

Ultrasound Evaluation of Knee Pathology

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Disclosures

- Consultant: Bioclinica
- Advisor: Philips
- Book Royalties: Elsevier
- Not relevant to this lecture

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Fundamentals of Musculoskeletal Ultrasound are
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Outline

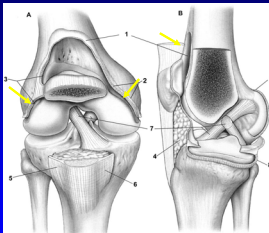
- Joint pathology
- Tendon pathology
- Cysts and bursae
- Meniscus
- Gout

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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

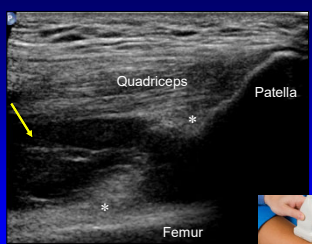
Suprapatellar Recess and Gutters




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

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Joint Effusion: sagittal plane



Sagittal

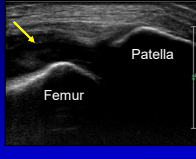


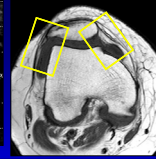
T2w

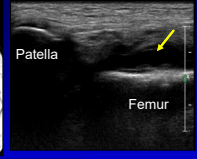


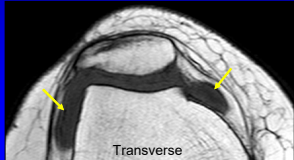
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Joint Effusion: transverse plane



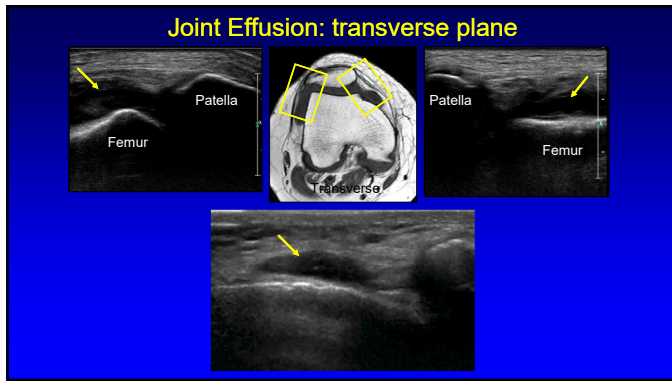




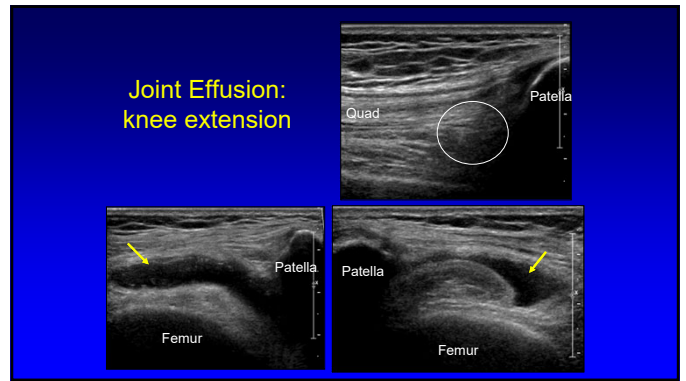


Transverse

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Lipohemarthrosis

- 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 Rob Kimbrough

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Intra-articular Body

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

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Synovial Hypertrophy: total knee arthroplasty and wear debris

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Patellar Clunk Syndrome

- After total knee arthroplasty
- Up to 7.5% incidence
- Fibrous nodule: intercondylar notch
- Pain with flexion - extension

Okamoto T. et al. J Orthop Sci 2002; 7:590

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Outline

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- Meniscus
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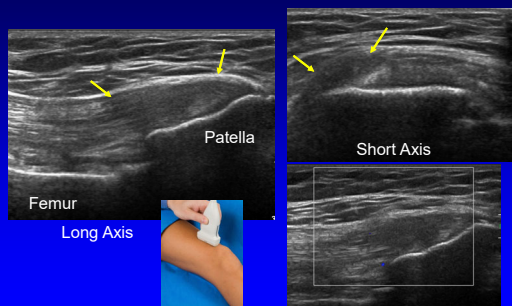
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Tendon Abnormalities

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

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Quadriceps Tendon: tendinosis



