

## Research Article

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# Correlation of ultrasonography findings of acute appendicitis with pathological acute appendicitis

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## ABSTRACT

**Background:** The vermiform appendix is important in surgery due to its propensity for inflammation which results in the clinical syndrome known as acute appendicitis. Approximately 7% of the population will have appendicitis in their life time, with the peak incidence occurring between 10 and 30 years. There occur numerous instances in the practice of medicine which demand of the physician expert diagnostic skill, sound judgment, quick and competent treatment. Ultrasound is found to diagnose inflammatory appendix its specificity of 90-99% and sensitivity of 75-90%.

**Methods:** This is a randomized study comprising of 138 patients of suspected acute appendicitis. The patients with suspected acute appendicitis were subjected to ultrasonography and high frequency probe was used in some cases. Patients were treated based on the clinical impression, following all standard surgical principals. The surgical specimen was sent for histopathological examination for confirmation of diagnosis. Data was collected, recorded and then processed.

**Results:** Out of total 138 patients included in study, 117 patients were subjected to emergency appendectomy. 111 patients out of 117 patients operated were true positive for acute appendicitis, confirmed by histopathology report.

Rest 6 patients out of 117 had normal appendix on histopathology. The Sensitivity of Ultrasonography was 98.19%, specificity was 81.48%, positive predictive value was 95.61% and negative predictive value was 91.66% in our study.

**Conclusions:** Ultrasonography is a good diagnostic indicator for acute appendicitis. It can be used as an adjunct in doubtful cases where diagnostic dilemma arises.

**Keywords:** Appendix, Acute Appendicitis, Ultrasonography

## INTRODUCTION

Acute appendicitis is the most common cause of an acute abdomen in young adults.<sup>1</sup> This condition is a common and urgent surgical illness with protean manifestations, generous overlap with other clinical syndromes, and significant morbidity, which increases with diagnostic delay. Giovanni Morgagni (1682-1771) in 1719 published a detailed account of the appendix, its site and relations in his "Achersaria Anatomica". Verneys in

1710, coined the term "Vermiform appendix", vermiform meaning worm-like.

Appendicitis is common in the 2nd and 3rd decades. It is rare in infancy and old age. Males are affected more commonly. Before puberty ratio is 1:1, after puberty 2:1 up to 25 years. The disease is common in highly civilized countries and certain communities, but rare in remote rural districts and among primitive people. Acute appendicitis occurs in lifelong vegetarians and even in

babies at the breast. Acute appendicitis is more common between the upper and middle classes than those belonging to working class. Involvement of lymphoid tissue in the tonsils and appendix may occur simultaneously. A blood borne infection may be present in these cases.<sup>2-4</sup>

Abdominal pain is the prime symptom of acute appendicitis.<sup>5</sup> Classically, pain is initially diffusely centered in the lower epigastrum or umbilical area, is moderately severe, and is steady, sometimes with intermittent cramping superimposed. After a period varying from 1 to 12 hours, but usually within 4 to 6 hours, the pain localizes to the right lower quadrant. Slight pyrexia (37.2-37.7°C) with a corresponding increase in the pulse rate to 80 or 90 is usual.<sup>6</sup> Vomiting generally occurs in the early stages of the attack, but usually a few hours after the initial pain due to protective pylorospasm. Irritation of the ureters by the retrocaecal appendix may give rise to pain mimicking right ureteric colic. As soon as the pain has shifted, there is localized tenderness either at Mc Burney's point or elsewhere, as determine by the site of the appendix. Guarding will usually be present over the right lower abdomen. Rigidity occurs when peritonitis sets in. Muscular rigidity occurs when the inflamed organ is in contact with the muscle.<sup>6</sup>

The diagnosis of acute appendicitis is essentially clinical however a decision to operate based on clinical suspicion alone can lead to removal of normal appendix in 15-30% of cases. It is clear that 80-85% patients with acute appendicitis will have a total WBC count of over 10,000/cu mm.<sup>7,8</sup> Neutrophilia of >75% will occur in 78% patients.

Ultrasound is a noninvasive procedure and can be done in all set-ups and can be applied to all age groups and in pregnancy. Ultrasound is found to diagnose inflammatory appendix its specificity of 90-99% and sensitivity of 75-90%. With graded compression method markedly enhances diagnostic accuracy avoiding negative appendicectomy rate and delay in diagnosis beyond 6 hrs of admission. The inflamed appendix can be visualized sonographically and the factors like diameter >6mm, wall thickness >3mm, complex mass, irregular asymmetry, loss of contour, free fluid, local adynamic ileus, graded tenderness over Mc Burney's point are in favor of appendicitis. Besides being highly specific in expert hands, USG has further advantage of excluding other diseases. Its disadvantage is the requirement of special equipment and expertise, also it is difficult to use in obese or distended abdomen.

Acute appendicitis has to be differentiated from other common conditions presenting similarly like perforated peptic ulcer, torsion of omentum, typhilitis, non-specific adenitis, terminal ileitis, Meckel's diverticulitis, ilio-caecal tuberculosis, ectopic gestation, twisted right ovarian cyst, acute pyelonephritis, pre-herpetic pain, and torsion testis.<sup>6,9</sup>

The treatment of acute appendicitis is immediate appendicectomy without delay. J.B. Murphy quoted "The earlier the operation, the lower the mortality". While there are no absolute rules, appendicectomy should be avoided in the presence of a mass or localized abscess. Cases admitted with diffuse peritonitis are treated with early operation.<sup>5,6,10</sup>

## METHODS

138 consecutive patients presenting to the department of surgery at this institution with right iliac fossa pain during the time period of November 2011 to October 2013 were included in the study. The patients with suspected acute appendicitis are evaluated on the basis of the Alvarado scoring system on admission.

