Original Research Article

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

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Abstract

Background and Objectives: Acute appendicitis is the most prevalent cause of acute surgical abdomen, and appendiciectomy is the most often performed emergency surgery in the United States and Canada. Its diagnosis continues to be a difficult problem, made more difficult by a high percentage of negative investigations. There is currently no one reliable test that has appropriate sensitivity and specificity characteristics. The study's main goal is to analyse the clinical presentations, signs, and treatment of acute appendicitis, as well as the effectiveness of various treatments. The role of ultrasound in the diagnosis of acute appendicitis and in lowering the rate of negative appendicectomies are also discussed. **Methodology:** From January 2019 to October 2021, the current study included 80 patients who were clinically diagnosed with acute appendicitis and were admitted to the General Surgery Department of the Kerala Institute of Medical Sciences (KIMS), Narketpally, for emergency appendectomy. Prior to surgery, blood was drawn to check the WBC count, DC, and USG abdomen. Following surgery, all patients were subjected to a histological examination, which was considered to be the gold standard. The results of ultrasound were compared to those of HPE reports in order to determine their importance in the diagnosis of acute appendicitis. **Observations:** In the current study, we had 80 participants, with 61 (61 percent) of them being men and 39 (39 percent) of them being female. The age range of 20 to 29 years was the one with the greatest number of patients (33 percent). Anorexia was discovered in 87 percent of patients, and Migrating Pain to RIF was discovered in 76 percent of patients. Nausea and vomiting were experienced by 79 percent of the patients. Tenderness in the right iliac fossa was detected in 98 percent of the cases. Patients with rebound discomfort were reported in 68 percent of cases. In 45 percent of the cases, a fever was seen. In our current investigation, the total leucocyte count was found to be high in 80 percent of the cases. In 42 percent of the cases, a shift to let was observed.All of the patients in our study were subjected to abdominal ultrasonography examination. Using Ultrasonography to diagnose acute appendicitis, the sensitivity and specificity of the test are 92.0 percent and 78.0 percent, respectively. The accuracy rate was 93 percent. For acute appendicitis, the positive predictive value (PPV) and negative predictive value (NPV) of ultrasound are 95 percent and 41 percent, respectively. In this study, the rate of negative appendectomy was 5.5 percent. Females account for the vast majority of cases (60 percent). **Conclusion:** Ultrasound is a non-invasive, reproducible, and safe diagnostic technique that is quick, easy, and reliable. There are no complications with ultrasound. It has higher sensitivity and positive predictive value in the diagnosis of acute appendicitis, and it lowers the rate of negative appendicectomy in the treatment of the condition.

Keywords: Ultrasound, acute appendicitis, negative appendicectomies, sensitivity, Histopathological Examination.

Introduction

It is the most common type of general surgical emergency, with acute appendicitis being the most prevalent diagnosis. It manifests as a wide range of symptoms that frequently overlap with those of other clinical syndromes. It also causes significant morbidity, which worsens with the length of time spent waiting for diagnosis[1].

Anorexia and periumbilical pain are the most common symptoms of appendiceal inflammation; however, the classic history of nausea, right lower quadrant (RLQ) pain, and vomiting occurs in only 50% of cases[2,3]. There is no single symptom or diagnostic test that reliably confirms appendiceal inflammation in all cases. Simultaneous appendicitis can advance to perforation, which is linked with a significantly increased risk of morbidity and mortality. As a result, surgeons have been more inclined to operate when the diagnosis is likely rather than waiting until the diagnosis is certain. However, because appendicitis can mimic a variety of other abdominal illnesses, making the differential diagnosis of appendicitis can be difficult.If patients have acute appendicitis, abdominal ultrasonography is a common imaging modality. Ionizing radiation is avoided because it is widely available, non-invasive, and non-ionizing[4].

The diagnosis and treatment of appendicitis have advanced significantly in recent years, yet the condition remains a clinical emergency and one of the most frequent causes of acute abdominal pain. Using Ultrasound Abdomen, Alvarado score, and other studies, as well as Histopathology, this research has addressed the current method in diagnosis and management of acute appendicitis and its consequences[5].

