Accuracy of Resident-Performed Right Upper Quadrant Ultrasonography
T Jang, C Aubin, R Naunheim

Citation

Abstract
Objective: The purpose of this study was to assess the accuracy of emergency medicine resident (EMR) performed RUQ ultrasonography (US) in the diagnosis of gallstones and acute cholecystitis.

Methods: This was a retrospective review of patients with suspected gall bladder pathology who underwent EMR-performed RUQ US prior to gold standard evaluation consisting of operative or department of radiology evaluation.

Results: 148 patients were included, 66 of whom had gallstones. EMR-performed RUQ US had a sensitivity of 95.5% (95% CI (86.4-98.8%)) and specificity of 90.2% (95% CI (81.2-95.4%)) for gallstones. 14 patients had acute cholecystitis. EMR-performed RUQ US had a sensitivity of 92.9% (95% CI (64.2-99.6%)) and specificity of 93.3% (95% CI (87.3-96.7%)) for acute cholecystitis.

Conclusions: EMRs can accurately perform RUQ US to diagnose gallstones and acute cholecystitis in selected patients, which was not previously established.

INTRODUCTION
It is estimated that 16-20 million Americans have gallstones, resulting in 500,000 operations per year (1). The accurate diagnosis of gallstones and/or cholecystitis is necessary given the increased mortality risk due to cholecystitis (1). Radiographic imaging has, thus, become standard of care in the evaluation of suspected biliary pathology, including ultrasonography (US), computed tomography (CT), and HIDA scans depending on institution and physician preference (1).

Four prior studies have shown that well-trained EPs could accurately perform RUQ US in selected patients (2-5), but none have evaluated the performance of emergency medicine resident (EMR) performed RUQ US. The purpose of this study was to assess the accuracy of EMR-performed RUQ US in the diagnosis of gallstones and acute cholecystitis.

MATERIALS AND METHODS
This was a retrospective review of patients presenting to an urban, academic ED with abdominal pain that was suspicious for gallstones or acute cholecystitis. Those who underwent EMR-performed RUQ US prior to operative treatment or department of radiology evaluation were included. Patients triaged by nursing staff to a walk-in urgent care were not included in this study and those with EMR-performed RUQ US after evaluation by the department of radiology were excluded.

Standardized data forms included in patient files were reviewed using a predesigned data sheet. These forms included documentation of (1) a sonographic Murphy's sign, (2) the presence of gall stones, (3) detection of pericholecystic fluid, (4) gallbladder wall thickness, (5) common bile duct (CBD) diameter, (6) the presence of a double wall sign, and (7) overall diagnostic impression as determined by the EMR based on history, physical exam, and the above factors.

All EMRs participated in a two-hour introduction to the operation of the Aloka SSD-1400 and RUQ US techniques prior to the study period and US examinations were performed using a 3.5 MHz curved linear array probe. Images were recorded with a Sony thermographic printer.
An RDMS EP-sonographer who completed a community college certification program subsequently reviewed US images and interpretations for resident feedback, but these comments were not used to alter the performance characteristics of the residents.

The results of the EMR-performed RUQ scans were compared against operative findings when available, otherwise department of radiology evaluations were used as gold standards for the diagnosis of gallstones and cholecystitis. Statistical analysis was done using VassarStats. This study was approved by the IRB at our institution.

RESULTS
From April 2000 to February 2002, 148 patients were evaluated by 29 EMRs with RUQ US prior to gold standard evaluation (table 1).

Table 1: Gold standard evaluations

<table>
<thead>
<tr>
<th>Gold Standard Evaluation</th>
<th>#</th>
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</thead>
<tbody>
<tr>
<td>OR only</td>
<td>2</td>
</tr>
<tr>
<td>CT/US then OR</td>
<td>13</td>
</tr>
<tr>
<td>Cholangiogram</td>
<td>1</td>
</tr>
<tr>
<td>US</td>
<td>82</td>
</tr>
<tr>
<td>HIDA then US</td>
<td>1</td>
</tr>
<tr>
<td>CT</td>
<td>62</td>
</tr>
</tbody>
</table>

Overall, 66 of the 148 patients had gallstones on gold standard evaluations. EMR-performed RUQ US had a sensitivity and specificity for gallstones of 95.5% (95% CI (86.4-98.8%)) and 90.2% (95% CI (81.2-95.4%)) (table 2). 14 patients had acute cholecystitis diagnosed by gold standard evaluations. EMR-performed RUQ US had a sensitivity and specificity for cholecystitis of 92.9% (95% CI (64.2-99.6%)) and 93.3% (95% CI (87.3-96.7%)) (table 2).

DISCUSSION
This study found that EMRs could accurately perform RUQ US for the detection of gallstones and diagnosis of cholecystitis in selected patients. Our sensitivity and specificity for gallstones were consistent with prior EM studies involving well-trained EPs (1,4,5,6, table 3) and even those in the radiology literature (7). That EPs can detect gallstones is important since 99% of patients with acute cholecystitis have gallstones (7).

One concern that has been raised is that EPs might miss evidence of cholecystitis, although they might be able to detect gallstones (8). In our population, only one patient with cholecystitis would have been missed by US findings alone. In that case, the operator correctly identified the presence of gallstones and normal wall thickness, but did not appreciate the presence of “mild” pericholecystic fluid identified by department of radiology RUQ US. However, the patient had an elevated WBC count and was admitted to the hospital for IV antibiotics and further management. Thus, no case of acute cholecystitis was missed in our sample.

This study is the first study evaluating EMR-performed RUQ US. Previous studies involved well-trained attendings or senior residents with limited numbers (1,4,5,6,7, table 3). In this study, however, the EMRs had limited didactic training (2 hours) and performed, on average, less than three prior US exams. Secondly, it is the only study in the EM literature evaluating a large number of residents outside of a specific research protocol (ie, not involving a few well-trained attending EPs) as almost 50% of the EM residents (29 of 60) performed RUQ US exams during the study period. Finally, it is the only study in the literature assessing the accuracy of EMR-performed RUQ US.

LIMITATIONS AND FUTURE QUESTIONS
There were several limitations to this study. First, a convenience sample was used. While this does limit the study, it may be that those patients a particular resident feels comfortable evaluating with US —whether due to patient habitus or other factors—can be accurately assessed for gallstones.
bladder pathology. If this is true, reserving more difficult patients (eg, morbidly obese patients) for immediate formal radiographic evaluation might allow for better utilization of resources in the ED. Secondly, as with all previous studies in the EM literature involving RUQ US, this was a single-center study. While a multi-center study would provide a better assessment of EMR ability to perform RUQ US, this would be difficult due to the varying levels of US utilization in different EDs and EM residencies. Third, although 29 of 60 residents performed exams during the study period, 13 of them accounted for 88 of the exams. This likely biased our study towards those EMRs interested in US. Finally, a consistent gold standard was not used. This, however, correlates with clinical practice as documented in the literature (1–9). Recent advances in CT helical technology have allowed for greater accuracy, proving in a number of cases to be more accurate than transabdominal RUQ US (10–12). Likewise, the gastroenterology literature using ERCP as the gold standard has also shown that helical CT can be more accurate than transabdominal RUQ US, especially in detecting common bile duct pathology (13–19).

CONCLUSION

Our data demonstrate that EMRs can accurately perform RUQ US for the diagnosis of gallstones and acute cholecystitis in selected patients, which has not been shown previously.

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