

Tips and tricks to optimize preinterventional imaging with CO₂ angiography and no- contrast MR angiography

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Disclosure

Speaker name:

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I have the following potential conflicts of interest to report:

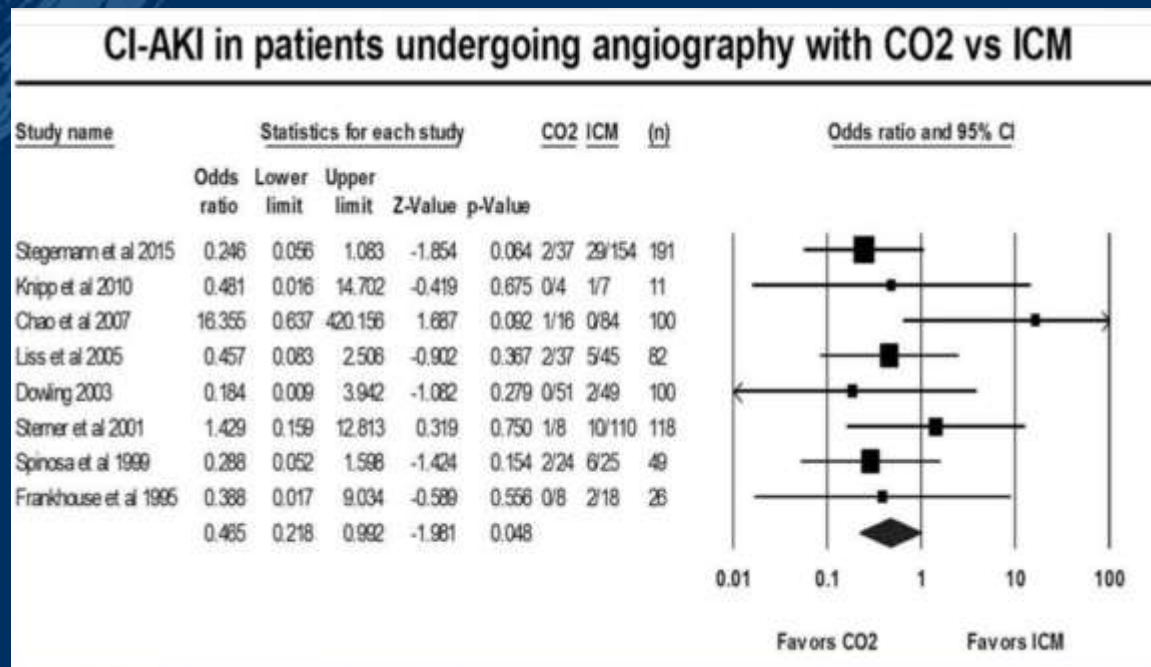
- Consulting
 - Employment in industry
 - Stockholder of a healthcare company
 - Owner of a healthcare company
 - Other(s)
-
- I do not have any potential conflict of interest

Zero Contrast Procedures

- Use of non-enhanced MRA and CO₂ angiography for work-up
 - (EVAR)
 - Peripheral applications

Iodinated contrast

- Nephrotoxicity
- Allergic reactions



Gd-based contrast

- Occurrence of nephrogenic systemic fibrosis
- Nephrotoxicity
 - Various case reports of acute renal failure at high dose
 - Safe in dosage <0.4 mmol/kg

Gemery et al, AJR 1998; 171:1277-1278

Kaufman et al, Radiology 1999; 212:280-284

Le Blanche et al, AJR 2002; 179:1023-1028

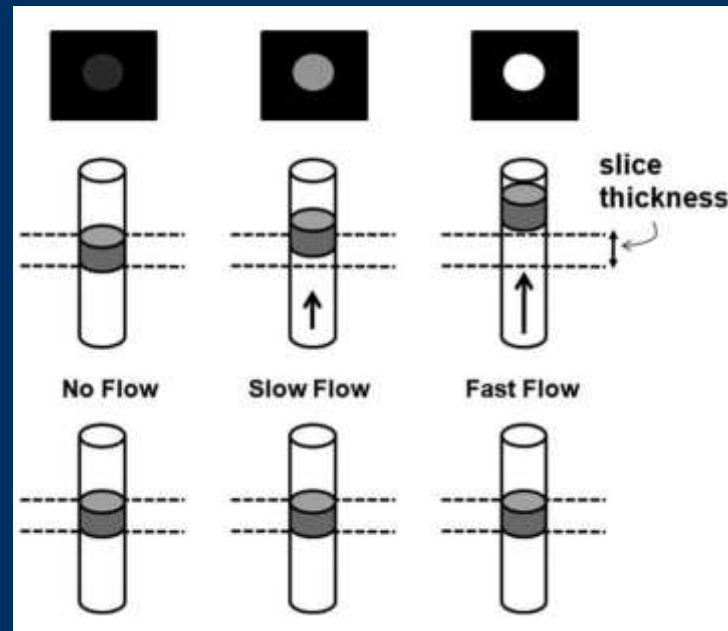
Prince et al, J Magn Reson Imaging 1996; 6:162-166

