



Acute Appendicitis : A Radio-Diagnostic Perspective- Ultrasonography (USG) and Computed Tomography (CT)

KEYWORDS

Acute Appendicitis, USG, CT.

Dr Sandhya Kothari

Associate Professor, Department of Radiodiagnosis, Dr Punjabrao Deshmukh Memorial Medical College, Amravati

Dr Nupur Kothari

MD Radiodiagnosis, Fellow Body Imaging, Lokmanya Tilak Medical College, Sion (Mumbai)

Dr Nilesh Agrawal

Assistant Superintendent, Government Medical College & Hospital, Nagpur

ABSTRACT Background: Accurate diagnosis of acute appendicitis is important, since the condition is a surgical emergency. Imaging may synergise clinical symptoms/signs & lab tests for the same.

Objective: To assess the accuracy of USG & CT in patients with clinical diagnosis of acute appendicitis.

Methodology: Clinically diagnosed acute appendicitis patients were evaluated with USG & CT and the findings were compared with perioperative & histopathological diagnosis.

Observations: Out of 100 clinically suspect acute appendicitis patients who underwent both USG and CT, 25 patients revealed disease other than appendicitis. In the other 75, diagnosis of acute appendicitis- in 72 cases on USG and in 74 cases on CT was made preoperatively. Surgery was done in all 75 cases. All 75 showed on operating table features of acute appendicitis. Histopathology confirmed appendicitis of all 75 removed appendices.

Conclusion: USG & CT both add value to diagnosis of acute appendicitis. USG has accuracy almost similar to that of CT in expert hands with newer sophisticated USG machines resulting in no radiation. If clear-cut diagnosis of acute appendicitis is made on initial USG then CT is not necessary.

INTRODUCTION

Acute appendicitis is a surgical emergency, usually diagnosed by clinical features and blood tests. Rates of negative findings for appendicitis at laparotomy based on these parameters have been reported at 16 to 47% [1,2,3]. Imaging studies are important as only around 60% of the patients present with classical clinical picture. Previous research has indicated that the negative appendectomy rate falls significantly with the use of imaging (USG and/or CT). According to Jeffry et al [4], usage of USG brings down negative laparotomy rate to ~10%. Several studies have dwelled upon usage of CT/USG in patients with suspected appendicitis.

The objective of our study was to assess the accuracy of USG & CT in patients with clinical diagnosis of acute appendicitis.

METHODOLOGY

Study design: Observational study.

Study setting: Medical College Hospital.

Study duration: September 1st 2011 to Feb 28th 2015.

Sample size: 110 male patients

Participant Selection:**Inclusion criteria –**

History s/o acute appendicitis (clinically labelled as acute appendicitis).

Alvarado score > 5 (considered s/o acute appendicitis) [5]

Exclusion criteria –

- Female patients

- Alvarado score < 5
- claustrophobia for imaging studies
- Fear of surgery

CT and USG were performed separately by two separate radiologists blinded for findings of each other. On USG, main feature to establish the diagnosis of acute appendicitis was direct visualization of the inflamed thickened appendix: a concentrically hypoechoic double layered, sausage/finger/tube like structure (Banana Sign) on longitudinal scan (Fig-1) and giving "Target" or "Bull's Eye" appearance on transverse scan (Fig-2), found at the point of maximum tenderness.

Figure 1-



Longitudinal Scan at right iliac fossa in case of acute appendicitis showing "Banana Sign"

Figure 2-



Transverse Scan at right iliac fossa in case of acute appendicitis showing "Target Sign"

Surgeon was also blinded about the radiological diagnosis, to the extent possible. Diagnosis of acute appendicitis

was assessed preoperatively and after the surgery was confirmed on the basis of histopathological examination.

Informed written consent was obtained from each patient or from patient's relative.

RESULTS

Out of admitted 110 male patients clinically suspected of acute appendicitis, 100 were examined with both USG and helical CT. 5 patients left the hospital due to fear of imaging and 5 patients, who needed to undergo urgent surgery (Alvarado score 9-10) were excluded from imaging.

Out of 100 patients clinically suspected of acute appendicitis who underwent both USG and CT, 25 patients revealed different disease other than appendicitis (Table 1). In the other 75, cases diagnosis of acute appendicitis- in 72 cases on USG and in 74 cases on CT was made preoperatively. Surgery was done in all these 75 cases. All 75 showed on operating table features of acute appendicitis. Histopathology confirmed appendicitis of all 75 removed appendices. USG failed to correctly diagnose appendicitis in three patients due to appendicitis only of tip, retrocaecal position and perforation. CT could not diagnose appendicitis in one case of appendicitis involving the tip but diagnosed the cases of appendicitis in retrocaecal appendix and appendicular perforation missed on USG.

