EVALUATION OF PRE-OPERATIVE DIAGNOSTIC EFFICACY OF MODIFIED ALVARADO SCORING SYSTEM IN ACUTE APPENDICITIS

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ABSTRACT

BACKGROUND

Acute Appendicitis is the one of the most common acute surgical condition of abdomen. Acute Appendicitis may occur but is most commonly seen in the second and third decade of life. Acute Appendicitis if not diagnosed early and treated properly, may lead to fatal outcome.

MATERIALS AND METHODS

A prospective study of 100 patients, with a clinical diagnosis of acute appendicitis, admitted in the department of general surgery, B.R.D. Medical College Gorakhpur during a period of one year.

RESULTS

The age group in which acute appendicitis occurred commonly was between 18 to 30 years. It is clear that incidence is less in younger and older is group with peak incidence in second and third decade. Female to male ratio was 1.8:1. Pain was the commonest presenting symptom and has been observed in all the cases (100% in present series) followed by nausea/vomiting in 87% cases and anorexia in 49% cases.

CONCLUSION

In the diagnosis of acute appendicitis the modified Alvarado Scoring System has a diagnostic value of 88.66%. This system is simple, reliable, cheap, non-invasive and safe diagnostic modality. The application of this scoring system improved diagnostic accuracy and consequently reduced negative appendectomy rate.

KEYWORDS

Acute Appendicitis, Perforation, Abscess, Peritonitis, Retrocaecal.

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BACKGROUND

Acute Appendicitis is one of the most common surgical emergency. Simple appendicitis can progress to perforation, which is associated with a much higher morbidity and mortality, and surgeons have therefore been inclined to operate when the diagnosis is probable rather than wait until it is certain[1]. The surgical principle about acute appendicitis "when in doubt, take it out", is not correct in view of the number of major and minor complications following appendectomy. Owing to its myriad presentations, acute appendicitis is a common but difficult diagnostic problem. The accuracy of clinical examination has been reported to range from 71% to 97% and varies greatly depending on the experience of examiner[2]. However, because mixed ruptured appendicitis have dire consequences, surgeons have traditionally accepted a 20% rate of negative findings at appendectomy and removal of a normal appendix[3]. The diagnosis of appendicitis can be difficult, occasionally taxing the diagnostic skill of even the most experienced surgeon. Equivocal cases usually require inpatient observation. This delay in the diagnosis may increase the morbidity and costs. Attempts to increase the diagnostic accuracy in acute appendicitis have included, imaging by ultrasonography, laparoscopy and even a radioactive isotope imaging[4,5,6,7].

Various scoring system have been devised to aid diagnosis[8,9].

The Alvarado score was described in 1986 and has been validated in adult surgical practice. The use of an objective scoring system such as Alvarado system can reduce negative appendectomy rate to 0-5%[10].

A scoring system described by Alvarado was designed to reduce the negative appendectomy rate without increasing morbidity which was modified by M. Kalan, D. Talbat, W.J. Cunliffe and A.J rich[11] Luhmann J et al (1980) showed that clinical experience is the most important item in proving the diagnosis of acute appendicitis which ought to be operated upon Daehlin L et al (1982), A high degree of alertness seems to be essential for the early diagnosis of acute appendicitis[12] Butchmann TG et al (1984), Any patient

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observed for a non-surgical condition of abdomen who fails to improve markedly during a brief course of supportive therapy must be thoroughly re-evaluated as a potential surgical candidate .A high index of suspicion is crucial [13]

Arbjornsson E (1985) using the scoring system described,30% of the unnecessary appendicectomies could have been avoided[14].

However, this system is not a substitute of clinical judgment and just and aid in diagnosing acute appendicitis and assist in arriving at a conclusion weather a particular case should be operated or not, so that the number of negative appendectomy will be reduced.

Aims and Objectives

- The aim of this study was to evaluate the pre-operative diagnostic efficacy of Modified Alvarado Scoring System in the diagnosis of acute appendicitis.
- To evaluate its feasibility and value as an aid in surgical decision making in case of possible appendicitis and in reducing the number of negative appendectomies.

