MRI Evaluation of Medial Patellofemoral Ligament Injury after Primary Patellar Dislocation in Children

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Background

- Injury to the MPFL is a common knee injury in children accounting for 9-16% of pediatric knee injuries.
- The MPFL is a primary constraint to lateral subluxation and dislocation of the patella.
- Disruption of the MPFL predisposes to recurrent dislocation but the anatomic site of injury is poorly characterized in children.

Study Questions

1) Where is the site of disruption of the MPFL in a pediatric population of patients after a first traumatic patellar dislocation?

2) Where is the location of the femoral attachment of the MPFL with respect to the distal femoral growth plate?

Methods

- MRI scans were reviewed from 2002 - 2008 of 44 children after acute patellar dislocation, excluding those with history of congenital dislocation, recurrent dislocation or prior surgery.

- Prior to inclusion, MRI scans were screened for high signal intensity in the lateral femoral condyle on short tau inversion recovery (STIR) sequences consistent with a recent dislocation event [Figure 1].

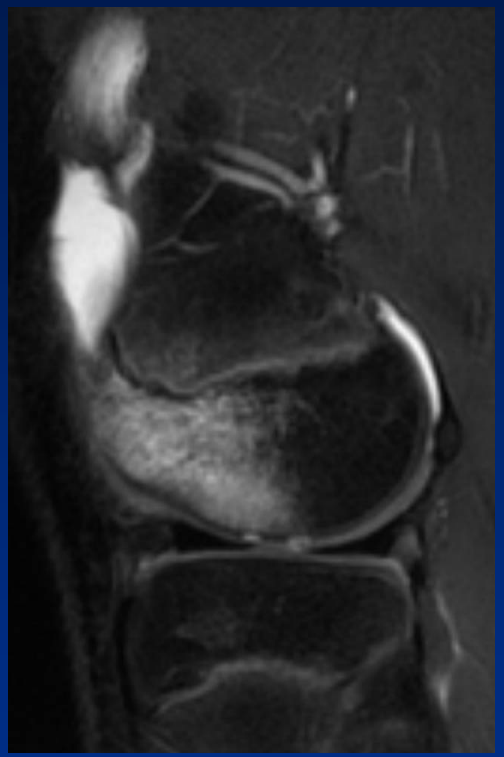


Fig. 1: Sagittal image of knee demonstrating lateral femoral condyle with high signal on STIR and joint effusion.

Methods

- MRI scans were independently reviewed by two physicians: a musculoskeletal radiologist and a senior orthopedic surgery resident.

- To verify a potential acute MPFL injury based on ligament disruption or discontinuity, the area in question was required to be confirmed by evidence of **surrounding soft-tissue edema** on STIR images [Figure 2].

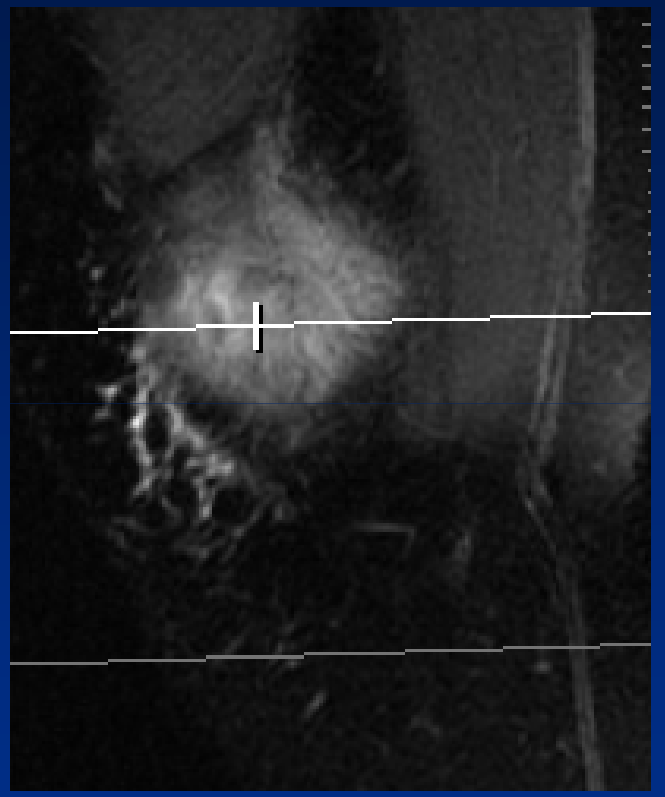


Fig. 2: Sagittal image just lateral to lateral femoral condyle demonstrating edema at femoral MPFL insertion consistent with soft tissue edema and acute injury.

