Secondary interpretations of outside abdominopelvic computed tomography at a tertiary referral center: Support for subspecialization?

Jonathan K. Vincent, MD
David P. Keating, MD
Judy K. Tam, MD
Disclosures

• No relevant financial relationships with any commercial interests.

• Off-label or investigational uses of medical products or devices will not be discussed.
Goals and Objectives

- Review the current literature on error rates in radiologic interpretation

- Present the results of original research investigating the discrepancy rate of secondary interpretations of outside abdominopelvic CT exams performed at the University of Vermont Medical Center

- Demonstrate that subspecialist secondary reads are highly accurate and reveal a high rate of discrepancies, but are associated with few adverse outcomes
Background

• Tertiary care referrals intended to optimize patient care
  – Expedite appropriate treatment, avoid unnecessary studies or interventions and reduce healthcare expenses

• OSH transfers often arrive with imaging already performed
  – Second opinion interpretations may be requested

• Opportunity to demonstrate *added value* to patient care
  – Identify missed findings or incorrect interpretations
  – Potential to alter management decisions
  – Ensure appropriate interventions at the right time
Prior studies have demonstrated highly variable overall discrepancy rates ranging from 1.3% to 41%.

Final interpretation often considered the “gold standard” without proof of accuracy.

High rates of intraobserver variability have been described:
- Abujudeh et al → 32% discrepancy rate for abdominal radiologists re-reading abdominopelvic CTs.

Variation in discrepancy rates by anatomic region:
- Chest and abdominopelvic CTs have higher discrepancy rates than neuroradiology CTs.

### Discrepancy Rates in the Literature

<table>
<thead>
<tr>
<th>Study</th>
<th>Region</th>
<th>Major Discrepancy Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platts-Mills et al</td>
<td>A/P</td>
<td>Chest</td>
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<td></td>
<td></td>
<td>Head</td>
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<tr>
<td>Walls et al</td>
<td>A/P</td>
<td>Chest</td>
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<td></td>
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<td>Head</td>
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<tr>
<td>Wu et al</td>
<td>A/P</td>
<td>Chest</td>
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<td>Head</td>
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</tbody>
</table>
Purpose

• Determine if significant discrepancy rates exist for the interpretation of abdominopelvic CTs between outside radiologists and abdominal subspecialists at the University of Vermont Medical Center

• Determine if discrepancy rates are influenced by fellowship training type or radiologist location

• Determine if discrepancies have any impact on patient outcomes
Materials and Methods

• Retrospective chart review
  – 284 consecutive abdominopelvic CT exams submitted for secondary read at the University of Vermont Medical Center between 6/1/2012 through 12/31/2012
  – Excluded if no OSH report available
  – Secondary interpretations performed by two abdominal subspecialist staff radiologists (10 and 17 years experience)

• Determine overall agreement between original report and secondary interpretation according to three-point system frequently used in the literature
  – Major discrepancy → potential to alter patient care and/or prognosis
  – Minor discrepancy → incidental finding unlikely to affect patient care and/or prognosis
  – No discrepancy → agreement

• All major discrepancies underwent further chart review to determine interpretation accuracy and potential adverse outcomes

• Interpretation accuracy verified via follow-up information as available
  – Pathology results, follow-up imaging, procedural findings or clinical follow-up
Information on the interpreting outside radiologist was obtained as available using internet records search

- Local or teleradiologist and fellowship training type
- Fellowship training was considered “subspecialty concordant” or “discordant” based on type
  - Concordant ➔ body, abdominal or cross-sectional imaging
  - Discordant ➔ breast, chest/thoracic, vascular and interventional, musculoskeletal, neuroradiology, nuclear medicine, pediatrics

Statistics

- Proportions calculated for all data
- Fisher exact test utilized for comparisons between groups
Results

- 243 exams met inclusion criteria

- Patient Demographics
  - 118 male (48.6%) and 125 female (51.4%)
  - Age range: 18-90 years
  - Mean age: 58.4 years

- Secondary read discrepancies
  - 49 “Major” – 20.2%
  - 81 “Minor” – 33.3%
  - 113 “None” – 46.5%
## Results

<table>
<thead>
<tr>
<th>Local Outside Radiologists</th>
<th>Fellowship Training Concordant Radiologists</th>
<th>Fellowship Training Discordant Radiologists</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major discrepancies</td>
<td>Major discrepancies</td>
<td>Major discrepancies</td>
<td>Correct</td>
</tr>
<tr>
<td>Minor or no discrepancy</td>
<td>Minor or no discrepancy</td>
<td>Minor or no discrepancy</td>
<td>Incorrect</td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
<td>Total</td>
<td>Unknown</td>
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<td>39</td>
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<td>25</td>
<td>38</td>
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<tr>
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<td>39</td>
<td>83</td>
<td>2</td>
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<td>195</td>
<td>44</td>
<td>108</td>
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</table>

