Radiographic Assessment of Revision Anterior Cruciate Ligament Reconstruction

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Background

• Magnetic Resonance Imaging (MRI) is a commonly used tool for knee evaluation after ACL reconstruction

• A MRI showing an “intact” ACL graft may not correlate well with the examination findings
Purpose

• To evaluate for concordance/discordance of the ACL graft assessment between arthroscopy, physical exam, and MRI

• To evaluate for contributing variables to discordance including graft type, mechanism of injury, tunnel positions, and concomitant intraarticular pathology
Materials & Methods

- Jan 2005 to Aug 2011
- 50 ACL revisions in 48 patients retrospectively reviewed
- Exclusions:
  - incomplete records
  - no MRI
  - infection as cause of revision
  - extraarticular procedures
Materials & Methods

• ACL graft integrity assessed on
  – Physical Exam
  – MRI
  – Arthroscopically

• Categorized into intact, partial tear, or complete tear
Materials & Methods

• MRI/radiograph evaluation:
  – Images reviewed by two independent observers twice (4 total reviews)
    • Assessed ACL graft integrity, meniscal tears, collateral ligament injuries, and cartilage injuries
  – Consensus of ACL status on MRI obtained by most frequent reading of independent evaluations
    • Discrepancies resolved by third reviewer
Materials & Methods

- Femoral tunnel, tibial tunnel, and graft angles measured on MRI

- Mechanical axis and incidence of osteoarthritis assessed on plain radiographs

*OsiriX digital imaging software (Geneva, Switzerland)
Materials & Methods

• Analysis:
  – Concordance/Discordance calculated comparing ACL graft status on MRI, physical exam, and arthroscopy
  – Fisher’s exact test used for categorical variables
  – Student-t test used for comparing categorical to continuous variables
Results

- Mean time from primary reconstruction to revision $4.6 \pm 3.6$ years
- 92% chief complaint instability
- 48% insidious onset mechanism
Results

MRI evaluation:

- inter- and intra-observer reliability was moderate with combined kappa of 0.41 and 0.49 respectively for ACL graft assessment

- 88% vertical femoral tunnel (between 12-1 o’clock)
Results

Comparison of ACL graft integrity on the 3 assessment modalities

- **Physical Exam**
  - Torn: 82%
  - Partial Tear: 18%

- **Arthroscopy**
  - Torn: 70%
  - Partial Tear: 30%

- **MRI**
  - Torn: 46%
  - Partial Tear: 30%
  - Intact: 24%
Results

Discordance of Physical Exam, MRI, and Arthroscopic Findings of ACL status

- Physical Exam / Arthroscopy: 28%
- MRI / Arthroscopy: 44%
- Physical Exam / MRI: 52%
Results

- Mechanism of injury was significantly associated with discordance of MRI and Arthroscopic evaluation of ACL graft (p=0.0003)

- Insidious onset mechanism significantly associated with an intact ACL graft on MRI (p=0.0014)

- PLC injury significantly associated with a torn ACL graft on arthroscopic evaluation (p=0.0014)
Results

- 74% osteoarthritis rate

  Presence of a combined meniscal tear and chondral injury significantly associated with osteoarthritis (p=0.0419)
Discussion

Key findings:

- High discordance rate between ACL graft status on MRI and arthroscopy
  - Significant diagnostic error if MRI is heavily relied upon to guide treatment
  - May contribute to delay in treatment

- Moderate kappa values of ACL assessment on MRI highlight diagnostic unreliability
Discussion

Insidious onset mechanism of injury is significantly associated with high discordance rate and with an intact ACL on MRI

– Atraumatic graft failure associated with technical error, unrecognized ligamentous injuries, and biological graft failure

– Multivariate analysis demonstrated no significant variables associated with mechanism of injury
Discussion

High rate of chondral (70%) and meniscal (66%) injuries consistent with other literature:

- 51-73% chondral injuries
- 45-77% meniscal injuries
- 57% combined meniscus and chondral injuries in MARS study group

➢ Patients should be extensively counseled on progression of arthritis
Discussion

Limitations:

- Retrospective study, no control group
- Use of coronal oblique MRI sequences may increase diagnostic accuracy
- Moderately sized study group
- Lack of KT-1000 data on physical exam
Conclusion

Evaluation of a failed ACL reconstruction by MRI is unreliable and inconsistent

- When assessing for possible revision surgery, emphasis should be placed on the subjective complaint, mechanism of injury, and physical exam.
- MRI should be used as an adjunctive assessment tool.