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Direct MR Arthrography of the Hip with Leg Traction: Feasibility for Assessing Articular Cartilage

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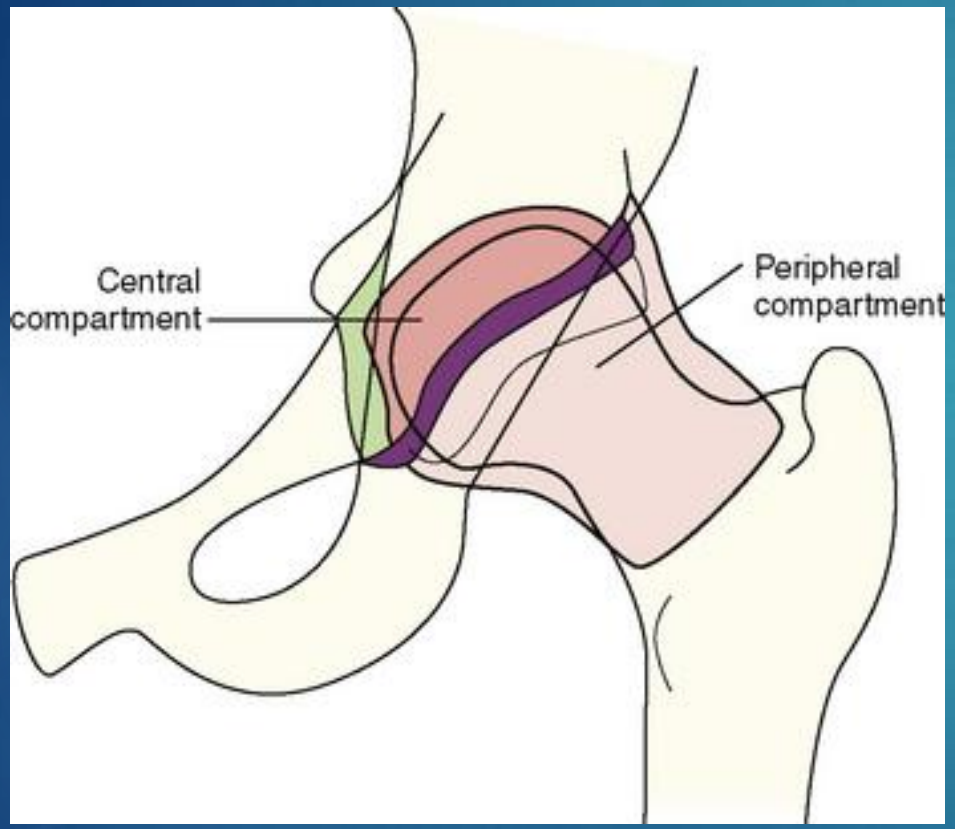
OBJECTIVE. Hip arthrography is an accurate diagnostic method for evaluation of the peripheral compartment, but its depiction of cartilage lesions is moderate. The purpose of this study was to add leg traction to MR arthrography of the hip to test its effect on visualization of cartilage surfaces.

CONCLUSION. Hip MR arthrography with leg traction is a technically feasible and safe procedure that improves visualization of the femoral and acetabular cartilage surfaces.

Problem

- The cartilage of the acetabulum and femoral head often cannot be seen as distinct entities.

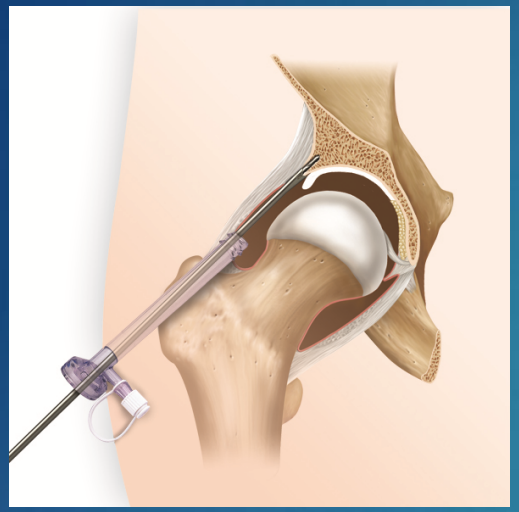


Peripheral compartment:

- Unloaded femoral cartilage
- Femoral neck
- Synovial folds

Central compartment

- **Loaded hyaline cartilage of the femur and acetabulum**
- Acetabular fossa
- Teres ligament



Arthroscopic evaluation of the hip

1. Flexion without traction for evaluation of the peripheral compartment
2. Extension **with traction** for evaluation of the central compartment

Intervention

MR arthrography with hip traction

Intervention

- 48 patients consecutively referred from December 2005 through December 2006 for hip MR arthrography for the evaluation of groin pain
  - Two patients underwent bilateral hip MR arthrography
  - 50 MR arthrographic examinations of the hip were performed
  - Mean age of 36 years
- Exclusion criteria were previous surgery, inadequate hip distention due to leakage from the joint, and pain related to injection
- 10 aged-matched patients who had undergone conventional MR arthrography served as control group (mean age of 35).

Intervention

- Leg traction was applied on the MRI table with a standard MRI-compatible orthopedic skin traction device with a fixed load of 6kg (13 lb).
  - Usually 10% of body weight for arthroscopy.
- Achieva 1.5 T, Philips Medical Systems
  - Phased array body coil
  - T1 fatsat coronal, axial, and sagittal oblique planes (along the long axis of the femoral neck).
  - T1 non-fatsat in oblique sagital plane
  - Coronal PD
- **T1 FS and PD sequences were performed in 15 patients before traction was applied.**

Intervention

- Images were evaluated by consensus of two of four subspecialty musculoskeletal radiologists.
- Criteria was based on the ability to visualize the femoral and acetabular cartilage surfaces as distinct entities.
  - Measure the distance between surfaces.

Intervention

- Three patients were excluded because of inadequate intraarticular distention with the contrast agent.
- In three patients, traction was insufficient to achieve separation between the femoral and acetabular cartilages.
  - **Had degenerative changes secondary to cam-type FAI**
- Average time to place traction device was 4 minutes.
- No complications

Comparison

- Control (no traction)
  - Mean cartilage surface separation without traction in the 10 patients in the control group was **0.2 mm.**
  - The observers were able to differentiate femoral from acetabular cartilage in 2/10 patients.

Results

- Study group
  - Observers were able to differentiate femoral from acetabular cartilage in all but **3** patients.
  - Mean separation of the cartilage surfaces with traction was **1.7 mm**
- 15 hips imaged without and with traction, the mean distance between femoral and acetabular cartilages was **0.2 mm** and **1.5 mm** respectively.

