Original article:

Evaluation of Emergency Department Ultrasound for Acute Appendicitis: A Retrospective Analysis

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ABSTRACT

Background: Acute appendicitis remains one of the most common presentations of acute abdominal pain in both adults and children. The present retrospective study was conducted to evaluate emergency department ultrasound for acute appendicitis.

Materials and Methods: The present retrospective study was conducted to assess all the patients that were admitted with the chief problem of appendicitis. Patients which were admitted in whom right lower quadrant (RQ) abdominal ultrasounds performed were included in the study. Only those cases were included in this retrospective analysis in which confirmation of the diagnosis was given. The recorded data was compiled, and data analysis was done using SPSS (SPSS Inc., Chicago, Illinois, USA).

Results: A total of 200 ultrasounds were performed for the problem of appendicitis. A total of 32 patients showed positive results for bedside ultrasound for appendicitis (BA). Out these 32 patients, 19 were affected by appendicitis while in 13 patients, appendicitis was absent. A total of 155 patients were reported to be BA negative. Out of them in 52 and 103 patients, appendicitis was present and absent, respectively. In total, out of 200 total patients, 84 cases showed presence of appendicitis while in 116 cases, appendicitis was absent. Prevalence in the present study was found to be 0.44 while the specificity and the sensitivity were found to be 0.91 and 0.42 respectively. Positive predictive values and the negative predictive values were found to be 0.75 and 0.67 respectively.

Conclusion: The present study concluded that a total of 32 patients showed positive results for bedside ultrasound for appendicitis (BA). Out these 32 patients, 19 were affected by appendicitis while in 13 patients, appendicitis was absent. A total of 155 patients were reported to be BA negative. Out of them in 52 and 103 patients, appendicitis was present and absent, respectively.

Key words: Bedside Ultrasound for Appendicitis (BA), Specificity, Sensitivity, Positive Predictive Values, Negative Predictive Values.

INTRODUCTION

Acute appendicitis (AA) results from inflammation of the appendix and is among the most common causes of acute abdominal pain that requires surgery, occurs in 7% of the population, with peak incidence age 10 – 30.1-3 In patients with acute appendicitis, the primary complaint is pain in abdominal area. The diagnostic pattern of colicky central abdominal pain followed by vomiting with shifting of the pain to the right iliac fossa was first described
by Murphy but it may only present in 50% of cases. Peri-umbilical colicky pain is the description of the typical pain as reported by the affected patients which further intensifies during the first 24 hours, becoming constant and sharp, and migrates to the right iliac fossa.

Visceral innervation of the midgut results in the referred pain or the initial pain. Loss of appetite, constipation, nausea, and profuse vomiting are other common symptoms encountered in such patients. Despite the advancements in the diagnostic technologies and clinical strategies, still false positive and false negative results in making the diagnosis of acute appendicitis are significantly reported. Physicians generally prefer to use laboratory tests and ultrasound (US) for the initial evaluation of patients with low pretest probability for AA. US is a noninvasive and reproducible diagnostic tool that does not require any contrast agent nor radiation exposure. Nonetheless, it is an operator-dependent method. The sensitivity and specificity of US for the diagnosis of AA are reported as being between 75 to 90% and 86% to 95%, respectively. The present retrospective study was conducted to evaluate emergency department ultrasound for acute appendicitis.

MATERIALS AND METHODS

The present retrospective study was conducted to assess all the patients that were admitted with the chief problem of appendicitis. Patients which were admitted in whom right lower quadrant (RQ) abdominal ultrasounds performed were included in the study. The involved EDs had training in the diagnosis and treatment of the lesions of the gall bladder, aorta, cardiac region, pelvis etc. but didn’t have much exposure to appendicitis.

A 200 ultrasounds were performed by the EDs which included in the study. Only those cases were included in this retrospective analysis in which confirmation of the diagnosis was given team of Radiologists. No additional information and hands-on instruction were given to the ED regarding the technique of ultrasound. Non-compressible RLQ tubular structure of at least six millimetres was the whole and sole primary sonographic criterion for the EDs for arriving to the final diagnosis of appendicitis. Other features and sonographic findings which were excluded from the list of primary criteria and were included under the category of secondary features included: Appendicolith, Extraluminal fluid collections, Hyperemia on color flow Doppler, Interruption of the echogenic submucosa. The recorded data was compiled, and data analysis was done using SPSS (SPSS Inc., Chicago, Illinois, USA).