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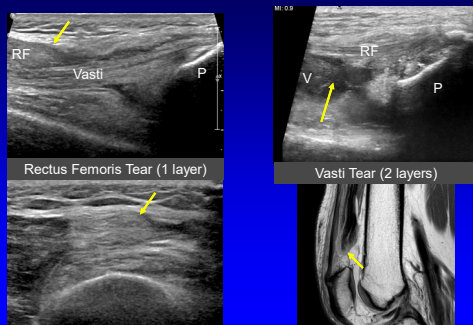
Quadriceps Tendon: tear

- 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

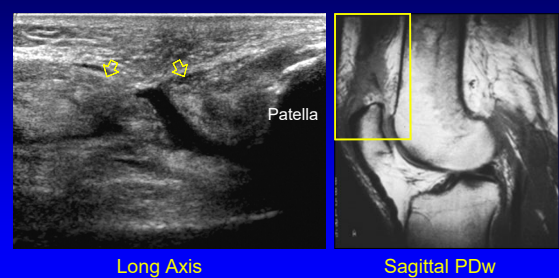
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Quadriceps Tendon: Partial Tears

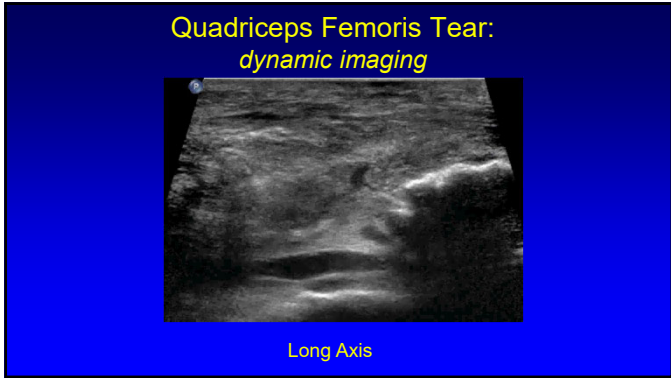


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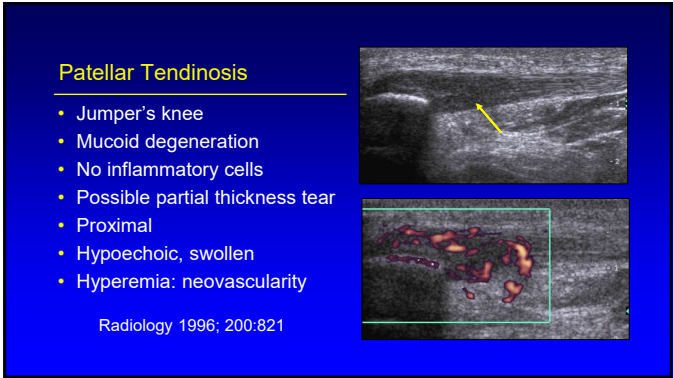
Quadriceps Tendon: full-thickness tear