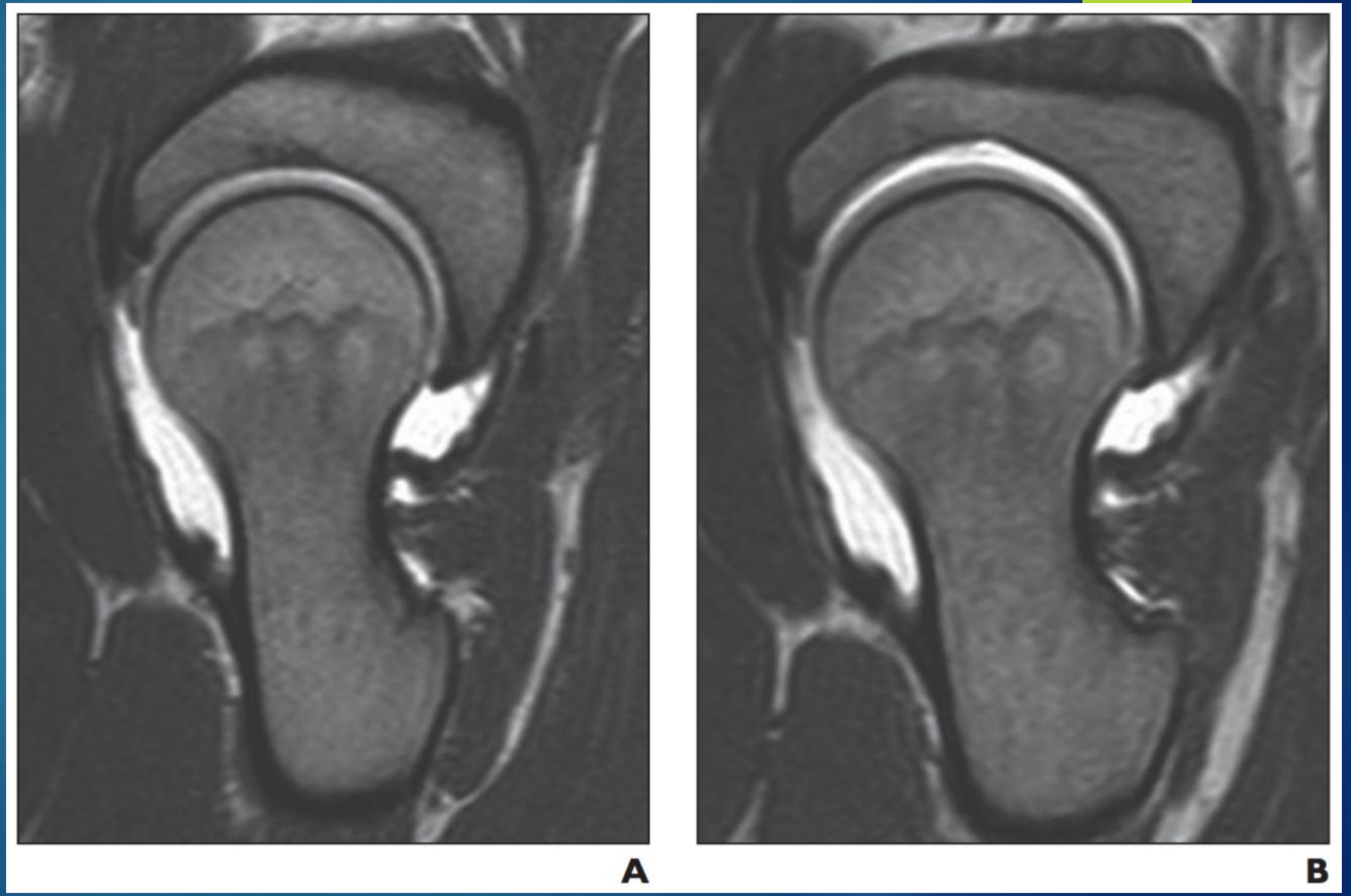
Results

- Study group
  - 20 patients had normal cartilage.
  - 25 had cartilage injury.
    - Femoral cartilage fraying - **17 patients**
    - Pure chondral defects (3 partial thickness, 2 full thickness) - **5 patients**,
    - Femoral osteochondral lesions - **3 patients**
    - Femoral subchondral lesions - **3 patients.**
    - Acetabular cartilage fraying - **9 patients.**
    - Acetabular pure chondral lesion (2 partial thickness and 4 full-thickness defect) - **6 patients.**
    - Acetabular osteochondral lesion - **8 patients**

