

# Ultrasound Evaluation of Knee Pathology

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## Disclosures

- Consultant: Bioclinica
- Book Royalties: Elsevier
- Contractor: POCUS PRO
- Advisory Board: Philips
- Not relevant to this talk

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## Pathology:

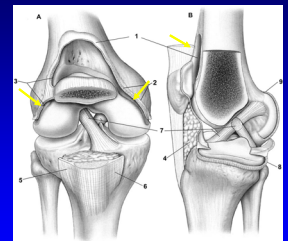
- Joint space
- Bursae and cysts
- Tendon
- Ligament
- Cartilage
- Miscellaneous

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## Joint Effusion

- Suprapatellar recess: superior
  - Prefemoral & quadriceps fat pad separation
  - Distends with partial knee flexion
- Medial and lateral recesses
  - Adjacent to patella
  - Distends with knee extension
  - Transducer pressure displaces joint effusion

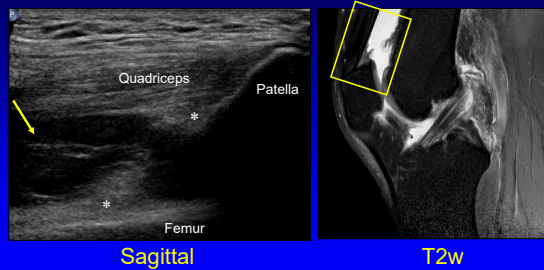
### Suprapatellar Recess and Gutters



From: Miller PJ et al. Am J Sports Med 2001;29:822.

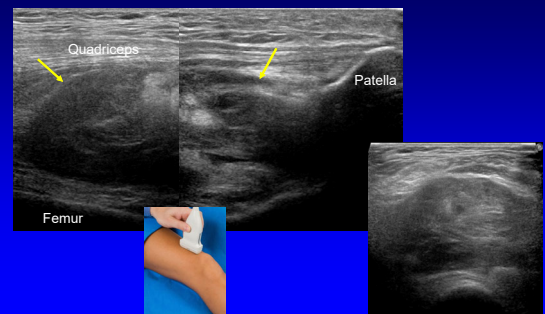
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## Joint Effusion: sagittal plane



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## Hemarthrosis



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### Intra-articular Body

- Joint recess
- Echogenic
- Possible shadowing
- Adherent versus loose body

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### Superior Plica

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### Lipoma Arborescens

- Sonographic findings:
  - Hyperechoic
  - Frond-like mass
  - Pliable
  - Joint effusion

From: Sheldon, P. J. et al.  
Radiographics 2005;25:105-119

**RadioGraphics**

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### Lipohearthrosis

- Intracapsular fracture / soft tissue injury
  - Fat from marrow or soft tissues
- Sonography:
  - Fat: hyperechoic
  - Serum: anechoic
  - Blood: hypoechoic

J Ultrasound Med 1995; 14:279  
Courtesy of Alex Chien, MD

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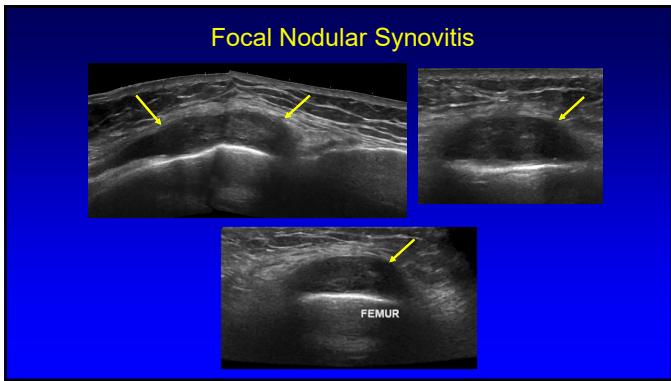
### Synovitis

- Diffuse:
  - Inflammatory: infection, rheumatoid
  - Proliferative: pigmented villonodular synovitis
- Focal:
  - Focal nodular synovitis
  - Dynamic imaging: snapping

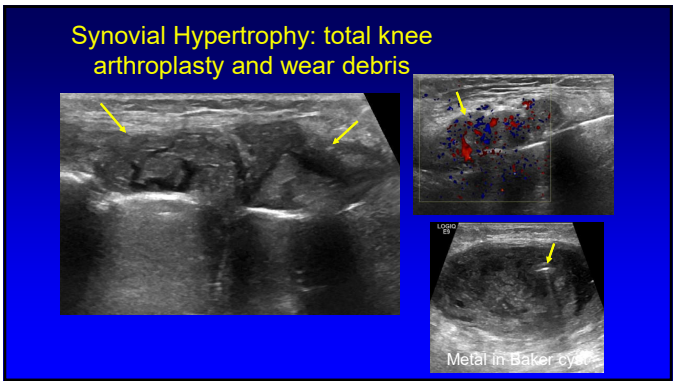
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### Focal Nodular Synovitis

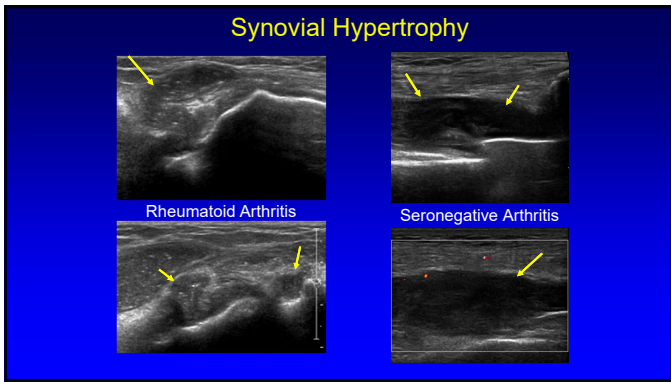
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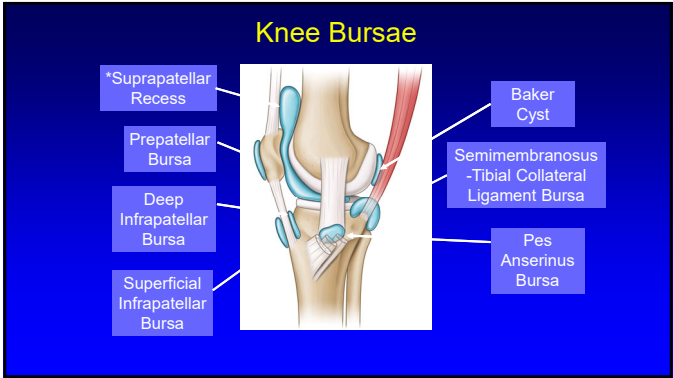
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- ### Pathology:
- Joint space
  - **Bursae and cysts**
  - Tendon
  - Ligament
  - Cartilage
  - Miscellaneous