MATERIALS AND METHODS

The material for this prospective study were collected from 100 patients with a clinical diagnosis of acute appendicitis, admitted in the department of general surgery, B.R.D. Medical College Gorakhpur U.P during a period from December 2013 to December 2014.

Inclusion Criteria

1. All the adult patients of both sex with clinical suspicion of acute appendicitis aged between 18 to 60 years admitted to the department of surgery B.R.D. Medical College Gorakhpur.

Exclusion Criteria

- Patients older than 60 years,
- Pregnant females,
- Appendicular mass,
- Appendicular abscess,
- Children,
- Appendicitis mimicking condition of gastrointestinal, urological or Gynaecological origin suspected, as diagnosed by ultrasound scan.

Depending on individual presentation of signs and symptoms, a score was calculated for each case of suspected appendicitis from 9 values.

	Score
Symptoms	
1. Migratory RIF pain 2. Anorexia 3. Nausea and vomiting	1 1 1
Signs	
1. Tenderness over RIF 2. Rebound Tenderness RIF 3. Fever	2 1 1
Laboratory findings	
Leukocytosis	2
Total	**9**

Table 1. Modified Alvarado Scoring System

The observed value in each case was added and expressed as end-score.

According to the end score-

- Those patients with score of >7-9 underwent appendectomy.
- Those patients with score of 5-6 who were suspected on clinical grounds as appendicitis, kept for observation for 24 hrs.
- Those patients with a score of 1-4 were observed and managed symptomatically and discharged with advised to come back if symptoms aggravated.

RESULTS

A prospective study consisting of 100 acute abdomen cases with a clinical diagnosis of acute appendicitis were undertaken to evaluate the sensitivity of Modified Alvarado Scoring system with respect to its diagnostic accuracy.

Age (Years)	**Male (No. (%))**	**Female (No. (%))**	**Total (No. (%))**
18-30	26 (26.0)	46 (46.0)	72 (72.0)
30-40	08 (08.0)	06 (06.0)	14 (14.0)
40-50	06 (06.0)	04 (04.0)	10 (10.0)
50-60	02 (02.0)	02 (02.0)	04 (04.0)
Total	**42 (42.0)**	**58 (58.0)**	**100 (100.0)**
Inference	72% of the patient are in the age group of 18-30 years		

Table 2. Age Distribution With Sex

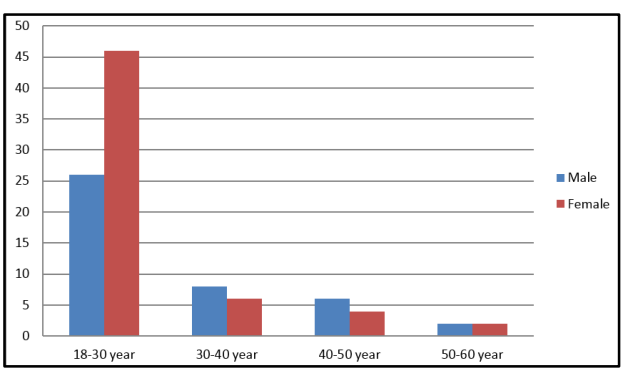

Figure 1. Graph Showing Age Distribution

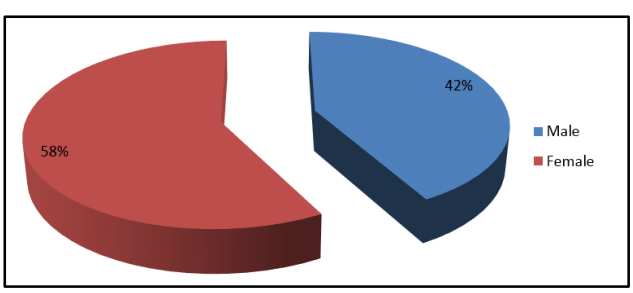

Figure 2. Graph Showing Sex Distribution

Clinical Features (Symptoms)	Number of Cases	Percentage
Abdominal pain	100	100.0
Anorexia	49	49.0
Nausea/Vomiting	87	87.0
Constipation	07	07.0
Diarrhea	04	04.0

