Peripheral Nerve Ultrasound

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

Median Nerve

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

Median Nerve


Carpal Tunnel Syndrome:
• Proximal median nerve swelling
  – Area: circumferential trace
    – Normal: < 9 mm²
    – Borderline: 9 – 12 mm²
    – Abnormal: > 12 mm²
      • 12.8 mm² = moderate (83% sens, 95% spec)
      • 14.0 mm² = severe (77% sens, 100% spec)

Klauser AS et al. Sem Musculoskel Rad 2010; 14:487
Ooi et al. Skeletal Radiol 2014; 43:1387

Denervation
• Edema: hyperechoic
• Fatty degeneration:
  – Hyperechoic
  – Echogenic interfaces
• Atrophy:
  – Hyperechoic with decreased muscle size
• Compare to other side!


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Carpal Tunnel Syndrome

- Compare areas:
  - Proximal: pronator quadratus
  - Distal: carpal tunnel
- 2 mm² = carpal tunnel syndrome
- 99% sensitivity
- 100% specificity

Klauser AS. Radiology 2009; 250:171

Bifid Median Nerve + CTS

- Carpal tunnel syndrome
- Increase in cross-sectional area of ≥ 4 mm²
- Intraneural hypervascularity: 95% accuracy in diagnosis of CTS

Klauser et al. Radiology 2011; 259: 808
Maltouhi et al. AJR 2006; 186:1240

Postoperative Carpal Tunnel

- Discontinuous or thickened transverse carpal ligament
- Anterior displacement of transverse carpal ligament
- Median nerve size:
  - May decrease
  - Does not correlate with success

Naranjo A et al. Scand J Rheum 2010; 39: 49

Pronator Teres Syndrome

- Median nerve compression between humeral and ulnar heads
- Trauma, congenital, pronator teres hypertrophy
- Rare
- Forearm pain, numbness, weakness


Accessory Abductor Digiti Minimi

- Normal variant: 24%
- Origin: palmaris longus, flexor retinaculum, fascia
- Insertion: abductor digiti minimi
- Superficial to ulnar nerve
  - Nerve compression
  - Uncommonly interposed

Timins et al. AJR 1999; 172: 1397
Ulnar Nerve: cyclist wrist

- Sensory branch impingement between hook of hamate and bicycle handlebar
- Courtesy of EFW Radiology, Calgary, Alberta, Canada

Ulnar Nerve: cubital tunnel syndrome
- Hypoechoic and enlarged
  - > 9 mm² area
  - Ratio greater than 2.8 compared to proximal
- Mild hypoechogenicity alone: may be normal
- Causes:
  - Idiopathic, overuse, joint process
  - Anconeus epitrochlearis: compression
  - Normal variant accessory muscle

  1 Thoirs K et al. J Ultrasound Med 2008; 27:737
  2 Yoon JS et al. Muscle Nerve 2008; 38:1231

Isolated Ulnar Nerve Dislocation

Snapping Triceps Syndrome: dynamic imaging

Cubital Tunnel Syndrome
**Supinator Syndrome**

- Abnormal
- Normal

**Common Peroneal Nerve: entrapment**

**Supinator Syndrome**

- Abnormal
- Normal

**Peroneal Intraneural Ganglion**

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

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

**Peroneal Intraneural Ganglia**

- From: Spinner et al.
  - Skeletal Radiol 2008;37:1091
- From: Spinner et al.
  - Clin Anatomy 2007;20:826

**Artificial Intelligence Failure #21:**

Labradoodle versus Fried Chicken
Peroneal Intraneural Ganglion

Intraneural Ganglion

Muscle Hernia (extensor digitorum): superficial peroneal nerve entrapment

Ganglion Cyst: tarsal tunnel syndrome

Tarsal Tunnel Syndrome: Varices

Dynamic Evaluation

- Compression
  - Between transducer and palpation
  - Bursae (dorsal) compress, neuromas (plantar) do not
- Sonographic Mulder Sign
  - Scan plantar, coronal plane
  - Neuroma displaces plantar
  - Palpable click

Toriani M et al. AJR 2003; 180:1121
Zanetti M et al. Radiology 1997; 203:516
Take Home Points

- Entrapment neuropathies:
  - Hypoechoic edema and nerve enlargement at and proximal to the entrapment site
- Dynamic evaluation:
  - Ulnar nerve: elbow
  - Morton neuroma
  - Sonopalpation

Syllabus on line and other educational material:
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