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### Anterior Knee Bursa

- Prepatellar bursa
- Superficial infrapatellar bursa
- Deep infrapatellar bursa

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### Prepatellar Bursa: complex fluid

Hemorrhage      Infection

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### 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

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### Adventitious Bursa: knee amputation

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### 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

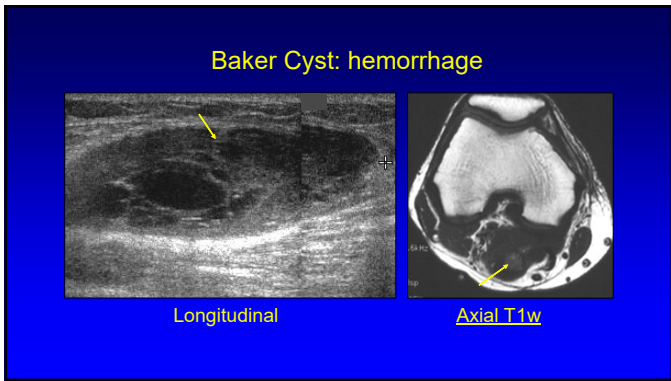
AJR 2001; 176:373

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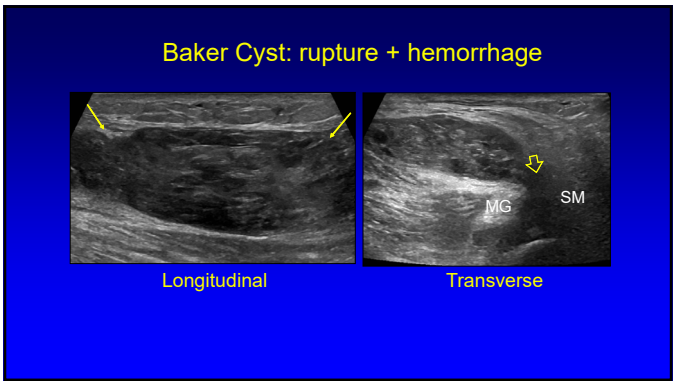
### Baker Cyst

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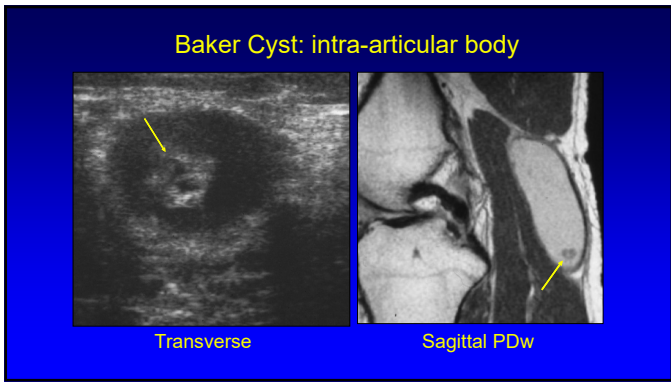




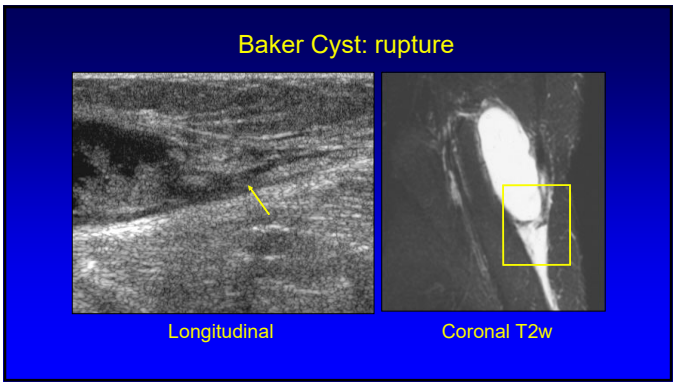
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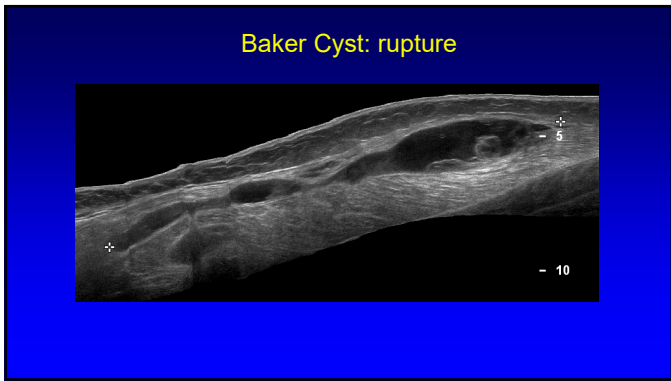
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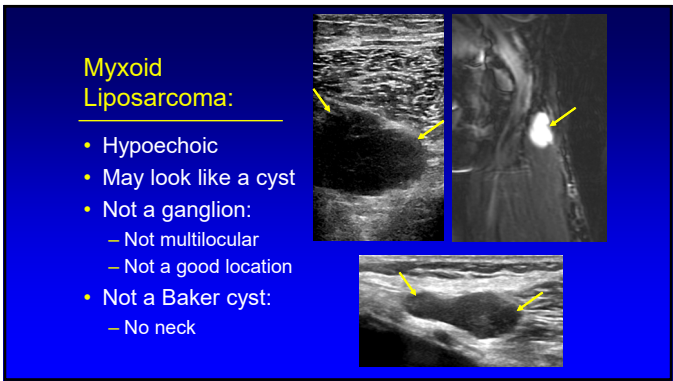
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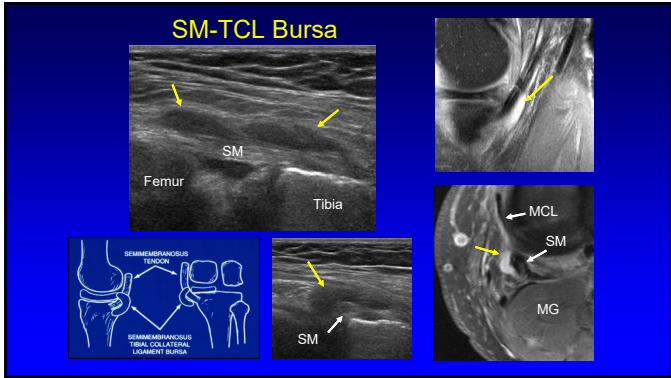
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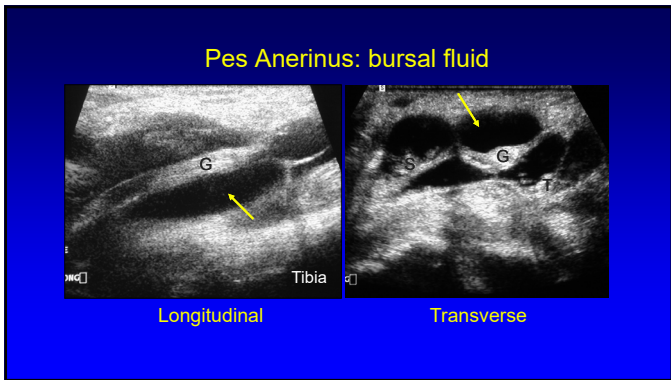
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### Pes Anserinus

