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## A clinico-pathological study of acute appendicitis with management and the role of ultrasound in diagnosis of appendicitis

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### Abstract

**Background:** Acute appendicitis is the most common cause of acute surgical abdomen and appendicectomy is the most commonly done emergency surgery. Its diagnosis remains an enigmatic challenge, plagued by a high rate of negative explorations. There is no single reliable test with satisfactory, sensitivity and specificity.

**Aim and Objective:** The objective of the study is to evaluate the clinical presentations, signs of acute appendicitis and its management. The role of USG in diagnosing acute appendicitis and reducing the rate of negative appendicectomies.

**Methodology:** The present study was conducted in 100 patients who have been clinically diagnosed of having Acute Appendicitis and posted for emergency appendicectomy in General Surgery, Department of MGM, attached to Kakatiya Medical College, Warangal, during the period from January 2018 to June 2020. Preoperatively blood for WBC count, DC and USG abdomen were done. All patients were subjected to histopathological examination postoperatively which was taken as gold standard. Results of Ultrasound were correlated with HPE reports to evaluate their role in diagnosis of acute appendicitis.

**Results and Observations:** In the present study we had 100 cases of which 61 (61%) were males and 39 (39%) were females. The number of patients was highest in the age group 20 to 29years (33%). Migrating Pain to RIF was found in 76% of patients, Anorexia in 87% of patients. Nausea/vomiting were present in 79% patients. Right iliac fossa tenderness was found in 98% of cases. Rebound tenderness was found in 68% of patients. Fever was present in 45% of cases. Total leucocyte count was elevated in 80% of cases in our present study. Shift to left was seen in 42% cases. In our study all the patients were subjected to abdominal ultrasound examination. The sensitivity and specificity of Ultrasonography for acute appendicitis is 94.8% and 80% respectively. Accuracy was 93%. The positive predictive value and negative predictive value of Ultrasonography for acute appendicitis is 98% and 44% respectively. Negative appendectomy rate in this study 5.5%.The majority (60%) is seen in females.

**Conclusion:** Ultrasound is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without any complications. It has greater sensitivity and positive predictive value in diagnosing acute appendicitis and it reduces the rate of negative appendicectomy.

**Keywords:** Ultrasonography, appendicectomy, WBC, diagnosis, fossa tenderness

### Introduction

Acute Appendicitis is the most common general surgical emergency. It presents with protean manifestations, generous overlap with other clinical syndromes, and significant morbidity, which increases with diagnostic delay.

No single sign, symptom, or diagnostic test accurately confirms the diagnosis of appendiceal inflammation in all cases, and the classic history of anorexia and periumbilical pain followed by nausea, right lower quadrant (RLQ) pain, and vomiting occurs in only 50% of cases.

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. However, the differential diagnosis of appendicitis is often a clinical challenge because appendicitis can mimic several abdominal conditions.

Abdominal ultrasonography is a popular imaging modality for acute appendicitis. It is widely available, non-invasive and avoids ionizing radiation.

Despite diagnostic and therapeutic advancement in medicine, appendicitis remains a clinical

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emergency and is one of the most common causes of acute abdominal pain.

My study has included the current approach in diagnosis and management of acute appendicitis & its complications by using Ultrasound Abdomen, Alvarado score, along with other investigations & Histopathology.

### Aim and Objectives

- To study the different modalities of presentation of acute appendicitis, the diagnosis and management.
- To study the role of ultrasound and to evaluate the sensitivity and specificity of sonography in the diagnosis of acute appendicitis

### Methodology

Patients who present with symptoms & signs of acute appendicitis and willing for admission MGM Hospital, Warangal under various surgical units, During the period of January 2018 to June 2020.

### Inclusion criteria for the study

1. Patients willing for investigation and surgery
2. Patients aged 15 years and above and of either sex.

### Exclusion criteria for the study

1. Pregnant females.
2. Patients age - 14 years and below
3. Patient with recent history of any abdominal surgeries

### Sample size: 100

After initial assessment of patients presenting to the Out Patient department or emergency department of MGM Hospital, Warangal with symptoms and signs suggestive of acute appendicitis, who met the inclusion criteria admitted and are initially subjected for Detailed history taking, Clinical examination Investigations like Haematological investigations, urine routine, X-ray. Abdomen / chest, USG abdomen as required.