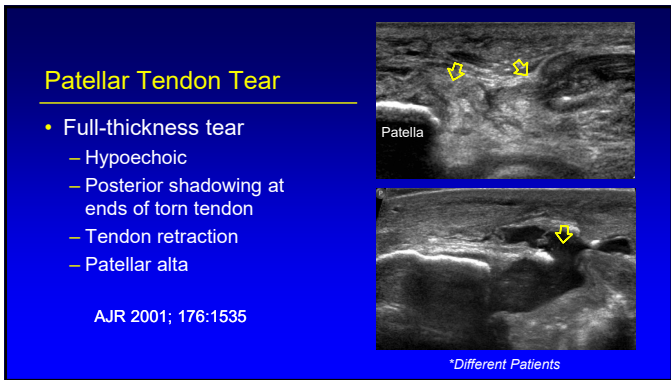
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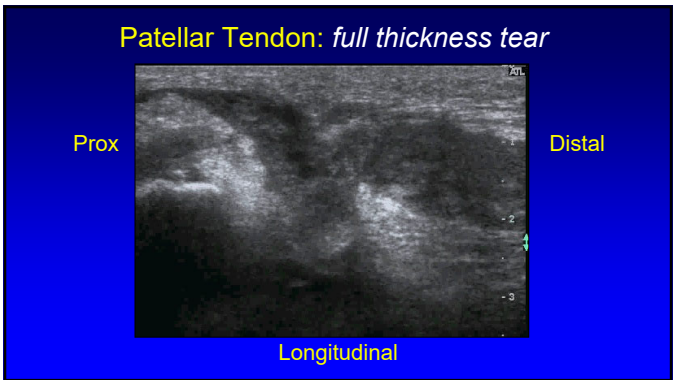
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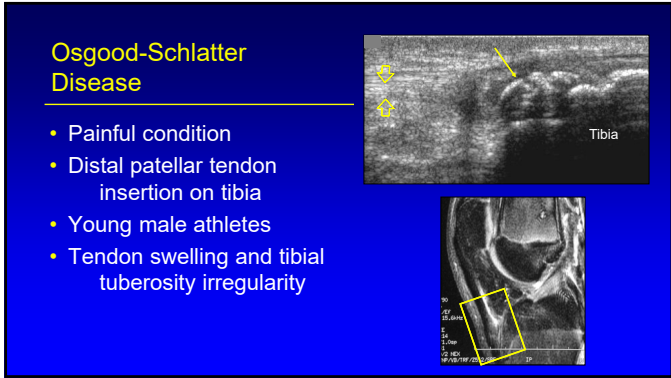
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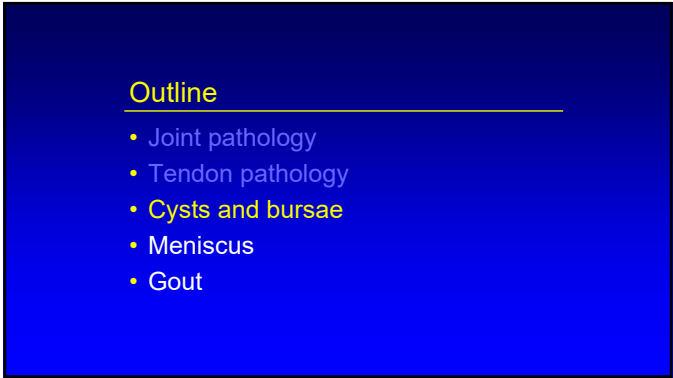
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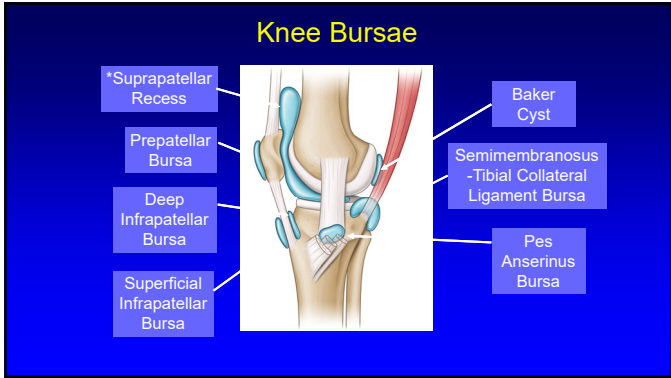
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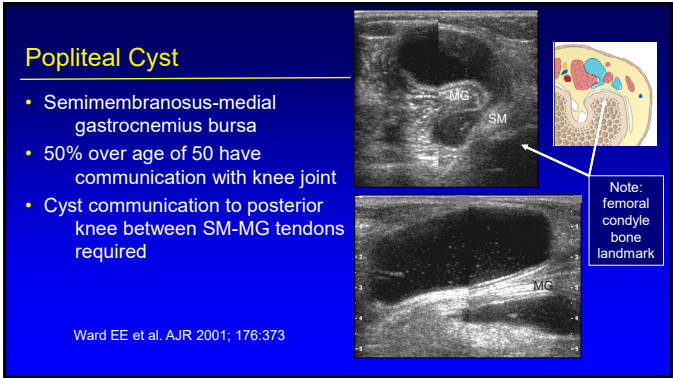
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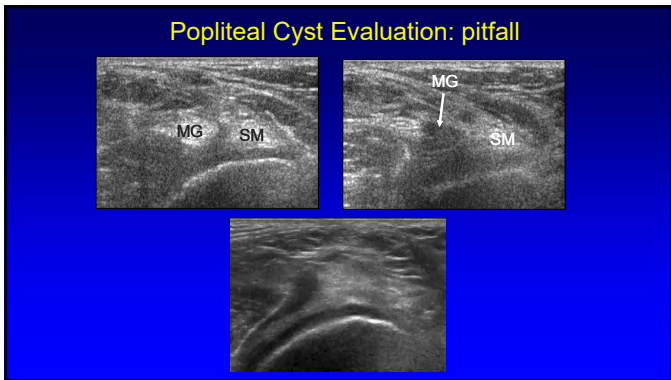
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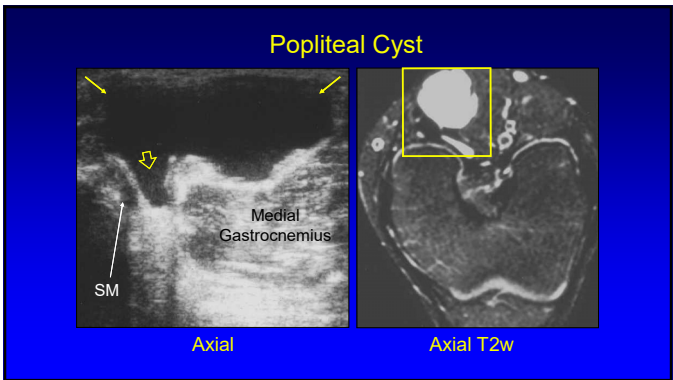
