

Ultrasound of Soft Tissue Masses

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Syllabus

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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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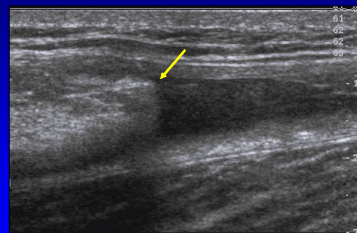
2

Question: tumor or pseudotumor?

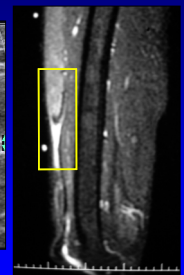
- Pseudotumors:
 - Tendon tear with retraction:
 - Rectus femoris, tibialis anterior
 - Muscle hernia
 - Anomalous muscle:
 - Accessory soleus
 - Extensor digitorum brevis manus
 - Rheumatoid nodule

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Rectus Femoris Tear: full tear, pseudomass



Long Axis



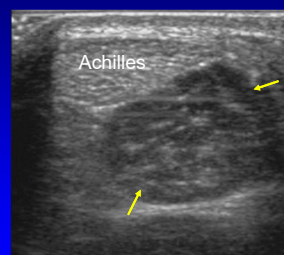
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Muscle Hernia: anterior tibialis

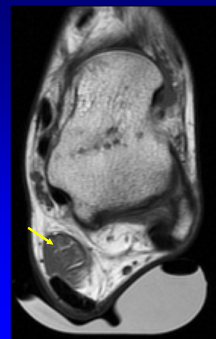


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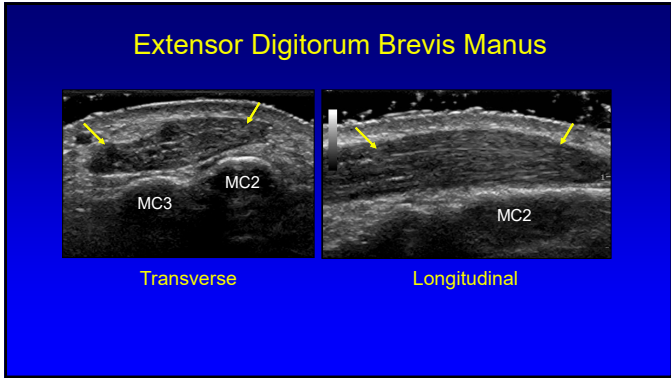
Accessory Soleus Muscle



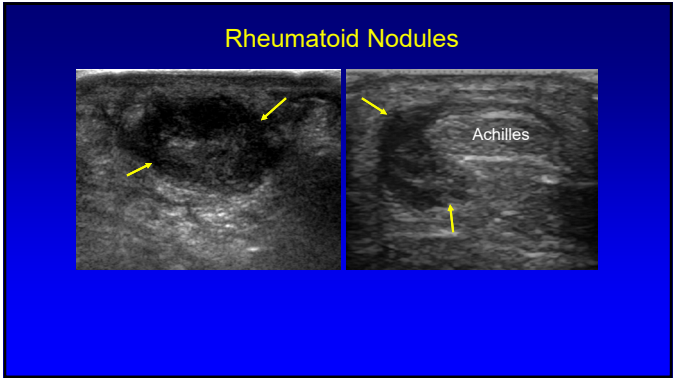
Transverse



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- ### Question: anatomic location?
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- Joint, tendon sheath, or bursal origin
 - Synovial: benign
 - Tendon
 - Gout
 - Osseous origin
 - Aggressive: infection or malignancy
 - Soft tissue origin
 - Variable etiology

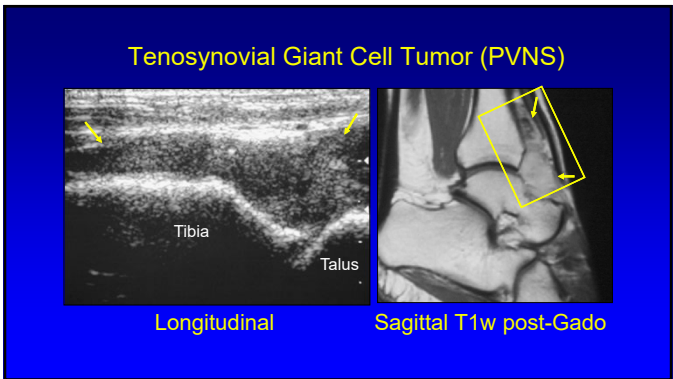
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- ### Outline:
-
- Joint recess
 - Bursa
 - Tendon
 - Lymph Node
 - Ganglion
 - Subcutaneous
 - Other