<table>
<thead>
<tr>
<th>Teleradiologists</th>
<th>Fellowship Training Discordant Radiologists</th>
<th>Adverse Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major discrepancies</td>
<td>Major discrepancies</td>
<td>Yes</td>
</tr>
<tr>
<td>Minor or no discrepancy</td>
<td>Minor or no discrepancy</td>
<td>No</td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
<td>Unknown</td>
</tr>
<tr>
<td>10</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>36</td>
<td>83</td>
<td>40</td>
</tr>
<tr>
<td>46</td>
<td>108</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discrepancy Type</th>
<th>Follow-up?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>42 Yes</td>
</tr>
<tr>
<td>Major</td>
<td>49</td>
</tr>
<tr>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7</td>
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<table>
<thead>
<tr>
<th>Follow-up Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 clinical only</td>
</tr>
<tr>
<td>9 path results</td>
</tr>
<tr>
<td>9 further imaging</td>
</tr>
<tr>
<td>3 procedures</td>
</tr>
<tr>
<td>11 combination</td>
</tr>
</tbody>
</table>

Secondary Read Accuracy:
- 7 correct
- 1 incorrect
- 2 unknown
- 8 correct
- 1 incorrect
- 11 correct
- 7 unknown
Results Summary

• High rate of discrepancies
  – Overall: 53.5%
  – Major: 20.2%
  – Minor: 33.3%

• Secondary read was more accurate than original interpretation in 95% of cases (p < 0.0001)

• Outside radiologists with discordant fellowship training had more major discrepancies than those with concordant fellowship training
  – 83.3% vs 16.7% (p = 0.12)

• No significant difference in proportion of major discrepancies between local outside radiologists and teleradiologists
  – 20% vs 21.7% (p = 0.84)

• Low rate of adverse outcomes (4.8%)
Example Case
44 y.o. female

**Initial read:**
Prior hysterectomy

**Secondary read:**
Necrotic porta hepatis nodes concerning for metastatic disease, consider EUS-guided biopsy

**Diagnosis:**
Metastatic endometrial cancer – confirmed via EUS-guided biopsy
Value of Secondary Reads

• Present study found higher discrepancy rates for abdominal subspecialist secondary reads than previously published in literature
  – Current study → 243 abdominopelvic CTs for various indications
    • 53.5% discrepancy rate overall
    • 20.2% major discrepancy rate
  – Yoon et al → 512 abdominopelvic CTs for trauma
    • 29.9% discrepancy rate overall
    • 2.3% major discrepancy rate
  – Difference possibly related to higher proportion of malignancy indications in current study?

• Subspecialist secondary interpretations are also highly accurate
  – Current study
    • 95% accuracy
  – Eakins et al → 305 body CTs at tertiary pediatric hospital
    • 95.7% accuracy
  – Hricak et al → abdominopelvic CTs and MRs in oncology patients
    • 92% accuracy
Value of Secondary Reads

- Subspecialty reads at tertiary cancer centers are essential for accurate staging, prognosis and management
  - Discrepancy rates of 33-41% reported in the literature
    - Gollub et al → 17% major discrepancy rate for body CT exams
      - Change in care in 9% of cases
    - Loevner et al → 41% overall discrepancy rate for head and neck CT and MR exams
      - Change in management in 98% of cases
      - Change in prognosis in 95% of cases
    - Kazerooni et al → CT reinterpretations for lung cancer
      - TNM staging changed in 33.3% of cases
      - Surgical vs. non-surgical disease status changed in ~50% of cases
Causes of Interpretation Errors

- Inadequate training for a given subspecialty, modality or disease process
  - Lack of experience or low volume for given entity
  - Bollen et al → radiologist experience is most important factor in determining accuracy
  - Bechtold et al → radiologist skill is most important factor in determining error rates

- Perceptual or cognitive errors
  - Excessive speed
  - Knowledge deficit

- Different threshold for reporting (i.e. incidental findings)

- Challenges unique to teleradiologists
  - Potentially diminished image quality
  - Limited access to clinical information or prior exams for comparison
  - Possible variation in work environment (different time zone or nocturnal schedule)

- Assumption that tertiary referral will follow with adequate evaluation
  - Especially in cases containing abnormalities
• Similar to literature, few major discrepancies in this study resulted in an adverse outcome
  – Current study → 4.8%
  – Platts-Mills et al → 3.4%
  – Ruchman et al → 0.4%
  – Chung et al → 0%

• May be related to subsequent modifications in management following a discrepant secondary interpretation?
Limitations

• Retrospective design
• Smaller sample size relative to some other studies
  – Wu et al meta-analysis demonstrated more widely variable discrepancy rates with smaller sample sizes compared to larger studies
• Radiologist training information may not all be publicly available
• Sources of potential bias
  – Sampling bias
    • Cases referred to tertiary center may be more likely to be abnormal and/or challenging
  – Observer bias
    • Lack of blinding
    • Reviewer subjectivity in determination of discrepancies
Conclusions

• Secondary interpretations provide an opportunity to add value to patient care.

• Subspecialist secondary interpretations of outside abdominopelvic CTs are highly accurate and demonstrate a high rate of discrepancies, particularly when malignancy is the indication.

• Fellowship training type may affect the rate of clinically significant errors when interpreting abdominopelvic CTs.

• There is no significant difference in the major discrepancy rate between local outside radiologists and teleradiologists.

• Despite a high rate of discrepancies, there is a low rate of associated adverse outcomes.
References

- Chung JH, Strigel RM, Chew AR, Albrecht E, Gunn ML. Overnight resident interpretation of torso CT at a level 1 trauma center an analysis and review of the literature. *Acad Radiol*. 2009 Sep;16(9):1155-60.
References (continued)