RESULTS

A total of 200 ultrasounds were performed by the EDs for the problem of appendicitis. A total of 32 patients showed positive results for bedside ultrasound for appendicitis (BA). Out these 32 patients, 19 were affected by appendicitis while in 13 patients, appendicitis was absent. A total of 155 patients were reported to be BA negative. Out of them in 52 and 103 patients, appendicitis was present and absent, respectively. In total, out of 200 total patients, 84 cases showed presence of appendicitis while in 116 cases, appendicitis was absent. Prevalence in the present study was found to be 0.44 while the specificity and the sensitivity were found to be 0.91 and 0.42 respectively. Positive predictive values and the negative predictive values were found to be 0.75 and 0.67 respectively.
Table 1: Distribution of patients

<table>
<thead>
<tr>
<th></th>
<th>Appendicitis</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
<td>Absent</td>
<td>Total</td>
</tr>
<tr>
<td>BUSA positive</td>
<td>32</td>
<td>13</td>
<td>45</td>
</tr>
<tr>
<td>BUSA Negative</td>
<td>52</td>
<td>103</td>
<td>155</td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>116</td>
<td>200</td>
</tr>
</tbody>
</table>

Table 2: BU accuracy

<table>
<thead>
<tr>
<th>BA’s accuracy</th>
<th>Point estimate</th>
<th>95 percent Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence</td>
<td>0.44</td>
<td>0.39</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.42</td>
<td>0.27</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.91</td>
<td>0.80</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>0.75</td>
<td>0.56</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>0.67</td>
<td>0.55</td>
</tr>
</tbody>
</table>

DISCUSSION

Approximately 3.4 million patients per year present to EDs in the United States with a chief complaint of abdominal pain, of which 250,000 (7%) are diagnosed with appendicitis. In crowded EDs, time is critical and rapid disposition is crucial. Moreover, delayed diagnosis of appendicitis leading to perforation is the leading cause of morbidity and mortality.

The diagnosis of appendicitis is made by graded compression technique that was first described by Puylaert in 1986. A linear high-frequency transducer is placed on the right lower quadrant and pressure is applied gradually while imaging, displacing the overlying gas-filled loops of bowel. Bedside ET ultrasound is becoming widely available. Ultrasound training is required in emergency physicians have demonstrated the ability to accurately perform focused ultrasound examinations.

A total of 200 ultrasounds were performed by the EDs for the problem of appendicitis. A total of 32 patients showed positive results for bedside ultrasound for appendicitis (BA). Out these 32 patients, 19 were affected by appendicitis while in 13 patients, appendicitis was absent. A total of 155 patients were reported to be BA negative. Out of them in 52 and 103 patients, appendicitis was present and absent, respectively. In total, out of 200 total patients, 84 cases showed presence of appendicitis while in 116 cases, appendicitis was absent. Prevalence in the present study was found to be 0.44 while the specificity and the sensitivity were found to be 0.91 and 0.42 respectively. Positive predictive values and the negative predictive values were found to be 0.75 and 0.67 respectively.

Diagnostic accuracy is perhaps the single most important aspect to monitor in radiology because of its strong connections with health outcomes. At the threshold of uncertainty, radiologists can err on the side of making false-positive or false-negative decisions depending on their concern for the consequences of their decisions.

Radiologists have reported sensitivities of 75 to 90%, specificities of 86 to 100%, and positive predictive values of 91 to 94%.

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Fox et al assessed the accuracy of emergency physicians using bedside ultrasound to detect appendicitis (BA). From the results, they concluded that insufficient evidence exists which could support the use of bedside ultrasound by emergency physicians to rule out appendicitis.  

Ang et al determined the accuracy of sonography in the diagnosis of clinically equivocal appendicitis. From the results, they concluded that ultrasound is a useful for the evaluation of acute abdominal pain in children.

CONCLUSION

The present study concluded that a total of 32 patients showed positive results for bedside ultrasound for appendicitis (BA). Out these 32 patients, 19 were affected by appendicitis while in 13 patients, appendicitis was absent. A total of 155 patients were reported to be BA negative. Out of them in 52 and 103 patients, appendicitis was present and absent, respectively. Proper training is required for performing ultrasound in suspected pathologies of abdominal region for avoiding false positive and negative cases.

REFERENCES


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