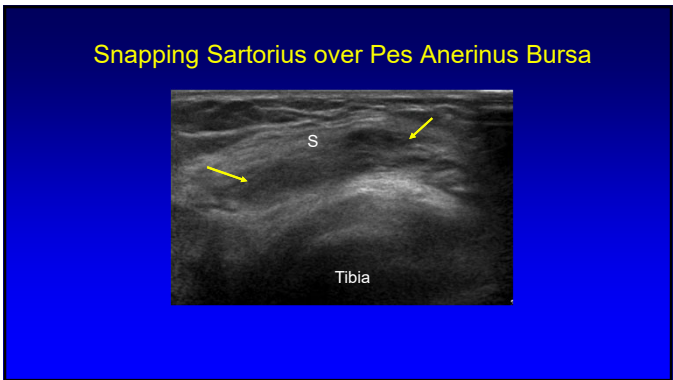
- Pes anserinus: "goose foot"
  - Sartorius
  - Gracilis
  - Semitendinosus
- Bursa:
  - Deep to conjoined tendon
  - Adjacent to proximal tibia
- Rarely distended

Radiology 1995; 194:525  
Uson J et al Scand J Rheum 2000; 29:184

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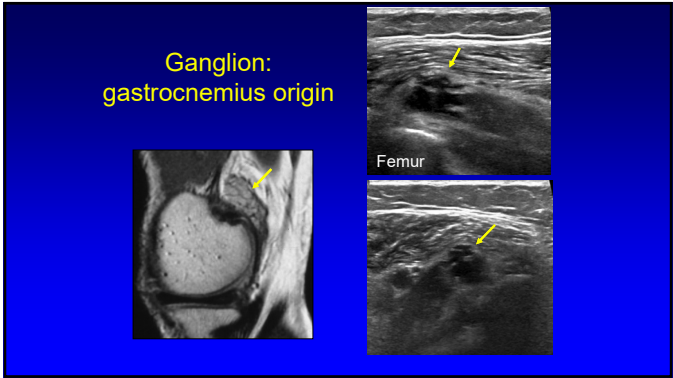


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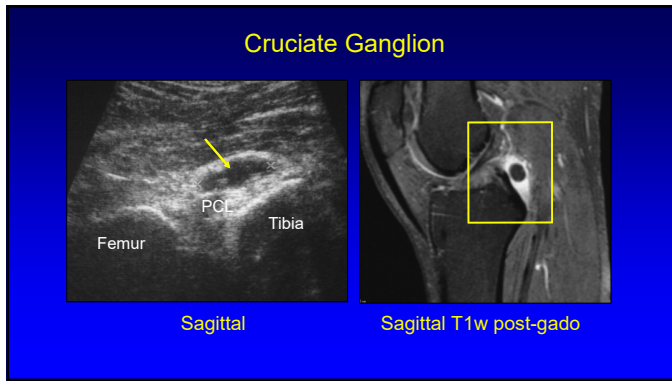
### Ganglion

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

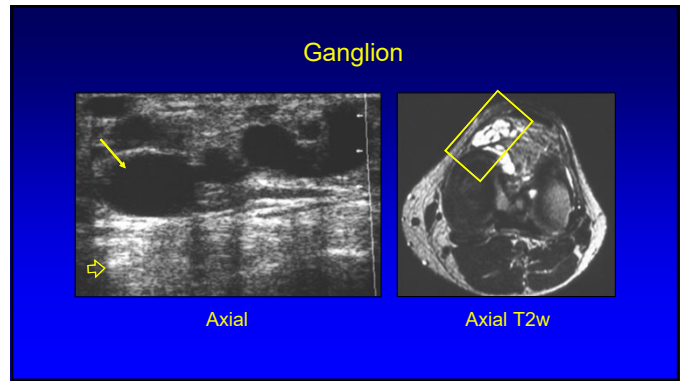
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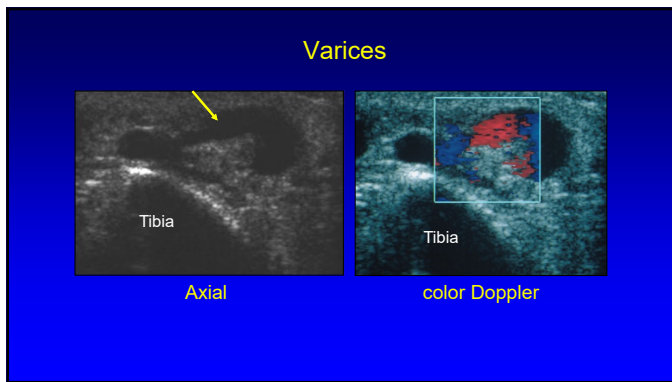
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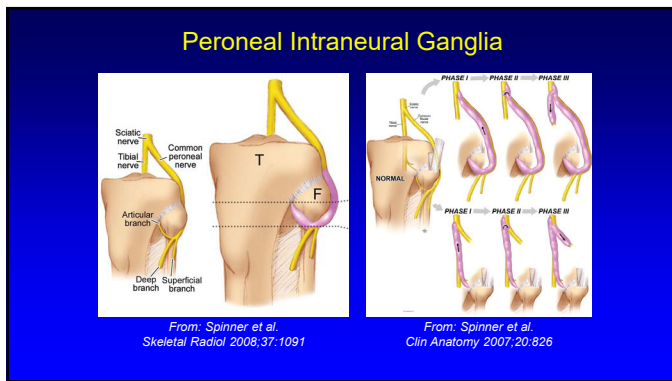
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### Peroneal Intraneural Ganglion