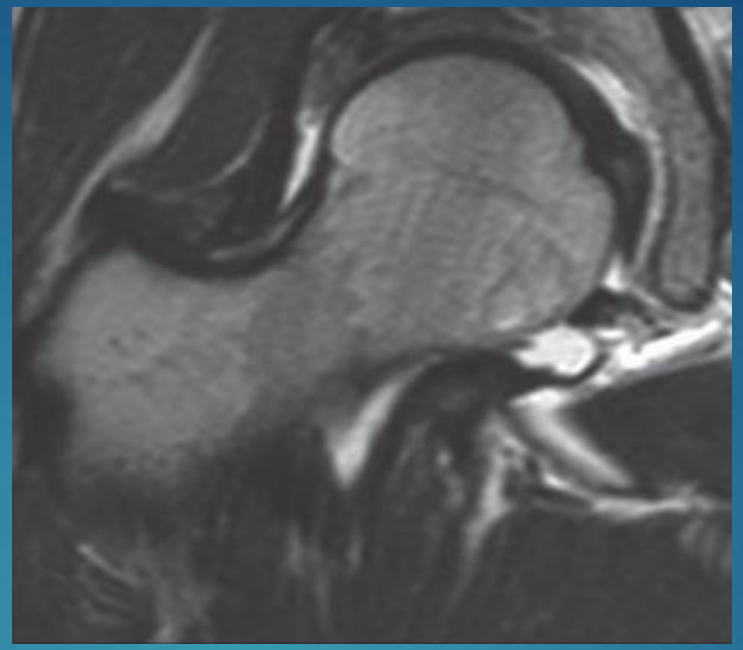
Results

- In the **15** patients imaged **without and with traction**
  - **2** pure femoral chondral lesions (one full thickness, one partial thickness) were seen only after traction.
  - **8** possible lesions seen without traction and were better characterized with traction
    - **2** showed normal cartilage
    - ***5*** showed femoral cartilage fraying
    - **1** showed femoral cartilage subchondral lesion
    - **1** showed acetabular cartilage fraying

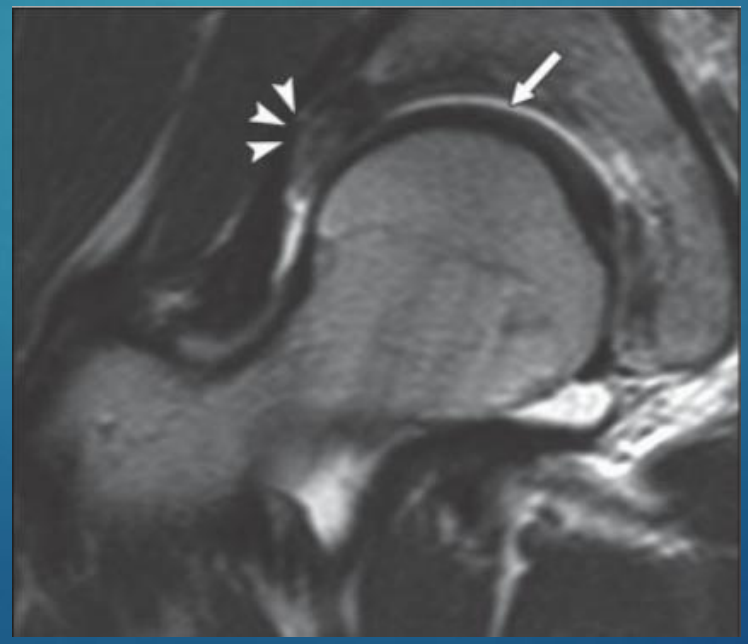
A and **B,** Oblique sagittal T1-weighted MR images without (**A**) and with (**B**) traction show marked distention of deep central compartment hip that allows differentiation of articular femoral and acetabular cartilages as separate structures.

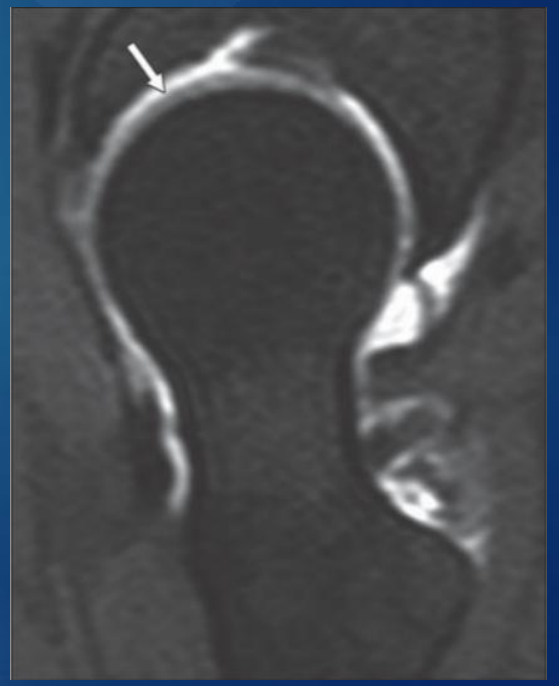


Top left and right, Coronal proton density–weighted fast spin- echo MR arthrogram without traction (**left**) and oblique sagittal fat-suppressed T1-weighted fast spin-echo image (**right**) readily show labral degeneration and tear, but femoral and acetabular cartilages are not evident as separate structures.



