CTV vs. MRV for imaging of venous disease

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Venous imaging

• Phlebography
  – ‘gold standard’
  – Invasive
  – Risk of inducing DVT

• CT venography

• MR venography
  – Standard contrast agents
  – Blood pool contrast agents

Choi JW et al Int J Cardiovasc Imaging 2015;31:417-426
Blood pool contrast agents

- Iron oxide BPA (USPIO)
- Gadolinium-based BPA (gadofosveset)
Contrast kinetics

% Signal

FP (First Pass)  SS (Steady State)

without Blood-Pool

Blood-Pool
Blood pool contrast agents

- **Arterial phase**
  - First-pass with 4 to 5-fold higher relaxivity (shorter T1) as compared with extracellular-CA
  - Lower bolus volume
    - Dose 0.03 mmol/kg
    - Injection rate 1 ml/s (first pass imaging)

- **Steady-state phase**
  - High resolution MR angiography (contrast kinetics allow for longer acquisition time)
  - Late phase filling (collateral filling)
  - Intravascular distribution for more than 1 h
  - Can be used as back-up in case of operator error

Nikolaou K et al, Radiology 2006;241:861-872
Applications

- Arterial imaging
  - Classic MRA indications (first pass)
  - Novel indications (steady state)
    - TOS
    - Multiple vascular bed imaging
- (T)EVAR follow-up
  - Endoleak detection
  - Dynamic contrast enhanced studies
- Venous imaging
  - Deep venous thrombosis
  - May-Thurner syndrome
  - Venous mapping
CTV-technique

• 100-150 ml non-ionic contrast (370 mg iodine/ml)
• Flow-rate 2.5 ml/s
• Scan delay 5 minutes

Choi JW et al Int J Cardiovasc Imaging 2015;31:417-426
Chung JW et al JVIR 2004;15:249-256
CTV

Occlusion VCI
CTV

Occlusion VCI
Phlebography

Occlusion VCI
Phlebography

Occlusion VCI
Deep venous thrombosis
CTV

Deep venous thrombosis
Deep venous thrombosis
CTV

Occlusion CFV-tumour
MRV-technique

• Standard Gd contrast medium or bloodpool agents
  – Gadobutrol (double dose 0.2 mmol/kg)
  – Gadofosveset
    (normal dose 0.25 mmol/ml; 10 ml)
• First-pass and steady-state imaging
• Both techniques equally reliable
• NB gadofosveset currently not available in Europe

Arnoldussen CWKP et al Eur Rad 2017;27:4986-4994
<table>
<thead>
<tr>
<th>Table 3</th>
<th>Scan parameters of the sequences used</th>
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<tbody>
<tr>
<td></td>
<td>BTFE Abdomen / pelvis</td>
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<tr>
<td>Scan mode</td>
<td>M2D</td>
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<tr>
<td>Repetition time (TR) (ms)</td>
<td>3.8</td>
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<tr>
<td>Echo time (TE) (ms)</td>
<td>1.92</td>
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<td>Flip angle (degrees)</td>
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<td>Acquisition time (TA) (min) (for all stations)</td>
<td>6:40</td>
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<td>Bandwidth (BW) (Hz)</td>
<td>595</td>
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<td>Acquisition voxel (mm)</td>
<td>1.19 × 1.40 × 6.00</td>
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<td>Reconstructed voxel (mm)</td>
<td>1.04 × 1.04 × 6.00</td>
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<td>Number of slices</td>
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<td>Acquisition matrix</td>
<td>336 × 228</td>
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<td>FoV</td>
<td>400 × 319</td>
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<td>Fat Supression</td>
<td>No</td>
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<td>Cardiac synchronisation (ECG)</td>
<td>Yes</td>
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</tbody>
</table>

Arnoldussen CWKP et al Eur Rad 2017;27:4986-4994
MRV

Deep venous thrombosis
MRV

Deep venous thrombosis
MRV

May-Thurner syndrome
MRV

May-Thurner syndrome
May-Thurner syndrome
MRV
Pelvic congestion syndrome
Pelvic congestion syndrome
Thoracic outlet syndrome
Thoracic outlet syndrome

Neutral

Abduction

MRV
CTV vs. MRV

- **CTV**
  - Less movement artifacts
  - Higher resolution
  - Better visualization surrounding structures
  - Readily available

- **MRV**
  - Better contrast enhancement
  - BP agents allow long scan window and yield high quality images
  - No-radiation exposure
  - No CIN
CTV vs. MRV
CTV vs. MRV
CTV vs. MRV
Venous imaging

• Importance of pre-interventional imaging to visualize variant anatomy to reduce radiation exposure

Barber B et al, JVIR 2012;23:211-215
Conclusions

• Both CTV and MRV have a role in diagnosis and pre-operative planning of venous disease
• MRV preferable method in most because of lack of radiation exposure (young age group)
• For congenital occlusive disease CTV is probably better
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