Roserioreanu et al, JVIR 2005;16:297-298

Nyman et al, Radiology 2002; 223:311-318

MRA without contrast

- In-flow techniques (TOF)
 - Limited FOV
 - Susceptible to artifacts



MRA-QISS

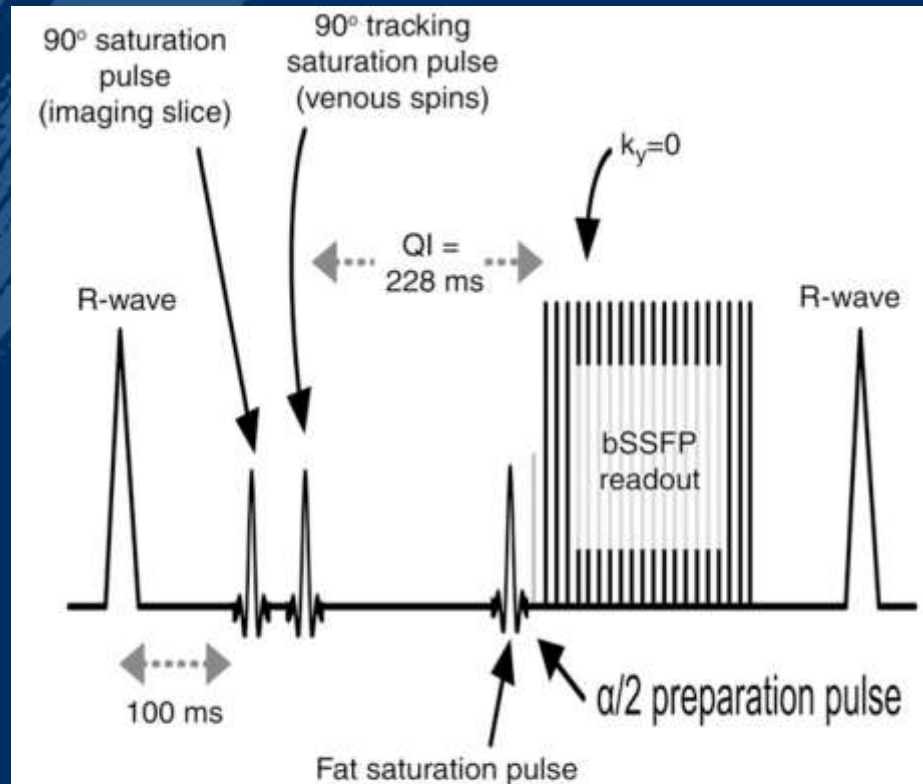
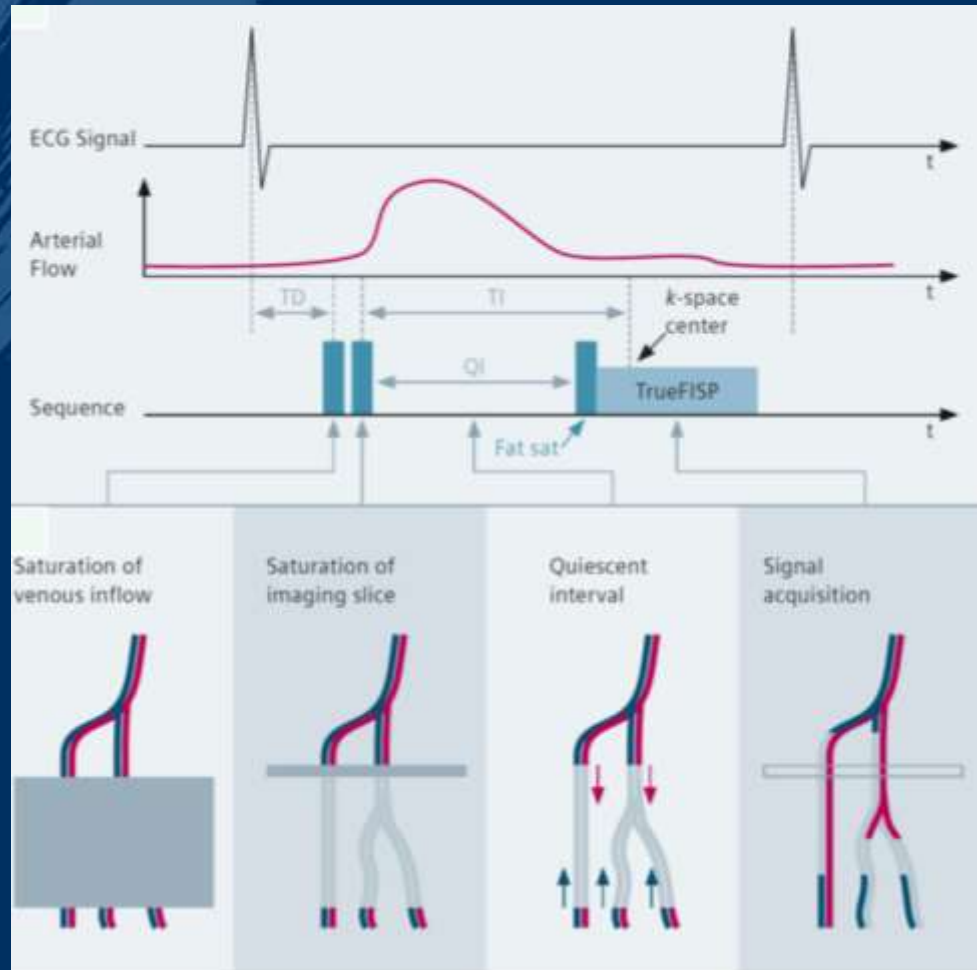
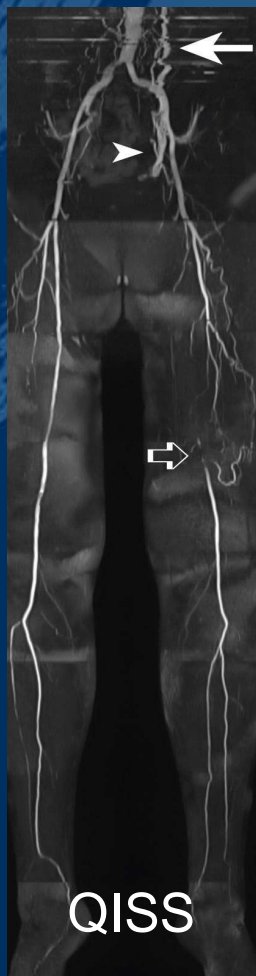


Figure 1: Diagram of QISS pulse sequence. A two-dimensional single-shot balanced steady-state free precession (*bSSFP*) pulse sequence is used to image arterial spins within the section during diastole, when flow is slow or absent. k_y = phase-encoding line, *QI* = quiescent interval, $\alpha/2$ = one half the radiofrequency excitation flip angle.