Following which they were evaluated using the Alvarado scoring.

The ultrasonographic examination was performed, initially with a hand held 3.5 MHz sector probe, in which the entire abdomen was scanned to exclude possible differential diagnosis of acute appendicitis. A 5 MHz sector probe scan of the right lower quadrant, using the graded compression technique as described by Puylaert followed. The patient was asked to identify the site of maximum tenderness (self-localization) and graded compression was used to displace bowel loops in that area. The presence of a tubular, non-compressible, non-peristaltic, blind ending structure in the right iliac fossa, with a diameter of more than 6 mm was taken as significant. Other signs were recorded with special reference to peri-appendiceal collection and appendicolith.

Treatment was planned, depending upon the type of appendicitis and the presence or absence of complications. Pre-operative preparation consisted of bed rest, parental fluids, electrolytes, antibiotics and nasogastric aspiration. The decision to operate was taken solely by the treating surgeon, on the basis of clinical impression and ultrasonographic findings.

Acute cases were treated with emergency surgery. Appendicular mass cases were chosen for elective surgery. Anesthesia was either general or spinal anesthesia.

Abdomen was opened by Mc. Burney's. In a few cases, incision

had to be extended laterally and upwards. Appendectomy was done and in the majority of cases, stump ligated with linen thread and no invagination was done. In a few cases, the stump was invaginated. Drains were kept when found necessary. Abdomen was closed in layers, using Vicryl for peritoneum, muscles and fascia, and interrupted silk or nylon sutures for skin. The final diagnosis of acute appendicitis was confirmed by histopathology report. After surgery the patients were discharged on 3-7 days except in cases of complications.

### Results

**Table 1:** Age incidence

Age(years)	Male		Female		Total	
	No	%	No	%	No	%
15-19	17	27.9	11	28.2	28	28
20-29	19	31.1	14	35.9	33	33
30-39	17	27.9	7	17.9	24	24
40-49	4	6.6	4	10.3	8	8
50-59	2	3.3	3	7.7	5	5
>60	2	3.3	0	0	2	2
Total	61		39		100	

### Gender and Age distribution in acute appendicitis

In the present study, out of 100 cases, only 39 cases occurred in females, and the remaining 61 cases occurred in males. The male to female ratio in the present study is approx. 1.56:1.

In males most common age group of presentation of acute appendicitis was between (20-29) (31.1%) followed by the age group (15-219 years) (17.9%) and age group (30-39) (17.9%).

In females also the most common age group of presentation was between age group of 20-29 years (35.9%) followed by age group of 15-19 years (28.2%).

**Table 2:** Sex incidence

Sex	Number	%
Male	61	61
Female	39	39
Total	100	100

In our study, out of 100 cases 61 were males and 39 were females. This is statistically insignificant with p value of 0.028.

**Table 3:** Symptoms of acute appendicitis

Symptoms	Present	Absent	Total
Migrating RIF Pain	76	24	100
Anorexia	87	13	100
Nausea/vomiting	79	21	100

In this study Migrating Right iliac fossa pain was present in 76% of patients which is significant. Anorexia was present in 87%. Nausea/vomiting were present in 79% of patients. All the above are statistically significant.

**Table 4:** Signs in acute appendicitis

Signs	Present	Absent	Total
Fever	45	55	100
Rif tenderness	98	2	100
Rebound tenderness	68	32	100

In the present study Fever (>38C) was present only in 45% of the patients and was absent in 55% of patients. Rif tenderness was present in statistically significant 98% of the patients. Rebound tenderness was present in 68% of patients.

**Table 4:** Leucocyte count & shift to left in acute appendicitis

Leucocyte	Present	Absent	Total
Total count raised (>12,000)	80	20	100
Shift to left (d.c) (75% neutrophils)	42	58	100

In our study total count was raised in 80% of patients with P value of 0.000 which is statistically significant. Shift to left was present in 42% of patients and was statistically insignificant.