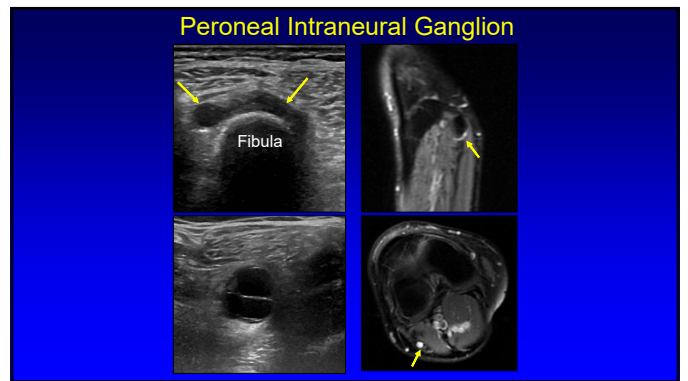
- Joint fluid from proximal tibiofibular joint
  - Enters peroneal nerve via articular nerve branches
  - Shown at MR arthrography after exercise
  - Extends proximal via epineurial sheath<sup>1</sup>
- May also form via tibial nerve<sup>2</sup>

<sup>1</sup>Spinner et al. Clin Anatomy 2007; 20:826  
<sup>2</sup>Spinner et al. Skeletal Radiol 2006; 35:172

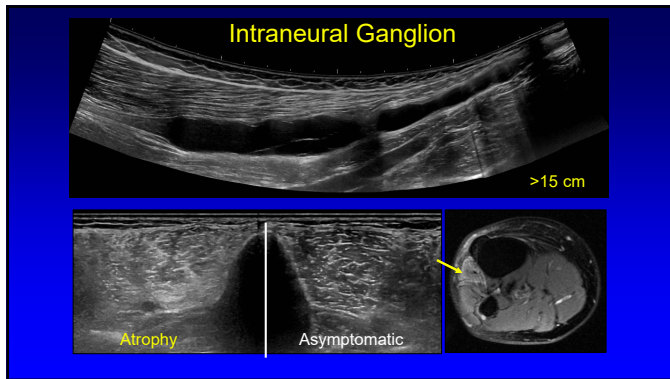
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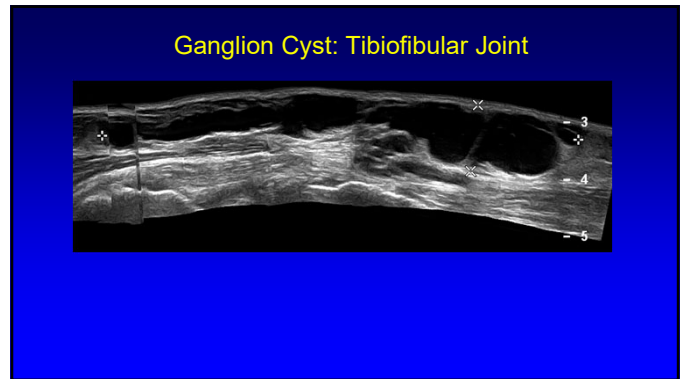
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**Pathology:**

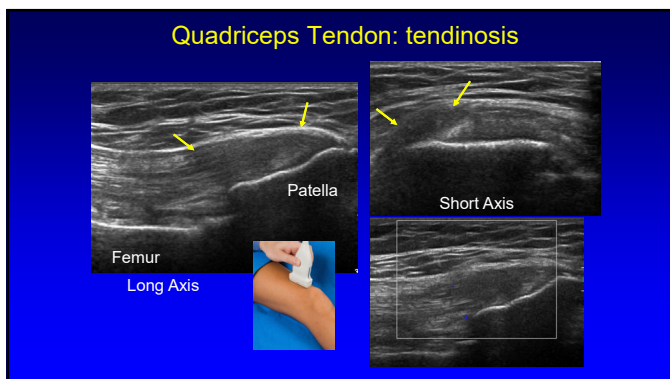
- Joint space
- Bursae and cysts
- **Tendon**
- Ligament
- Cartilage
- Miscellaneous

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**Tendon Abnormalities**

- Tendinosis:
  - Swollen, hypoechoic, no inflammation
- Tear:
  - Partial-thickness tear
  - Full-thickness tear: retraction

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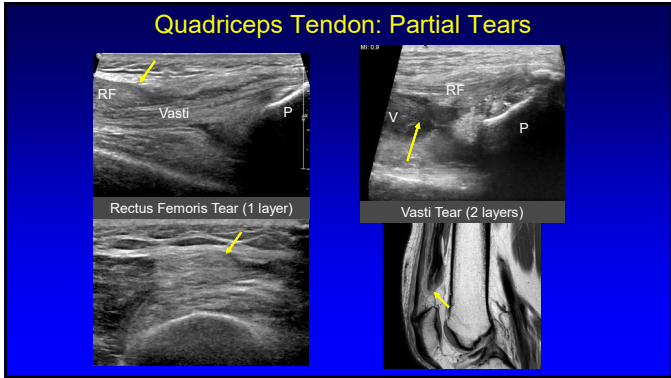
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**Quadriceps Tendon: tear**

