Knee Pathology and Intervention

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Pathology:
• Tendon
• Ligament
• Cartilage
• Fluid collections and cysts
• Peripheral nerves
• Miscellaneous

Tendon Abnormalities
• Tendinosis:
  – Swollen, hypoechoic, no inflammation
• Tear:
  – Partial-thickness tear
  – Full-thickness tear: retraction

Quadriceps Tendon: tendinosis

Quadriceps Tendon
• Full-thickness tear
  – Complete tendon disruption
  – Tendon retraction: dynamic imaging
  – Joint fluid extending through tear

La et al. AJR 2001; 22:1323
**Quadriceps Tendon:** full-thickness tear

**Long Axis**

**Sagittal PDw**

**Quadriceps Femoris Tear:**

*dynamic imaging*

**Long Axis**

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**Patellar Tendinosis:**

- Jumper’s knee
- Hypoechoic swelling
- Mucoid degeneration, possible interstitial tearing
- Hyperemia: neovascularity
- No inflammatory cells

*Radiology 1996; 200:821*

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**Patellar Tendon:** tendinosis

- 45 tendons
- 76% improved at 4 weeks, 24% no change
- Improved outcome at 4 weeks if:
  - Less pain prior to procedure
  - Well-defined area of tendinosis at US
  - No correlation with other ultrasound findings (color, size, location, etc.)

**Patellar Tendon: PRP**

- Pre-procedure
- PRP injection

**Patellar Tendon**

- Randomized controlled: 23 patients
- PRP + fenestration versus fenestration alone
- PRP outcomes better at 12 weeks
- No significant difference in outcomes when greater than 26 weeks


**Patellar Tendon: full-thickness tear**

- Long Axis Sagittal PDw
- Patella
- Prox Distal Longitudinal

**Iliotibial Band Friction Syndrome:**

- Pain: repetitive friction of ITB over lateral femoral condyle
- Sonography:
  - Secondary bursa formation
  - ITB: hypoechoic and swollen
  - Adjacent soft tissue hypoechoic edema

J Ultrasound Med 1998; 17:257
Inflammatory Arthritis: gout

- Erosions: cortical irregularity
- Joint effusion
- Double contour sign:
  - Echogenic crystal layer over hyaline cartilage
- Tendon involvement:
  - Popliteus, patellar

Gout: popliteus

Gout: patellar tendon

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MCL: sprain

MCL: full-thickness tear
Lateral Collateral Ligament Injury

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Meniscus:
- Normal: hyperechoic
- Degeneration: hypoechoic
- Tear: defined hypoechoic cleft to articular surface

*Invest Radiol 1986; 21:332

Meniscus: Accuracy
- 35 patients
- Sensitivity / Specificity = 86% / 69%
- PPV / NPV = 83% / 75%
- Most studies:
  - US is markedly limited

*JBJS-Br 2008; 90-B:1045.
**Meniscus: chondrocalcinosis**

**Trochlear Groove: Articular Cartilage**

**Gout**

- Double contour sign:
  - Hyperechoic foci on surface of hyaline cartilage
  - Does not demonstrate anisotropy
  - Unlike normal cartilage interface
  - Disappears with serum urate < 6 ml/dl

Thiele RG, Rheumatol Int 2010; 30:495

**Gout: Double Contour Sign**

**Osteochondral Abnormality**

From: Thiele RG, Rheumatology 2007; 46:1116
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Joint Effusion
- Suprapatellar recess
  - Superior
    - Prefemoral & quadriceps fat pad separation
    - Distends with partial knee flexion
  - Medial and lateral to patella
    - Distends with knee extension
    - Transducer pressure displaces joint effusion

Suprapatellar Recess and Gutters

Knee Joint
- Suprapatellar recess or medial/lateral recesses
- In plane
- Transducer: axial
- Needle: lateral to medial

Anterior Knee Bursa:
- Prepatellar bursa
- Superficial infrapatellar bursa
- Deep infrapatellar bursa

Prepatellar Bursa: aseptic fluid
- Sagittal
- Axial

Superficial Infrapatellar Bursa
- Case #1
- Case #2

Deep Infrapatellar Bursa
- Normal
- Abnormal

Adventitious Bursae:
- Site of friction
- Myxomatous degeneration of fibrous tissue
- Medial epicondyle:
  - Rider’s bursa: horseback riding
  - Limbo-dancing
  - Trinidadian art form of limbo dancing
Baker Cyst:
• Semimembranosus-medial gastrocnemius bursa
• 50% over age of 50 have communication with knee joint
• Cyst communication to posterior knee between SM-MG tendons required

AJR 2001; 176:373
**Baker Cyst**
- Aspiration
  - Inferior to superior
  - Medial to lateral
- Aspirate joint effusion first if present
- Steroid injection
  - Baker cyst injection works better than intra-articular injection


**Pes Anserinus**
- Pes anserinus: “goose foot”
  - Sartorius
  - Gracilis
  - Semitendinosus
- Bursa:
  - Deep to conjoined tendon
  - Adjacent to proximal tibia

Radiology 1995; 194:525

**Pes Anerinus: bursal fluid**

**Parameniscal Cyst:**
- Medial more common
- Anechoic or hypoechoic
- Extends to periphery of meniscus
- Look for meniscal tear

1AJR 2001; 177:409
2AJR 1998; 171:491

**Lateral Meniscus: tear and parameniscal cyst**

**Ganglion Cyst**
- Anechoic or hypoechoic
- Possibly multilocular
- Gastrocnemius origins, Hoffa’s fat pad, cruciate ligaments
- Exclude other cysts (meniscal)
Ganglion Cyst

Sagittal Sagittal PDw

Femur

Ganglion Cyst

Sagittal Sagittal PDw

Patellar T

Tibia

Cruciate Ganglion Cyst

Sagittal Sagittal T1w post-gado

Femur

Tibia

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Nerve Entrapment

US findings:
- Nerve enlargement proximal to entrapment
  - Best appreciated transverse to nerve
- Abnormally hypoechoic
  - Especially the connective tissue layers
  - Variable enlargement or flattening at entrapment site

Common Peroneal Nerve:
- Courses around fibular neck
- Osteofibrous tunnel:
  - Between fibula and peroneus longus
  - Repetitive injury, direct compression
- Injury: fibular fracture
Common Peroneal Nerve: entrapment

1. Joint fluid from proximal tibiofibular joint
   - Enters peroneal nerve via articular nerve branches
   - Shown at MR arthrography after exercise
   - Extends proximal via epineurial sheath\(^1\)
   - May also form via tibial nerve\(^2\)

\(^1\) Spinner et al. Clin Anatomy 2007; 20:826
\(^2\) Spinner et al. Skeletal Radiol 2006; 35:172

Note: "signet ring" appearance

From: Spinner et al. Skeletal Radiol 2008;37:1091
Intraneural Ganglion

Nerve Transection

- Neuroma formation:
  - Disorganized and tangled nerve end
  - Normal response to nerve transection
  - After amputation:
    - US important to determine if symptomatic

J Clin Ultrasound 1997; 25:85

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Deep Venous Thrombosis

- Hypoechoic thrombus
- Not compressible
- No flow

Popliteal Vein Thrombosis
Take Home Points:

- Common indications:
  - Fluid, cysts, extensor tendon
- Very limited:
  - Meniscus, cartilage, cruciate ligaments
- Suprapatellar recess:
  - Look all around patella
- Baker cyst: often communicates with joint