M.R. IMAGING OF THE EXTENSOR MECHANISM

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LECTURE OUTLINE

• Introduction
• Imaging anatomy
• Lesions affecting the extensor mechanism
• Summary
INTRODUCTION

Extensor mechanism of knee

• Essential to ambulation
• Subject to various disorders e.g. traumatic, congenital, inflammatory
• May result in anterior knee symptoms
INTRODUCTION

Extensor mechanism of knee

- Imaging may help define lesions
- Radiographs – acute bony trauma
- MR imaging
  - comprehensive assessment of joint, bone and soft tissues
IMAGING ANATOMY

Structures

• Quadriceps muscles & tendon
• Patellar retinacula
• Patella
• Patellar tendon
• Others- Hoffa’s fat pad
Anatomy of the extensor mechanism
IMAGING ANATOMY

Quadriceps muscle/tendon

• 4 quadriceps muscles
  • rectus femoris, vastus lateralis, v. medialis & v. intermedius
  • join as the quadriceps tendon
  • inserts into superior patella
Anatomy of the extensor mechanism
IMAGING ANATOMY

Quadriceps tendon

- Tendon: hypointense MR signal separated by linear bands of fat
- anterior lamina: rectus femoris
- middle: v. medialis & lateralis
- posterior lamina: v. intermedius
- trilaminar
Anatomy of the distal quadriceps tendon

Laminar appearance due to interspersed fat
IMAGING ANATOMY

Patellar retinacula

- Formed by tendinous fibers from medial and lateral vastus muscles
- Extend from medial and lateral collateral ligament complexes to margins of patella
- Mediolateral stability
Anatomy of the extensor mechanism
IMAGING ANATOMY

Patellar retinacula

• Best seen on axial MR images
• Well-defined linear bands of hypointense signal on all sequences
Anatomy of the patellar retinacula
IMAGING ANATOMY

Patella

• Triangular sesamoid bone
• Articular surface
  • divided by vertical ridge into small medial & large lateral facet
  • cartilage up to 7 mm thick
Anatomy of the patella
IMAGING ANATOMY

Patellar tendon

• Composed of fibers of the rectus femoris (quads: anterior lamina)
• Extends from inferior pole of patella to the tibial tuberosity
• Normally 5cm = patella length
IMAGING ANATOMY

Patellar tendon

• Best seen on sagittal images
  • well-defined band of hypointense signal

• Axial images – flattened ovoid shape
Anatomy of the patellar tendon
IMAGING ANATOMY

Other structures

- Intrapatellar fat pad of Hoffa
- Pre- and infrapatellar bursae
Anatomy of the fat pad of Hoffa

Jacobson JA et al. Radiographics 1997;17;675-91.
EXTENSOR MECHANISM

Acute injuries

- May be due to direct force
- More often secondary to indirect injury
  - violent deceleration force
  - predisposing conditions: gout, diabetes, collagen vascular disease
EXTENSOR MECHANISM

Acute injuries

- Dislocation
- Fractures
- Tendon ruptures
Distracted patellar fracture and subsequent repair
EXTENSOR MECHANISM

Chronic injuries

- Usually due to repetitive trauma
- Patellar tendon injury
- Transient patellar dislocation
- Patellar chondral lesions
- Bursitis
EXTENSOR MECHANISM

Patellar tendon injury

- Proximal patellar tendon
  - common (jumper’s knee)
  - tendon thickening and increased signal on PD/T2
- Tendinous junction with patella - relatively avascular
35/M. Proximal patellar tendinosis
40/M. Chronic patellar tendinosis
EXTENSOR MECHANISM

Patellar tendon injury

• Osgood-Schlatter disease
  • chronic inflammation of tendon insertion at tibial tuberosity
  • tuberosity irregularity
  • heterotopic bone formation
  • marrow and soft tissue edema
19/M. Osgood-Schlatter disease
EXTENSOR MECHANISM

Patellar tendon injury

• Sinding-Larsen-Johansson disease
  • also seen in juveniles
  • chronic repetitive microtrauma
  • attachment of superior patellar tendon to patella
20/M. Sinding-Larsen disease
EXTENSOR MECHANISM

Transient patellar dislocation

• Often clinically missed
• Patellar and trochleal groove dysplasia: predisposes
• Results from
  • extreme valgus stress
  • forced internal femoral rotation on fixed foot
EXTENSOR MECHANISM

Transient patellar dislocation

• MRI findings are characteristic
  • medial retinacular tear
  • marrow edema
  • medial patella and lateral margin of lateral femoral condyle
• osteochondral defect/ loose body
“kissing lesions”

21/M. Patellar dislocation post-reduction
Patellar dislocation with osteocartilaginous fragment
EXTENSOR MECHANISM

Patellar chondral lesions

- Various classifications
- ?term: chondromalacia
- Descriptions
  - cartilage intact: signal change
  - defect: size, location, depth, extent
22/M. Focal chondral lesion with subchondral edema & cyst
30/M. Small medial facet chondral defect
51/M. Large medial facet chondral defect with subchondral cysts
37/M. Severe medial facet chondral loss
39/M. Osteoarthritis with cartilage irregularity and defects
EXTENSOR MECHANISM

Bursitis

• Not uncommon
  • especially in occupations that require kneeling
• Inflammation
• Well-defined fluid collection in known bursal location
  • prepatellar, infrapatellar
51/M. Preacher’s knee: infrapatellar bursitis
EXTENSOR MECHANISM

Other lesions

• Bipartite patella
• Hoffa’s fat pad disorders
EXTENSOR MECHANISM

Bipartite patella

- Normal variant
  - small separate ossification center at superolateral patella
- Symptomatic cases
  - very rare
  - may be due to chronic stress
36/M. Bipartite patella
39/M. Bipartite patella with stress changes
EXTENSOR MECHANISM
Hoffa’s fat pad disorders

• Hoffa disease
  • infrapatellar fat pad impingement

• Injury

• Synovial lesions

• Tumors
30/M. Shear injury of Hoffa’s infrapatellar fat pad. Linear fluid collection. Associated with ACL injury.
24/M. PVNS of Hoffa’s fat pad

Follow-up MRI post-excision
SUMMARY

• Many conditions can affect the extensor mechanism of the knee
• Be familiar with anatomy
• MR imaging is useful in evaluating injuries and other disorders
Thank you for your attention