Table 1. 2/A. Presenting Symptoms

Clinical Features (Signs)	Number of Cases	Percentage
RIF- tenderness	100	100.0
Rebound- Tenderness	100	100.0
Fever	51	51.0
Muscle guarding	18	18.0
Abdominal rigidity	04	04.0
Psoas sign	03	03.0
Obturator sign	06	06.0
Rovsing's sign	04	04.0
Hyperthesia at Sherren's Triangle	04	04.0
Rectal tenderness	06	06.0

Table 2/B. Presenting Signs

Clinical Features	Number of Cases	Percentage
Symptoms		
Migratory RIF pain	100	100.0
Anorexia	49	49.0
Nausea/Vomiting	87	87.0
Signs		
RIF-tenderness	100	100.0
Rebound- Tenderness	100	100.0
Fever	51	51.0
Laboratory finding		
Leucocytosis	23	23.0

Table 2/C. Presenting Clinical Features

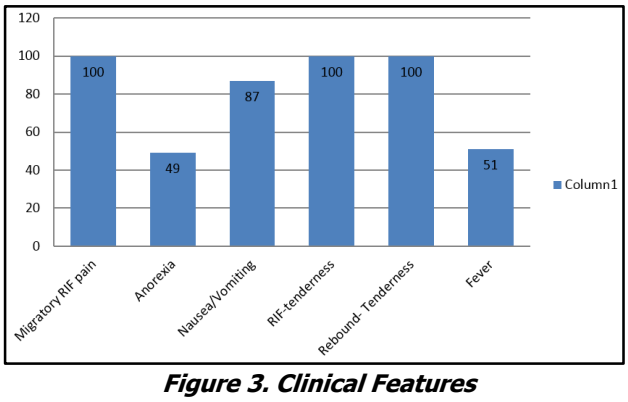

Figure 3. Clinical Features

Modified Alvarado Score	Total (No. (%))	Male (No. (%))	Female (No. (%))
7-9	47 (47.0)	18 (18.0)	29 (29.0)
5-6	50 (50.0)	23 (12.0)	27 (10.0)
1-4	03 (03.0)	02 (02.0)	01 (01.0)

Table 3. Results of Modified Alvarado Score

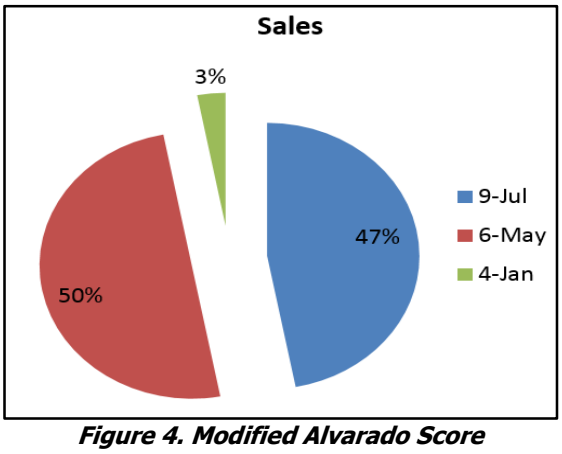

Figure 4. Modified Alvarado Score

Histopathological (n=100)	Number of Cases	Percentage
Ac. Appendicitis	73	73.0
Ac. Suppurative	07	07.0
Ac. Gangrenous	04	04.0
Ac. Perforative	03	03.0
Normal	10	10.0

Table 4. Pathological Diagnosis of the Specimen of Appendix sent for Histopathological Study