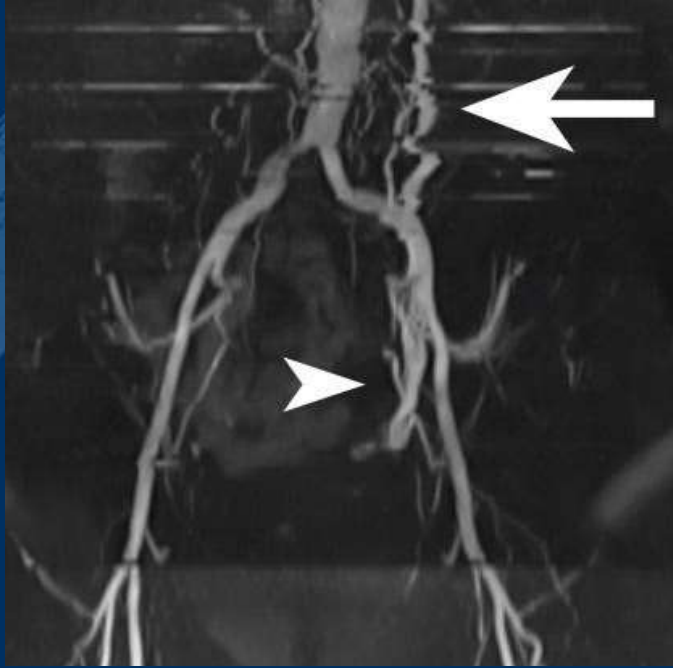
MRA-QISS



QISS vs. CE-MRA PAD



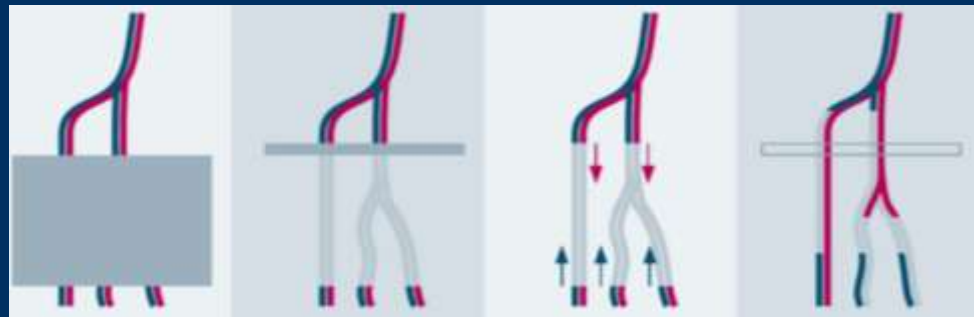
QISS vs. CE-MRA PAD



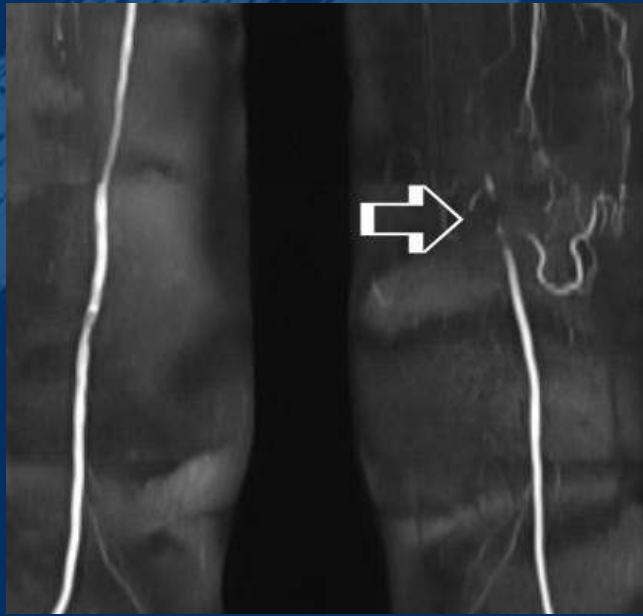
QISS



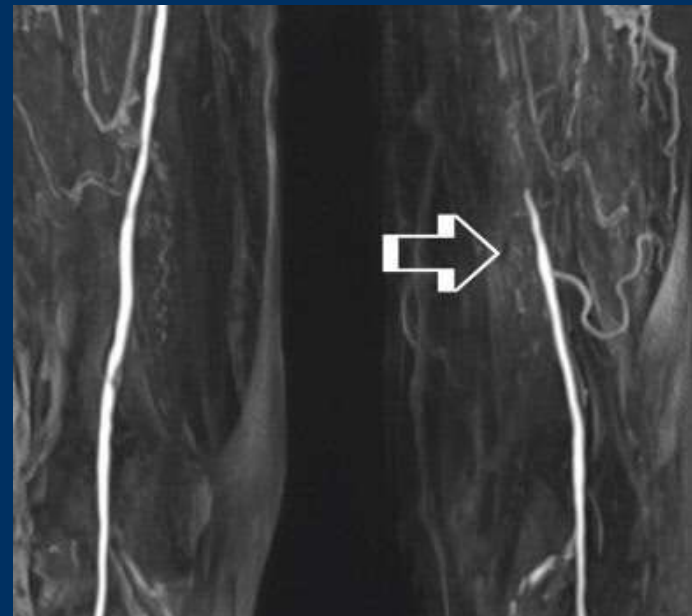
