



## ACCURACY OF ULTRASONOGRAPHY IN THE DIAGNOSIS OF ACUTE APPENDICITIS

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### Abstract:

**INTRODUCTION:** Acute appendicitis is one of the most common abdominal conditions requiring surgical intervention. Also prompt diagnosis is necessary to avoid complications, such as gangrene and perforation and delayed diagnosis may result in life-threatening conditions, such as abscess, peritonitis, or sepsis. Among imaging methods Ultrasound (US) is a valuable tool.

**MATERIAL AND METHODS:** patients included who were presenting. With signs and symptoms concerning for acute appendicitis and who underwent a diagnostic ultrasonography. US was performed by the radiologist with patient was in a supine position with hips flexed in order to relax the abdominal muscles. Graded compression was applied over the patient's maximal site of pain.

**RESULTS:** a total of 84 patients were included in the study. The mean age of the study population was 36±18.3. of the 84 cases, 40 (48%) were male and 44 (52%) were female in our study group. 38 (45% cases presented with fever, 56 (67%) with vomiting and 74 (88%) presented with pain in right hypochondriac fossa. WBC count was raised in (>11000/mm<sup>3</sup>) 38 (45%) of the patients. 82 patients were diagnosed and confirmed by ultrasonography. Of the 82 patients 62 with acute appendicitis were at the oedematous stage and 20 were diagnosed at the perforated stage.

**CONCLUSION:** Graded-compression ultrasonography can be performed at any time, irrespective of specific preparation. US have more advantages as compared to other modalities as time to diagnosis is reduced, low cost, less radiation and contrast dye exposure. Imaging is required in adult patients with clinically suspected acute appendicitis to confirm the diagnosis for prompt and accurate treatment.

### Introduction

Acute appendicitis is one of the most common abdominal conditions requiring surgical intervention<sup>i</sup>. Appendicitis is the one of the most frequent abdominal surgical emergencies with lifetime incidence of around 8.6% in males and 6.7% in females<sup>ii</sup>. Delay in diagnosis can result in perforation and significant morbidity or mortality. Also prompt diagnosis is necessary to avoid complications, such as gangrene and perforation and delayed diagnosis may result in life-threatening conditions, such as abscess, peritonitis, or sepsis<sup>iii</sup>,<sup>iv</sup>. Exact etiological cause of acute appendicitis is still not known but there are many contributing factors. The primary factor is probably luminal obstruction, which may result from megaliths, lymphoid hyperplasia, foreign bodies, parasites and primary neoplasms or metastasis<sup>v</sup>. Acute appendicitis may be called simple in the

absence of gangrene, perforation or abscess around the inflamed appendix, or complicated when there is perforation, gangrene or periappendiceal abscess. Abdominal pain followed by vomiting is the primary presentation. Then migration of the pain to the right iliac fossa is seen<sup>vi</sup>. But sometimes classical presentations are absent and so it is very difficult to diagnose the condition with atypical presentations seen often in infants and elderly patients. Leucocytosis, C-reactive protein elevation a history of fever and other factors can be considered in the diagnosis of acute appendicitis. Also markers like interleukin 6, serum amyloid a, rino leukograms, Calprotectin and have been studied as diagnostic tools in acute appendicitis<sup>vii</sup>.

Two things are very crucial in acute appendicitis first, any delay in diagnosis and subsequent perforation of the appendix and second, an unnecessary

appendectomy. Also it has been demonstrated that the increased use of pre-operative imaging in patients resulted in a cost-effective way to decrease the negative appendectomy rate<sup>viii</sup>.

Among imaging methods Ultrasound (US) is a valuable tool, introduced by Puylaert in 1986<sup>ix</sup>. US, findings suggestive of appendicitis include, a thickened wall, outer appendiceal diameter greater than 6 mm, a no compressible lumen, absence of gas in the lumen, appendicoliths, echogenic inflammatory periappendiceal fat change, and increased blood flow in the appendiceal wall<sup>x, xi</sup>.

**MATERIAL AND METHODS**

This was a prospective observational study in which patients included who were presenting. With signs and symptoms concerning for acute appendicitis. The study protocol was approved by the institutional ethical board and written informed consent was obtained from all the patients who were willing to participate in the study. After ultrasonography standardized data collection form was filled.

