Audit of appropriate ED imaging workup for intracranial aneurysm in the setting of known or suspected subarachnoid hemorrhage

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Background and Aim of the Audit

• Concern for appropriate imaging:
  • Many patients with CT diagnosed SAH or suspected imaging occult SAH were being worked up with a CTA arch to vertex when a CTA head is the gold standard

• CTA head benefits:
  • Less radiation exposure
    • 70% dose reduction (1.6 mSV vs 5.4 mSV)
  
  • At the center involved in this audit, the CTA head study has significantly better contrast attenuation of the intracranial vasculature

These images belong to the same normal patient, one was a CTA Head study where his vessels appear smooth, while the other one is a CTA arch to vertex study, where his intracranial vessels look quite irregular.
Standard and Audit Target

American College of Radiology ACR appropriateness criteria: for clinically suspected SAH:

- Non-contrast CT head: usually appropriate
- Non-contrast CT head and CTA head: may be appropriate.
- CTA neck with IV contrast (basically what CTA arch to vertex adds on top of a CTA head study): usually not appropriate

Audit Target:

- 100% of the time, patients with CT diagnosed SAH or suspected imaging occult SAH and concern for intracranial aneurysms should obtain a CTA head rather than a CTA arch to vertex.

Methods

First cycle
Retrospective review of the clinical indications of all CTA arch to vertex studies performed for ED patients from July 1st, to October 31st, 2018

“SAH”, “worst headache”, or “aneurysm”, etc

Inappropriate

Other: “stroke”, “dissection”, N/A etc

Second cycle
Prospective review of clinical indications of all CTA arch to vertex studies performed for ED patients from November 1st 2018, to June 30th, 2019

Clinical history: “SAH”, “worst headache”, or “aneurysm”, etc

Inappropriate

Other: “stroke”, “dissection”, N/A, etc

A total of 30 hours were involved in the audit.
### First Cycle Results (Pre-intervention)

<table>
<thead>
<tr>
<th></th>
<th>Inappropriate CTA arch to vertex performed for ED patients for ? aneurysm</th>
<th>Total CTA arch to vertex studies performed for ED patients</th>
<th>% of inappropriate studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2018</td>
<td>4</td>
<td>54</td>
<td>7.4%</td>
</tr>
<tr>
<td>August 2018</td>
<td>2</td>
<td>40</td>
<td>5.0%</td>
</tr>
<tr>
<td>September 2018</td>
<td>6</td>
<td>58</td>
<td>10.3%</td>
</tr>
<tr>
<td>October 2018</td>
<td>3</td>
<td>52</td>
<td>5.8%</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>15</strong></td>
<td><strong>204</strong></td>
<td><strong>7.4%</strong> (does not meet target)</td>
</tr>
</tbody>
</table>

July to October 2018
Intervention

• Source of Error
  • Requesting physician may order CTA arch to vertex inappropriately
  • Unit clerk may input the incorrect CTA protocol
  • Radiology staff/resident may protocol it incorrectly

• Action
  • Collaboration with ED’s CQI
    • E-mails sent to ED staff regarding appropriate imaging issue
    • Reminder posters placed at order entry stations
  • Communication with Radiology Staff and Residents
    • Email reminder to identify inappropriate requests and correct them diligently
  • Raise unit clerk awareness (not performed in this audit)
# Second Cycle Results (Post-intervention)

<table>
<thead>
<tr>
<th></th>
<th>Total CTA arch to vertex studies performed for ED patients</th>
<th>Inappropriate CTA arch to vertex performed for ( \text{?} ) aneurysms</th>
<th>% of inappropriate studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 2018</td>
<td>58</td>
<td>1</td>
<td>1.7%</td>
</tr>
<tr>
<td>December 2018</td>
<td>52</td>
<td>3</td>
<td>5.8%</td>
</tr>
<tr>
<td>January 2019</td>
<td>51</td>
<td>1</td>
<td>2.0%</td>
</tr>
<tr>
<td>February 2019</td>
<td>64</td>
<td>3</td>
<td>4.7%</td>
</tr>
<tr>
<td>March 2019</td>
<td>44</td>
<td>3</td>
<td>6.8%</td>
</tr>
<tr>
<td>April 2019</td>
<td>57</td>
<td>3</td>
<td>5.3%</td>
</tr>
<tr>
<td>May 2019</td>
<td>57</td>
<td>2</td>
<td>3.5%</td>
</tr>
<tr>
<td>June 2019</td>
<td>69</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total: Nov 2018 – Jun 2019</strong></td>
<td><strong>452</strong></td>
<td><strong>16</strong></td>
<td><strong>(3.5% improved from 7.4%), does not meet target</strong></td>
</tr>
</tbody>
</table>
Inappropriate CTA arch to vertex performed for ED patients for ? aneurysms

Total CTA arch to vertex studies performed for ED patients

% of inappropriate studies

Pre-intervention Post-intervention

- Inappropriate CTA arch to vertex performed for ED patients for ? aneurysms
- Total CTA arch to vertex studies performed for ED patients
- % of inappropriate studies
After educating and reminding the ED physicians and radiology staff and residents, the incidence of inappropriate imaging was reduced by more than 50% (7.4 -> 3.5%) over the next 8 months.

A collaborative effort between the emergency and radiology department is required for improvement of patient care.

With time, the level of awareness drops, repeated reminders are needed.

Broaden our scope of intervention:
- Technologists (increase awareness)
- Reach out to other specialties
  - Inappropriate studies were also ordered by Neurology, Internal Medicine, Family Medicine, etc.