CE-MRA



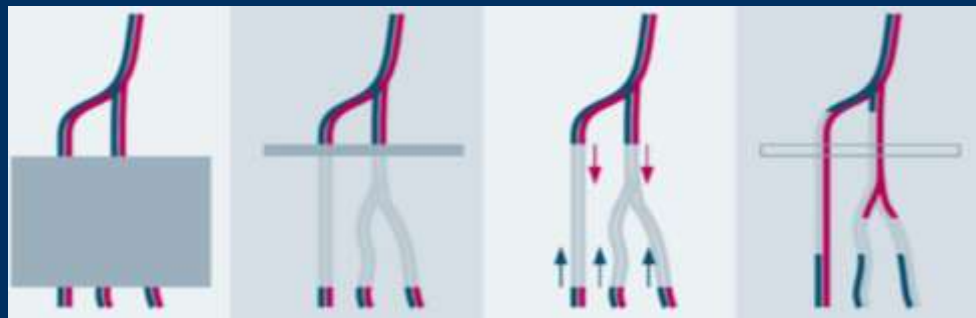
QISS vs. CE-MRA PAD



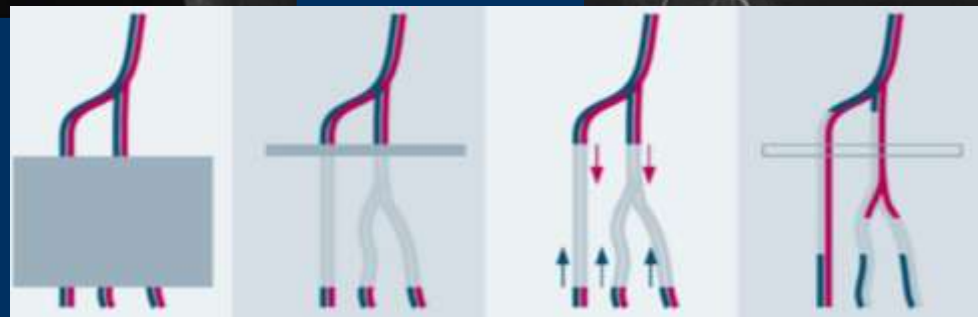
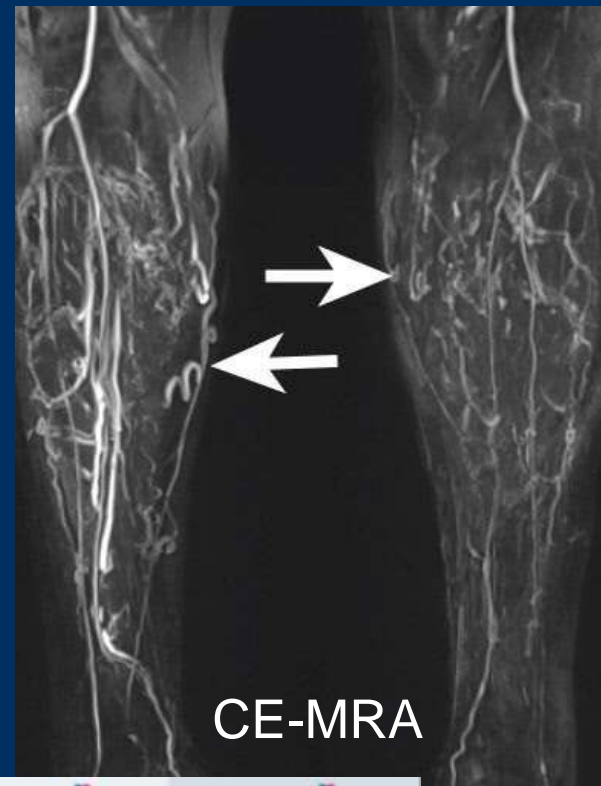
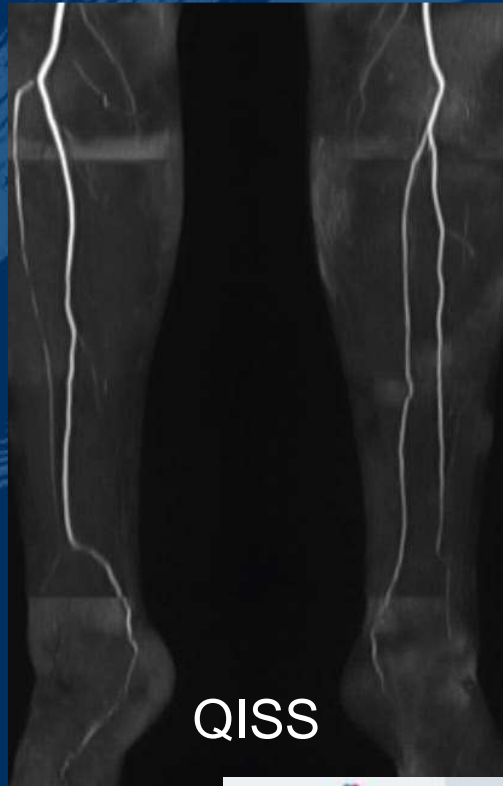
QISS