In our study we included the patient with suspected acute appendicitis who underwent a diagnostic ultrasonography. US was performed by the radiologist with patient was in a supine position with hips flexed in order to relax the abdominal muscles. Graded compression was applied over the patient’s maximal site of pain. The presence of a dilated appendix with >6 mm diameter, non-compressible, blind-ending in long axis of the tubular structure was considered a positive study. Non-visualization or indeterminate studies were considered negative. Pre-test probability of acute appendicitis was placed into categories of low (1–3), moderate (4–6), and high (7–10) Alvarado score.

A total of 84 patients were included in the study with signs and symptoms suggestive of acute appendicitis.

Statistical analysis of the data was performed using the Statistical Package for Social Sciences

**RESULTS**

A total of 112 patients were diagnosed of acute appendicitis of which only 84 were included in the study as some were not willing to participate in the study. The mean age of the study population was 36±18.3.

**TABLE 1: Patient’s demographic variables, vital signs, laboratory findings**

Variable	N=84	Percentage
male	40	48%
Female	44	52%
Fever	38	45%
vomiting	56	67%
Pain in right hypochondriac fossa	74	88%
WBC count > 11000/mm <sup>3</sup>	38	45%

40 (48%) were male while 44 (52%) were female in our study group. 38 (45% cases presented with fever, 56 (67%) with vomiting and 74 (88%) presented with pain in right hypochondriac fossa. WBC count was raised in (>11000/mm<sup>3</sup>) 38 (45%) of the patients. Of the total 84 patients having clinical diagnosis of acute appendicitis 82 patients were diagnosed and confirmed by ultrasonography. Of the 82 patients 62 with acute appendicitis were at the oedematous stage and 20 were diagnosed at the perforated stage. These results were confirmed by histopathological examination.

**Table 2: Shows Histopathological Examination**

	N=84	percentage
Diagnosis by USG	82	98%
Oedematous stage	62	74%
Perforation stage	20	24%

**DISCUSSION AND CONCLUSION**

Computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography (US) are the primary imaging studies to diagnose acute appendicitis especially in children.<sup>xii</sup> After the introduction of graded compression US has become the imaging of choice for radiologists. The use of ultrasonography to diagnose acute appendicitis is safe and cost-effective<sup>xiii</sup>.

Perforated appendicitis is a pathology developed after progressive acute appendicitis as shown by Akyildiz et. al. and not a different entity<sup>xiv</sup> and time required to for surgical intervention was longer in cases of perforated appendicitis. The use of diagnostic imaging techniques in patients with suspected acute appendicitis reduces the time and surgical intervention can be done quickly, it also decreases the possibility of negative appendectomy, and reduces both the cost and morbidity related to delay in diagnosis and treatment<sup>xv</sup>. Ultrasonography is commonly used as a imaging technique in acute

appendicitis as it is inexpensive, rapid, portable and non-invasive and has sensitivity of 78%–96% and specificity of 85%–98%<sup>xvi</sup>. Some recent studies has shown diagnostic accuracy can be improved by combining clinical assessment with US<sup>xvii</sup>.

In our study out of 84 cases 40 (48%) were male, while 44 (52%) were female in our study group. 38 (45% cases presented with fever, 56 (67%) with vomiting and 74 (88%) presented with pain in right hypochondriac fossa. WBC count was raised in (>11000/mm<sup>3</sup>) 38 (45%) of the patients

There was slight higher number of female cases in our study. Van Atta et al. have shown in their study that implementation of an imaging protocol using ultrasonography as the primary modality to evaluate paediatric patients with suspected acute appendicitis leads to a decrease in the number of computed tomography scan<sup>xviii</sup>. In a meta-analysis it was found that overall sensitivity and specificity of US were 86.7% and 90.0%, respectively for diagnosis of acute appendicitis. They also suggested that US could be useful for the diagnosis of acute appendicitis, especially when patients were younger age, male, and highly clinical suggestive<sup>xix</sup>. In the same study sensitivity of US in adult and adolescent patients was 86%, specificity 81%. Differences in various studies are observed as US is an operator-dependent technique and individual skill may be an important factor to determine the diagnostic accuracy<sup>xx</sup>.

There may be slight variation in the results as in obese patients, and in individuals who had previous laparotomy, adequate compression of the abdomen according to the graded compression technique, cannot be always obtained

Imaging is required in adult patients with clinically suspected acute appendicitis to confirm the diagnosis for prompt and accurate treatment. Graded-compression ultrasonography can be performed at any time, irrespective of specific preparation. US have more advantages as compared to CT as time to diagnosis is reduced, low cost, less radiation and contrast dye exposure.

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