



A Prospective Observational Study of Role of Modified Alvarado Score, Ultrasound Abdomen and Histopathology in the Diagnosis of Acute Appendicitis

Authors

Dr Sirikonda Srikanth, Dr Thogari Kranthi Kumar*, Dr K.S. Lakshmi Sri Vidya

*Corresponding Author

Dr Thogari Kranthi Kumar

Abstract

Appendicitis is the one of the most common surgical emergency with a lifetime risk of 8.6% in males and 6.7% in females. The diagnosis of acute appendicitis is predominantly based on clinical findings. When appendicitis manifests in its classic form, it is easily diagnosed and treated. This study tries to correlate between clinically diagnosed acute appendicitis and histopathologically examined specimen. In view of the above, it was decided to study the correlation between the combination of modified Alvarado score (MAS) and ultrasound in reducing negative appendectomy rates and to determine the accuracy between them.

In our study we found that Ultrasonography and Modified Alvarado Score are both beneficial in diagnosis of acute appendicitis.

Keywords: *appendicitis, modified Alvarado score (MAS), appendectomy.*

Introduction

Appendicitis is the one of the most common surgical emergency with a lifetime risk of 8.6% in males and 6.7% in females.¹The diagnosis of acute appendicitis is predominantly based on clinical findings. When appendicitis manifests in its classic form, it is easily diagnosed and treated. Unfortunately, these classic symptoms occur in just over half of patients, therefore an accurate and timely diagnosis of atypical appendicitis remains clinically challenging and is one of the most commonly missed problems in the emergency department.

Furthermore, the consequence of missing appendicitis, leading to perforation, significantly

increases morbidity and prolongs hospital stay.² Although the mortality rate has been vastly reduced, the diagnostic inaccuracy rate of 15% to 20% has remained unchanged in the past century. High rates of negative appendectomy (operation without histological confirmation of appendicitis) have been reported with some groups such as females of reproductive age (up to 26%).³The main factors contributing to this high negative laparotomy rate have been the nonspecific clinical features of acute appendicitis. A complication rate of up to 6.1% following removal of normal appendices was also reported⁴

To decide between lesser of two evils, that is, a negative appendectomy or an appendicular perforation can be often be a vexing problem. Ultrasound has been proposed as an ideal non-invasive adjunct to diagnosis in suspected appendicitis.

This study tries to correlate between clinically diagnosed acute appendicitis and histopathologically examined specimen. In view of the above, it was decided to study the correlation between the combination of modified Alvarado score and ultrasound in reducing negative appendectomy rates and to determine the accuracy between them.

Materials and Methodology

Source of data were patients of all age, either sex, admitted under the Department of General Surgery, Kamineni Hospitals with the diagnosis of acute appendicitis and undergoing appendectomy.

Study period was from June 2015 to March 2017. It was a prospective observational study.

A total minimum number of 150 patients will be studied.

Direct interview with patient and obtaining a detailed history.

Thorough clinical examination.

A pretested structural proforma will be used to collect relevant information.

Results

Sex

Table - I

	Frequency	Percent
Female	47	31.3
Male	103	68.7
Total	150	100.0

One fifty patient were recruited into the study during the period of study.

The mean age of the cases included in the study was 23.75 ± 11.75;

103 cases were males (68.70%) and 47 were females (31.3%)

Complaints *Frequencies

Table - II

	N	Percent	Percent of Cases
Pain	148	60.9%	98.7%
Fever	74	30.5%	49.3%
Vomiting	21	8.6%	14.0%
Total	243	100.0%	162.0%

On evaluation of the complaints of the patients on admission to the emergency unit:

98.7 % had abdominal pain,

49.3% had fever, and

14.0% had vomiting.

Anorexia

Table- III

	Frequency	Percent
No	72	48.0
Yes	78	52.0
Total	150	100.0

On evaluation around 52% of patients (n=78) had anorexia

48% of patients (n=48) had no anorexia.

Nausea

Table - IV

	Frequency	Percent
No	64	42.7
Yes	86	57.3
Total	150	100.0

On evaluation 42.7 % of patients (n=64) had nausea

57.3% of patients (n=86) had no nausea.

Tenderness

Table – V

	Frequency	Percent
Yes	150	100.0

All patients presented to casualty with the complaints of pain abdomen, those who are included in the study had right iliac fossa tenderness (n=150)

Rebound Tenderness

Table - VI

	Frequency	Percent
No	13	8.7
Yes	137	91.3
Total	150	100.0

On evaluation 91.3% of patients (n=137) had rebound tenderness and 8.7% of patients (n=13) had no rebound tenderness.

Rise in Temperature

Table - VII

	Frequency	Percent
No	33	22.0
Yes	117	78.0
Total	150	100.0

On evaluation 78.0% patients (n=117) had rise in temperature and 22.0% patients (n=33) had no rise in temperature.

