Value of semiquantitative perfusion imaging in critical limb ischemia for perfusion guided revascularisation

Peter Huppert
Dpt. of Radiology, Neuroradiology and Nuclear Medicine
Klinikum Darmstadt, Germany
Disclosure

Speaker name:

Peter Huppert, M.D.

☐ I have the following potential conflicts of interest to report:
☐ Consulting
☐ Employment in industr
☐ Stockholder of a healthcare company
☐ Owner of a healthcare company
☐ Other(s)
  x I do not have any potential conflict of interest
Tissue Perfusion Imaging during FD-based DSA

• Dyna-CT
  „C-arm-CT“, cone beam-CT“

• Dynamic tissue contrast mapping during DSA
3D Tissue Perfusion: C-Arm-CT (Dyna-CT™ Siemens)

- Based on FP-technology
- Digital 3d Image acquisition
- 270-dgr rotation (8 sec)
- Reconstr. of CT images
- 3 D images and MPR
- Perfusion imaging with CM

Applications:
- interv. oncol.
- interv. neuro.
Dynamic tissue contrast mapping: (I Flow™ Siemens)

- DSA and time density curve analysis
- 3D rotational angiography
- 3D vessel and tissue imaging
- Semiquantitative tissue perfusion imaging
Dynamic tissue contrast mapping: (I Flow™ Siemens)

- DSA and time density curve analysis
- 3D rotational angiography
- 3D vessel and tissue imaging
- **Semiquantitative tissue perfusion imaging**
  - Voxel-based time-contrast-curves
  - Voxel-based AUC measurement
  - Colour-coded maps of AUC values
  - Red-yellow-green-blue voxels = semiquantitative perfusion imaging
Postprocessing: contrast dynamic & perfusion mapping

**contrast dynamic (vessel-based)**
- time-contrast
- AUC
- time to peak

**perfusion mapping (tissue-based)**
- voxel-based AUC
- blue/green/yellow/red = no/low/medium/high perfusion volume/Δt („PBV“ = perfusion blood volume)
Potential Value of Perfusion Imaging in CLI Patients

Microcirculation perfusions reserve

- Testing of precapillary sphincters by i.a. α-receptors (Tolacoline)*
- Perfusions reserve = Index of perfusion before / after α-blockage*

Endpoint of IV revascularisation

- Semiquantitative Perfusion within ROI before/after revascularisation
- Fusion vessel and perfusion

Perfusion Reserve: positive

<table>
<thead>
<tr>
<th>ROI</th>
<th>before</th>
<th>after</th>
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<tr>
<td>&gt; 60 HU</td>
<td>12.459 PBV</td>
<td>68.789 PBV</td>
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after α-receptor blocking
Perfusion Reserve: negative

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<tr>
<th>ROI</th>
<th>before</th>
<th>after</th>
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</thead>
<tbody>
<tr>
<td>&gt; 60 HU</td>
<td>26.748 PBV</td>
<td>43.766 PBV</td>
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after $\alpha$-receptor blocking
Endpoint: Rutherford V lesion D1-3

Recanalization of ATA or PTA or both?
Endpoint: Rutherford V lesion $D_{1-3}$

Before PTA

After PTA
Methods during feasibility study

- Catheter position in popliteal artery
- Contrast injection 6 cc/sec
- Imaging delay 5 sec
- Acquisition parameters adpt. to small volumes
- Stable position of foot and lower leg
- 10 patients

- 89 CLI pts. treated by angioplasty
- Time-contrast-perfusion imaging pre/post PTA
- In 59/68 increased perfusion volume post PTA
- In 9/68 no increase post successful PTA
- Testing of α-adrenerg receptors had potential value to identify PTA-refractory impaired microcirculation
Murray T et al.:

• 21 CLI pts. treated by angioplasty
• Perfusion-Angiography pre/post PTA
• 2 ROI`s (for foot und hindfoot)
• Based on time-density curves: AUC, TTP, PDV
• 29% increase of AUC after successful PTA
• No changes of TTP and PDV
• Motion artefacts are most important limitation
Preliminary conclusions

• 3D perfusion imaging of the pedal tissue during DSA is feasible by various techniques.

• Potential role during RV in selected cases:
  - to determine endpoint of interventional revascularization
  - to identify PTA refractory patients due to impaired microcirculation in case of negative α-receptor blocking

• Our next steps: standardisation of methods, prospective evaluation with correlation to clinical f/u
Thank You for Attention !
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