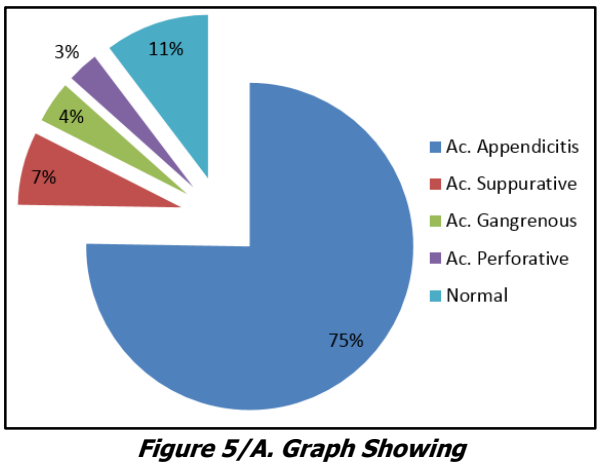

Figure 5/A. Graph Showing Histopathological Correlation

Alvarado Score	Histopathological Examination			
	Appendicitis	Normal Appendix	'p' value	Or Appendicitis
5-6 (n=50)	44	06	0.0001	0.34
7-9 (n=47)	42	05	0.0001	
Inference	Increased proportion 5.0% of negative appendectomy is noticed (0.34 times more) for the Alvarado Score 5-6 and significantly decreased proportion (3.0%) negative appendectomy is noticed (0.24 times less) for the Alvarado score 7-9.			
OR: odd ratio				

Table 5/A. Results of Modified Alvarado Score

	Total Number of Patients	Score 7-9	Appendicitis	Sensitivity
Men Women	18 29	18 29	18 24	100.0% 82.75%
		Score 5-6		
5-6 (n=50) 7-9 (n=47)	23 27	23 27	21 23	91.30% 85.18%
Inference		Alvarado Score 7-9 has more diagnostic value for diagnosing Appendicitis compared to Alvarado score 5-6. Overall Alvarado score>5 has got more sensitivity and of diagnosing patients for appendicitis		

Table 5/B. Diagnostic Value of Modified Alvarado Score

Variables	Results (Sensitivity)
Total - Alvarado Score > 7 - Alvarado Score < 7	 =89.36% =88.00%
Males - Alvarado Score > 7 - Alvarado Score < 7	 =100.0% =91.30%
Females - Alvarado Score > 7 - Alvarado Score < 7	 =82.75% =85.18%

Table 5/C. Diagnostic Value of Modified Alvarado Score

Negative Appendectomy	Number of Cases	Percentage
Male	02	02.06
Female	09	09.28
Overall	11	11.34

Table 6. Showing Negative Appendicectomy

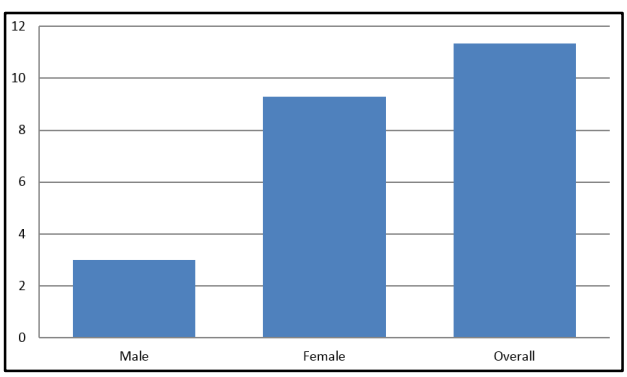

Figure 5. Negative Appendectomy

Post-operative Complication (n=100)	Number of Cases	Percentage
Wound infection	02	02.06
Respiratory tract infection	09	09.28
Paralytic illness	11	11.34

Table 7. Showing Post-operative Complications

Statistical Methods- Fisher exact test has been used to find the significance of scoring system of Appendicitis in Male and Female in conformation with HPE. The Odds Ratio has been used to find the strength of relationship between scoring system with HPE. Diagnostic statistics have been used to find the diagnostic value of scoring system in diagnosing for Appendicitis.

Test	Criteria		
	+	-	Total
+	A	B	A+B
-	C	D	C+D
Total	A+C	B+D	N

Sensitivity = A/ (A+C)
Specificity = D/ (B+D)
PPV = A/ (A+B)
NPV = D/(C+D)

DISCUSSION

Acute appendicitis remains a common abdominal emergency throughout the world. The diagnosis of acute appendicitis continues to be difficult due to the variable presentation of the disease and the lack of reliable diagnostic test. None of the investigations like USG, CT, can conclusively diagnose appendicitis.

It has proved that some of the investigations already discussed are costly, time consuming, require more sophisticated equipment and expertise, while some are not feasible and not readily available.

So, even today, a through clinical examination with basic investigations like WBC count remains cornerstone in the diagnosis of acute appendicitis.

Although there has been some improvement in the diagnosis of acute appendicitis over the past several decades, the percentage of negative appendectomy reported in various series varies from 8 to 33%.