Aim & 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 in KIMS, Narketpally under various

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surgical units, during the period of January 2019 to October 2021

Inclusion criteria for the study

1. Patients willing for investigation and surgery
2. Patients aged15years and above and of either sex.

Exclusion criteria for the study

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

Sample size

80

After initial assessment of patients presenting to the Out Patient department oremergency department of KIMS, Narketpalli with symptoms and signs suggestive of acute appendicitis between between January 2019 and October 2021, 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 (selflocalization) and graded compression was used to displace bowel loops in thatarea. 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[5].

Treatment was planned, depending upon the type of appendicitis and the presence or absence of complications. Pre-operative preparation consisted of bedrest, 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 ornylon sutures for skin. The final diagnosis of acute appendicitis was confirmed by histopatology report. After surgery the patients were discharged on 3-7days except in cases of complications.

Results

Table 1: Age incidence

Age(Years)	Male		Female		Total	
	NO	%	NO	%	NO	%
15-19	14	27.45	8	15.68	26	32.5
20-29	16	31.37	11	21.56	25	31.25
30-39	14	27.45	5	9.8	17	21.25
40-49	3	5.8	3	5.88	6	7.5
50-59	2	3.92	2	3.92	4	5
>60	2	3.92	0	0	2	2.5
TOTAL	51		39		80	

Gender and Age distribution in acute appendicitis

In the present study, out of 80 cases, only 29 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 20-29years(35.9%)followed by age group of 15-19years (28.2%).

Table 2: Sex Incidence

Sex	Number	%
Male	51	63.5
Female	29	36.25
Total	80	100

Table 3: Symptoms Of Acute Appendicitis

Symptoms	Present	Absent	Total
Migrating RIF pain	62	18	80
Anorexia	73	7	80
Nausea/Vomiting	75	5	80

In this study Migrating Right iliac fossa pain was present in 62 % of patients which is significant. Anorexia was present in 73%.Nausea/vomiting were present in75 % of patients. All the above are statistically significant.

Table 4: Signs in acute appendicitis

Signs	Present	Absent	Total
Fever	58	32	80
RIF tenderness	78	2	80
Rebound tenderness	61	29	80

In the present study Fever(>38C)was present only in 58 % of the patients and was absent in 32 % of patients. RIF tenderness was present in statistically significant 78% of the patients. Rebound tenderness was present in61%of patients.

Table 5: Appendicitis

Leucocyte count & shift to letin acute appendicitis

Leucocyte	Present	Absent	Total
Total countraised (>12,000)	62	18	80
Shift to left(D.C) (75% neutrophils)	38	42	80

In our study total count was raised in 62% of patients with P value of0.000which is statistically significant. Shift to left was present in 42% of patients and was statistically in significant.

Table 6: Duration of hospital stay

Duration(in days)	Total number of patients
≤ 2	18
3-5	46
6-7	13
>7	3

In our study, majority of the patients stayed in the hospital for a duration of 3-5days (46) followed by those who stayed for less than 2days(18). Surgical site infection was the major cause for late discharge.

Table 7: Ultrasound findings

USG findings	Number
Appendicitis	60
Appendicular Abscess	3
Appendicular Mass	5
Appendicular Perforation	4
Normal study	8
	80

In our study all the patients were subjected to abdominal ultrasound examination. 60 patients had features suggestive of Acute Appendicitis, 5 patients had appendicular mass and 4 patients had appendicular perforation. 8 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 4 cases which had Appendicular Mass and 2 patients who had Alvardoscore of less than 4 were managed conservatively. Remaining 80 patients underwent open Appendectomy.

Table 8: USG and HPE Correlation

USG	HPE Positive	HPE Negative	Total
Positive	61 (TRUEPOSITIVE)	1(FALSEPOSITIVE)	**62**
Negative	5 (FALSENEGATIVE)	4 (TRUENEGATIVE)	**9**
Total	**66**	**5**	**71**

From the above table we get the following values for USG in Acute Appendicitis.

Table 9: USG statistical measure of performance

Sensitivity	92 %
Specificity	78 %
Predictive value of positive test	95%
Predictive value of negative test	41%
Accuracy	90%

Table 10: Intra operative findings

Intra Operative Findings	Number Of Patients	%
Normal	6	8.4
Inflammed appendix	55	68.75
Perforated appendix	6	8.4
Gangrenous appendix	8	8.7
TOTAL	**71**	**88.75**

Distribution of cases as per histopathological report

In our study out of 71cases which were operated and subjected for histopathological examination of specimen, 5 cases had normal histology and 86 cases had positive features of acute appendicitis. The negative predictive value of our study was5.5%

Table 11: Histo-pathological examination of acute appendicitis specimen

Histopathologic Examination	No of patients	%
Normal	3	4.22
Acute appendicitis	45	63.38
Acute perforative Appendicitis	7	9.8
Acute gangrenous Appendicitis	14	19.71
Total	**71**	

The majority of the finding on histopatholgical examination was found to be that of Acute appendicitis (63.38 %) followed by that of Acute Gangrenous Appendicitis(19.71 %)and it was found to be statistically significant.

