Radiologic Evaluation Paradigm for Acute Gastrointestinal Bleeding

Adam Zybulewski, MD
Pratik Shukla, MD
Marcin Kolber, MD
Erik Berkowitz, MD
James Silberzweig, MD
Morris Hayim, MD
Adam Zybulewski, M.D.

• No relevant financial relationship reported
Introduction

• Approximately 75% of upper and 80% of lower GI bleeds will cease spontaneously with supportive measures alone. The remaining nearly 25% of cases require further intervention to localize and treat the source of bleeding.

• In the setting of obscure GI bleeding (source not identified on endoscopy), radiologic evaluation is often employed to localize and inform further treatment.
Nuclear Medicine Tagged-RBC Scintigraphy (NMS)

- Nuclear Medicine tagged-RBC Scintigraphy (NMS)
  - GOLD STANDARD
  - Sensitivity: 93%
  - Specificity: 95%
  - **Bleeding Rate: 0.1 mL/min**
Computed Tomography Angiography (CTA)

- Computed Tomography angiography (CTA)
  - Sensitivity: 89%
  - Specificity: 85%
  - Bleeding Rate: 0.3-0.5 mL/min

- Potential benefits:
  - Anatomic detail
  - Less delay
  - CTA more closely approximates the rate of bleeding required to identify and potentially treat the source of bleeding during catheter-directed mesenteric angiography.

- Efficacy of CTA in the setting of GI Bleeding:
  - Wu, Lian-Ming et al. (2010) - meta-analysis of 9 studies with 198 patients showed pooled sensitivity of 89% and specificity of 85% for the use of CTA in the detection of GI bleeding
  - Yoon et al. (2006) - high sensitivity (90.9%) and specificity (99%) in 26 patients with massive GI bleeding.
Catheter-Directed Angiography

• Catheter-directed Mesenteric Angiography
   • Sensitivity: 63-90% upper GI and 40-86% lower GI bleeding
   • Bleeding rate: 0.5-1 mL/min
Objective

- At our institution, we recommend the use of CTA as the primary radiologic study for the diagnosis and localization of GI bleeding.

- Purpose:
  - to compare the predictive power of CTA and NMS for predicting a positive result on mesenteric angiography (regardless of ability to treat, rate of bleeding or site of bleeding).

- Hypothesis:
  - When compared to NMS, CTA will better predict the results of catheter-directed mesenteric angiography.
Methods

- Multi-Center retrospective review
  - Mount Sinai Beth Israel, Mount Sinai West, Mount Sinai St. Luke’s Hospital, Mount Sinai Brooklyn

- Inclusion criteria:
  - Any patient undergoing catheter-directed mesenteric angiography for localization and possible treatment of GI bleeding
    - Prior imaging with either CTA, NMS, or both.
Methods

- November 2012 – July 2015

- 132 patients (88 male, 44 female), average age: 73 ± 15.2 years
  - 140 mesenteric angiography procedures for evaluation/treatment of acute GI bleeding

- 47 mesenteric angiograph studies excluded
  - No prior CTA or NMS

- 88 total patients (51 male, 37 female), average age: 73.6 ± 14.4 years
  - 93 mesenteric angiography studies
    - 46 patients (25 male, 21 female)
      - Average age: 73.3 ± 15.4 years
      - 47 CTAs
    - 51 patients (32 male, 19 female)
      - Average age: 74.6 ± 14.3 years
      - 51 NMS
Data Analysis

- **Positive predictive value (PPV):**
  - True positive on either CTA or NMS / total number of true and false positives for either CTA or NMS
  - True positive = CTA or NMS demonstrates a positive test result, which is confirmed on catheter-directed mesenteric angiography
  - False positive = CTA or NMS demonstrates a positive result, which is not confirmed on catheter-directed mesenteric angiography

- **Negative predictive value (NPV):**
  - True negative on either CTA or NMS / total number of true and false negatives for either CTA or NMS
  - True negative = CTA or NMS demonstrates negative result, confirmed as negative on catheter-directed mesenteric angiography
  - False negative = CTA or NMS demonstrates a negative result, not confirmed on catheter-directed mesenteric angiography
## Results

### Catheter-Directed Mesenteric Angiography

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<th>Negative</th>
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<tr>
<td>Positive</td>
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<td>17</td>
<td>35</td>
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<tr>
<td>Negative</td>
<td>1</td>
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<td>12</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>19</strong></td>
<td><strong>28</strong></td>
<td><strong>47</strong></td>
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**CT Angiography**

- **Positive Predictive Value:**
  - \( \frac{TP}{TP + TN} = \frac{18}{35} = 0.51 \)

- **Negative Predictive Value:**
  - \( \frac{TN}{TN + FN} = \frac{11}{12} = 0.91 \)
Nuclear Medicine Tagged-RBC Scan

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<th>Positive</th>
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<tbody>
<tr>
<td>Positive</td>
<td>8</td>
<td>40</td>
<td>48</td>
</tr>
<tr>
<td>Negative</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>43</td>
<td>51</td>
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- **Positive Predictive Value:**
  - \( \frac{TP}{TP + TN} = \frac{8}{48} = 0.17 \)

- **Negative Predictive Value:**
  - *Not calculated as no patients proceeded to mesenteric angiography after negative NMS*
Discussion

- A negative CTA correctly predicts a negative mesenteric angiogram in 91% of cases.

- A positive CTA is 3 times more likely to predict a positive result on mesenteric angiography when compared to NMS (51% vs. 17%).
Institutional Treatment Paradigm

- **Obscure GI Bleed**
  - **CTA**
    - **Active Hemorrhage**
      - Mesenteric Angiography
    - **No Active Hemorrhage**
      - Supportive Care
        - Rebleeding / Failure of supportive care
          - Repeat CTA
            - Nuclear Medicine tagged-RBC Scintigraphy
          - Repeat CTA
            - Nuclear Medicine tagged-RBC Scintigraphy
Discussion

• Retrospective: Lee et al. (2009), Jaeckle et al. (2008)
• Prospective: Zink et al. (2008), Yoon et al. (2006)

• Few patients (n = 15 - 41)
• Patients were highly selected (massive GI bleeding) – excluded “intermittent” GI bleeds
• No head-to-head direct comparison to MA
• Reference Standard:
  • Mesenteric Angiography, Endoscopy, Capsule Enteroscopy, Surgery, or even NMS
Limitations/Future Directions

- Limitations:
  - Retrospective Study
    - Time to mesenteric angiograph could not be reliably obtained

- Future Directions:
  - Prospective head-to-head randomized study
References


