What Is CT Arthrography? (CTR)

- Arthrogram: imaging a joint after injecting contrast
  - Air
  - Water/saline
  - Positive contrast (iodinated, Gd)
- CT Arthrogram: using CT to image a joint after injecting it with contrast
What is CT Arthrography?

Advantages

• CTR
  – FDA OK
  – No magnet contraindix
  – Multidetector row scanners:
    • Sub-mm resolution
    • Less artifact from metal
    • Quick scans
  – Cartilage contrast
  – But…paucity of data

• MRR
  – Soft tissue contrast
  – Fluid collections
  – Marrow changes
  – Early cartilage degradation
  – No radiation
  – Abundant data

CTR: Indications

• Failed MRR—claustrophobia
• MR contraindications
• Metal in joint
• Hyaline cartilage defects
• Evaluation for calcified structures, including “loose bodies”
MRR Injection

- **Solution**
  - 50% lidocaine/ropi
  - 25% saline
  - **25% contrast (300)**
  - 1:200 gadolinium

CTR Injection

- **Cocktail:**
  - 50% contrast (300)
  - 50% lidocaine or ropivacaine
- Same injection amounts as MRR

CTR Scan Technique

- Helical scan
- Multiple detector rows
- Small field of view
- At least 200 mA, 120 kV
  - ↑ metal, hip/shoulder
- Reconstructions: As thin as you can!
  - Overlapping (0.625 mm @ 0.3 mm intervals)
- Reformat at 1-2 mm
- High resolution algorithm (bone)/kernel

Disclaimer: not all images in this presentation performed this way!
Shoulder: Scanning

• First data set: neutral
• Reformats: 3 planes
• Second set: External rotation or ABER
  – Abducted
  – Externally
  – Rotated

Shoulder: Positioning

Known claustrophobia; 5 lido, 5 saline, 10 contrast → 12 injected

Shoulder: Scanning

Metal anchors; 10 lido, 10 contrast → 12 injected
Shoulder: Indications

- Rotator cuff tears
  - Except partial thickness bursal
- Labrum
- Cartilage
- Capsule integrity
- Postoperative cuff and labrum

Woertler K. *Eur Rad* 2007; 17:3038-3055
Lecouvet F. *Eur J Rad* 2008; 68:120-136

Shoulder: Accuracy

  - 42 virgin shoulders:
    - Rotator cuff: Sens and spec 95-100%
    - Labrum/Capsule: Sens and spec 87-96%
  - 28 operated shoulders:
    - Rotator cuff: Sens and spec 94-100%
    - Labrum/Capsule: Sens and Spec 88-94%
    - MRI: 19-31% for all variables
- Lecouvet FE. *Eur Radiol* 2007; 17:1763-71
  - 22 shoulders, articular cartilage lesions
    - Grade 3 or higher: Sens 89-96%, spec 98%

Shoulder: MR Bailout

25% Contrast

Shoulder: Prior Repair

50% Contrast
Shoulder: Prior Repair

Shoulder: AC Reconstruction

Shoulder: Metal

Shoulder: Metal

25% Contrast
Shoulder: Calcific Tendonitis

Elbow: Injection

- Lateral approach
- Patient prone or seated
- 90 degree flexion
- 23 G 1.5 inch needle
- Angle fluoro appropriately first!
- 3-6 mL
Elbow: Scanning

- Mighty Mouse position best
  - Prone
  - Arm and elbow fully extended overhead
- If must flex \(\rightarrow\) 90 degrees

Elbow: Indications

- Intra-articular fragments—“loose bodies”: controversial
- Articular cartilage
- Osteochondral lesion stability

Elbow: Accuracy

  - 26 Cadavers
  - CTR and MRR
  - High grade cartilage lesions:
    - CTR 87% sensitive, 94% specific
    - MRR 85% sensitive, 95% specific

Elbow: r/o L.B.

- Half lidocaine, half contrast, 2.5 ml

Dubberley JH. *JBJS (Br)* 2005; 87-B:684-686.
Elbow: r/o L.B.

6 lidocaine, 7 contrast, 7 saline→8 injected
Elbow: r/o L.B.

Wrist: Injection

- Dorsal approach
- Patient prone or seated
- 23 G 1.5 inch needle
- Angle fluoro appropriately first!
- 1-4 mL...

Wrist: Scanning

- Mighty Mouse position works
  - Prone
  - Arm and elbow fully extended overhead
- Anything overhead preferred
Wrist: Indications

- Controversial whether even to use cross-sectional imaging
- CTR and MRR better able to localize specific sites of ligament tears
- TFC tears well demonstrated with CTR
- MRI sometimes underperforms

De Filippo M. *Eur J Radiol* 2009 in press.
- 43 wrists, 15 prior surgery:
  - TFC: Sens and spec 92-94%
  - Interosseous Ligaments: Sens and spec 80-100%
  - Cartilage: Sens and spec 94-100%

- 76 wrists
  - TFC Central: Sens 88-91%, spec 85-95%
  - TFC Peripheral: Sens 30-40%, spec 94-97%
  - SL Ligament: Sens 94%, spec 62-86%
  - LT Ligament: Sens 85-97%, spec 79-81%
  - Cartilage: Sens 45-58%, spec 93-97%
**Wrist: Palmer IIC**

Image(s) removed: copyrighted


**Wrist: TFC and LT**

Image(s) removed: copyrighted


**Hip: Indications?**

• Cartilage defects
• Labral tears
• “Loose bodies”
• Data not out yet
Knee: Indications

- Very accurate for meniscal tears and ACL
- Post-operative knee: CTR may be study of choice
- Cartilage damage
- Other soft tissue pathology not ideal
- ACL fibrosis may be difficult

Knee: Accuracy

- Lee W et al. Kor J Rad 2004; 5:47-54.
  - 38 subjects
  - ACL
    - Sens: 88-100%
    - Spec: 93-97%
  - Menisci
    - Sens: 92-100%
    - Spec: 98%

- De Felippo M. Eur J Rad 2009; 70:342-351.
  - Prior surgery (n=37)
    - Menisci: Sens 96%, Spec 100%
    - ACL: Sens 86-91%, Spec 100%
    - Cartilage: Sens 91-95%, Spec 93%
    - MRI: Sens 50-68%, Spec 27-53%

Knee: Shrapnel
Knee: Prior Fracture (r/o LB)

No loose body
Small cartilage defect

Ankle: Injection

- Anterior
  - Between EHL and EDL
  - Avoid dorsalis pedis
- 1.5 inch needle
- Angle under tibia using lateral
- 4-7 mL
Ankle: Indications

• Cartilage defects!
• Osteochondral lesions of the talus (OLT)
• Anterolateral impingement syndrome

Ankle: Anterolateral Impingement

Image(s) removed: copyrighted

Hauger O. AJR 1999; 173:685-690

Ankle: MR Contraindications

Image(s) removed: copyrighted

Schmid MR. Skel Radiol 2003; 32:259-265

CONCLUSION
Summary

- CT Arthrography now a robust technique:
  - Sub-millimeter resolution
  - Multi-detector row technology
- Indications:
  - Patients with MR contraindications
  - MR bailout—claustrophobia
  - Adjacent metal
  - Fine detail on cartilage lesions