Distribution of cases as peralvarado'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 12: Alvarado score in study group

Alvarado's score	Number of patients
<3	0
4	2
5	6
6	8
7	18
8	15
9	26
10	5
TOTAL	**80**

In our study scores suggestive of acute appendicitis (5 or more) was found tobe present in 80 patient and 2 patients had scores of less than 4 and were managed conservatively. Of the 80 cases that were operated upon 5 had Normal Histopathological report.

Table 13: Correlation of clinical findings (alvarado score) with HPE findings

Alvarado Score	Histopathology		Total
	Positive	Negative	
<5	0	1	0
5-6	11	4	22
≥7	54	0	54
Total	65	5	71

In our study majority of patients (54) had Alvarado score of more than 7 which was statistically significant with pvalue of 0.000. The second most common group was that of scores between 5to 6 (22).

Table 14: USG findings and negative appendicectomy

USG finding with appendicular pathology who underwent Surgery	Histopathology findings			
	Positive for appendicular pathology	%	Negative (normal)	%
71	64	94.5	7	5.4

Our study, 64 patients out of 71 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 thestudy of 80 cases with regard to incidence, age, sex, symptoms, signs, Alvarado scoring system investigation operative findings, and histopathological examination.

Clinical features

Age incidence

Table15: Age incidence compared with various Authors

In the present study the common age group found was 20-29year(33%)

Author	Age group	Percentage
Gallendo Gallego et al[6]	20-30yr	52.00
Present study	20-29yr	33.0

Sex incidence

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

Table16: Sex incidence compared with various Authors

Author	M;F ratio
HARDWIG KORNER etal[7]	1.4:1.00
DAVIDG ADDISS etal[8]	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 84% of patients in present series. Anorexia nearly always accompanies appendicitis.

Table17: Anorexia compared with various Authors

Author	Percentage
George Mathews, etal[9]	92
Kallan Met al[10]	85
Presnt study	84

Nauseaor Vomiting

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

Right Iliac fossa tenderness

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

Table 18: Right iliac Fossa tenderness compared with various Authors

Author	Percentage
Gallindo Gallegoet al[6]	94
George Mathews etal[9]	99
Present study	98

Rebound Tenderness

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

Table19: Rebound tenderness compared with various Authors

Author	Percentage
Gallindo Gallego etal[6]	56
Owen Td et al[11]	60
Present study	68

Fever

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

Table 20: Fever compared with various Authors

Author	Percentage
Kallan M et al[12]	40
Wilcox etal[13]	50
Present study	45

USG Sensitivity and Specificity in diagnosis of acute appendicitis

In the present study USG findings showed 92% sensitivity and 80% specificity in diagnosing acute appendicitis. Compared with various authors in the following table

Table 21: USG Sensitivity and Specificity compared with various Authors

Author	Sensitvity	Specificty
Puylaert JBC M etal[14]	89	100
Gallindo Gallego etal[6]	89	82
Present study	92	80

Alvarado's Score

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

Table 22: Alvarado score of 7or more compared with various Authors

Author	Percentage
Bhattacharjeeet al[15]	82.25
Present study	72

Negative appendicectomy rate

The present study shows negative Appendicectomy rate of 5.5%. Out of this60% were seen in females. This is high negative appendicectomy.