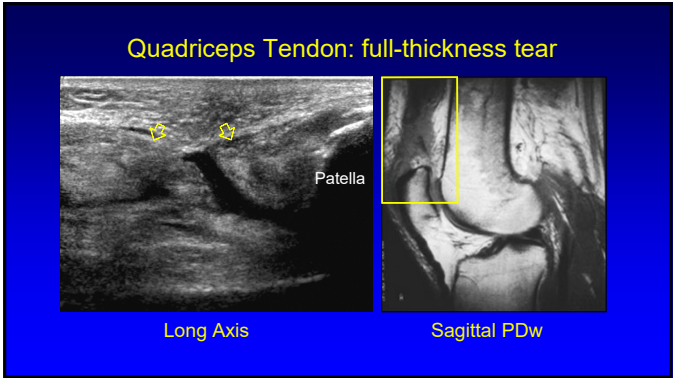
- Partial tear:
  - One to two of three tendon layers torn
- Full-thickness tear
  - Complete tendon disruption
  - Tendon retraction: *dynamic imaging*
  - Joint fluid extending through tear
- 100% accuracy for diagnosis of high-grade and full-thickness tears requiring surgery

Foley R et al. J Ultrasound Med 2015; 34:805

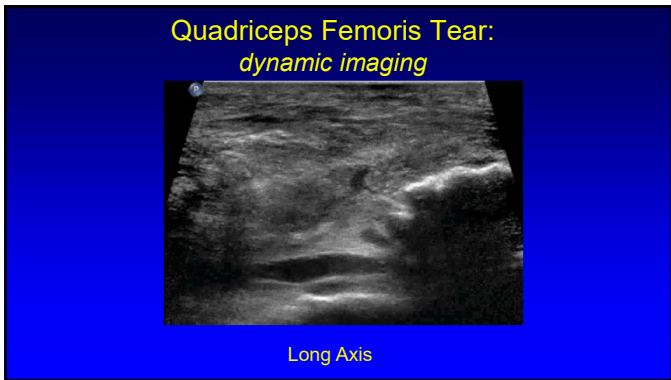
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### Patellar Tendinosis

- Jumper's knee
- Mucoïd degeneration
- No inflammatory cells
- Possible partial thickness tear
- Proximal
- Hypoechoic, swollen
- Hyperemia: neovascularity

Radiology 1996; 200:821

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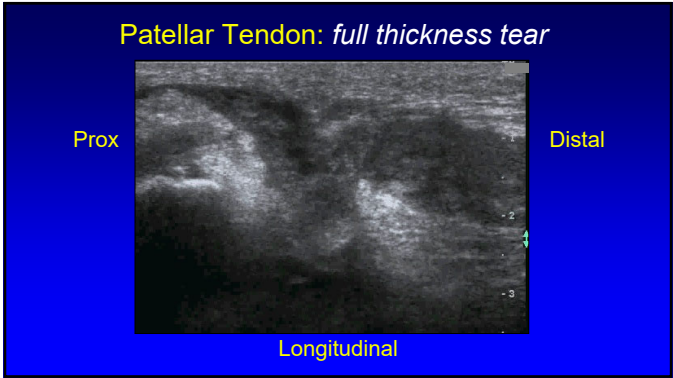
### Patellar Tendon Tear

- Full-thickness tear
  - Hypoechoic
  - Posterior shadowing at ends of torn tendon
  - Tendon retraction
  - Patellar alta

AJR 2001; 176:1535

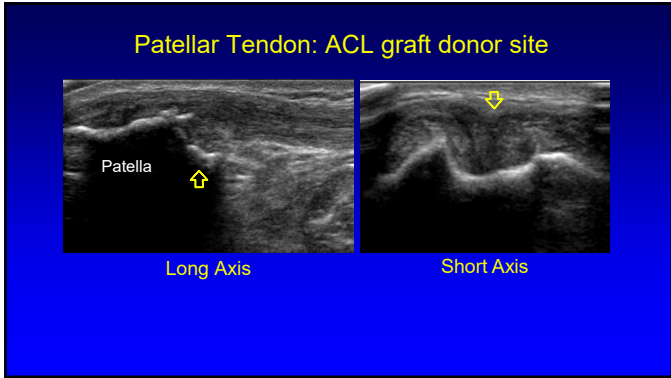
Patella  
\*Different Patients

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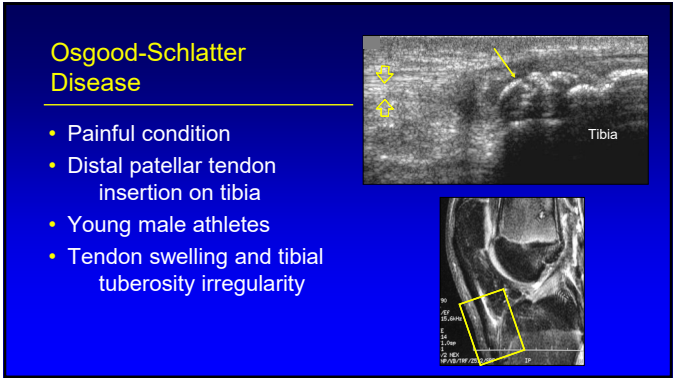


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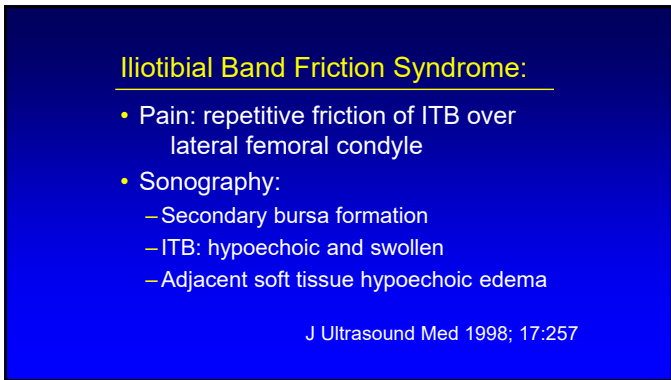




