado scoring system is more helpful in male patients by showing lower negative appendicectomy rate and high positive predictive value for male patients as compared to females. In females, additional investigations maybe required to confirm diagnosis. Literature also supports this observations.[16,17]

STATISTICAL ANALYSIS

To statistically determine the efficacy of modified Alvarado score system, we used statistical software SPSS and the 't' test to find out the above-mentioned system was significant. The mean and standard deviation were calculated. The mean values were compared using 't' test. Cross tabulation was also done, sensitivity and specificity estimated.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Score 1* Diag	50	100.0%	0	0%	50	100.0%

Score 1* Diag Cross tabulation Count

	Diag		Total
	.00	1.00	
Score 1.00	6	8	14
1.00	4	32	36
Total	**10**	**40**	**50**

	Value	Std. Error[a]	Approx. T[b]	Approx. Sig.
Measure of agreement Kappa	.348	.149	2.520	0.012
N of valid cases	50			
Symmetric Measures				

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.

T-Test

Diag.	N	Mean	Std. Deviation	T	P
Score .00	10	7.000	0.94281	2.574	0.013
1.00	40	7.8750	0.96576		
T-Test					

Score	F	Sig.	t	df	Sig. (2-Tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal Variances Assumed	0.410	0.252	-2.574	48	0.013	-.8750	-0.33994	-1.55850	-.19150
Equal Variances Not Assumed			-2.612	14.117	0.020	-.8750	-0.33497	-1.59289	-.15711
Independent Samples Test									

			.00	1.00	Total
Score 1	.00	Count	4	5	9
		% within Score 1	44.4%	55.6%	100.0%
		% within DIAG	40.0%	12.5%	18.0%
	1.00	Count	6	35	41
		% within Score 1	14.6%	85.4%	100.0%
		% within DIAG	60.0%	87.5%	82.0%
		Count	10	40	50
		% within Score 1	20.0%	80.0%	100.0%
		% within DIAG	100.0%	100.0%	100.0%
Score 1 * Diag Cross Tabulation					

Alvarado Score	HPE Positive	HPE Negative
>7	35	6
<7	5	4
Total Number of Cases	**40**	**10**

The mean Alvarado score for HPE positive is 7.87 with a standard deviation 0.96, whereas for negative HPE the score is 7 (0.94).

't' value is 2.574, which is statistically significant.

'p' value is 0.013.

We have also compared Alvarado score of >7 with HPE outcome of 40 HPE positive patients. 35 patients were having >7 Alvarado score showed that the sensitivity is 87.5%. Those who had negative HPE report having a score of <7 showed that the specificity is 40%. The false positive is 6% and false negative is 5% for both male and females.

The study has a positive predictive value of 85%.

CONCLUSION

Acute appendicitis is one of the most frequent reasons for emergency abdominal operations. Correct preoperative diagnosis sometimes can be difficult. In our country, the surgeon should largely rely upon clinical findings. This study showed that clinical scoring like the Alvarado score can be a cheap and quick tool to apply in emergency departments to rule in acute appendicitis. This scoring system is a dynamic one allowing observation and clinical re-evaluation of the clinical picture. Its application improves diagnostic accuracy and consequently reduces negative exploration and complication rates (e.g. perforation). Even with an Alvarado score of >6, many female cases had an inflamed appendix. Hence, females with a score of >6 maybe advised to undergo USG and if needed laparoscopy. The implementation of modified Alvarado score is simple cost effective. For the hospital, more important is that the individual patients benefit significantly from important diagnostic accuracy of this common emergency abdominal conditions.

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