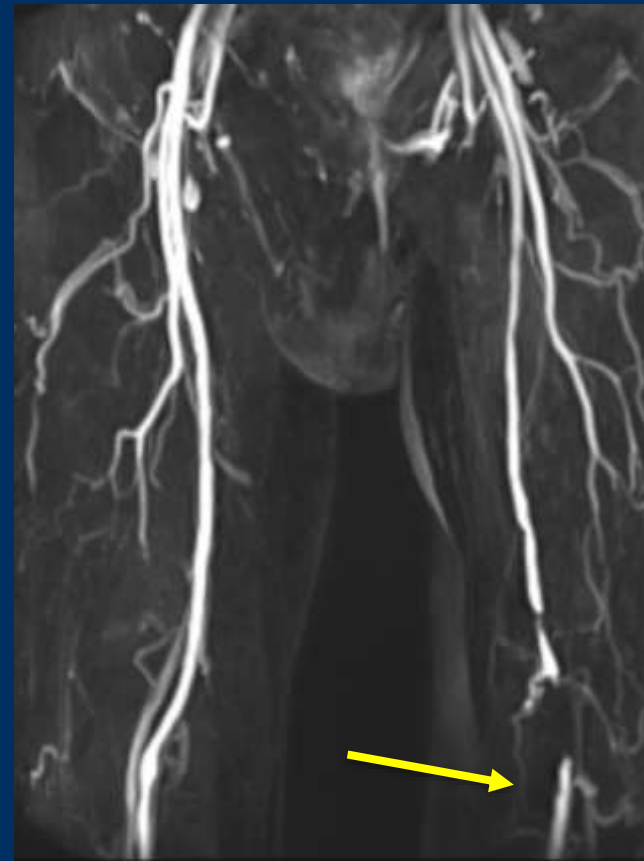
CE-MRA



QISS vs. CE-MRA PAD



QISS MRA vs. CE-MRA



QISS-MRA vs. CTA vs. DSA

- QISS-MRA provides high diagnostic accuracy compared with DSA
- QISS-MRA less prone to image artifacts than CTA
- QISS-MRA better visualizes heavily calcified segments with impaired flow
- QISS-MRA obviates the need for contrast administration in PAD patients
- QISS and QIR/ECG-FSE MR angiography protocols demonstrate comparable diagnostic accuracies with high specificity
- In segment-based analyses, there was no difference between QISS-MRA and CE-MRA in sensitivity or specificity

Varga-Szemes A et al, JACC Cardiovasc Imaging 2017;10:1116-1124

Hanrahan CJ JVIR 2018;29:1585-1594

Wei LM, JET 2019;26:44–53

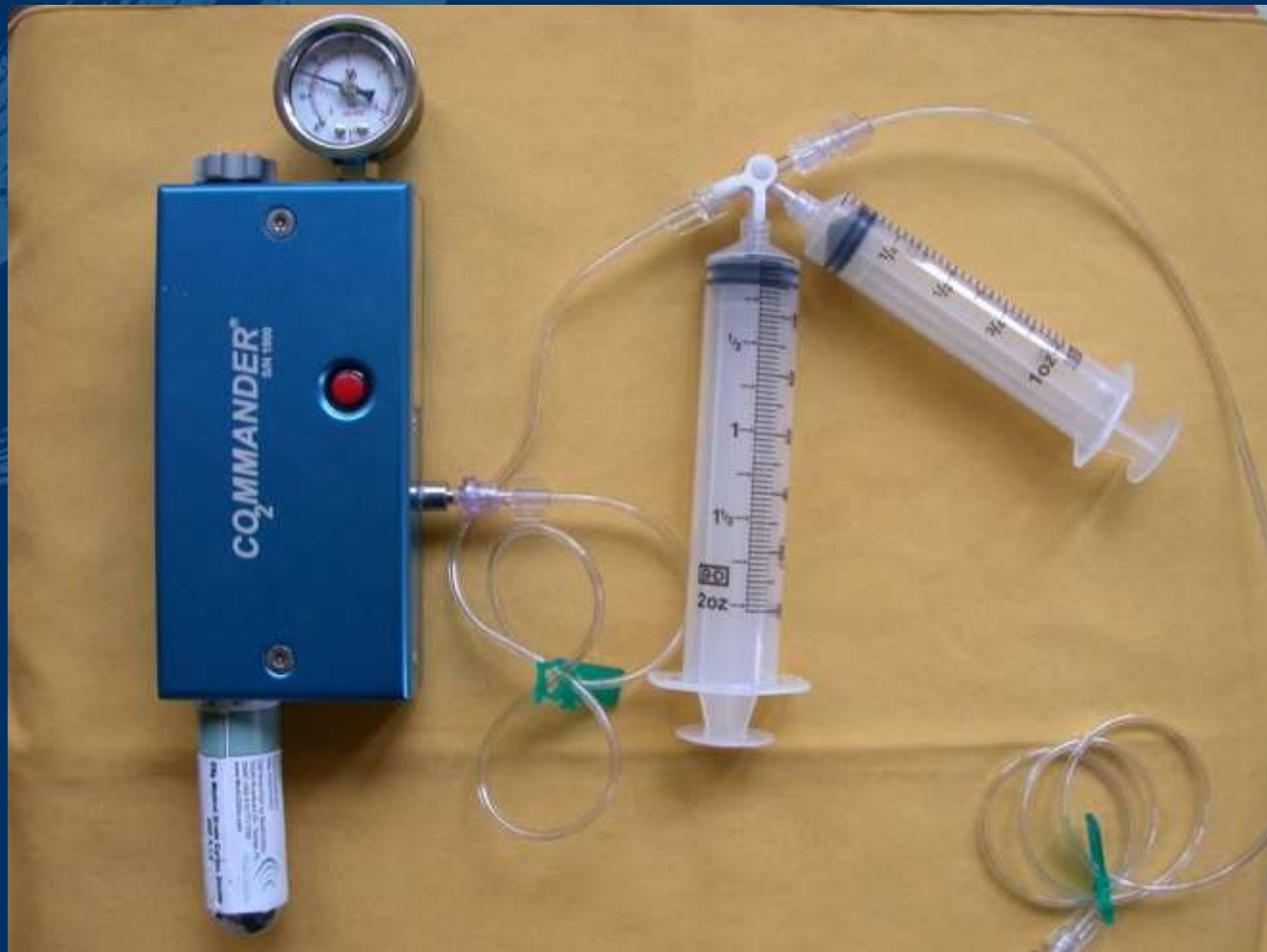
CO₂ angiography

- Lack of toxicity or allergic reactions
- Rapid intravascular clearance
- Buoyancy (potentially disadvantageous)
- Ultra-low viscosity/density
- Reflux (ostial depiction)
- Nonmiscibility (fluid displacement)
- Colorless and odorless (potentially dangerous with 'old technology')
- Compressibility (pressure build-up)