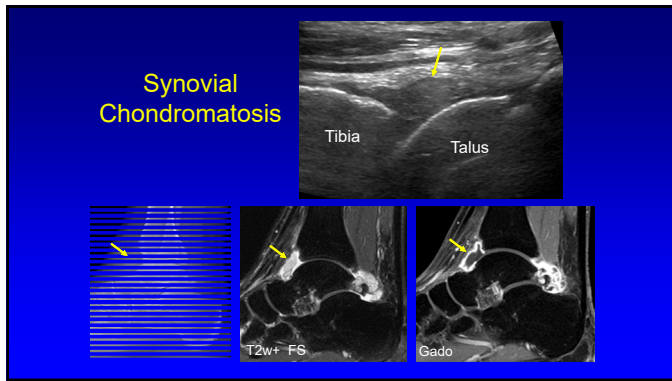
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- ### Synovial Disorders
-
- Inflammatory:
 - Atypical infection, gout, rheumatoid arthritis
 - Proliferative:
 - Tenosynovial giant cell tumor
 - (pigmented villonodular synovitis)
 - Localized nodular synovitis
 - Synovial chondromatosis
 - Lipoma arborescens
 - Synovial sarcoma rarely involves a joint

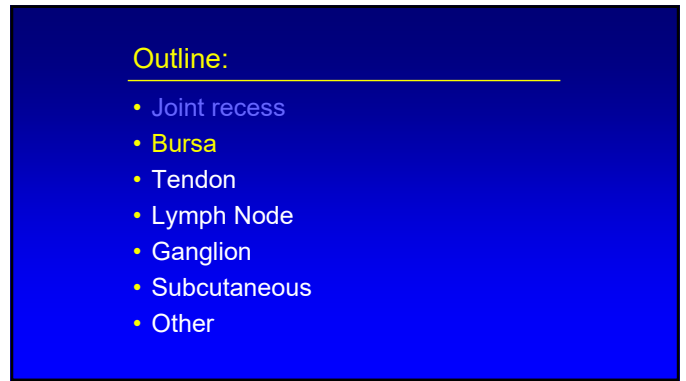
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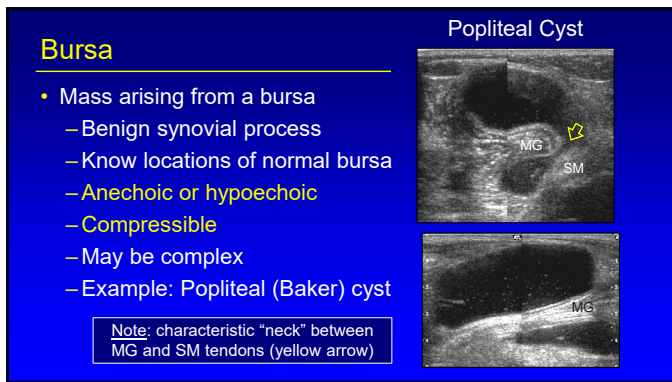
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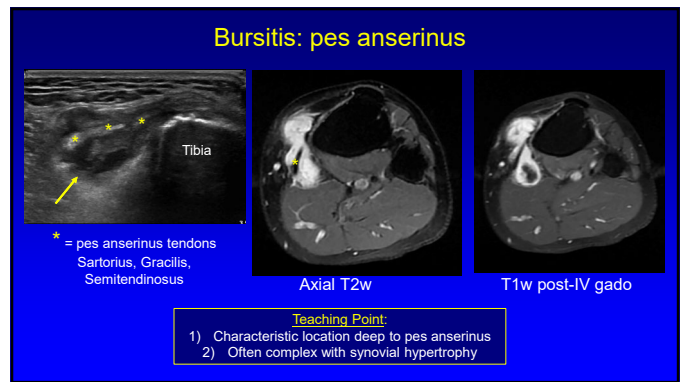
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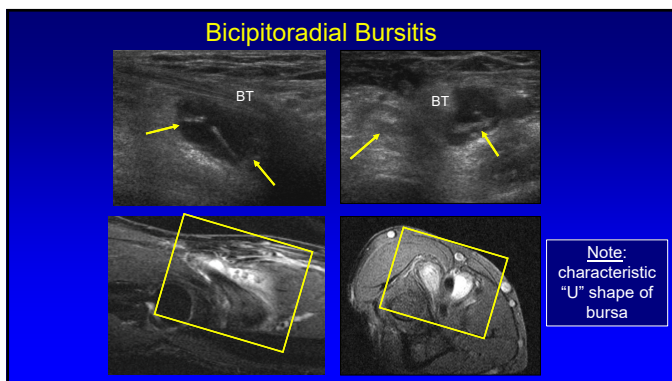
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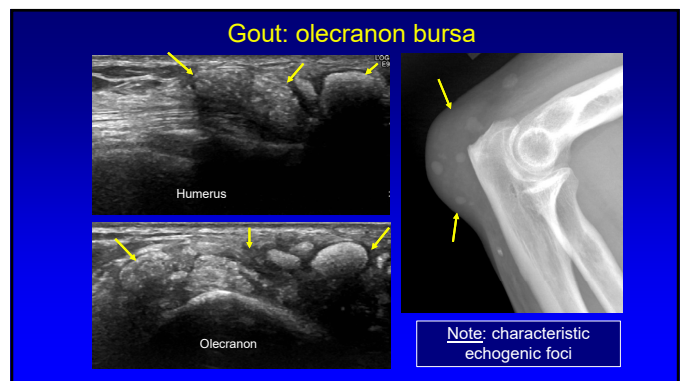
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Outline:

- Joint recess
- Bursa
- **Tendon**
- Lymph Node
- Ganglion
- Subcutaneous
- Other

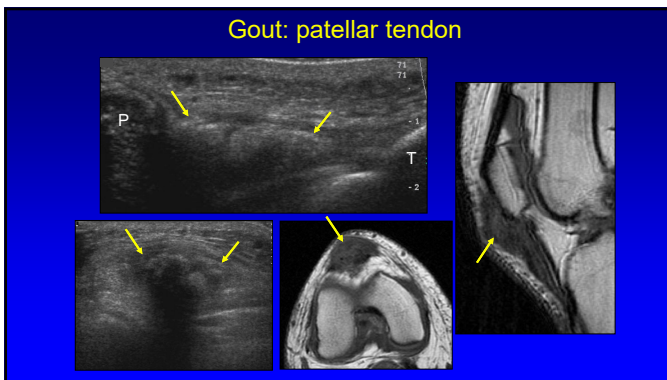
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Tendon

- Gout
 - Popliteus tendon: knee
 - Patellar tendon
 - Quadriceps tendon
- Tenosynovial giant cell tumor
- Pseudotumor:
 - Tendon tear and retraction
 - Rectus femoris, tibialis anterior

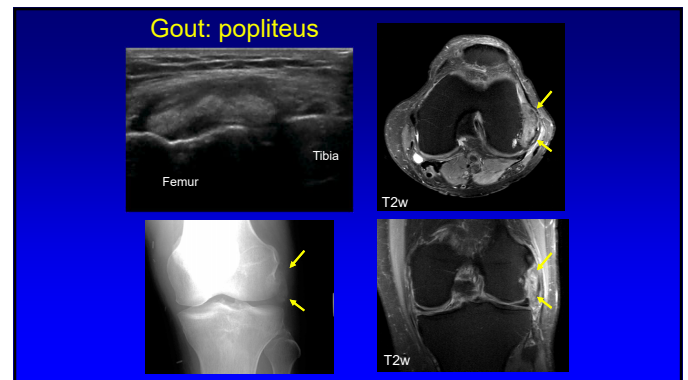
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Gout: patellar tendon



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Gout: popliteus

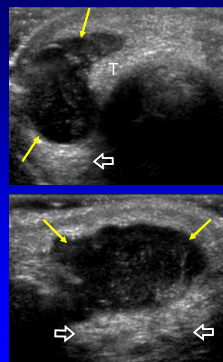


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Tenosynovial Giant Cell Tumor

- (Giant cell tumor of tendon sheath)
- Hypoechoic mass
- In contact with tendon sheath
- Does not move with tendon
- Increased through-transmission (open arrows)
- Possible hyperemia

Note: increased through-transmission



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Outline:

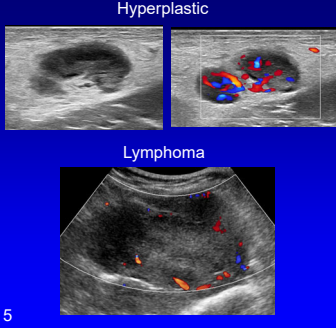
- Joint recess
- Bursa
- Tendon
- **Lymph Node**
- Ganglion
- Subcutaneous
- Other

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Lymph Node

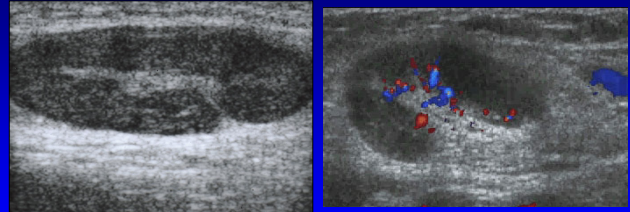
- Hyperplastic (or reactive):
 - Oval, hyperechoic hilum, hilar vascular pattern
- Malignant:
 - Asymmetric thick cortex
 - Round
 - Loss of hyperechoic hilum
 - Mixed vascular pattern

Vassallo et al. Radiology 1992; 183:215



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Lymph Node: reactive

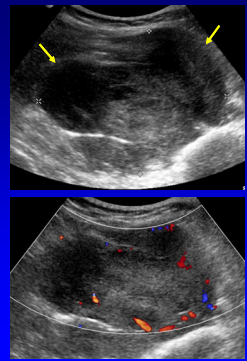


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Lymphoma: nodal

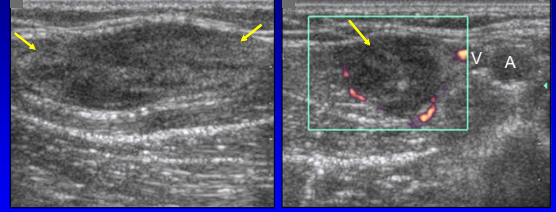
- Hypoechoic enlarged lymph node mass
- Malignant:
 - Round shape
 - Absence of echogenic hilum
 - Irregular vascular pattern

Vassallo et al. Radiology 1992; 183:215



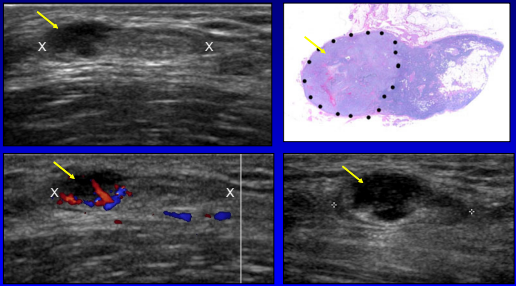
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B cell Lymphoma : axillary



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Lymph Node: angiosarcoma metastasis



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Outline:

- Joint recess
- Bursa
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- Ganglion
- Subcutaneous
- Other

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Ganglion

- Ultrasound features:
 - Hypoechoic
 - Multilocular
 - Not compressible
- Specific locations
- Differential: paralabral, parameniscal cysts

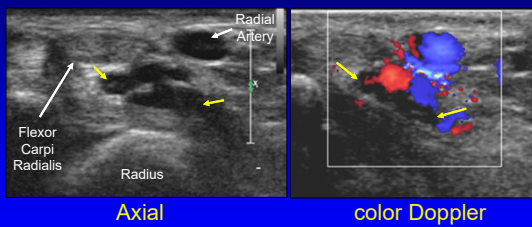
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Ganglia

- Wrist:
 - Volar: between radial artery and FCR
 - Most common site (69%)
 - Dorsal: over scapholunate ligament
- Knee:
 - Cruciates, gastrocnemius tendon
 - Hoffa fat pad
- Ankle: tarsal tunnel

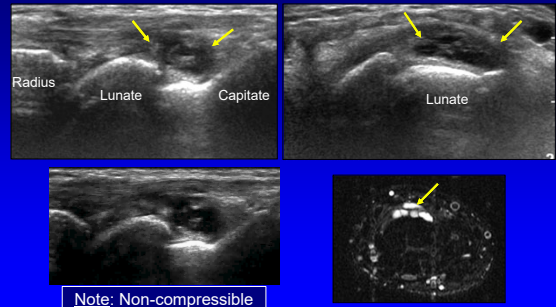
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Ganglion: volar wrist