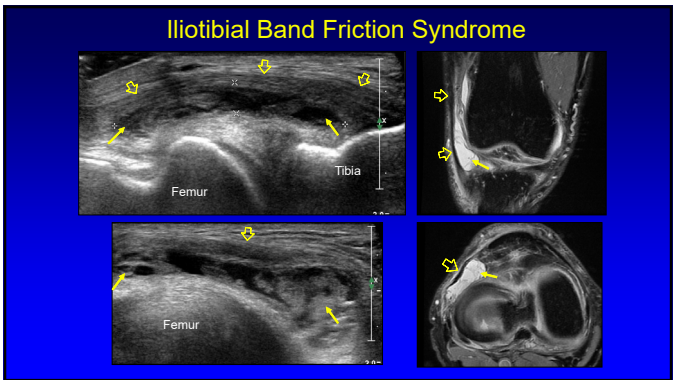
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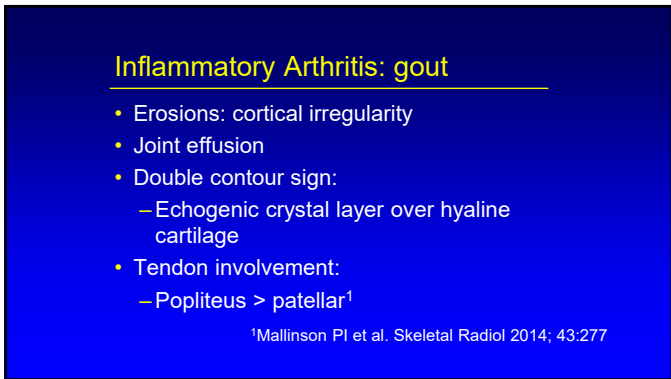
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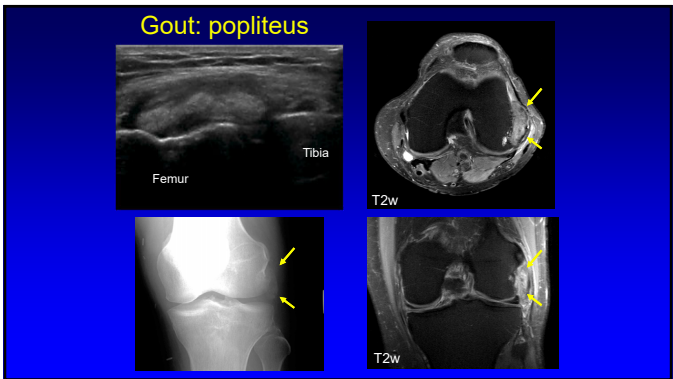
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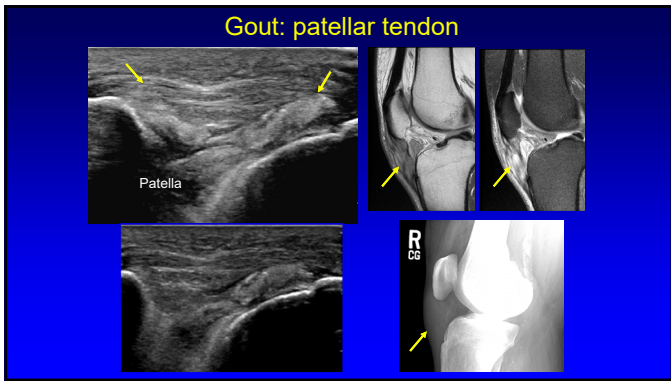
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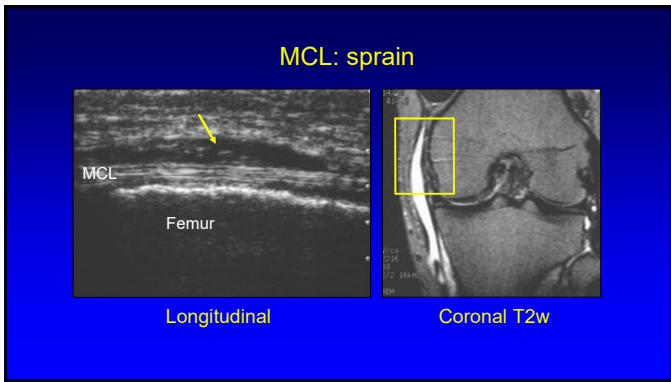


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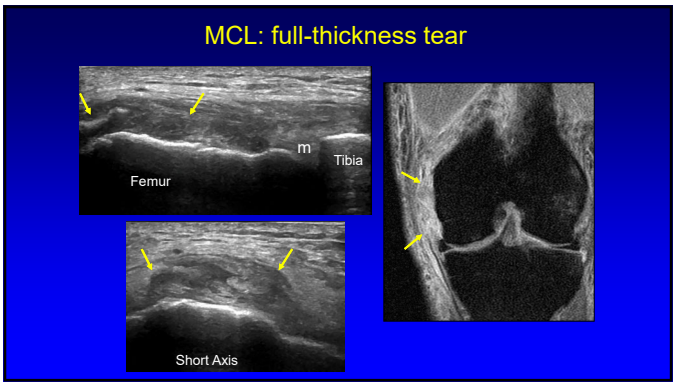
### Pathology:

- Joint space
- Bursae and cysts
- Tendon
- **Ligament**
- Cartilage
- Miscellaneous

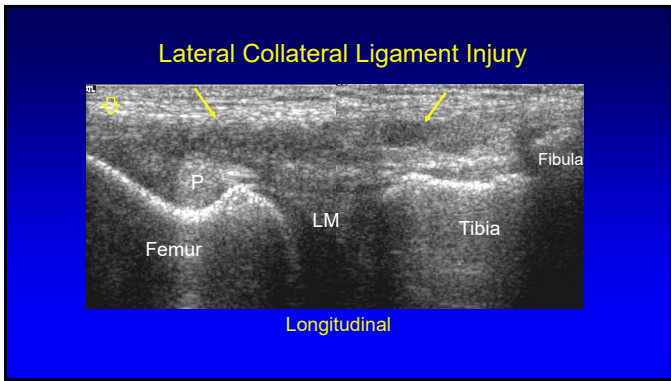
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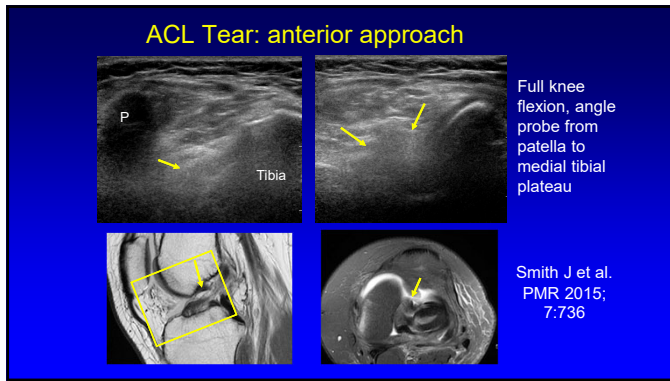
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### ACL Tear