Old technology



Hand-held injector

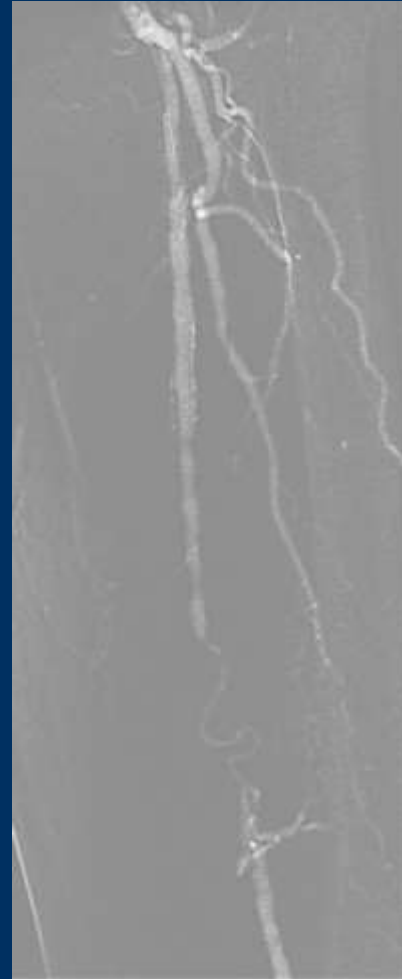
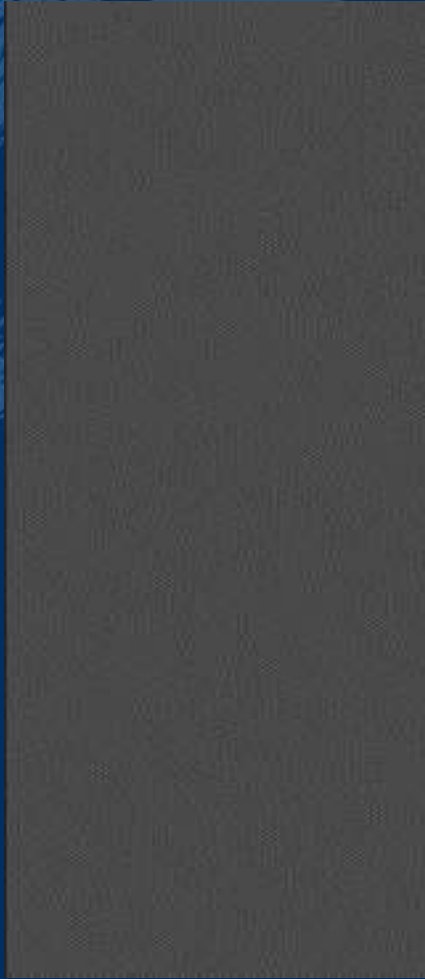


Automated CO₂ injector



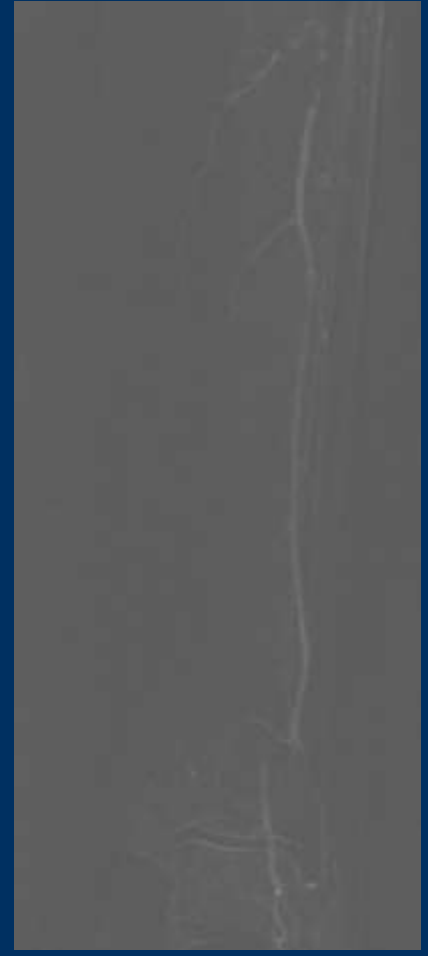
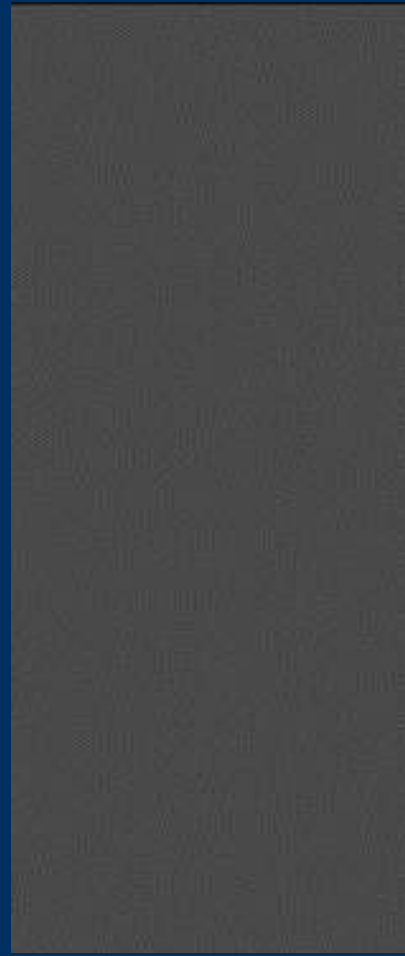
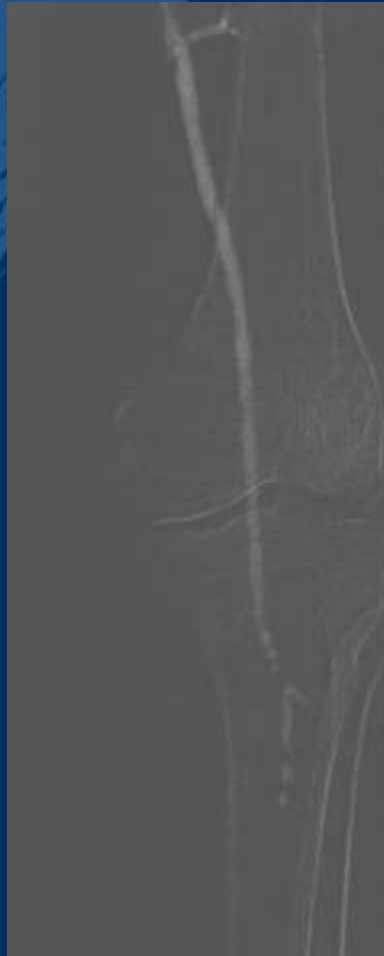
Angiodroid

