Plexopathy/Radiculopathy

Holli A. Horak, MD
University of Arizona
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## Radiculopathy/ Plexopathy

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<th>Radiculopathy</th>
<th>Plexopathy</th>
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<td>Much less common</td>
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<td>Common referral to</td>
<td>High Index of suspicion</td>
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<td>EMG laboratory</td>
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<td>Referral may not mention plexopathy</td>
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<tr>
<td>Anatomy</td>
<td>“shoulder pain”</td>
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Plexopathy/ Radiculopathy

Definition

- **Plexopathy**
  - Distal to the ventral primary rami
  - Distal to the DRG
  - Proximal to the individual nerve

- **Radiculopathy**
  - Proximal to split of dorsal/ventral rami
  - Proximal to DRG
EMG/NCS correlation

**Radiculopathy**
- Abnormalities in Motor nerves supplied by that nerve root level
  - S1 radiculopathy
  - Tibial nerve
- Normal SNAP waveform
  - Lesion proximal to DRG

**Plexopathy**
- Multiple motor nerves affected
  - All peripheral nerves distal to plexus lesion
- SNAPS affected
  - Lesion is distal to DRG
Anatomy: Cervical Plexus: R-T-D-C-B

- **Roots:** C5-6-7-8-T1
- **Trunks:** Upper, middle, lower
- **Divisions:** 3 anterior and 3 posterior
- **Cords:** Lateral, Posterior, medial
- **Branches:**
  - Musculocutaneous, Median nerves
  - Axillary, Radial nerves
  - Ulnar, Median nerves
Stylized Brachial Plexus
Anatomy: Lumbar Plexus

- Ventral Rami L1-2-3-4 spinal nerves
- Anterior and posterior divisions
  - Posterior: Femoral nerve L2-3-4
  - Anterior: Obturator nerve L2-3-4
- Lumbosacral trunk:
  - L4 (some) and L5 ventral rami
    - Connect to sacral plexus
Anatomy: Sacral plexus

- Ventral Rami: S1-2-3-4
  - Plus Lumbosacral trunk (L4-5)
- Anterior and Posterior divisions
  - Anterior: Tibial nerve
    - L4-5-S1-2
  - Posterior: Common Peroneal nerve
    - L4-5-S1-2
  - Posterior:
    - Superior Gluteal nerve
    - Inferior Gluteal nerve
Plexopathy pathologies

- **Brachial Plexus**
  - Trauma
  - Neoplastic
  - Post radiation
  - Thoracic outlet
  - Idiopathic
  - Hereditary

- **Lumbosacral Plexus**
  - Trauma
  - Neoplastic
  - Post radiation
  - Retroperitoneal hemorrhage
  - Diabetic amyotrophy
  - Idiopathic
Etiologies of plexopathy: Trauma

- **Birth**
  - **Erb’s**
    - Upper trunk
      - Shoulder dystocia
      - High birth weight
  - **Klumpke’s**
    - Lower trunk
      - Breech position
      - arm 1st position
Etiologies: traumatic

- **Brachial plexus**
  - Falls w/ hyperextension
  - High impact trauma
  - **Nerve root avulsion**
  - Surgical

- **L-S plexus**
  - Pelvic fractures
EMG/NCS correlation

- Sensory studies:
  - Brachial plexus:
    - Medial Antebrachial Cutaneous
    - Lateral Antebrachial Cutaneous
- EMG: muscles
  - Arising from same nerve root level
  - But different peripheral nerve/ cord origins (if possible)
Brachial Plexus: Neoplastic

- Pancoast Tumor
  - Lower trunk/medial cord
  - Horner’s syndrome
    - Anhydrosis, miosis and ptosis

- Breast Cancer

- Lymphoma
  - Infiltration in nerve sheaths
Lumbosacral plexus: neoplastic

- Direct tumor spread
  - Colon Ca, Cervical Ca, Prostate
- Lymphoma
  - Nerve sheath spread
Post-radiation plexopathy

- Brachial and L-S plexii can be involved
- Difficult to distinguish from neoplastic
  - 5yrs post XRT
  - Subacute to chronic
  - Less painful
  - Myokymia
    - But not 100% specific!
Distinguishing post-XRT from neoplastic plexopathy