Conclusion

The present study included 80 participants, 51 of whom were males and 29 of whom were girls (see table below). Patients with acute appendicitis were diagnosed in 66 of the 71 patients who had surgery as part of the study. Consequently, we come to the end of the discussion

- As a result, ultrasound can be used to confirm acute appendicitis in a cost-effective and timely manner, lowering the rate of negative appendectomy.
- With suspected acute appendicitis, ultrasonography significantly improves diagnostic accuracy, with a 90% improvement inaccuracy.
- This application has the potential to lower the negative appendectomy rate, which in our study was at 5.5%.
- Consequently, ultrasound is quite useful in the diagnosis of acute appendicitis in both men and women. • This procedure eliminates the possibility of female Pelvic pathology, which lowers the likelihood of a negative appendicectomy.
- An ultrasound is a straightforward, reliable, non-invasive, repeatable, and safe diagnostic tool for the detection of acute appendicitis that has no associated problems.
- Acute appendicitis and its complications can be diagnosed with ultrasound, which has a 92.0 percent sensitivity and specificity and a 78 percent specificity in diagnosing them.
- Comprehensive history taking, evaluation of clinical symptoms and signs, in conjunction with particular tests and Ultrasound abdomen, can increase diagnostic accuracy and reduce the rate of negative appendectomy by as much as 50%.

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References

1. Evola G, Ferrara F, Di Fede GF, Patanè M, Sarvà S, Piazza L. Left-sided acute appendicitis in a patient with situs viscerum inversus totalis: A case report. International Journal of Surgery Case Reports. 2022 Jan 1;90:106658.
2. Aggenbach L, Zeeman GG, Cantineau AE, Gordijn SJ, Hofker HS. Impact of appendicitis during pregnancy: no delay in accurate diagnosis and treatment. International Journal of Surgery. 2015 Mar 1;15:84-9.
3. Bouchard ME, Slidell MB, Jones BA. Appendicitis. InTextbook of Pediatric Gastroenterology, Hepatology and Nutrition 2022 (pp. 673-680). Springer, Cham.
4. Gomes CA, Sartelli M, Di Saverio S, Ansaloni L, Catena F, Coccolini F, Inaba K, Demetriades D, Gomes FC, Gomes CC. Acute appendicitis: proposal of a new comprehensive grading system based on clinical, imaging and laparoscopic findings. World Journal of Emergency Surgery. 2015 Dec;10(1):1-6.
5. Haijanen J, Sippola S, Grönroos J, Rautio T, Nordström P,

Rantanen T, Aarnio M, Ilves I, Hurme S, Marttila H, Virtanen J. Optimising the antibiotic treatment of uncomplicated acute appendicitis: a protocol for a multicentre randomised clinical trial (APPAC II trial). BMC surgery. 2018 Dec;18(1):1-1.
6. Gallindo Gallego, Fadrique, Neto, Calleja, Fernandej; evaluation of ultrasonograpy and clinical diagnostics oring in suspected appendicitis Br.J.Surg:1998;85:3740.
7. Körner H1, Söndenaa K, Söreide JA, Andersen E, Nysted A, Lende TH, KjellevoldKH Incidence of acute nonperforated and perforated appendicitis: age-specific andsex-specific analysis. World JSurg. 1997Mar-Apr;21(3):313-7.
8. Addlss, D. G. (CDC, Atlanta, GA 30333), N. Shaffer, B. S. Fowler, and R. V.Tauxe. The epidemiology of appendicitis and appendectomy in the United States.AmJEpidemiol 1990;132:910-25.
9. GeorgeMathewsJohn,SibaPrasadPattanayak,CharanPanda,K.Raj a Ram Mohan Rao, Evaluation of Ultrasonography as a Useful Diagnostic Aidin Appendicitis. IJS 2002;64(5):436-439.
10. Kallan M, Talbot D, Cunliffe WJ, Rich AJ, "Evaluation of modified alvarod Scorein diagnosis of Acute Appendicitis: A prospective study ". Ann, RCS of Engl;76(6):418-419, 1994
11. Owen TD, William H. Stiff G, Jenkenson LR, Rees B1: Evaluation of AlvaradoScorein Acute Appendicitis: Journal of social medicine,1992;85:87-88.
12. Kallan M, Talbot D, Cunliffe WJ, Rich AJ, "Evaluation of modified alvarod Scorein diagnosis of Acute Appendicitis : A prospective study ". Ann, RCS of Engl;1994;76(6):418-419.
13. Wilcox RT, TraverSo LW, Have the evaluation and Treatment of acute appendicitischangedwith new technology?Surgclin North A1997:77:1355-131714.
14. Puylaert, JBCMet al Acute Appendicitis visualization using graded-compressionradiology1986;158;355-360.
15. BhattacharjeePk,chowdaryT,RoyD:Prospective Evaluation of modified Alvarado Score for diagnosis of acute appendicitis : journal of Indian medical Association, 2002;122:1.

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