**Table 5:** Duration of hospital stay

Duration ( in days )	Total number of patients
≤ 2	23
3-5	56
6-7	18
>7	3

In our study, majority of the patients stayed in the hospital for a duration of 3-5 days (56) followed by those who stayed for less than 2 days (23). Surgical site infection was the major cause for late discharge.

**Table 6:** Ultrasound findings

USG findings	Number
Appendicitis	76
Appendicular Abscess	3
Appendicular Mass	6
Appendicular Perforation	6
Normal study	11
	<b>100</b>

In our study all the patients were subjected to abdominal ultrasound examination. 76 patients had features suggestive of Acute Appendicitis, 6 patients had appendicular mass and 6 patients had appendicular perforation. 11 patients had Normal study on Ultrasonography out of which 9 were clinically (Alvarado scoring more 5 or more) found to have appendicitis and underwent appendectomy. Remaining 2 patients were managed conservatively. Out of this 6 cases which had Appendicular Mass and 3 patients who had Alvarado score of less than 4 were managed conservatively. Remaining 91 patients underwent open Appendectomy.

**Table 7:** USG and HPE correlation

USG	HPE positive	HPE negative	Total
Positive	81 (true positive)	1 (false positive)	82
Negative	5 (false negative)	4 (true negative)	9
Total	86	5	91

**Table 8:** USG statistical measure of performance

Sensitivity	94.8%
Specificity	80%
Predictive value of positive test	98%
Predictive value of negative test	44%
Accuracy	93%

**Table 9:** Intra operative findings

Intra operative Findings	Number of Patients	%
Normal	9	9.8
Inflamed appendix	65	71.4
Perforated appendix	9	9.8
Gangrenous appendix	8	8.7
Total	91	100

### Distribution of cases as per Alvarado's score

In our study all the cases were subjected to Alvarado scoring system, to clinically evaluate the patients. Those with scores of 5 or more were operated upon and score below 4 was managed conservatively.

**Table 10:** Alvarado score in study group

Alvarado's score	Number of patients
<3	0
4	3
5	9
6	11
7	24
8	19
9	28
10	6
TOTAL	100

In our study scores suggestive of acute appendicitis (5 or more) was found to be present in 97 patient and 3 patients had scores of less than 4 and were managed conservatively. Of the 91 cases that were operated upon 5 had Normal Histopathological report.

**Table 11:** Correlation of clinical findings (Alvarado score) with HPE findings

Alvarado score	Histopathology		Total
	Positive	Negative	
<5	0	0	0
5-6	17	5	22
≥7	69	0	69
Total	86	5	91

In our study majority of patients (69) had Alvarado score of more than 7 which was statistically significant with p value of 0.000. The second most common group was that of scores between 5 to 6 (22).

**Table 12:** USG Findings and negative appendicectomy

USG finding with appendicular pathology who underwent Surgery	Histopathology findings			
	Positive for appendicular pathology	%	Negative (normal)	%
91	86	94.5	5	5.4

Our study, 86 patients out of 91 who were diagnosed and operated as Appendicitis had Positive histopathological confirmation of the disease. Five patients were found to be Negative for histopathological Features of Appendicitis.

### Discussion

The discussion is based on the observations and analysis of the results in the study of 100 cases with regard to incidence, age, sex, symptoms, signs, Alvarado scoring system investigation operative findings, and histopathological examination.

### Clinical features

#### Age incidence

**Table 13:** Age incidence compared with various Authors In the present study the common age group found was 20-29 year (33%)

Author	Age group	Percentage
Gallendo gallego <i>et al.</i> [5]	20-30 yr.	52.00
Present study	20-29 yr.	33.0

### Sex incidence

It has been established beyond doubt by several authors that male Sex predominated over female in the incidence of acute appendicitis.

