Significant contrast dose-reduction with Digital Variance Angiography in carotid and cerebral X-ray angiography

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Disclosure

Speaker name: Viktor Orias MD

I have the following potential conflicts of interest to report:

☐ Employment in industry: Kinepict Health Ltd.
Kinetic imaging (or DVA)

• New, patented x-ray image processing method
• Digital Variance Angiography (DVA) instead of subtraction (DSA)
• Significant image quality advantage over current reference-standard DSA in lower extremity arteriography with iodinated contrast media (1) and carbon-dioxide (2)
• First aim: DVA feasibility in carotid angio setting

Carotid and cerebral X-ray angiography

- Contrast medium
  - Nephrotoxicity
  - "Selective injections of hyperosmolar contrast material into the common and internal carotid arteries may..."
    - Cause pain, resulting in patient movement
    - Decreased image quality
    - Increased patient discomfort
    - "May produce transient disruption of the blood-brain barrier with associated neurologic deficit or seizure" (3)

- Second aim: to reduce contrast dose without image quality loss

Materials and methods

- Bács-Kiskun County Hospital Kecskemét, GE Innova IGS530 (4 fps, low X-ray dose setting)
- Iobitridol (Xenetix 350) 350 mg I / ml, 5fr Simmons 2 catheter
- 26 patients undergoing carotid PTA, GFR over 60 ml/min/1.73 m²
- Standard protocol: 6 ml ICM with 0.5 s rise time, 3 ml/sec flow angiography before and after carotid intervention (DSA of both common carotid arteries selectively, AP and lateral view, 105 image pairs)
- Low-dose protocol: 1 run with 50% ICM dose (3 ml) with 0.2 s rise time and same flow (19 image pairs)
- No patient received more than 100 ml of ICM
Materials and methods

- Comparison of DVA and DSA by signal-to-noise ratio (SNR) and visual image quality evaluation
  - SNR measurement and comparison: intravascular and extravascular (background) ROIs selected and compared
  - Visual evaluation of single images on a scale from 1 (no diagnostic value) to 5 (outstanding image quality) by 6 raters
Images

GE postprocessed DSA

Postprocessed DVA
## Results – SNR comparison

<table>
<thead>
<tr>
<th></th>
<th>DVA (100%)</th>
<th>DSA (100%)</th>
<th>DVA (50%)</th>
<th>DSA (50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNR mean</td>
<td>14.65</td>
<td>7.09</td>
<td>11.66</td>
<td>4.91</td>
</tr>
<tr>
<td>SNR median</td>
<td>10.95</td>
<td>5.41</td>
<td>9.13</td>
<td>4.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>DVA(100%) to DSA(100%)</th>
<th>DVA(50%) to DSA(100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean SNR(R)</td>
<td>2.89</td>
<td>1.64</td>
</tr>
<tr>
<td>Median SNR(R)</td>
<td>2.09</td>
<td>1.69</td>
</tr>
</tbody>
</table>

**SNR(R):** \( \frac{SNR(DVA)}{SNR(DSA)} \)
### Results – visual evaluation scores

<table>
<thead>
<tr>
<th></th>
<th>DSA Mean</th>
<th>DSA SEM</th>
<th>DVA Mean</th>
<th>DVA SEM</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>standard protocol</strong></td>
<td>3.49</td>
<td>0.08</td>
<td><strong>3.53</strong></td>
<td>0.04</td>
<td>1260</td>
</tr>
<tr>
<td><strong>low-dose protocol</strong></td>
<td>3.00</td>
<td>0.11</td>
<td><strong>3.51</strong></td>
<td>0.10</td>
<td>168</td>
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</table>

No significant image quality loss with low-dose protocol DVA.
### Results – visual evaluation scores

<table>
<thead>
<tr>
<th>Protocol</th>
<th>DSA (Mean, SEM)</th>
<th>DVA (Mean, SEM)</th>
<th>n</th>
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<tbody>
<tr>
<td>standard protocol</td>
<td>3.49 (0.08)</td>
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Low-dose protocol DVA has same image quality as standard protocol DSA.
## Results – visual evaluation scores

<table>
<thead>
<tr>
<th>Protocol Type</th>
<th>DSA (Mean)</th>
<th>DVA (Mean)</th>
<th>SEM</th>
<th>SEM</th>
<th>n</th>
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Notable image quality loss with low-dose protocol DSA
Conclusions

• DVA has an *obvious quality advantage* over DSA in carotid and cerebral X-ray angiography setting

• 50% ICM dose reduction *does not cause noticeable loss* of image quality while using DVA
  - Low-dose protocol DVA still *outperforms* standard-dose protocol DSA
  - Further investigation needed to safely *decrease X-ray dose* as well
Thank you for your attention!

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