Electrodiagnostics for Back & Neck Pain

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Electrodiagnostics

• Electromyography (EMG)
  – Needle EMG exam (NEE)

• Nerve conduction studies (NCS)
  – Motor
  – Sensory
  – Late responses (H-reflex, F-wave)
What to expect during test
Why order:

• Confirm presence of radiculopathy
• Exclude peripheral nerve mimics
  – Entrapment neuropathy (carpal tunnel)
  – Polyneuropathy (Diabetic PN)
  – Plexopathy
• Determine root level(s), chronicity, severity
When to order:

• Physical exam findings don’t correlate with imaging
• Neuroimaging abnormality with unclear functional significance
  – 48% of EMG confirmed cervical radiculopathy patients had normal clinical neurologic exam  (Lauder, Arch PM&R 2000)
• Suspicion of peripheral nerve problem other than radiculopathy
Case 1

• 54 yo female neck pain, L arm pain + L hand tingling in thumb and all fingers x 4 months.

• PMH: breast Ca, mastectomy, nodes neg., no RT, disease free 10 years, no trauma

• Exam: local neck tenderness, normal neuro

• C spine MRI: mild canal + foraminal stenosis C4-5, C5-6
Case 1 Differential Dx

- Radiculopathy
- Plexopathy
  - Tumor recurrence
  - no radiation plexopathy
- Mononeuropathy/Entrapment
  - Median
  - Ulnar (less likely)
Case 1 cont’d

- NCS: prolonged median motor and sensory distal latencies, otherwise normal
- EMG: left UE and PSM normal
- Dx: left carpal tunnel syndrome
- Normal EMG does not “rule out” radiculopathy but makes it less likely
Common Low Back Causes of Radiculopathy

Lumbar Disk Herniation
- Low back pain
- Radicular symptoms
- EMG 1+ nerve roots
- Asymmetric pattern

Lumbar Spinal Stenosis
- Low back pain
- Neurogenic claudication = leg sx from walking or standing relieved by sitting or flexing
- EMG chronic multilevel nerve roots
- EMG Unilateral or bilateral
Needle EMG most important

• Looks for denervation
  – Fibrillations, positive sharp waves, reduced recruitment

• Or chronic reinnervation
  – Large amplitude long duration motor unit action potentials, polyphasic MUAPs early reinnervation

• 2+ muscles from same nerve root (myotome) but different peripheral nerves

• Normal muscles in adjacent myotomes
Nerve Conduction Studies

• Usually normal in radiculopathies
• Useful to evaluate differential dx
  – Carpal tunnel syndrome vs. C6, C7 radic
  – Peroneal neuropathy at fibular neck vs. L5 radic
  – Polyneuropathy vs. bilateral LS radiculopathy in lumbar spinal stenosis
H-reflex

- Becomes abnormal within days of onset of acute S1 radiculopathy (30% of LS radics)
- Ability to diagnose S1 radiculopathy early
- Unfortunately no H-reflex for L5 radiculopathy (48% of LS radics)
  - Sandoval, 2010
Case 2

- 36 y.o. male right low back & buttock pain radiating to calf and lateral foot for 2 months
- Exam: + right SLR, weak toe-rise on right, absent right ankle reflex, sensory loss right lat foot
- MRI: not done
Case 2 cont’d

• Nerve conduction studies:
  – right H-reflex no response
  – left H-reflex normal
  – tibial and peroneal motor normal
  – sural sensory normal
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Case 2 cont’d

• Impression: most consistent with subacute right S1 radiculopathy
• EMG abnormal in S1 myotome
• Gastrocnemius has no L5 innervation
• Paraspinals: why normal in radic?
  – First muscles to reinnervate and lose fibs
• Abnormal H-reflex
Timing of Electrodiagnostics

• Fibrillation (denervation) onset
  – 7-10 days paraspinal muscles
  – 3-6 weeks limb muscles

• Polyphasic MUAPs (early reinnervation)
  – 3 weeks proximal muscles, 3 months distal

• Large amplitude long duration MUAPs
  – 3 months proximal muscles, 6 months distal (Plastaras, 2011)
Sensitivity & Specificity

• No “gold standard” for diagnosing radiculopathy against which electrodiagnostics may be compared
• Correlation between neuroimaging and electrodiagnostics uncertain because of high incidence of imaging abnormalities in asymptomatic people
Surface EMG & nonspecific chronic low back pain (NCLBP)

- sEMG measures of flexion-relaxation distinguish low back pain from controls
- sEMG hold promise as objective marker of low back pain (Geisser, 2005)
- No defined role for guiding therapy at this point
Take Home Points

• most likely to benefit from electrodiagnostic evaluation
  – poor correlation between radicular symptoms and imaging
  – High chance of peripheral nerve mimic
    • Carpal tunnel syndrome vs. cervical radic
    • Peripheral polyneuropathy vs. lumbar spinal stenosis

• extension of clinical history and physical exam