Leucocytosis

Table - VIII

	Frequency	Percent
Yes	119	79.3
No	31	20.7
Total	150	100.0

In our study we took WBC count more than 10,000 cells/mcl was taken as leucocytosis. In 150 cases, the white blood cell count was high in 119 cases (79.3%), and the white blood cell count was normal in 31 cases (20.7%).

Mas

Table - IX

	Frequency	Percent
<7	46	30.7
≥7	104	69.3
Total	150	100.0

Ultrasonography

Table - X

	Frequency	Percent
Normal Appendix	44	29.3
Acute Appendicitis	106	70.7
Total	150	100.0

In our study all 150 patients underwent USG abdomen , in those USG showed acute appendicitis in 106 patients (70.7%), and normal study in 44 patients (29.3%).

Histopathology

Table - XI

	Frequency	Percent
Normal Appendix	19	12.7
Appendicitis	131	87.3
Total	150	100.0

In our study histopathology showed appendicitis in 131 patients(87.3%) and Normal appendix in 19 patients (12.7%).

Mas * Histopathology

Table - XII

	Normal Appendix	Appendicitis	Total
<7	16	30	46
	34.8%	65.2%	30.7%
≥7	3	101	104
	2.9%	97.1%	69.3%
Total	19	131	150
	12.7%	87.3%	100.0%

Chi square= 29.335 df=1 P value=0.0001

In 104 cases (69.3%), the Alvarado score was found to be higher than 7. This score was found to be less than 7 in 46 cases (30.7%). The sensitivity of the Alvarado score was calculated as 84.2%, the specificity as 77.1%.

Ultrasonography * Histopathology:

Table - XIII

	Normal Appendix	Appendicitis	Total
Normal Appendix	14	30	44
	31.8%	68.2%	29.3%
Acute Appendicitis	5	101	106
	4.7%	95.3%	70.7%
Total	19	131	150
	12.7%	87.3%	100.0%

Chi square= 20.644 df=1 P value=0.0001

According to these results, in all the cases, the sensitivity of USG was determined as 73.7%, specificity as 87.3%.

In our study, 60 cases (40%) had undergone open appendicectomy and 90 cases (60%) had undergone laparoscopic appendicectomy.

Sex * Histopathology

Table - XIV

	Normal Appendix	Appendicitis	Total
Female	7	40	47
	4.68%	26.65%	31.3%
Male	12	91	103
	8.02%	60.64%	68.7%
Total	19	131	150
	12.7%	87.3%	100.0%

Chi square= 0.307 df=1 P value=0.58

In our study histopathological examination showed normal appendix in 19 cases (12.7%), Of which 7 were females (4.68%) and 12 were males (8.02%).

Histopathology examination showed Appendicitis in 131 cases (87.3%), of which 40 were females (26.65%) and 91 were males (60.64%).

Table – XV

	Normal Appendix	Appendicitis	Total
Female	7	40	47
	14.9%	85.1%	31.3%
Male	12	91	103
	11.7%	88.3%	68.7%
Total	19	131	150
	12.7%	87.3%	100.0%

Chi square= 0.307 df=1 P value=0.58

According to histopathological study, in total number of males 11.70% showed normal appendix and 88.30% showed appendicitis.

According to histopathological study, in total number of females 14.90% showed normal appendix and 85.10% showed appendicitis.

T-Test

Table - XVI

	Histopathology	N	Mean	Std. Deviation	P value
Age	Normal Appendix	19	24.63	9.221	0.752
	Appendicitis	131	23.75	11.615	

Mean age of patients with normal appendix shown on histopathology is 25 +/- 9 years

Mean age of patients with appendicitis shown on histopathology is 24 +/- 11 years.

Discussion

- The diagnosis of acute appendicitis in patients presenting with typical clinical finding can be made mostly on the clinical and laboratory findings. Radiation of pain, loss of appetite, nausea, vomiting, and tenderness in the right lower quadrant, fever, and leukocytosis are highly effective and practical criteria for diagnosing acute appendicitis. However, about one third of the acute appendicitis cases have atypical clinical findings, symptoms, and laboratory findings. In these cases, radiological evaluations are required.⁵
 - Acute appendicitis is primarily a disease of adolescents and adults and its peak incidence is in the 2 nd and 3 rd decades of life.⁶
 - In the study conducted by Demircan, *et al.*, with 85 patients, the mean age was 33.5 ± 12.8 years. 55.3% (47) of the patients were males and 44.7% (38) were females. 16.5% (14) of the patients were in the range of 17-20 years of age 69.4% (59) were in the range of 20-50 years of age, and 14.1% (12) were in the over 50years age group.⁷
 - In the study conducted by Dikicier, *et al.*, 48% of the cases (n = 139) were males, 52 were (148) females and the mean age was 31.5.⁸
- In our study, the patient age was in agreement with that of the literature,^{6,7,8} and as it is evaluated for gender, the male gender was higher.
- A careful patient history and detailed clinical examination are essential in the diagnosis of acute appendicitis. However, in the laboratory analyses, leukocytosis is a finding which supports the diagnosis of appendicitis.⁹
 - In the study conducted by Demircan, *et al.*, with 85 patients, as 10,000/mm ≥ was taken for the lower limit value for leukocytosis, only 4.7% of the patients (n = 4) had values below this value.⁷