Table 1- Findings on USG, CT, Perioperative Assessment & Histopathology of operated specimen in cases of acute appendicitis

USG	CT	Perioperative Diagnosis	Histopathological Diagnosis
25 cases were diagnosed with other organ diseases on USG (22- Ureteric stone, 1- Mesenteric lymphadenitis, 1-Right ectopic kidney, 1-Terminal ileal inflammatory disease)	Same as on USG	Not operated for Acute Appendicitis	-
72 of 75 revealed Acute Appendicitis	74 of 75 revealed Acute Appendicitis	All 75 patients had Acute Appendicitis	All 75 excised appendices showed features of Acute Appendicitis

DISCUSSION

In the present study, unenhanced or enhanced CT, as interpreted by the expert and experienced radiologist in a teaching hospital, had sensitivity, specificity, positive predictive value and negative predictive value almost similar to that of USG. These findings are largely in sync with the evidence generated previously.

According to Wise et al [6], CT is significantly better than USG for diagnosing appendicitis. For the continuous effort to reduce the incidence of perforation and negative findings at appendectomy, CT and USG are considered potentially beneficial in the diagnosis of acute appendicitis. Studies have shown the negative appendectomy rate going down from over 20% to less than 9% with the use of imaging [7,8,9,10]. Graded compression USG along with posterior manual compression of the right lower quadrant at area of maximum tenderness (technique used for the present study), has gained increasing acceptance in establishing the diagnosis of acute appendicitis with sensitivities ranging from 77% to 95% and specificities ranging from 94% to 96% [11,12,13,14]. Sensitivity and specificity of USG found in our study also confirmed these results.

USG is a rapid, noninvasive, radiation free, relatively inexpensive and requires no special patient preparation or contrast material administration. But graded compression

USG is operator dependent as it requires a high level of skill. Prints of USG images cannot be always reliably reassessed, as USG is a dynamic procedure. Another important limitation of USG is that the sensitivity and specificity for perforated appendicitis are lower than for non-perforated appendicitis [15,16]. Obese patients and patients with a retrocaecal appendix or with severe abdominal pain are difficult to examine using USG. These patient-related factors limit the diagnostic capability of USG. In our study, three cases missed on USG were one each of distal tip appendicitis, retrocaecal appendicitis and perforated appendix.

An important factor accounting for the variability in diagnostic accuracy reported with graded compression USG is that many USG examinations are not done by expert radiologists. In our study, the rate of accuracy of diagnosing acute appendicitis on USG has been high due to an expert senior and dedicated sonologist and as all only male cases with Alvarado score of > 5 were taken.

Some superiority of helical CT over USG for the diagnosis of acute appendicitis in the present study was noted. A number of large prospective trials have demonstrated that CT is a highly accurate test for confirming or excluding acute appendicitis [17,18], but radiation hazards have to be kept in mind. Although various authors debate the figure, a normal appendix is seen more frequently at CT

than USG. Thus CT carries a better true negative rate.

With regard to the accuracy of USG compared with CT in the diagnosis of acute appendicitis, our USG results are better to those of previous reports [19,20,21]. In our study results are better probably because both USG and helical CT were done by experienced radiologists and all were male patients with Alvarado score more than 5. In 25 patients an alternative diagnosis was found at imaging evaluation. The cases of ureteric stone, regional terminal ileitis and mesenteric adenitis were detected at both CT and USG.

In our view, graded compression USG with posterior manual compression and focused helical CT technique examining the abdominopelvic junction, both provide sensitive and accurate diagnosis of acute appendicitis. USG finding should not be interpreted in isolation as appendicitis on USG alone cannot be excluded when an appendix has not been found and clinical correlation is important as even a negative study does not exclude the diagnosis. Debate still raises over the use of USG and CT in the setting of suspected acute appendicitis, and local practice will depend on the surgeons, expertise of radiologists and availability of imaging facilities at short notice; but in our view imaging should be done if Alvarado score is > 5.

CONCLUSION

USG & CT both add value to diagnosis of acute appendicitis. USG for the diagnosis of acute appendicitis has accuracy almost similar to that of CT in expert hands with newer sophisticated USG machines resulting in no radiation. If clear-cut diagnosis of acute appendicitis is made on initial USG then CT is not necessary.

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