Optical Coherence Tomography (OCT) In The Treatment Of Lower Extremity: How Does It Work And What Are The Limitations

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Introduction

OCT (Optical Coherence Tomography)

- Intravascular based imaging
  - Similar to IVUS
  - Near infrared light
- Current Uses in coronary arteries
  - Stent strut apposition
  - In-stent restenosis
  - Fibrous cap thickness

In-stent Restenosis – Tibial Imaging

Example: Stent Strut Malapposition in Coronary Intervention

Fibrous Cap Thickness – Coronary arteries

Disclosures

- No Relevant Disclosures
Are angiograms sufficient for endovascular therapy in PAD?

- Angiograms are 2D representations of a 3D vessel
- Angiograms are susceptible to artifacts that influence decision making
- Angiograms are “lumenograms” that give no information regarding the vessel morphology

Angiogram derived stenoses are dependent on angle

OCT

- Advantages
  - High Resolution
  - Rapid image acquisition
- Disadvantages
  - Requires flushing of blood for imaging
  - RBC attenuation
  - Fragile catheter optics

Contrast Example

Initial Experience with OCT

OPTIMISE Trial

- Purpose: Optimize imaging with OCT in peripheral vessels
- OCT requires blood clearing
- Mediums
  - Heparin Saline
  - Contrast
  - Dextran
  - CO₂
Primary Outcome: Clear Imaging Field (CIF)

Patients

<table>
<thead>
<tr>
<th></th>
<th>n = 23</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>67 ± 11</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>9 (39%)</td>
<td></td>
</tr>
<tr>
<td>Rutherford Class 1-3</td>
<td>10 (44%)</td>
<td></td>
</tr>
<tr>
<td>Rutherford Class 4</td>
<td>7 (30%)</td>
<td></td>
</tr>
<tr>
<td>Rutherford Class 5</td>
<td>6 (26%)</td>
<td></td>
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</tbody>
</table>

Mean ± Standard Deviation

Frequency (Percent)

Intervention

<table>
<thead>
<tr>
<th></th>
<th>Mean ± Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop Hct (%)</td>
<td>37 ± 6</td>
</tr>
<tr>
<td>PreOP GFR (mL/min/1.73 m²)</td>
<td>85 ± 50</td>
</tr>
<tr>
<td>PostOP GFR (mL/min/1.73 m²)</td>
<td>73 ± 21</td>
</tr>
<tr>
<td>p = 0.41</td>
<td></td>
</tr>
<tr>
<td>Total Contrast (ml)</td>
<td>94 ± 35</td>
</tr>
<tr>
<td>Total Dextran (ml)</td>
<td>30 ± 15</td>
</tr>
<tr>
<td>Total CO₂ (ml)</td>
<td>125 ± 38</td>
</tr>
<tr>
<td>Lumen Diameter (mm)</td>
<td>4.5 ± 1.3</td>
</tr>
<tr>
<td>Lumen Cross-sectional Area (mm²)</td>
<td>16.5 ± 9.6</td>
</tr>
</tbody>
</table>

Mean ± Standard Deviation

Qualitative Findings

Vessel Size and CIF Proportion

R² = 0.1258
TABLE: SFA Plaque Composition by Flush Medium

<table>
<thead>
<tr>
<th></th>
<th>Fibrotic</th>
<th>Calcific</th>
<th>Lipidic</th>
<th>Normal</th>
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<tbody>
<tr>
<td>Dextran</td>
<td>62.1</td>
<td>5.5</td>
<td>6.3</td>
<td>25.6</td>
</tr>
<tr>
<td>Heparinized Saline</td>
<td>63.0</td>
<td>5.4</td>
<td>6.5</td>
<td>22.9</td>
</tr>
<tr>
<td>Contrast</td>
<td>57.9</td>
<td>6.9</td>
<td>9.1</td>
<td>24.4</td>
</tr>
<tr>
<td>P value</td>
<td>0.819</td>
<td>0.941</td>
<td>0.769</td>
<td>0.938</td>
</tr>
<tr>
<td>Overall %</td>
<td>61.0</td>
<td>6.0</td>
<td>7.3</td>
<td>24.3</td>
</tr>
</tbody>
</table>

Conclusions

- First demonstration of OCT in peripheral vessels comparing flush media
- Guide catheters increase image quality.
- OCT catheters are fragile.
- Hand injected Contrast, Dextran, & Heparin/NS are similar with this small sample size.
- CO2 does not produce sufficient clearing in these larger vessels when hand injected.

Possible Clinical Implications

- Axial imaging may aid in pre and post intervention assessment of lower extremity vessels.
- This may prevent “remnant” stenosis – i.e. disease left untreated or poorly treated
- Currently, remnant stenosis may be confused with restenosis
- OCT may become a valuable adjunct in peripheral interventions similar to coronary interventions

Thank You