Pathology of Knee Nerves

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Outline
- Nerve entrapment
- Intraneural ganglion cyst
- Nerve transection
- Peripheral nerve sheath tumors

Anatomy: common fibular (peroneal) nerve
- Forms at bifurcation of sciatic nerve with tibial nerve (L4, L5, S1, S2)
- Courses posterior to biceps femoris and fibula, wraps around fibular neck divides:
  - Superficial: peroneal muscles, sensory
  - Deep branch: anterior compartment muscles
- Gives off:
  - Lateral sural cutaneous nerve
  - Articular branches (3)

Anatomy: lateral

From: Netter’s Atlas of Human Anatomy

Common Fibular (Peroneal) Nerve

From: Netter's Atlas of Human Anatomy

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Common Fibular (Peroneal) Nerve:
- Entrapment
  - Between fibula and peroneus longus
  - Swollen, hypoechoic nerve
- Injury:
  - Direct trauma, laceration
  - Fibular fracture

Common Fibular Nerve: entrapment

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

J Ultrasound Med 1993; 2:73

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Intraneural Ganglion

- Pain: knee or peroneal nerve distribution
  - Possible palpable mass, fluctuating course
- 18% of those with foot drop\(^1\)
- No identifiable etiology
  - Weight loss, trauma, leg crossing
- High body mass index\(^2\)
  - Unlike other causes for peroneal neuropathy

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

Intraneural Ganglion

- Joint fluid from proximal tibiofibular joint
  - Enters fibular nerve via articular nerve branches
  - Shown at MR arthrography after exercise
  - Extends proximal via epineurial sheath\(^1\)
- May also form via tibial nerve\(^2\)

1Spinner et al. Clin Anatomy 2007; 20:826
2Spinner et al. Skeletal Radiol 2006; 35:172

Intraneural Ganglia

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

Fibular Intraneural Ganglion

Note: “signet ring” appearance

Fibular Intraneural Ganglion

Courtesy of Yoav Morag, Ann Arbor, Michigan

Fibular Intraneural Ganglion
Fibular Intraneural Ganglion

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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

Tibiofibular Joint Ganglion

- Nerve entrapment
- Intraneural ganglion cyst
- Nerve transection
- Peripheral nerve sheath tumors

Outline

J Clin Ultrasound 1997; 25:85
Stump Neuroma: knee

Longitudinal

Transverse

Transsection Neuroma: Common Fibular Nerve

Longitudinal

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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: radial nerve branch

Schwannoma: deep peroneal nerve branch

Ancient Schwannoma

Neurofibroma: deep branch of radial nerve

Note: increased through-transmission
Neurofibroma: deep branch of radial nerve

Transverse

Neurofibromatosis

Localized

Plexiform

Neurofibroma: diffuse

Subcutaneous, hyperechoic, 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

• Fibular nerve entrapment: fibularis longus
• Intraneural ganglion cyst
• Transection neuroma:
  – Correlate with symptoms
• PNST: nerve continuity

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