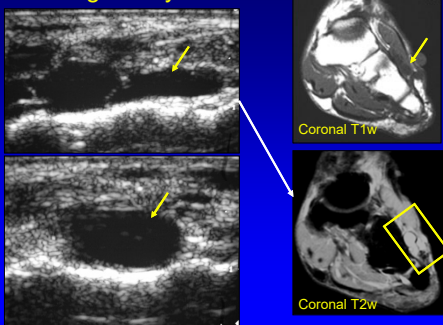
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Ganglion: dorsal wrist



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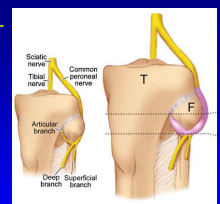
Ganglion Cyst



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Peroneal Intraneural Ganglion

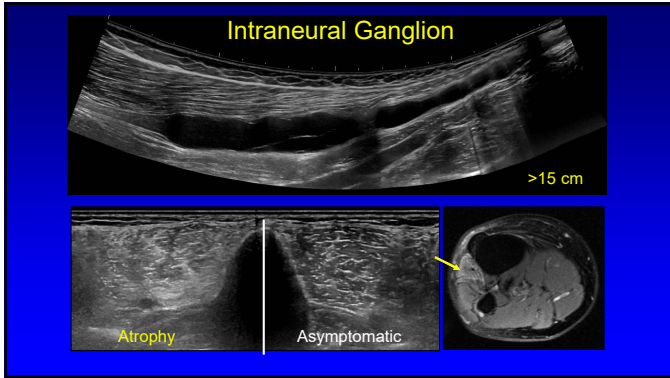
- Up to 22% of patients with foot drop
- Patients have high body mass index
- Joint fluid from proximal tibiofibular joint
 - Enters peroneal nerve via articular nerve branches
 - Shown at MR arthrography after exercise¹
 - Extends proximal via epineural sheath¹



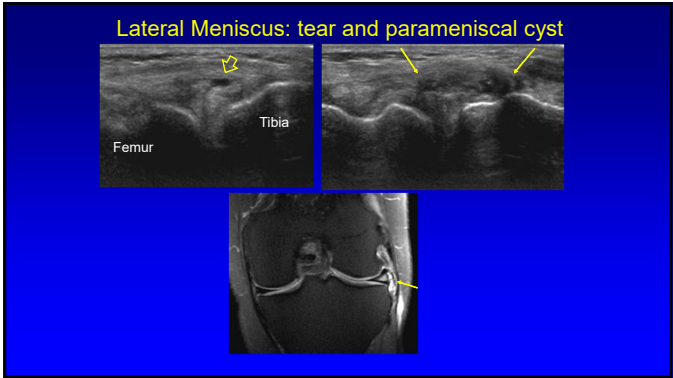
¹Spinner et al. Clin Anatomy 2007; 20:826

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

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- Outline:**
- Joint recess
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 - Tendon
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 - **Subcutaneous**
 - Other

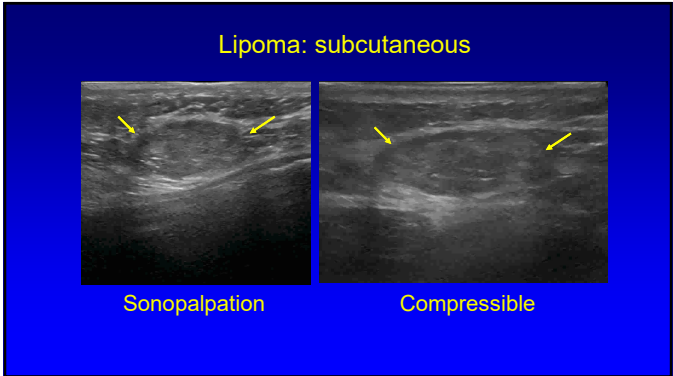
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- Subcutaneous Masses**
- Lipoma
 - Fat necrosis
 - Epidermal inclusion cyst
 - Other: benign versus malignant
- *Note: subcutaneous masses that are hyperechoic are almost certainly benign*
- Jacobson JA et al. Radiology 2022; 304:18

