Discrepancies Between Overnight Teleradiology and Next Day In-House Radiology Interpretations of Emergency Department Computed Tomographic Scans

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BACKGROUND
Private teleradiology groups have become the standard means by which emergency physicians obtain after-hours interpretations for non-study images in the United States. Teleradiologist interpretation of radiographic studies during afterhours Emergency Department (ED) care has the potential to influence patient management decisions.

OBJECTIVES
1. Estimate rates of major discrepancies between teleradiology and inhouse radiology.
2. Determine what proportion of major discrepancies are due to teleradiology misinterpretations.
3. Assess the effect of major discrepancies on patient management and adverse events.

METHODS
1. Included 550 consecutive CT scans of the head, cervical spine, chest, and abdomen and pelvis sent to teleradiology during a 3-month period between December 2004 and February 2005.
2. CT scans initially read by a teleradiologist working at a private, for-profit group (Teleradiology Diagnostic Services), next-day read provided by a private in-house group.
3. For each scan, one study author (TP) compared the teleradiology and inhouse radiologist interpretations.
4. Major discrepancy defined as a difference that could be reasonably expected to result in a change in disposition, consultation or treatment.
5. Follow-up data used to classify major discrepancies as an overread or underread by teleradiology or inhouse radiology and to assess for adverse patient events that could be attributed to the discrepancy.

STATISTICAL METHODS
Sample size was estimated to provide an overall rate of major discrepancies with a margin of error of ±1%. Using a predicted major discrepancy rate of 2%, a 95% confidence interval, and a power of 80%, the required 1156 pairs of interpretations, Based on current usage of teleradiology services, we anticipated enrollment of 10 pairs of study interpretations each day. Allowing for variance in enrollment and lost or incomplete data, we estimated that sufficient cases would be obtained in 3 months.

RESULTS
1. 787 studies sent to teleradiology during the 3 month study period, 550 included in the analysis (Figure).
2. Major discrepancies occurred in approximately 6% of studies overall, with similar rates for the 4 study types (Table 1).
3. Eight of the 32 major discrepancies were attributed to a misinterpretation by the teleradiologist and nine to a misinterpretation by the inhouse radiologist (Table 2).
4. Of the eight discrepancies thought to be due to teleradiologist error, four were classified as overreads, two of which led to inappropriate hospital admission. Four discrepancies were classified as underreads by teleradiology.
5. In only one of 32 major discrepancies did a misinterpretation by teleradiology lead to an adverse event. This patient presented with abdominal pain, was diagnosed with a small bowel polyp by teleradiology. The next day he was diagnosed with a high-grade small bowel obstruction by inhouse radiology. Three days later the patient returned to the ED and that day had surgery for intussusception. The patient was well at 2-year followup.
6. Six types of pathology accounted for almost half of the major discrepancies: intraparenchymal cerebral contusion or hemorrhage (8 cases), pulmonary embolism (2 cases), small bowel pathology (5 cases), and renal calculi (2 cases).

LIMITATIONS
1. We studied a single teleradiology and inhouse radiology group. All radiologists from both groups are US board certified.
2. We were unable to assess all pairs of radiology interpretations for study.
3. Images in our study were acquired using a 4-slice CT scanner. Current CT scanners are widely used and provide more detailed images; these images may look different in different discrepancies.
4. Rates of discrepancies between teleradiologists and inhouse radiologists may be different for other types of studies.
5. Clinicians could discuss preliminary findings with the teleradiologist by phone, sometimes leading to changes in the teleradiology report. We do not know how often this occurred. If the teleradiology interpretations we studied do contain amended reports, our estimates of major discrepancies would probably be lower than if communication between clinicians and teleradiologists were not possible.
6. We classified pairs of interpretations as having a major discrepancy if the discrepancy could reasonably be expected to result in a change in disposition, consultation or treatment. Clinicians may have decided what a reasonable change was.
7. We chose follow-up data as the criterion for classifying discrepancies rather than further review by independent radiologists. This method of defining the presence or absence of illness is subjective to error.
8. Our inhouse radiologists had access to teleradiology interpretations and additional clinical information. For this reason, this study is not a head-to-head comparison of two radiology groups. Rather, our goal was to determine how often a radiologist would change an interpretation that would be significantly different from the official, next-day interpretation.

CONCLUSIONS
Major discrepancies in interpretations between teleradiologists and inhouse radiologists occurred for approximately 6% of CT scans. Major discrepancies that we could attribute to teleradiologist misinterpretation occurred in less than 2% of studies, with only one patient suffering an adverse event from a teleradiology misinterpretation. Our findings support the cautious use of teleradiology interpretations for ED decision making; a larger study is needed to validate this conclusion.

Table 1. Major discrepancy rates for the four types of CT scans

<table>
<thead>
<tr>
<th>Type of CT</th>
<th>Major Discrepancies</th>
<th>Total Studies</th>
<th>Discrepancy Rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>76</td>
<td>550</td>
<td>6% (4.7 - 9.6)</td>
</tr>
<tr>
<td>Head</td>
<td>26</td>
<td>160</td>
<td>16% (10.2 - 22.8)</td>
</tr>
<tr>
<td>C-spine</td>
<td>17</td>
<td>20</td>
<td>85% (71.5 - 98.9)</td>
</tr>
<tr>
<td>Chest</td>
<td>17</td>
<td>44</td>
<td>39% (27.1 - 51.9)</td>
</tr>
<tr>
<td>Abdomen/Pelvis</td>
<td>20</td>
<td>201</td>
<td>10% (6.6 - 13.4)</td>
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