### Inclusion criteria

- All patients presenting with right iliac fossa pain with clinical diagnosis of acute appendicitis during the study period, after informed consent, consecutively enrolled into the study.
- Patients of all age groups and both sexes were included in study.

### Exclusion criteria

- Patients with a palpable mass in the right iliac fossa.
- Those who fail to provide information and had no relatives nearby were excluded from the study.

### Plan of action

- Ethical approval to conduct the study was obtained from the joint institutional ethical committee before the commencement of the study.
- Detailed clinical examination of all the patients carried out and relevant investigations were ordered.
- Abdominal ultrasound was performed in all cases and findings noted.

### Ultrasonography criteria of acute appendicitis

All patients included in this study were subjected for ultrasonography by experienced sonologist. Diagnosis of acute appendicitis was made on the basis of following criteria:

- Visualization of appendix.
- Diameter >6mm.
- Wall thickness >3mm.
- Complex mass (echo poor, asymmetric).
- Irregular symmetry.
- Loss of contour.
- Free fluid.
- Local adynamic ileus.
- Graded tenderness over Mc Burney's point.

The decision to operate was based on the clinical impression by the clinician taking charge of the patient. All appendices removed at operation were sent for histopathology. The diagnosis of acute appendicitis was confirmed by histopathological examination. Data was collected. Then, the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were determined.

#### Management of operated cases

- The cases subjected to emergency surgery are adequately prepared by parenteral fluids, electrolyte supplementation, and administration of broad spectrum antibiotics intravenously (usually combination of Ceftriaxone 1g 12th hourly +Metronidazole 500 mg 8th hourly).
- Surgery was done under spinal anesthesia. Grid iron incision was employed in majority of the cases. All appendices removed during operation were subjected to histopathological examination.
- Post operatively patients are kept nil orally, till bowel sounds returned; parenteral fluid, electrolytes, antibiotics and analgesics were continued.
- Patients were monitored for any post-operative complications and treated wherever needed. Post operatively sutures were removed on 7-9 days
- Patients were usually discharged after they resumed proper oral intake and general condition was satisfactory.

#### RESULTS

A prospective study of 138 consecutive patients presenting with right iliac fossa pain was undertaken to evaluate Ultrasonography as a diagnostic indicator and histopathology.

Out of total 138 patients included in study, 117 patients were subjected to emergency appendectomy. 111 patients out of 117 patients operated were true positive for acute appendicitis, confirmed by histopathology report. Rest 6 patients out of 117 had normal appendix on histopathology.

In present study the male to female ratio was 2.17:1. Maximum incidence was found in the age group of 21 to 30 years and Mean age was 27.41 years. Incidence of disease in total number of patients referred to department of surgery during study period in this institution (total 15,226 patients) is 0.76%. Ultrasonography was performed in all 138 cases included in study. Diagnosis of acute appendicitis was made in 113 cases.

**Table 1: Various ultrasonography findings in present study.**

Ultrasonography diagnosis	Cases
Acute appendicitis	113
Renal/ureteric stone	8
Normal study	11
Mrd	1
Ovarian cyst	1
Endometriosis	1
Colitis	2
Hollow viscus perforation	1
<b>Total</b>	<b>138</b>

**Table 2: Statistical analysis – ultrasonography.**

	Appendicitis (+)	Appendicitis (-)	Total
Ultra- sonography (+)	109	5	114
Ultra- sonography (-)	2	22	24
<b>Total</b>	<b>111</b>	<b>27</b>	<b>138</b>

**Table 3: Determined values after histopathology.**

<b>Sensitivity</b>	<b>98.19%</b>
Specificity	81.48%
Positive predictive value	95.61 %
Negative predictive value	91.66 %

**Table 4: Performance of ultrasonography in present study compared with other studies.**

	Puylaert	Abu yousef mm	Charles D Douglas	Present study
No. of patients	60	68	302	138
Sensitivity	89%	80%	94.7%	98.19%
Specificity	100%	95%	88.9%	81.48%
PPV	89%	91%	-	95.61%
NPV	91%	89%	-	91.66%

Total 8 cases had renal/ureteric calculus. No sonographic abnormality was detected in 11 cases. 1 case each was found to have ovarian cyst, endometriosis, and medical

renal disease. 1 case was diagnosed as hollow viscous perforation which was later found to have perforated Gastric Ulcer. 2 cases were diagnosed as having colitis.

The specimen of the appendix was sent for histopathological examination in all operated cases. The histopathological examination confirmed the diagnosis of acute appendicitis in 85 cases. Necrotizing and gangrenous changes were seen in 11 and 16 cases respectively. The appendix was found to be normal in 6 cases.

## DISCUSSION

On statistical analysis performance of ultrasonography in present study is: sensitivity 98.19%, specificity 81.48%, positive predictive value 95.61% and negative predicting value 91.66%. Puylaerts in series of 60 patients evaluated performance of ultrasonography.<sup>11</sup> They found sensitivity 89%, specificity 100%, positive predictive value 89% and negative predicting value 91%.

Charles D Douglas evaluated 302 patients of acute appendicitis.<sup>12</sup> In his series sensitivity of ultrasonography was 94.7% and specificity was 88.9%.

Ultrasonography is highly operator dependent investigation. Hence values for sensitivity and specificity vary in literature. Present study compares well with findings in other national and international studies.

## CONCLUSION

Ultrasonography is also a sensitive investigation for diagnosing acute appendicitis. It also helps in diagnosing any other condition that may mimic acute appendicitis. It requires the presence of trained personnel and special equipment which is a disadvantage. It can be used as an adjunct in doubtful cases where diagnostic dilemma arises. It can work effectively in routine practice as an adjunct to surgical decision-making in questionable cases of acute appendicitis.

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