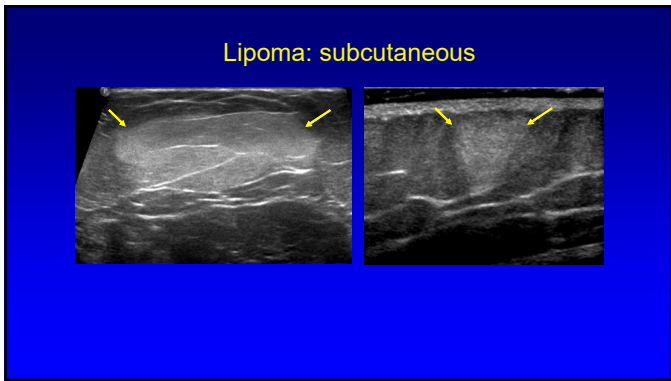
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- Lipoma: subcutaneous**
- Oval or oblong
 - Homogeneous
 - Isoechoic to adjacent fat
 - Hyperechoic:
 - With increased fibrous tissue components
 - No internal vascularity
 - Compressible
 - Clinically benign
-
- Inampudi et al. Radiology 2004; 233:763

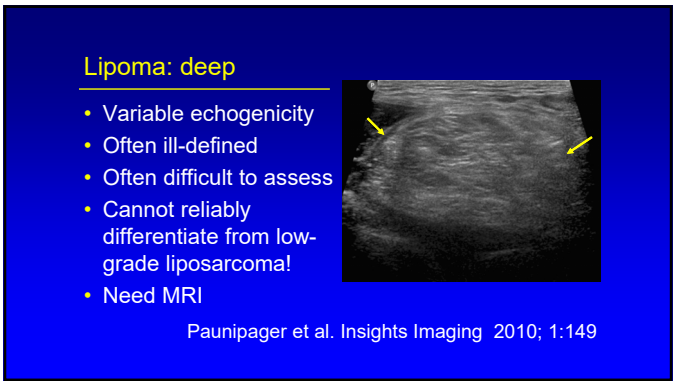
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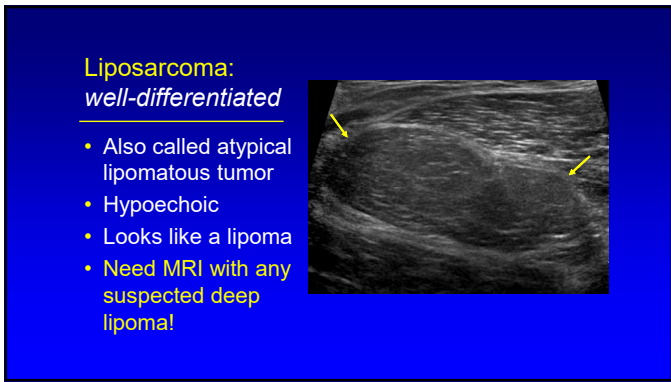
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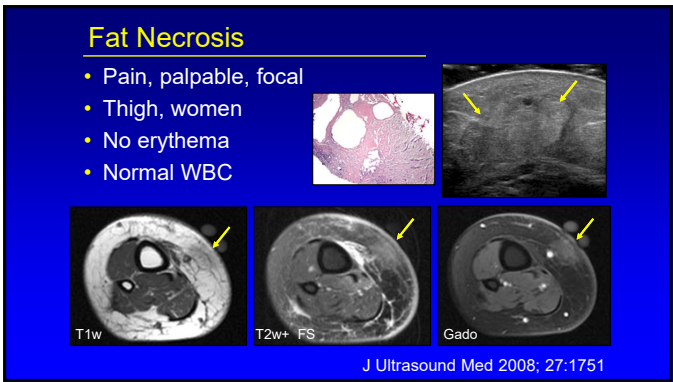
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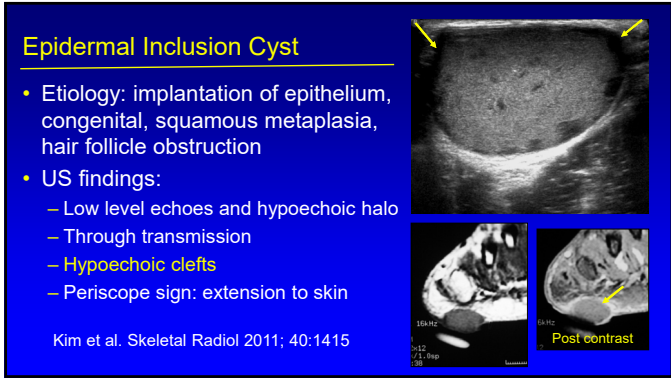
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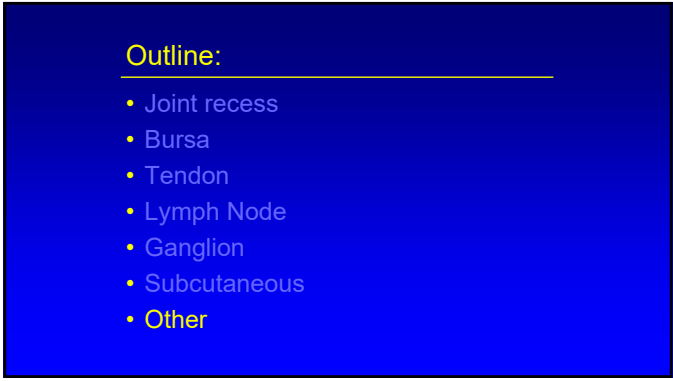
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Peripheral Nerve Sheath Tumors

