MR Based 3D Imaging In Peripheral Vascular Interventions: A Way To Reduce Radiation Exposure
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Conflict of interest
• None

MR merging

Image fusion
• 4 steps
  – Segmentation (coronal source images)
  – Planning
  – Registration
    • MRA: 3D-3D (cone-beam CT)
  – Live

Segmentation
Planning

Registration (3D-3D)

- Two different modalities (CT-like cone-beam and MR)
- Registration done on structures that can easily be seen on both
  - Vessels (even when non-enhanced)
  - Bony structures (SI-joint, hips)
  - Vessel calcification less visible on MRA
- Use coronal source images

Registration (3D-3D)

Registration (3D-3D)

Optimizing overlay

Registration (3D-3D)

‘Live’
Uterine artery embolization procedures (n=20)
- Accurate overlay in all cases
- In 85% of cases the uterine artery was successfully catheterized with no iodinated contrast medium at all, by purely relying on the MR angiography roadmap

Average maximum difference in position of vasculature on angiography and MRA/CTA fusion roadmap was 6.41 mm with a standard deviation of 11.12 mm
- Excluding three patients with major leg and pelvis movement during the procedure, average maximum difference was 1.86 ± 0.95 mm (approximately 95% of differences were between 0 and 3.72 mm; 2 ± 1.96 standard deviation)
Advantages

• Significant reduction in contrast dose
• Shorter procedure time
• Trend toward lower fluoroscopy time
• Trend toward reduction of DAP (P=.18)
  – 2D angiography: 1,188 Gy.cm² +/- 1,067
  – 3D RA: 984 Gy.cm² +/- 581
  – 3D-3D image fusion: 655 Gy.cm² +/- 457

3D-3D

• Effective dose
  – Cone-beam CT 1.53 -1.66 mSv
  – 6-second DSA run with 3 frames per second 0.91-1.46 mSv

Advantage of MRA based fusion

• Reduction of dose related to CTA 20-30 mSv (triphasic)
• Reduction of amount of iodinated contrast

Conclusion

• 3D image fusion using MRA has matured into a technique that can easily be implemented in daily practice and helps in reducing contrast and radiation exposure