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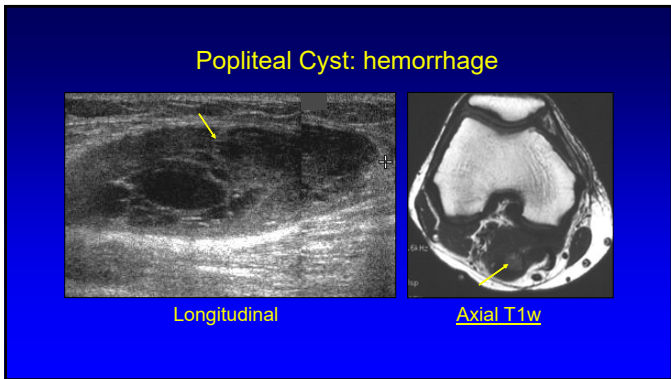
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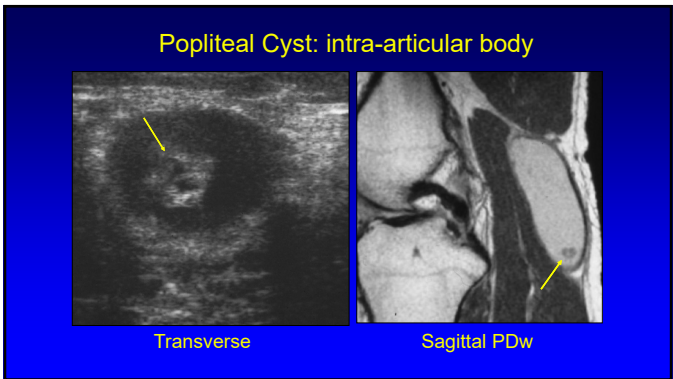
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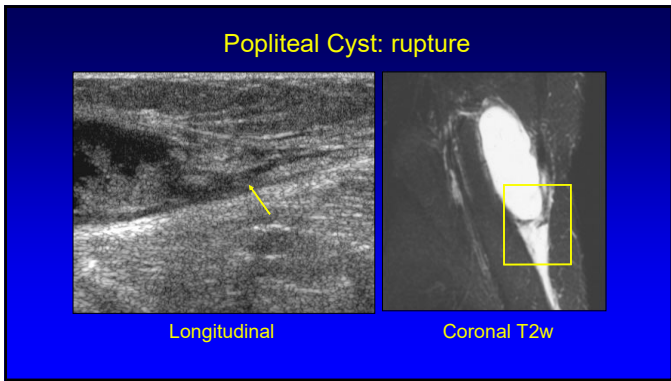
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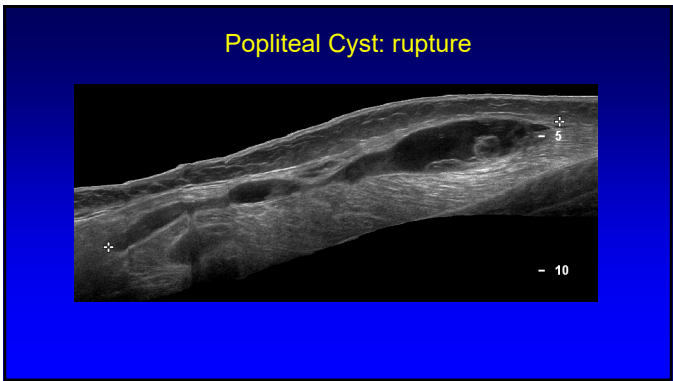
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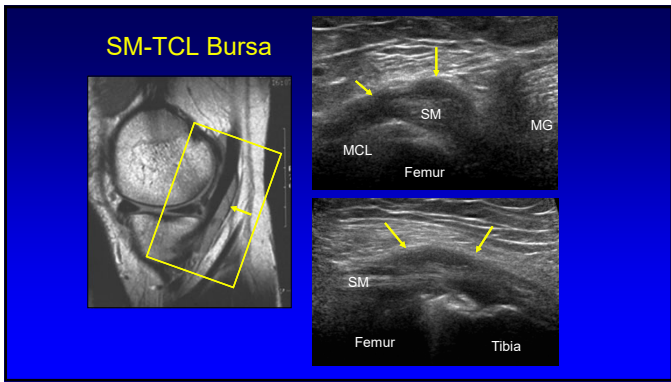
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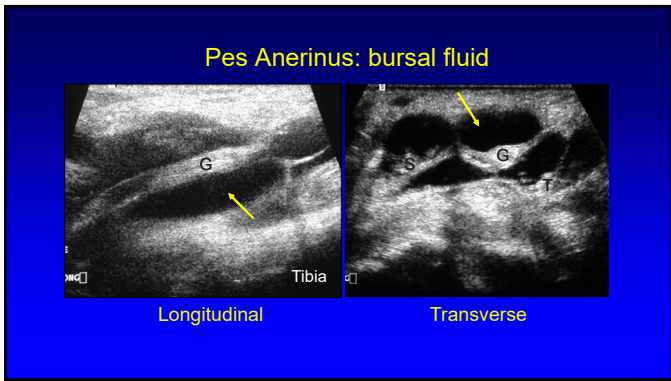
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Pes Anserinus