The modified Alvarado score proved to be effective in one study in adult patients with acute appendicitis. The modified Alvarado scoring system is simple to use and easy to apply, since it relies on history, clinical examination and basic lab investigations.

The present study was undertaken to evaluate the usefulness of modified Alvarado scoring system in reducing the number of negative appendectomy.

Pain was the commonest presenting symptoms and has been observed in all the cases (100%) in the present series. The classical shifting of pain from umbilical region to RIF was seen in all cases.

Next common symptoms observed were nausea/ vomiting in 87% of cases and anorexia in 49% of cases.

Majority of the patients had aching type of pain and some (8%) had colicky pain.

Fever was of low grade with corresponding rise in pulse rate and was present in 51% of cases.

Majority of the patients presented within 24 hrs. after the onset of pain, with most of them presenting between 12-24 hrs of onset of pain.

On clinical examination, tenderness at McBurney's point was the commonest sign (97%). Guarding was present in 20% of patients. It was present when the inflammation was server. Rebound tenderness was present in 83%. In these cases, there was presence of local peritonitis or when inflamed appendix was more anteriorly placed. Abdominal rigidity in 8% was due to perforated appendix or gangrenous appendix.

Rovsing's sign was positive in 14%. This sign is seen whenever there is inflammation in the RIF. Psoas test was positive in 12% cases, whereas obturator test was positive in 24% due to retrocaecal appendix.

In the present study the TLC was increased in 76%, and it was within normal range in 24%.

Plain X-ray abdomen taken in erect posture showed, ground glass appearance in 2 patients, suggestive of diffuse peritonitis. 2 patients had fluid levels localized to the caecum. Free gas under the diaphragm was not present in the cases with perforated acute appendicitis. In none of the patients, faecolith casting a radio-opaque shadow could be demonstrated.

For assessment, the patients were categorized into 2 groups namely, male and female. Out of 100 cases studied, 42 were male and 58 were female.

Out of 42 males, score of 7-9 were 18, score of 5-6 were 22 and 2 had the score of 1-4.

Out of 58 female patients, 29 had score 7-9, 28 had score 5-6 and 1 had score 1-4.

Total of 97 patients were operated, of which 40 were males and 57 were females.

18 males having score of 7-9 were had acute appendicitis.

Male patients having score of 5-6 were 22, out of which 20 patients had acute appendicitis, 2 patients had normal appendix and had mesenteric lymphadenitis.

In 29 female patients having a score 7-9, 24 had acute appendicitis, 5 patients had normal appendix with other diseases. In 27 females with score 5-6, 23 had acute appendicitis, 4 had normal appendix with diseases (PID).

	Total Number of Patients	Score 7-9	Appendicitis	Sensitivity
Men Women Children	18 29	18 29	18 24	100.0% 82.75%
		Score 5-6		
Men Women Children	23 27	23 27	21 23	91.30% 85.18%

Table 8

1-4 score not included. These patients were not operated (2 male, 1 female).

When compared with Mohamed I et al series it is evident that modified Alvarado scoring system is more sensitive. It can be used as a complementary method in diagnosing acute appendicitis.

Variables	A1-Hashemy et al	Our series (Sensitivity)
Total - Alvarado Score>7 - Alvarado Score<7	Sensitivity = 53.9%	 = 93.61% = 96.0%
Males - Alvarado Score>7 - Alvarado Score <7	Sensitivity = 56.4%	 = 93.10% = 95.65%
Females - Alvarado Score>7 - Alvarado Score <7	Sensitivity = 48.0%	 = 94.40% = 96.29%

Table 9

Series	Sensitivity
Kalan et al[11]	81.63%
Denizbasi A[15]	95.40%
Al-Hashemy et al[10]	53.90%
Shrivastava UK et al[16]	92.40%
Present study	88.66%

Table 10

Increased proportion 5.00% of negative appendectomy is noticed (0.34 times more) for the Alvarado Score 5-6 and significantly decreased proportion (3.00%) negative appendectomy is noticed (0.24 times less) for the Alvarado Score 7-9.