- Axial plane
- Abnormal hypoechoogenicity
- Lateral wall of intercondylar notch
- 91% sensitive, 100% specific

AJR 1995; 164:1461

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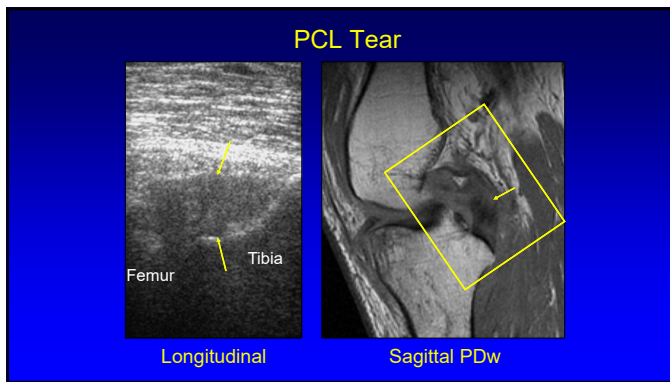
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### Posterior Cruciate Ligament Injury

- Sagittal plane
- Heterogeneous, hypoechoic, ill-defined posterior border, >10 mm thickness
- Pitfall: anisotropy

Radiology 2001; 219:375

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### Pathology:

- Joint space
- Bursae and cysts
- Tendon
- Ligament
- **Cartilage**
- Miscellaneous

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### Meniscus:

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

\*Invest Radiol 1986; 21:332

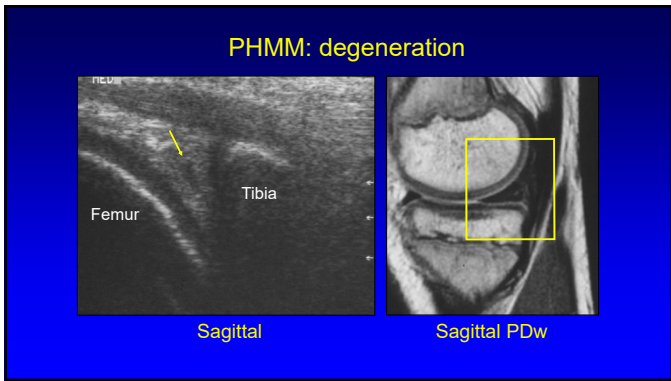
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### Meniscus: Accuracy

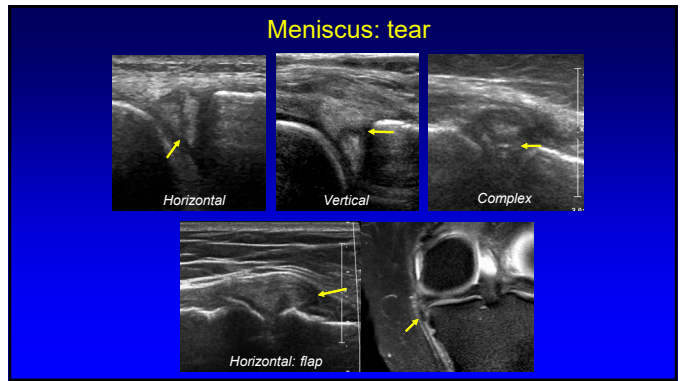
- 70 patients with surgical correlation
- Sensitivity / Specificity = 88% / 85%
- PPV / NPV = 85% / 88%
- Most studies:
  - US is markedly limited
  - Especially lateral meniscus