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

Radiology 1995; 194:525

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Anterior Knee Bursa

- Prepatellar bursa
- Superficial infrapatellar bursa
- Deep infrapatellar bursa

Patella PT

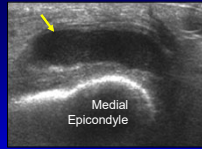
PT Tibia

Normal Tibia

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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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Peroneal Intraneural Ganglion

- Pain: knee or peroneal nerve distribution
 - Possible palpable mass, fluctuating course
- 18% of those with foot drop¹
- No identifiable etiology
 - Weight loss, trauma, leg crossing
- High body mass index²
 - Unlike other causes for peroneal neuropathy

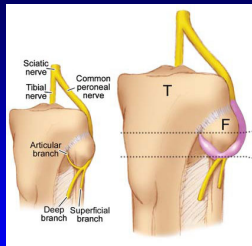
¹Visser et al. Neurology 2006; 67:1473
²Young et al. Neurology 2009; 72:447

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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 sheath¹

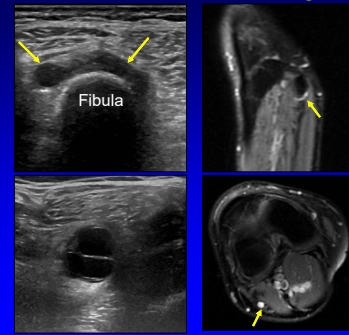
Spinner et al. Clin Anatomy 2007; 20:826



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

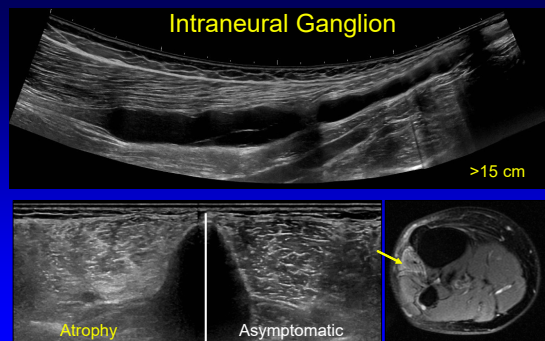
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Peroneal Intraneural Ganglion



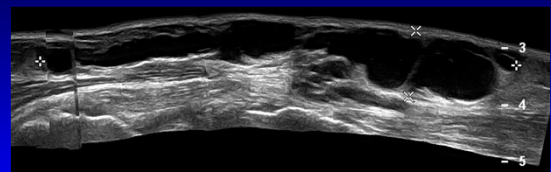
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Intraneural Ganglion

