Ultrasound Appearance of Normal Muscle, Fat, and Nerve

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Fat
- Pure fat is echo free
- Increased fibrous tissue = increased echogenicity
- Differences in impedance at interfaces


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- Not relevant to this talk

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Lipomas
- Liposarcoma: well-differentiated
  - Hypoechoic
  - Looks like a lipoma
  - Need MRI with any suspected deep lipoma!

Fat
- Edema and inflammation
  - Increased echogenicity
  - Hoffa disease
    - Infrapatellar fat pad impingement
    - Panniculitis
    - Fat necrosis
  - Trauma: heterogeneous

Hoffa Disease
Heel Fat Pad Syndrome
Fat Necrosis
- Pain, palpable, focal
- Thigh, women
- No erythema
- Normal WBC

J Ultrasound Med 2008; 27:1751

Muscle
- Hypoechoic muscle fibers
- Hyperechoic fibroadipose layers
- Short axis: starry night appearance
- Long axis: pennate patterns

Peetrons P. Eur Radiol 2002; 12:335

Muscle Architecture
- Biceps Brachii
- Deltoid

Muscle Injury: mechanisms
- Stretch injury:
  - Elongation of a muscle during active contraction
  - Musculotendinous junction
  - Muscles that span 2 joints
- Direct impact:
  - Muscle belly: contusion, tear and hematoma
- Penetrating injury
- Grade 1, 2, and 3

Peetrons P. Eur Radiol 2002; 12:335
Blankenbaker. Semin Musculoskelet Radiol 2010; 14:176

Muscle-Tendon Injury: Tendon Formation
- Direct
- Peripheral
- Central

Biceps Brachii Tendon: complete tear

Long Axis

Blankenbaker. Semin Musculoskelet Radiol 2010; 14:176

 Courtesy of Robert Monaco, New Jersey
Medial Head of Gastrocnemius Tear

Long Axis

Short Axis

Rectus Femoris: central aponeurosis

Muscle: fatty infiltration

- Increased echogenicity
  - From interfaces
  - Differences in impedance
- Sound beam attenuation

Muscle: differential diagnosis

- Increased echogenicity:
  - Fatty degeneration / infiltration
  - Full-thickness tendon tear
  - Denervation
  - Edema (trauma)
  - Myositis
  - Fibrosis
- Hyperechoic, decreased size: atrophy

DOMS: delayed onset muscle soreness

Triceps Brachii: medial head

Deltoid

Beef Tenderloin

Strip Steak

Filet mignon when cut

Delmonico, New York Strip

Psoas muscle

Longissimus Coli

$19 USD/pound

$15 USD/pound

XX

Aponeurosis Tear (Indirect Head): Rectus Femoris

Short Axis

Long Axis
Semimembranosus: remote tear

Polymyositis: sartorius

Pseudohypertrophy
- Thigh: tensor fascia lata
- Denervation: spine, chronic
- Pseudomass appearance:
  - Enlarged muscle
  - Fat infiltration

Atrophy: supraspinatus and infraspinatus

No Atrophy

Normal Peripheral Nerve
- Ultrasound appearance:
  - Hypoechoic nerve fascicles
  - Hyperechoic connective tissue
- Transverse:
  - Honeycomb appearance

Median Nerve

- Proximal
- Distal
- Long Axis

Ulnar Nerve

- At hook of hamate
- Sensory branch:
  - Superficial to hook
  - One or two trunks
  - White arrows
- Motor branch:
  - Ulnar side of hook
  - Yellow arrow


Take Home Points

- Fat:
  - Hypoechoic
  - Increased echogenicity: many causes
- Muscle:
  - Muscle architecture: explains injury patterns
  - Increased echogenicity: many causes
- Peripheral nerves:
  - Hypoechoic fascicles
  - Short axis

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