Methods

- The MPFL was divided into 3 zones:
  - **Patellar insertion zone**: insertion site to a point 1.5 cm proximal to theinsertion
  - **Femoral insertion zone**: insertion site to a point 1.5 cm distal to the insertion
  - **Midsubstance**: Tendon between patellar and femoral insertion zones.
- The distance between the MPFL insertion onto the distal femur and the medial distal femoral growth plate or physeal scar was measured (Fig. 3)

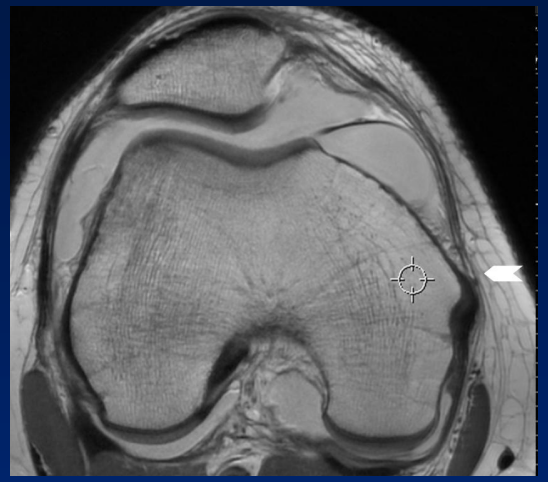
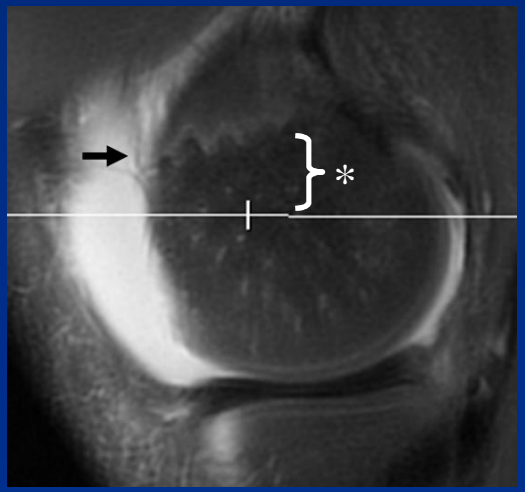


Fig. 3: Level of MPFL insertion onto femur denoted by arrow- head (above) and horizontal line (below). Asterisk marks distance from growth plate to insertion onto medial femur distally.



Results

- MPFL injuries found at:
  - Patellar insertion only in **62%**
  - Femoral insertion only in **12%**
  - Both insertions in **13%**
  - No identifiable injury in **6%**
- Reliability of identification of zone of injury on MRI between observers
  - $\kappa = 0.41$
  - Moderate concordance

Fig. 4A: Axial image with cursor at location of MPFL disruption (arrow)

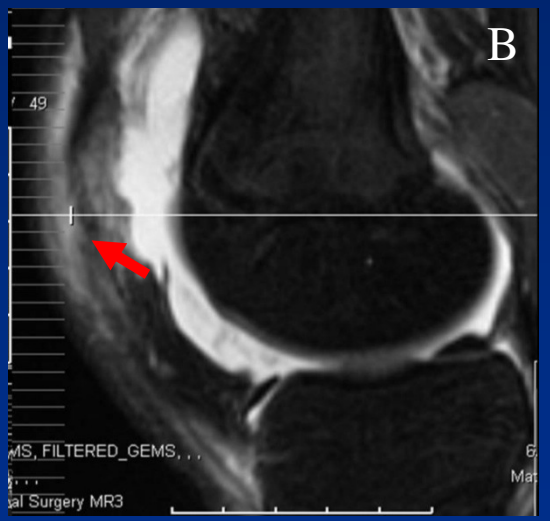


Fig. 4B: Sagittal STIR image with edema at corresponding location (arrow) confirming acute soft-tissue injury.

Results

- The femoral MPFL insertion averaged **5mm** distal to the distal femoral growth plate*
  - Range 7.5mm proximal to 16mm distal

- The insertion of the MPFL in relationship to the physis or physeal scar was:
  - **Distal in 86%**
  - Proximal in 8%
  - At the level of the physis in 6%

Discussion

- Orthopedic literature describing the location of MPFL injury after patellar dislocation has most frequently identified the femur as primary site of injury.
- Our study identifies a patellar zone of injury in 62% of patients is the first study to describe pediatric MPFL injuries including only first-time dislocators based on lateral femoral condyle edema pattern and history.
- Similarly, other studies have failed to confirm location of soft-tissue injury using evidence of edema at the suspected site of MPFL injury.

Discussion

- The location of the MPFL in relation to the growth plate has not previously been described.
- We found the insertion to be to the medial distal femoral growth plate by 5mm on average and distal to the physis in 86% of patients.
- This relationship is important for anatomic restoration of the insertion site, graft tensioning and isometry as well as graft positioning with respect to the joint line in patients with open growth plates (Figure 5).

Fig. 5: Coronal MRI image demonstrating screw placement after MPFL reconstruction at anatomic location of femoral insertion without disruption of open physis.