- Schwannomas and neurofibromas appear similar at ultrasound
- Well-defined fusiform mass
- Hypochoic, internal low level echoes
- Peripheral nerve: entering and exiting
 - Split fat sign
 - Schwannoma: may be eccentric to nerve

Reynolds et al. AJR 2004; 182:741

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Peripheral Nerve Sheath Tumors

- Increased posterior through-transmission:
 - Simulate a complex cyst
- Hyperemia (unlike a cyst)
- Schwannomas may be heterogeneous:
 - Cystic: "ancient schwannoma"
- Target appearance:
 - Echogenic fibrous center
 - Peripheral hypoechoic mucinous rim

Reynolds et al. AJR 2004; 182:741

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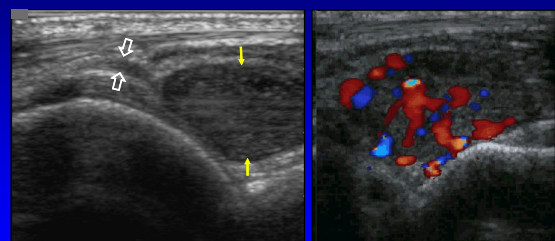
Schwannoma

- Benign peripheral nerve sheath tumor
- Presents: ages of 20 – 30 years
- Usually solitary
- Multiple: schwannomatosis
- Associated with neurofibromatosis Type I
- Histology: Antoni A and B regions

Murphey et al. Radiographics 1999; 19:1253

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Schwannoma: deep peroneal nerve branch

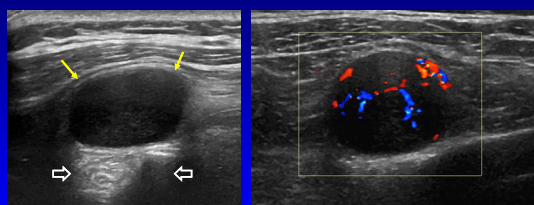


Longitudinal

color Doppler

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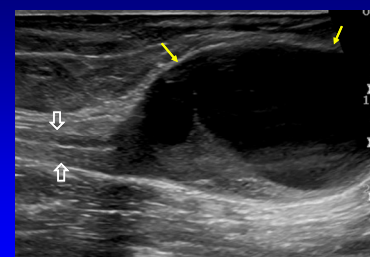
Schwannoma



Note: increased through-transmission

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Ancient Schwannoma



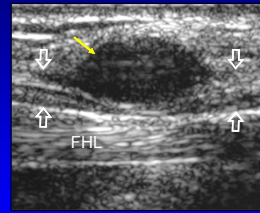
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Neurofibroma: 3 forms

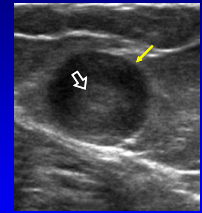
- Localized:
 - Less than 5 cm, painless
 - Plexiform:
 - Diffuse nerve trunk involvement
 - Diffuse:
 - Dermal and subcutaneous thickening
 - Neurofibromatosis Type I:
 - Dermal neurofibromas, café-au-lait spots
- Murphey et al. Radiographics 1999; 19:1253

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Peripheral Nerve Sheath Tumors