In our series negative appendectomy rate in females with score 5-6 was 5.2% and with score 7-9 was 5.2 %. Men with score 5-6 had negative appendectomy rate of 1.0% and with score 7-9 had negative appendectomy rate of 0.0%. Hence in the overall males (1.0%) had less negative appendectomy rate compared to females (5.2%).

The Overall Alvarado score of >5 has got more sensitivity (88.66%) and greater diagnostic accuracy for diagnosing patients with appendicitis. This indicates that by particularly adopting this system, negative appendectomy can be reduced. Those patients who scored <5 did not require subsequent appendicitis, indicating the usefulness of the system in ruling out acute appendicitis.

In our series, when the score was more than 7, suggesting an inflammation localized to the RIF, surgery was done within 6hrs of the patient getting admitted to hospital and it was observed that these patients had inflamed appendix, again indicating the sensitivity of the system.

In patients with score of 5-6, were observed and reassessed after a period of 12-24 hrs. In patients with persistence of abdominal tenderness, with increased WBC count, appendectomy was done. These patients were also found to have congested and inflamed appendix.

In our present study, the usefulness of the system was demonstrated by reducing the number of negative appendectomy especially in women.

CONCLUSION

This study showed that in the diagnosis of acute appendicitis, the modified Alvarado scoring system has a high diagnostic value (88.66%). Applicability of this scoring system is a simple, reliable, cheap, non-invasive, repeatable and safe diagnostic modality without extra expense and complications. It is easy to follow in peripheral hospitals where back up facilities are minimal. It can be very helpful for surgeons working in peripheral hospitals, provided it is applied appropriate and objectively in patients with suspected appendicitis. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendectomy rate and also reduces complication rates.

REFERENCES

[1] Hoffmann J, Rasmussen OO. Aids in the diagnosis of acute appendicitis. Br J Surg 1989;76(8):774-779.
[2] John H, Neff U, Kelemen M. Appendicitis diagnosis today: clinical and ultrasonic deductions. World J Surg 1993;17(2):243-249.
[3] Jones PF. Suspected acute appendicitis: trends in management over 30 years. Br J Surg 2001;88(12):1570-1577.
[4] Balthazar EJ, Megibow AJ, Hulnick D, et al. CT of appendicitis. AJR Am J Roentgenol 1986;147(4):750-710.
[5] Takada T, Yasuda H, Uchiyama K, et al. Ultrasonographic diagnosis of acute appendicitis in surgical indication. Int Surg 1986;71(1):9-13.
[6] Clarke PJ, Hands LJ, Gough MH, et al. The use of laparoscopy in the management of right iliac fossa pain. Ann R Coll Surg Engl 1986;68(2):68-69.
[7] Rypins EB, Evans DG, Hinrichs W, et al. Tc 99m-HMPAO white blood cell scan for diagnosis of acute appendicitis in patients with equivocal clinical presentation. Ann Surg 1997;226(1):58-65.
[8] Teicher I, Landa B, Cohen M, et al. Scoring system to aid in diagnosis of appendicitis. Ann Surg 1983;198(6):753-759.
[9] Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med 1986;15(5):557-564.
[10] Al-Hashemy AM, Seleem MI. Appraisal of modified Alvarado score for acute appendicitis in adult. Saudi Med J 2004;25(9):1229-1231.
[11] Kalan M, Talbot D, Cunliffe WJ, et al. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. Ann R Coll Surg Engl 1994;76(6):418-419.
[12] Daehlin L. Acute appendicitis during the first three years of life. Acta Chir Scand 1982;148(3):291-294.
[13] Buchman TG, Zuidema GD. Reasons for delay of the diagnosis of acute appendicitis. Surg Gynaecol Obstet 1984;158(3):260-266.
[14] Arnbjornsson E. Scoring system for computer-aided diagnosis of acute appendicitis. The value of prospective versus retrospective studies. Ann Chir Gynaecol 1985;74(4):159-166.
[15] Denizbasi A, Unluer EE. The role of emergency medicine resident using the Alvarado score in the diagnosis of acute appendicitis compared with the general surgery resident. Eur J Emerge Med 2003;10(4):296-301.
[16] Shrivastava UK, Gupta A, Sharma D. Evaluation of the Alvarado score in the diagnosis of acute appendicitis. Trop Gastroenterol 2004;25(4):184-186.