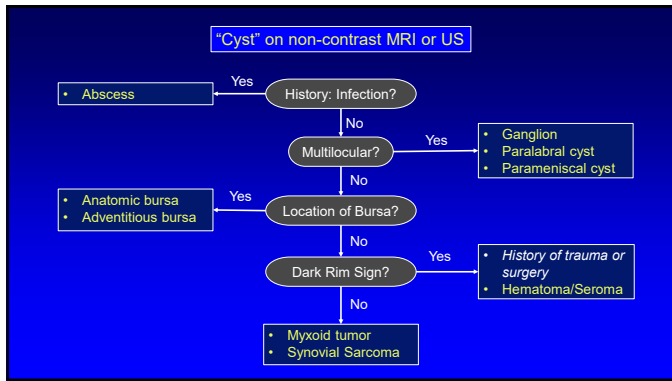


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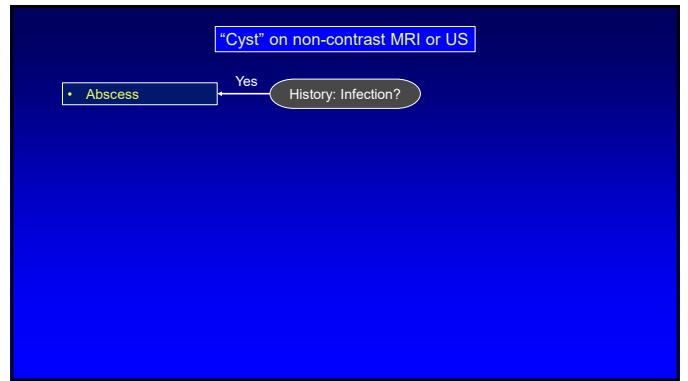
Ganglion Cyst: Tibiofibular Joint