**Table 14:** Sex incidence compared with various Authors

Author	M;F Ratio
Hardwig korner <i>et al.</i> [6]	1.4:1.00
David g addiss <i>et al.</i> [7]	1.4:1.00
Present study	1.56:1

### Pain

Pain was a complaint in all the cases in this study. The classical migrating pain in which the initial location of pain in most cases presented with pain around umbilicus followed by in the right lower quadrant was seen in 76% of the patients. This has sensitivity, 81%; specificity, 53%.

### Anorexia

Anorexia was present in 87% of patients in present series. Anorexia nearly always accompanies appendicitis.

**Table 15:** Anorexia compared with various Authors

Author	Percentage
George Mathews, <i>et al.</i> [8]	92
Kallan M <i>et al.</i> [9]	85
Present study	87

### Nausea or Vomiting

Nausea /Vomiting was present in 79% of cases in present series. In George Mathew *et al.*, nausea was present in 92% and vomiting in 70.9%.

### Right Iliac fossa tenderness

Right iliac fossa tenderness was present in 98% the cases at the time of presentation, a major contribution for diagnosis of Acute Appendicitis.

**Table 16:** Right iliac Fossa tenderness compared with various Authors

Author	Percentage
Gallindo Gallego <i>et al.</i> [5]	94
George Mathews <i>et al.</i> [8]	99
Present study	98

### Rebound Tenderness

In the present series, 68% of the cases had rebound tenderness.

**Table 17:** Rebound tenderness compared with various Authors

Author	Percentage
Gallindo Gallego <i>et al.</i> [5]	56
Owen Td <i>et al.</i> [10]	60
Present study	68

### Fever

Fever was present in 44 cases (44%) in present series. In the majority of cases fever was of low grade and continues: the incidence of fever in the Literature and the present series is compared in the following tables.

**Table 18:** Fever compared with various Authors

Author	Percentage
Kallan M <i>et al.</i> [11]	40
Wilcox <i>et al.</i> [12]	50
Present study	44

### USG Sensitivity and Specificity in diagnosis of acute appendicitis

In the present study USG findings showed 94.8% sensitivity and 80% specificity in diagnosing acute appendicitis. Compared with various authors in the following table.

**Table 19:** USG Sensitivity and Specificity compared with various Authors

Author	Sensitivity	Specificity
Puylaert JBCM <i>et al.</i> [13]	89	100
Gallindo Gallego <i>et al.</i> [5]	89	82
Jeffrey <i>et al.</i> [14]	89.9	96.2
Ziedan <i>et al.</i> [15]	74.2	93.7
Present study	94.8	80

### Alvarado's Score

In this series 77% of patients had Alvarado score of 7 or more than 7.

**Table 20:** Alvarado score of 7 or more compared with various Authors

Author	Percentage
Bhattacharjee <i>et al.</i> [16]	82.25
Sudhir Kumar Mohanty <i>et al.</i> [17]	81.61
Present study	77

### Negative appendectomy rate

The present study shows negative appendectomy rate of 5.5%. Out of this 60% were seen in females. This is high negative appendectomy. This is probably due to pelvic inflammatory diseases, and ruptured follicular cysts.

### Conclusion

In the present study we had 100 cases of which 61 were males and 39 were females. In the study 91 were operated and acute appendicitis was found in 86 patients. So we conclude

- Ultrasound can therefore be used as a cheap and inexpensive way of confirming acute appendicitis thus reducing negative appendectomy rate.
- Ultrasonography increases the diagnostic accuracy in patients with suspected acuter appendicitis to the tune of 93%.
- Its application can reduce negative appendectomy rate which is 5.5% in our study.
- Thus Ultrasound is very effective in the diagnosis of acute appendicitis in both men and females. It rules out Pelvic pathology in female which decreases the negative appendectomy rate.
- In the diagnosis of acute appendicitis, the Ultrasound is a simple, reliable, non- invasive, repeatable and safe diagnostic modality without complications.
- Ultrasound is useful in the diagnosis of acute appendicitis and its complications with a sensitivity and specificity 94.8% and 80% respectively.
- Thorough history taking, evaluation of the clinical symptoms and signs combined with the specific tests and Ultrasound abdomen can improve the diagnostic accuracy and significantly reduce the rate of negative appendectomy.

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**Conflict of Interest**

None

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