Disclosure

Speaker name:
R.R. Kruse

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
Collateral damage in endovascular treatment of SFA occlusive disease: Fact or fiction

R. Rombout Kruse, MD; EJ Vinke BSc; FB Poelmann, MD; D. Roohof, MD; S. Holewijn, PhD; C.H. Slump, PhD; MMPJ Reijnen, MD, PhD

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Collateral circulation.

- Role in decreasing clinical state

- Maximum collateral system flow: unknown

- Measuring collateral flow?

- In failure: (endo)vascular reconstruction:
  - open surgery: good medium/long term results.
  - Minimally invasive: Viastar.
Possible drawbacks

- Coverage of collateral circulation
  - negative effect occlusion
  - withholding interventionalists

- a need to know the hemodynamic relevance
- Lensvelt et al JVS 2013. 341 pts. No deterioration after graft failure
- Cardiologic literature: CFI: Traupe et al; Circulation 2013; Quantitative assessment of Periph coll circulation in 30 pts

- Not much is written on collaterals and occlusion by covered stents
- Some radiological studies
Determining significance of collateral circulation

- Anatomical pathways
- Volume
methods
- Computational model of 37 DSA’s

- DSA scoring system:
  - Short/long lesions
  - Stenosis/occlusion
  - Nr of collaterals prox end of lesion to knee
  - Diameters above and below lesion

- Poiseuille’s law

- Ohm’s law
Computational flow model

• Poiseuille’s law

\[ Q = \frac{\pi r^4 \Delta P}{\eta 8L} \]

• Ohm’s Law

\[ V = I \cdot R \rightarrow R = \frac{V}{I} \]

• Combination of the two

\[ R = \frac{\eta 8L}{\pi r^4} \]

• Total Resistance

\[ R_{tot} = R_1 + R_2 + R_3 \]
Computational model

- Schematic presentation of flow model parameters
set values

- **computational flow model parameters.**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
<th>Value</th>
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<tbody>
<tr>
<td>$P_{in}$</td>
<td>Blood pressure at SFA origo</td>
<td>94 mmHg</td>
</tr>
<tr>
<td>$P_{out}$</td>
<td>Blood pressure at SFA end</td>
<td>91 mmHg</td>
</tr>
<tr>
<td>$\Delta P$</td>
<td>Blood pressure difference</td>
<td>3 mmHg</td>
</tr>
<tr>
<td>$\eta$</td>
<td>Blood viscosity</td>
<td>0.032 P</td>
</tr>
<tr>
<td>$L_{tot}$</td>
<td>Total SFA length</td>
<td>35 cm</td>
</tr>
<tr>
<td>$R_h$</td>
<td>Healthy SFA radius</td>
<td>3 mm</td>
</tr>
<tr>
<td>$d_c$</td>
<td>Collateral to SFA distance</td>
<td></td>
</tr>
<tr>
<td>$L_{coll}$</td>
<td>Collateral length</td>
<td></td>
</tr>
<tr>
<td>$L_{occ}$</td>
<td>Lesion length</td>
<td></td>
</tr>
<tr>
<td>$R_{occ}$</td>
<td>Stenotic SFA radius</td>
<td></td>
</tr>
<tr>
<td>$N_{coll}$</td>
<td>Amount of collaterals</td>
<td></td>
</tr>
<tr>
<td>$r_c$</td>
<td>Collateral radius</td>
<td></td>
</tr>
</tbody>
</table>
Flow results stenotic vs occlusion

Maximum collateral system flow was 5.1% of healthy SFA flow in the stenosis group and 20.8% in the occlusion group.
Flow results short vs long lesions

Maximum collateral flow in lesions <15 cm and ≥15 cm was 11.2% and 6.7% of healthy SFA flow.
Discussion

- Maximum collateral system flow: 5.1-21% of healthy SFA flow depending on lesion type and length.

- Collateral system flow is a small portion: some collaterals may be occluded.
Limitations

- Theoretical mathematical model.

  Poiseuille’s law: rigid tubes
  steady flow
  not Newtonian fluid

- Parameters were set
Conclusion

Maximum SFA collateral system flow is a fraction of healthy SFA flow, regardless of the observation that collaterals increase total flow in all subgroups.

Occlusion of a collateral vessel during (endo)vascular treatment of POAD is therefore probably without consequence.
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