Diagnostic Ultrasound of Peripheral Nerves

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Disclosures:
- Consultant: Bioclinica
- Book Royalties: Elsevier
- Advisory Board: GE, Philips
- Unpaid consultant for regular and sugar-free Red Bull products

Outline
- Normal ultrasound appearance
- Entrapment syndromes: knee
- Nerve trauma and transection neuromas
- Peripheral nerve sheath tumors

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


Volar Wrist: median nerve & flexors

Longitudinal

Median Nerve

Proximal

Distal

Longitudinal
Median Nerve

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Common Peroneal Nerve: entrapment

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

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
- May also form via tibial nerve

From: Visser et al. Neurology 2006; 67:1473
From: Spinner et al. Skeletal Radiol 2006; 35:172
Peroneal Intraneural Ganglion

Fibula

Intraneural Ganglion

Asymptomatic

Atrophy

>15 cm

Denervation

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

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Radial Nerve Compression: Saturday Night Palsy

Long Axis

Short Axis

Ulnar Nerve: cyclist wrist

Sensory branch impingement between hook of hamate and bicycle handlebar

Courtesy of EFW Radiology, Calgary, Alberta, Canada
Nerve Transection

- Hypoechoic and retracted nerve ends if complete
- Neuroma formation:
  - Disorganized and tangled nerve end
  - Normal response to nerve transection
- After amputation:
  - US important to determine if symptomatic

J Clin Ultrasound 1997; 25:85

Radial Nerve Transection: humerus fracture

Ulnar Nerve: injury from puncture wound

Stump Neuroma: knee

Transection Neuroma: sciatic

Transection Neuroma: brachial plexus
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Peripheral Nerve Sheath Tumor

• Benign:
  • Schwannoma (neurilemoma)
    • Solitary, <5 cm, flexor surfaces
  • Neurofibroma: 3 forms
    • Localized: 90%, painless, < 5 cm
    • Diffuse: subcutaneous, 90% associated with NF1
    • Plexiform: associated with neurofibromatosis
• Malignant

Murphy MD, RadioGraphics 1999; 19:1253

Peripheral Nerve Sheath Tumor

• Hypoechoic mass
• Nerve continuity (most important)
• Posterior acoustic enhancement
  • Possible pseudocyst appearance
• Neurofibroma
  • Central, fusiform, lobular, and avascular
• Schwannoma
  • Eccentric, possible calcifications, cystic

Reynolds D et al. AJR 2004; 182:741

Schwannoma

Note: increased through-transmission

Ancient Schwannoma

Neurofibromatosis

Localized

Plexiform
Neurofibroma: diffuse

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

Chen W. J Ultrasound Med 2007; 26:513

Malignant Peripheral Nerve Sheath Tumor

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

Take Home Points

- Nerve identification: short axis
- Entrapment: hypoechoic enlargement
  - Intraneural ganglion cyst
- Transection: neuroma formation
- PNST:
  - Nerve continuity, pseudocyst appearance
  - Cannot differentiate benign vs. malignant

See www.jacobsonmskus.com for syllabus and other educational material
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