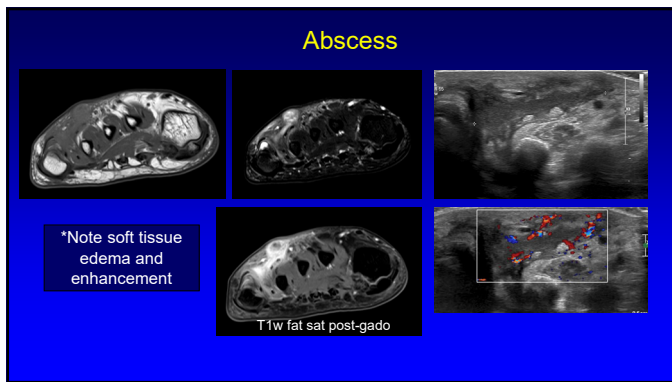
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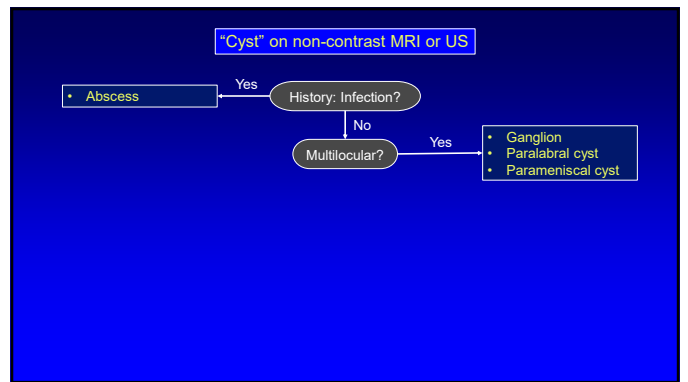
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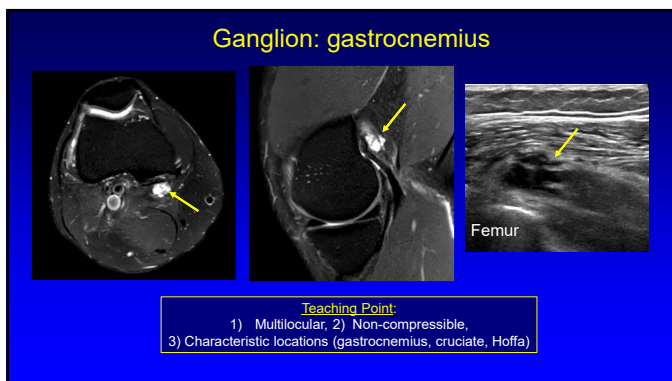
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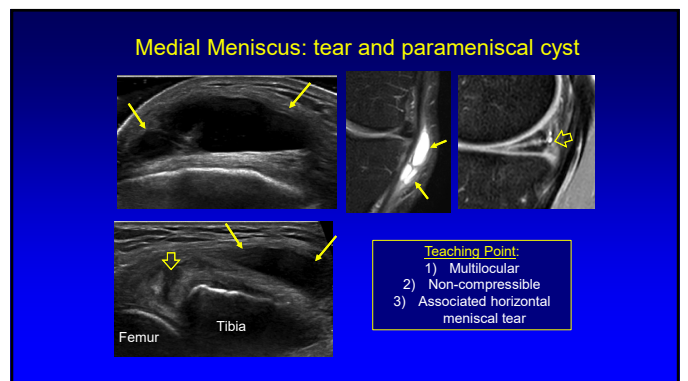
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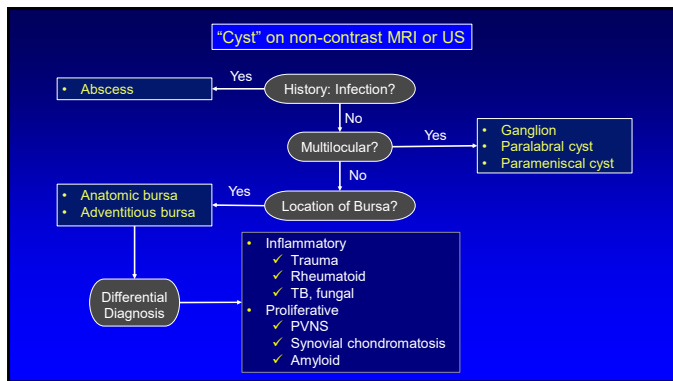
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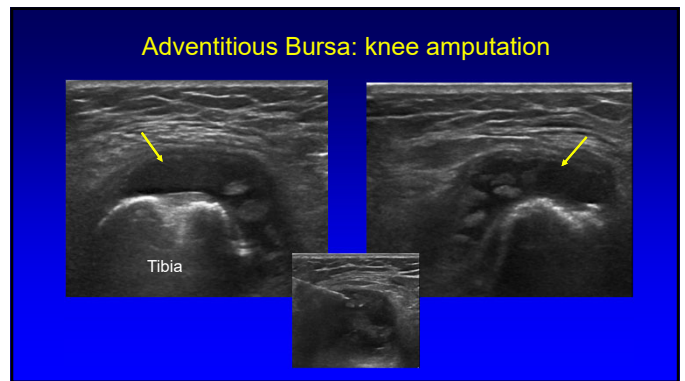
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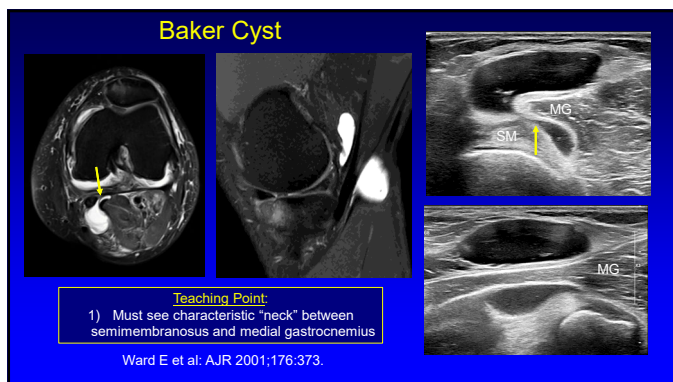
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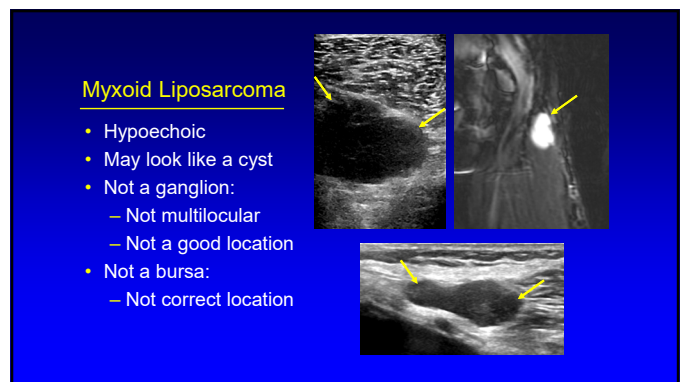
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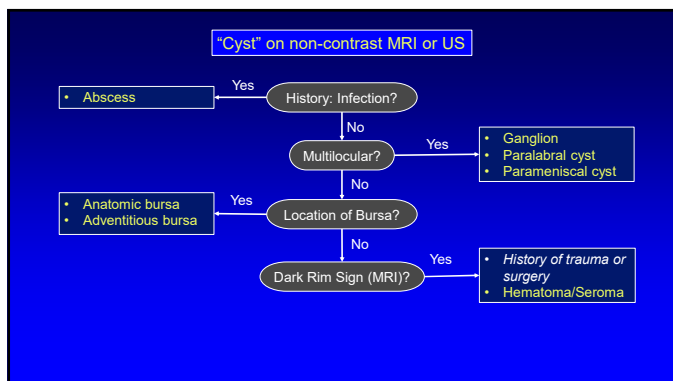
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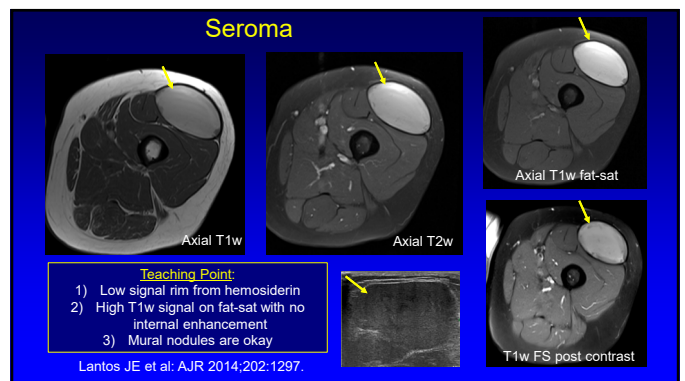
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Hematoma