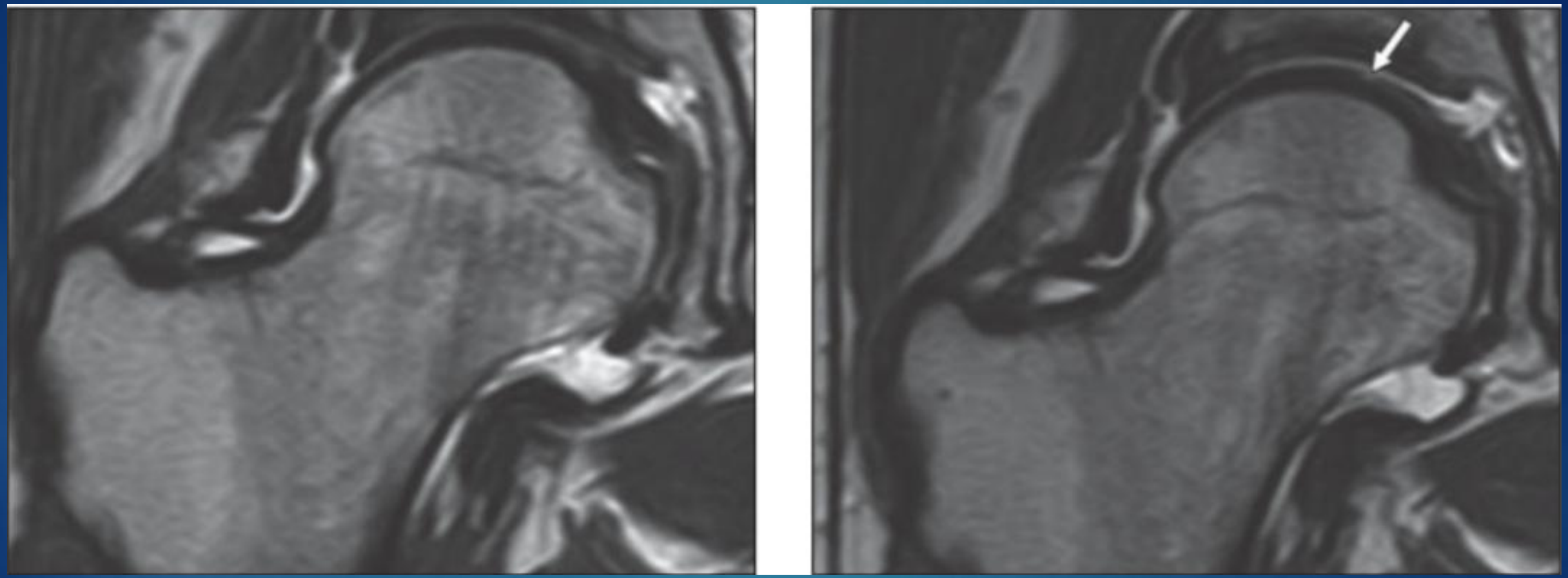
Bottom left and right, Traction proton density–weighted fast spin-echo (**left**) and fat-suppressed T1-weighted (**right**) images corresponding to **top left** and **top right** show separation (*arrow*) between cartilage surfaces, which allows assessment of cartilage defects. Labrum tear (*arrowheads*, **left**) is evident.





28-year-old man with right hip pain. Oblique sagittal T1-weighted image MR arthrogram shows large subchondral lesion without involvement of articular cartilage (*arrow*).

40-year-old man with decreased internal rotation of left hip. Oblique sagittal T1-weighted MR arthrogram shows osteochondral anterosuperior lesion extending to cartilage and small cartilage flap (*arrow*).



Limitations

- Used the same traction in all patients without taking in to account for sex and weight.
- Small sample size
- Only 15 patients imaged with and without traction.
- Only cartilage was evaluated.
- Feasibility study only. Unknown whether more accurate then standard MRA, MRI or if the findings seen actually affect management and patient outcomes.