Our study, agreed with findings in literature as the white blood cell counts were high in and of the cohort.

- The most important initial symptom is pain, which is present in 90-100% of the patients.¹⁰
- In a study carried out by Mentas, *et al.*, in 22 cases (27.5%), there was no pain radiation to the right lower quadrant and in 70% of cases, there was right lower quadrant tenderness, which was rebounding in 75% of cases, and the Rovsing's sign was positive 66% of the cases.¹¹

Consistent with the findings in this study. in our study, clinical examination findings consistent with the literature were present.

- In a study carried out by Mentas, *et al.*, in 63.7% of cases, the Alvarado score was higher than 7: in 36.3% of the cases, the Alvarado score was determined as 6 and lower than 6.¹¹

In our study, the Alvarado score was 7 and above 7 in 61.3% of the cases.

- In a study carried out by Chong, *et al.*, regarding the Alvarado score, the sensitivity was determined as 68.3%, the specificity as 87.9%.¹²
- In another study carried out with a thousand patients, the sensitivity was determined as 87.41%, the specificity as 74.39%.¹³

In our study, we calculated the sensitivity of the Alvarado score as 77.1% , specificity as 84.21%

- Similar to our results, in the study conducted by Jalil, *etal.*, the Alvarado score's sensitivity was reported as 66%, specificity as 81%, were reported.¹⁴
- In another study conducted in 2004, the sensitivity of the Alvarado score was determined as 53.85 and the specificity was determined as 80%.

Furthermore, it was reported that the sensitivity and specificity in males (56.4 and 100%) were higher than those in females (48 and 62.5%).¹⁵The findings of our study were consistent with

this study.

- In other studies, it was reported that the sensitivity of Alvarado score in males were higher than that in females.^{15,16} This study is consistent with the finding in the literature, the sensitivity rate of the Alvarado score were higher in males.
- In one of the studies, it was reported that the sensitivity of USG in acute appendicitis has been reported as 81-88% and the specificity has been reported as 78-84%.¹⁷
- In another study conducted by Wilson, *et al.*, the, the sensitivity of USG as 76-96%, and the specificity as 47-94%.¹⁸
- Orr, *et al.*, found the sensitivity of USG in acute appendicitis as 85% and the specificity as 92%.¹⁹
- In the study of Reich, *et al.*, the sensitivity of USG was determined as 68%,²⁰ and while our USG results were lower than the results of previous studies.

The reason for the lower sensitivity, specificity of the USG may be due to the different evaluations of the patients by different radiologists with different experiences.

- It is important to reach an early and accurate diagnosis before the complications occur.
- The objective is to reduce the rate of negative appendectomy without increasing the perforation rate.
- While early surgical interventions performed to prevent complications have resulted in negative laparotomies in 8-30% of the cases, interventions that are performed late in order to wait for the clinical picture to fully settle, lead to an increase in the rate of perforated appendicitis.²¹

Consistent with the literature, in our study, negative appendectomies were determined in 7.89% of the cases, comparatively lesser rate of negative appendectomies.

- In the study of Reich, *et al.*, 10% of the cases in whom the USG findings were

found to be compatible with appendicitis, resulted in negative laparotomies.²⁰

- In the study conducted by Parks, *et al.*, the negative appendectomy rate was reported as 5% for USG and 12.2% for physical examination.

In our study, as the negative appendectomy rates were consistent with the literature for Alvarado scores (2.88%), the rates were determined to be high for USG (4.71%).²²

The disadvantages of USG depend on the experience of sonologist, not being performed optimally due to some problems originating from the patient (excess intra-abdominal fat mass, excessive intestinal gas, etc.) or the inability to visualize the appendix.²³

Conclusion

Ultrasonography and Modified Alvarado Score are both beneficial in diagnosis of acute appendicitis. Though Ultrasonography is operator dependent, it has reasonable sensitivity and specificity in diagnosis. Moreover; a cut-off point of 7 for the MASS score will yield more sensitivity and a better diagnosis of appendicitis, with lower incidence of negative appendectomy compared to the previous studies.

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