- Acute: hyperechoic
- Subacute: hypoechoic
- Chronic: hypoechoic with internal echoes or anechoic

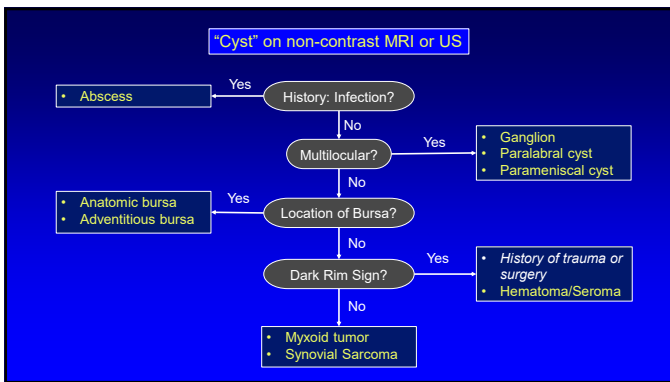
Teaching Points:

- 1) Often non-specific
- 2) May simulate tumor
- 3) History is important
- 4) MRI often needed

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Pitfall: malignancy simulating hematomas

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Intramuscular Myxoma

Teaching Point:

- 1) Low T1 signal and variable enhancement
- 2) US: increased through transmission
- 3) Location (thigh)

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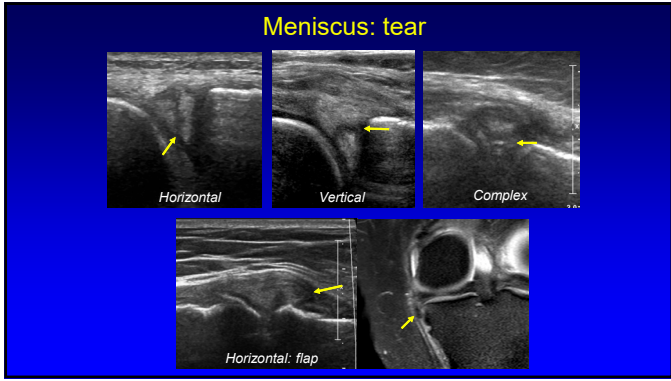
Outline

- Joint pathology
- Tendon pathology
- Cysts and bursae
- **Meniscus**
- Gout

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PHMM: degeneration

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Parameniscal Cyst

- Medial more common¹
- Anechoic or hypoechoic
- Extends to periphery of meniscus²
- Look for meniscal tear

¹AJR 2001; 177:409
²AJR 1998; 171:491

Femur Tibia

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Meniscus: Accuracy

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

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

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Osteoarthritis: meniscus extrusion

MCL Femur Tibia

Medial Meniscus

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Meniscus: chondrocalcinosis

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Outline

- Joint pathology
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Inflammatory Arthritis: gout

- Erosions: cortical irregularity
- Joint effusion
- Double contour sign:
 - Echogenic crystal layer over hyaline cartilage
- Tendon involvement:
 - Popliteus > patellar¹

¹Mallinson PI et al. Skeletal Radiol 2014; 43:277

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Gout: Double Contour Sign

Normal

Gout

CPPD

From: Thiele RG, Rheumatology 2007; 46:1116

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Gout: Double Contour Sign

Trochlea

Trochlea

Femur

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Tophi

- Hyperechoic heterogeneous with hypoechoic rim
- Tiny internal speckles*
- “wet clump of sugar” appearance
- Variable shadowing: even without calcification

MT

PP

Fernandes et al. Skeletal Radiol 2011; 40:309

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Gout: popliteus

Femur

Tibia

T2w

T2w

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Gout: patellar tendon

P

T

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Take Home Points

- Joint effusion:
 - Suprapatellar, medial, lateral recesses
- Popliteal cyst:
 - Must see neck or channel to diagnose!
- "Cyst" algorithm
- Meniscus
- Gout: double contour, tophus

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Thank you!



Syllabus on line and other educational material:
www.jacobsonmuskus.com



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