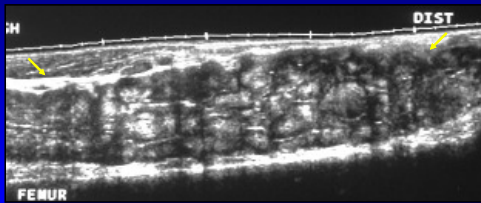
Schwannoma:
Eccentric to tibial nerve



Neurofibroma:
target appearance

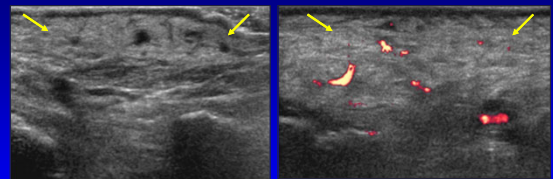
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Neurofibroma: plexiform



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Neurofibroma: diffuse



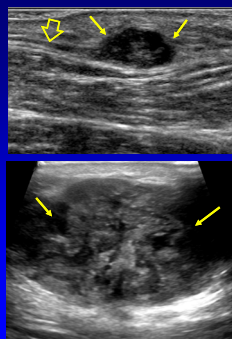
Subcutaneous, hyperechoic, interconnecting hypoechoic tubular or nodular structures, vascular

Chen W, J Ultrasound Med 2007; 26:513

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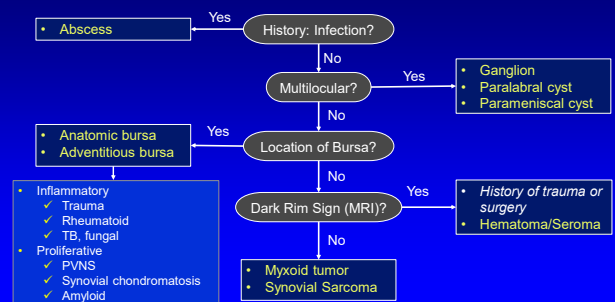
Malignant Peripheral Nerve Sheath Tumor

- Hypoechoic
- Heterogeneous
- Variable blood flow
- 25 -70%: NF 1 or prior radiation
- Rapid growth or increased pain



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"Cyst" on non-contrast MRI or US



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Abscess

Teaching Point:

1) Soft tissue edema, 2) Clinical findings

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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

Metastasis: Renal Cell Carcinoma

Sarcoma: high grade

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Synovial Sarcoma

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Myxoid Liposarcoma

- Hypoechoic
- May look like a cyst
- Not a ganglion:
 - Not multilocular
 - Not a good location
- Not a bursa:
 - Not correct location

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Metastasis

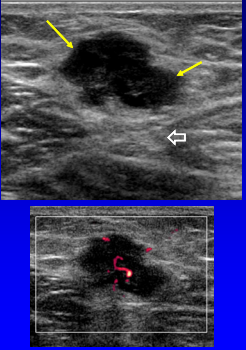
Squamous cell carcinoma

Note: increased through-transmission (open arrows)

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Melanoma

- Hypoechoic mass
- Usually increased flow on color Doppler
- Lymph node:
 - Focal cortical enlargement
 - Diffusely abnormal



Nazarian et al. AJR
1998; 170:459

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Take Home Points

- Key to differential diagnosis:
 - Specific anatomic location
- Joint and tendon: benign
- Bursa: key location, unilocular, compressible
- Ganglion: location, multilocular, not compressible
- Lipoma: subcutaneous, oval, compressible
- Malignancy: hypoechoic, heterogeneous

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REVIEWS AND COMMENTARY • STATEMENTS AND GUIDELINES

Radiology

Ultrasonography of Superficial Soft-Tissue Masses: Society of Radiologists in Ultrasound Consensus Conference Statement

Jon A. Jacobson, MD • William D. Middleton, MD • Sandra J. Allison, MD • Niravhar Dholji, MD • Kenneth S. Lee, MD • Benjamin D. Levine, MD • David P. Lucas, MD • Mark D. Murphy, MD • Loren N. Mazarian, MD • Geoffrey W. Siegel, MD • Jason M. Wiggins, MD

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Conflicts of interest are listed at the end of this article.

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The Society of Radiologists in Ultrasound convened a panel of specialists from radiology, orthopedic surgery, and pathology to write a consensus regarding the management of superficial soft-tissue masses imaged with US. The recommendations in this statement are based on analysis of current literature and common practice strategies. This statement reviews and illustrates the US features of common superficial soft-tissue lesions that may manifest as a soft-tissue mass and suggests guidelines for subsequent management.

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Thank you!



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