Case #1



Use 'stacking of images'

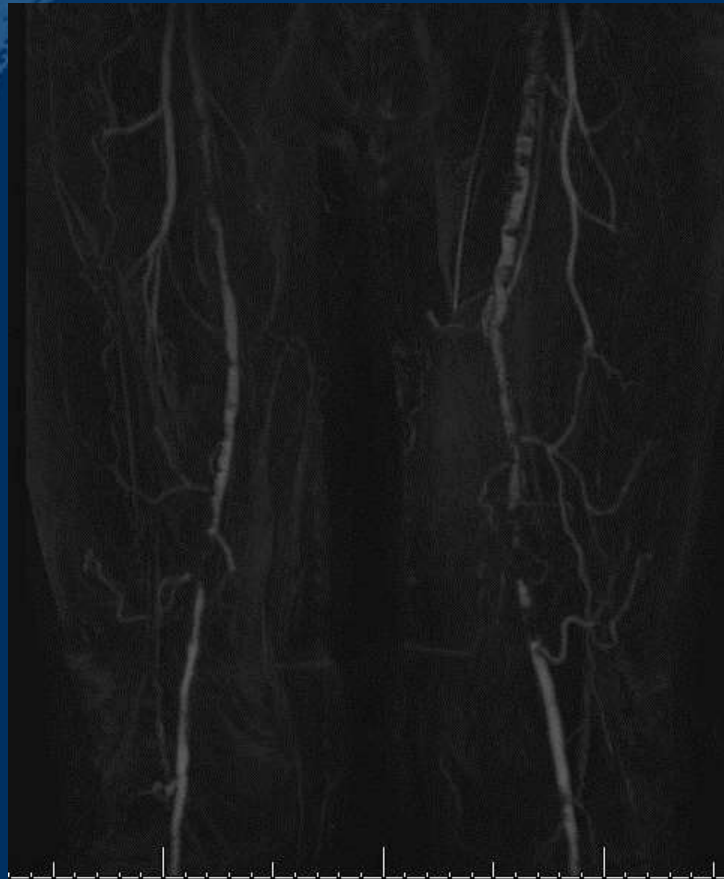
Case #1



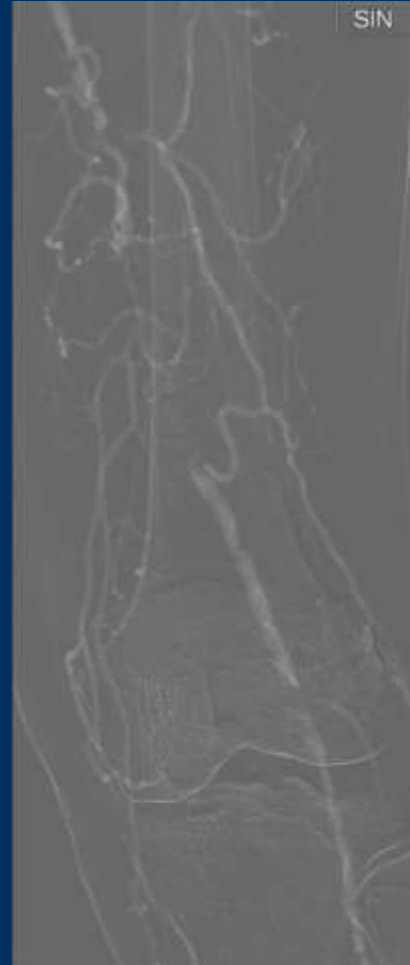
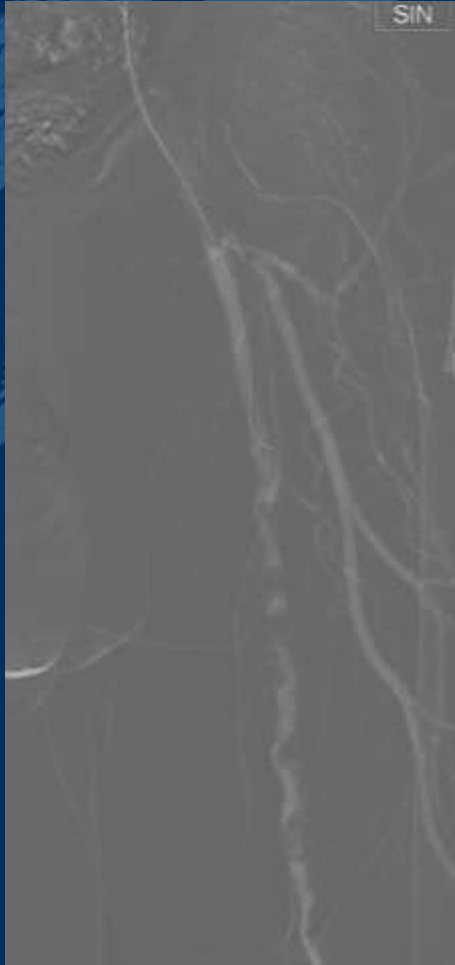
Use 'stacking of images'

