Reducing radiation exposure in endovascular surgery

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Disclosure

Speaker name:
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I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other(s)

I do not have any potential conflict of interest
Outline

• Background
• Objective
• Methods
• Results
• Conclusion
Increasing shift towards endovascular treatment of vascular disease

Increasingly complex procedures associated with longer procedural times

Increasing fluoroscopic ionizing radiation

**Australian Vascular Audit data – Open vs EVAR procedures**
Radiation related toxicity

- Roguin et al – 31 brain and neck tumors in interventional cardiologists
- El-sayed et al – acute DNA damage response during fluroscopically guided procedures
- EVAR and TEVAR for aortic aneurysms present highest radiation exposure

Roguin A et al. Am J Cardiol 2013
El-Sayed T et al. Circulation 2017
Patel AP et al. Eur J Vasc Endovasc Surg 2013
CO2 angiography

• Advantages
  • Wide availability
  • Low cost
  • Non-toxicity
  • Rapid tissue solubility
  • Low viscosity

CO2 angiography associated with reduced operating and fluoroscopy time – Criado et al

Objective

We sought to evaluate whether carbon dioxide (CO2) angiography in comparison to standard iodinate contrast (IC) for the repair of abdominal aortic aneurysm (AAA) was associated with reduced intraoperative radiation exposure.
Methods

Prospective review of all patients who underwent AAA repair between 2013-18.

Primary outcomes included:

- Procedure duration
- Screening time
- Number of runs
- Radiation dose
Results

A total of 149 AAA repairs were performed
96 patients underwent AAA repair using CO2 angiography
44 patients underwent AAA repair using iodinated contrast
## Demographic data

<table>
<thead>
<tr>
<th>Patient comorbidities</th>
<th>CO2 angiography</th>
<th>Iodinated contrast angiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>67 (70%)</td>
<td>30 (68%)</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>62 (65%)</td>
<td>27 (61%)</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1</td>
<td>2 (2%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Type 2</td>
<td>24 (25%)</td>
<td>12 (27%)</td>
</tr>
<tr>
<td>Cardiac conditions</td>
<td>45 (47%)</td>
<td>19 (43%)</td>
</tr>
<tr>
<td>Renal disorders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild impairment</td>
<td>9 (9%)</td>
<td>1 (2.3%)</td>
</tr>
<tr>
<td>Moderate/Severe impairment</td>
<td>5 (5%)</td>
<td>4 (9.1%)</td>
</tr>
<tr>
<td>Renal calculi</td>
<td>5 (5.2%)</td>
<td>2 (4.5%)</td>
</tr>
<tr>
<td>Other</td>
<td>47 (49%)</td>
<td>32 (73%)</td>
</tr>
</tbody>
</table>
Results

Procedures undertaken

Number of cases

<table>
<thead>
<tr>
<th>Types of cases</th>
<th>Carbon Dioxide (n)</th>
<th>Iodinated Contrast (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenestrated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fenestrated (revision)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fenestrated + IBE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard + IBE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th></th>
<th>Carbon Dioxide (n=96)</th>
<th>Iodinated Contrast (n=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure duration (mins)</td>
<td>102.9 (SD 67.1)</td>
<td>127.1 (SD 65.5)</td>
</tr>
<tr>
<td>Screening time (mins)</td>
<td>35.3 (SD 26)</td>
<td>41.6 (SD 25.2)</td>
</tr>
<tr>
<td>Runs</td>
<td>13 (SD 8)</td>
<td>20 (SD 8)</td>
</tr>
<tr>
<td>Radiation dose (uGym²)</td>
<td>35001.7 (SD 31617)</td>
<td>112632.0 (SD 166250.5)</td>
</tr>
</tbody>
</table>
Results

• Technical success – 99% (CO2) vs. 97.7% (IC)
• Clinical success – 95% (CO2) vs. 100% (IC)
• Median hospital length of stay – 3 days
  • ICU length of stay – 1 day
Results

Complications
CO2 angiography cases
- Limb cannulation (8)
- Endoleak (9)
- Ischaemic Limb (1)
- Puncture site bleeding (1)
- Others (12)
Contrast angiography cases
- Limb cannulation difficulty (1)
- Others
  - Loss of R) IIA wire requiring axillary approach to deliver second R) IIA stent
  - R) IIA dissection not caused by device resolved at the end of the procedure
Conclusion

• CO2 angiography was associated with reduced intraoperative radiation exposure in comparison to standard iodinated contrast

• CO2 is feasible in patients undergoing complex endovascular repair of AAA

• Future randomised trials evaluating the utility of CO2 in reducing radiation exposure are warranted.
THANK YOU
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