Akatsu Y et al. JBJS 2015; 97:799

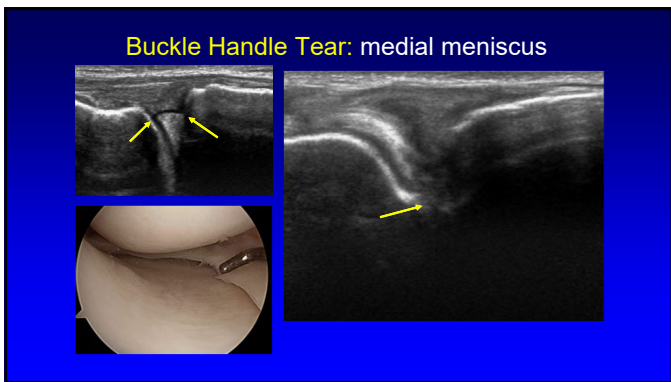
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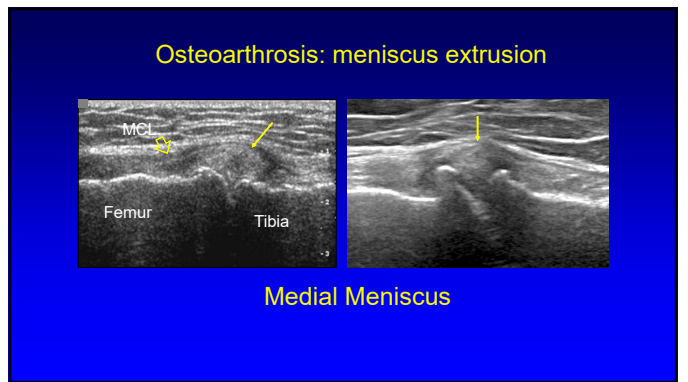
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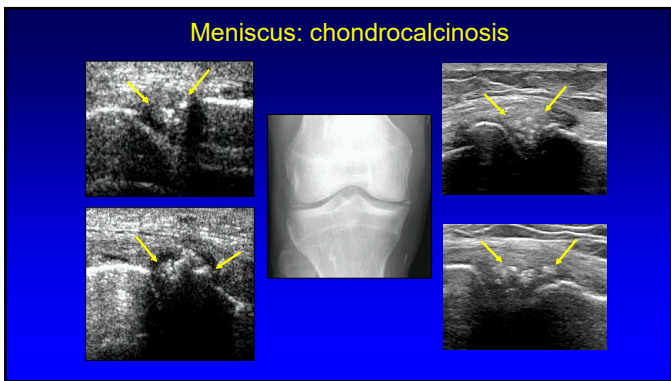
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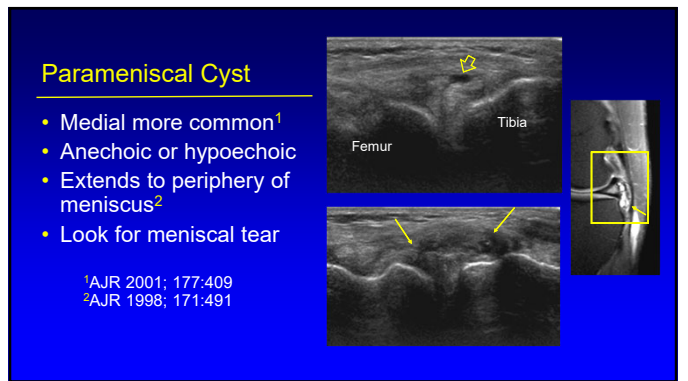
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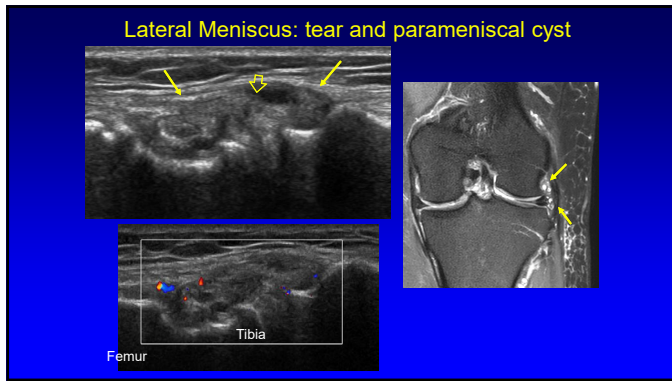
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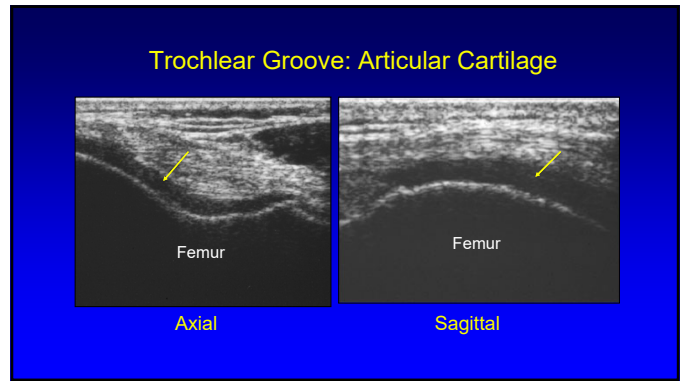
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### Gout: double contour sign

- Hyperechoic foci on surface of hyaline cartilage
- Sensitivity = 83%, specificity = 76%
- Does not demonstrate anisotropy
  - Unlike normal cartilage interface
- Disappears with serum urate < 6 ml/dl

Thiele RG, Rheumatol Int 2010; 30:495  
Ogdie A, et al Ann Rheum Dis 2014

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### Gout: Double Contour Sign

From: Thiele RG, Rheumatology 2007; 46:1116

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### Gout: Double Contour Sign

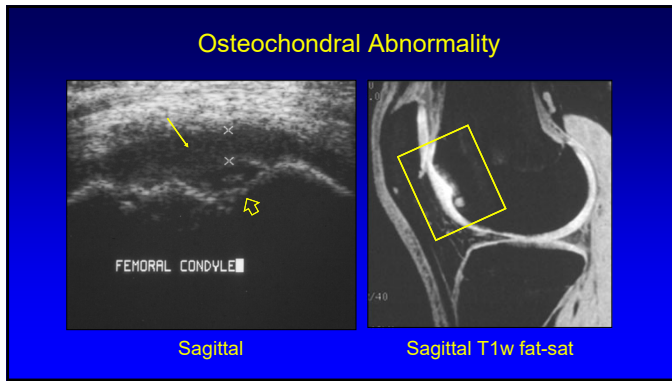
*Pitfall: can also see with CPPD or pseudogout!*

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### Chondrocalcinosis: CPPD or pseudogout

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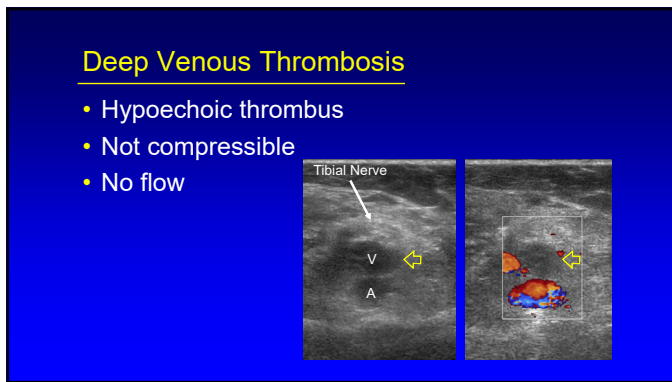




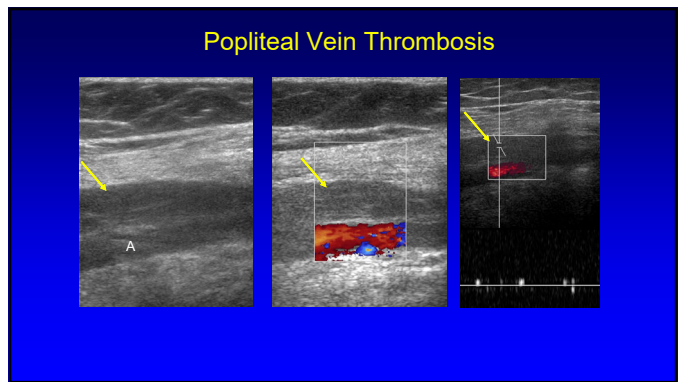
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- ### Pathology:
- 
- Joint space
  - Bursae and cysts
  - Tendon
  - Ligament
  - Cartilage
  - **Miscellaneous**

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- ### 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

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[www.jacobsonmskus.com](http://www.jacobsonmskus.com)

Twitter handle: @jjacobsn

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