Case #2

- Severe iodine allergy



Case #2



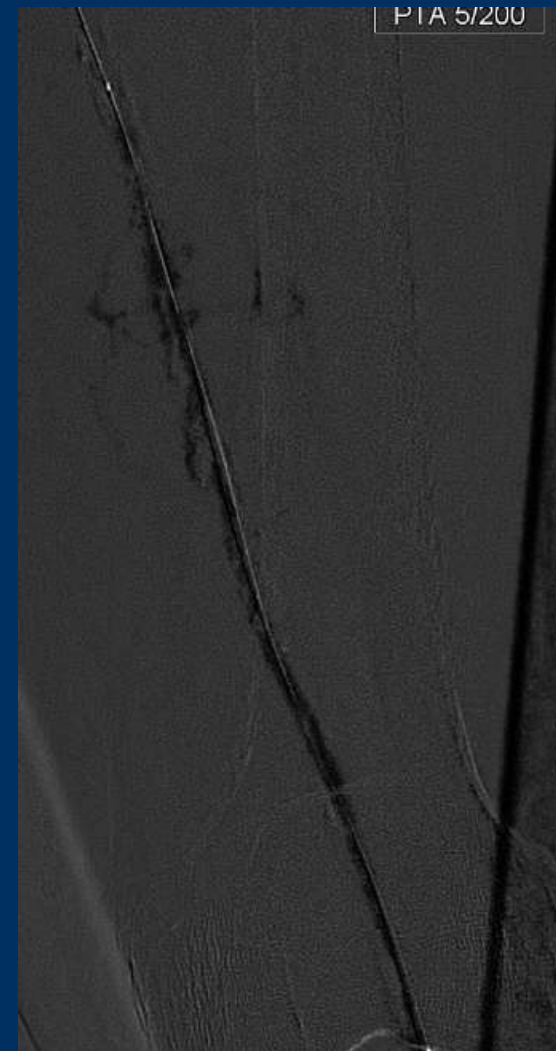
Case #2

- Balloon inflation with Gd

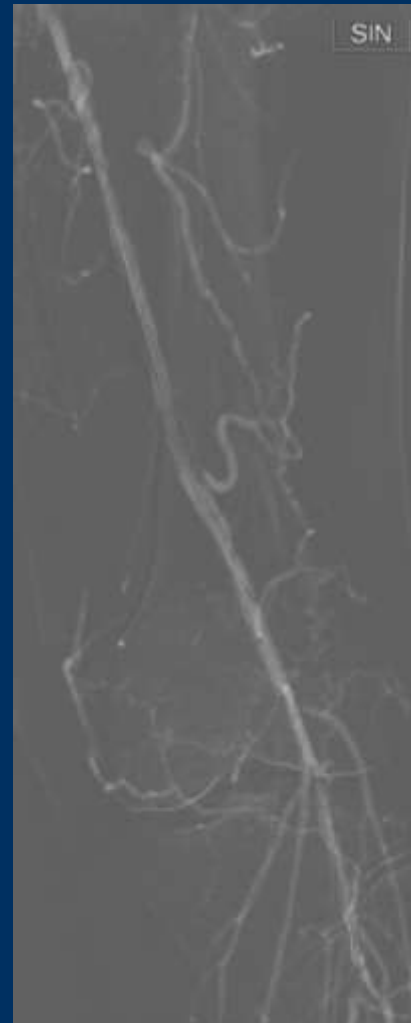
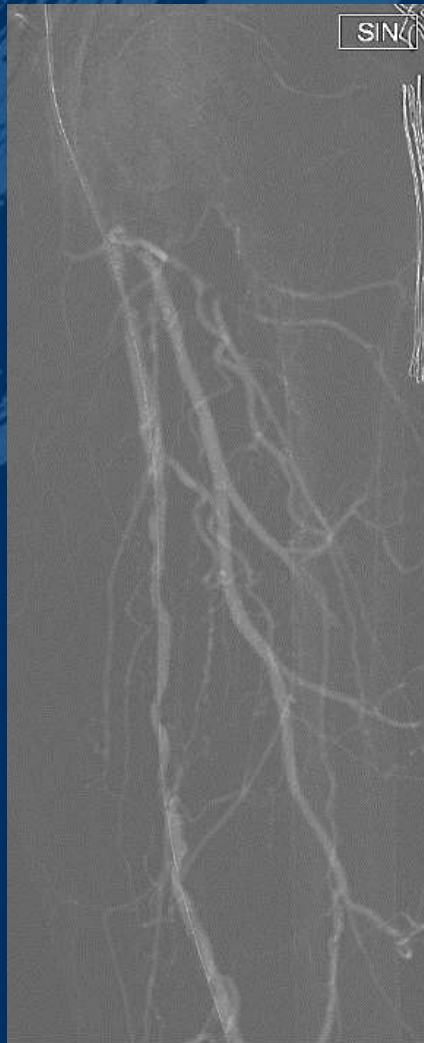


Case #2

- Balloon inflation with Gd
- Balloon rupture!



Case #2



Conclusions

- Current technology (non CE-MRA and CO₂ angiography allows for zero-contrast procedures for peripheral arterial endovascular procedures
- Think about
 - ‘image stacking’
 - Use of Gd for balloon filling in allergic patients
- MORE CO₂!

MORE CO₂!



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