- PET scan/ MRIs /CTs spinal cord
- serial examination
- Look for other sites of metastasis
  - PET scan
  - Bone scan
  - Chest/abd CT
- Last resort: surgical exploration
Brachial plexus: Thoracic Outlet Syndrome

- True Neurogenic TOS
  - Lower trunk
  - Insidious
  - Hand muscle wasting
    - Thenar and intrinsic hand muscles
  - Sensory loss in C8-T1 distribution
- Cervical rib most common cause
Brachial Plexus: True TOS

- **NCS:**
  - absent Ulnar SNAP
  - Absent Medial Antebrachial Cutaneous SNAP
  - Reduced Median CMAP

- **EMG:**
  - abnormalities in Lower trunk muscles
Other Thoracic outlet syndromes

- **Arterial TOS**
  - Stenosis of subclavian artery
  - Ischemia in hand

- **Venous TOS**
  - Stenosis/occlusion of subclavian vein
  - Swelling of limb

- **Disputed Neurologic TOS**
  - Chronic aching and pain
  - No objective sensory or motor loss
Idiopathic etiologies

- Neuralgic Amyotrophy UE
  - Parsonage-Turner syndrome
  - Acute
  - Very painful
  - May be bilateral

- L-S plexus (non-diabetic)
  - Less common
  - auto-immune?
Hirayama disease: Monomelic amyotrophy

- Hirayama disease
  - progresses 1-5 yrs
    - Plateaus
  - Distal > proximal weakness
- O'Sullivan-McLeod syndrome
  - longer period of 25 to 40 years
- male predominant
  - Arm > leg
  - Typically 1 limb
Etiologies: Hereditary

- Brachial plexopathy
- HNA: Hereditary Neuralgic Amyotrophy
  - NABP: Neuralgic amyotrophy w/ Brachial plexopathy
  - Septin 9 gene
    - Gene locus 17q25
    - AD
Etiologies: vascular

- Lumbosacral plexus
- Retroperitoneal hematoma
  - Hyperacute weakness and pain
    - May have drop in Hb
  - Hospitalized setting
  - Traumatic
L-S plexus: Diabetic Amyotrophy

- Acute weakness/ pain/ sensory loss
  - Asymmetric
  - But can be bilateral

- Painful
  - Sensory loss as well as direct nerve pain

- Weakness
  - Femoral nerve/ Quadriceps most affected
  - Patients often report “knee buckling”
NCS/EMG correlation: Diabetic Amyotrophy

NCS
- Low amplitude CMAP
  - Proximal lesion
- Sural may be spared
- Side to side comparison

EMG
- Femoral nerve most affected
  - Active denervation
  - Quadriceps
- Paraspinals may be involved
Diabetic Amyotrophy

- Etiology: ?
  - Associated w/ abrupt change in glucose control
  - Perhaps vascular (ischemic)
  - Perhaps inflammatory
- Acute treatment
  - None proven
    - Trial of IV solumedrol
    - May control pain and/or speed recovery
- Chronic treatment
  - Typically spontaneous recovery (but prolonged!)
Plexopathy vs. Radiculopathy

- Can there be an overlap between Plex- and Radiculopathy?
  - Yes
  - Eg. L-S plexus
    - Dorsal rami can be affected in diabetic amyotrophy
    - “lumbosacral radiculoplexoneuritis”
Study Design: Radiculopathy

- Brief examination
- Motor nerves:
  - Carry fibers from suspected nerve root involved
  - Compare to unaffected nerves
    - contralateral studies
- Sensory nerves
  - Should be unaffected
Study Design Radiculopathy

- EMG
- >1 muscle
  - Innervated by that nerve root level
  - Supplied by different peripheral nerves
- Ie.
  - Biceps: C5-6 musculocutaneous
  - Deltoid: C5-6 axillary
Study Design: Plexopathy

- NCS
- Affected motor nerves
- Affected sensory nerves
  - Originate from cords
    - LABC
    - MABC
- May need side to side comparison
Study Design: plexopathy

- EMG
- 2 or more muscles
  - affected portion of plexus
  - Different peripheral nerve
- Compare to unaffected muscles
  - Same nerve root origin, but different plexus route
  - Same peripheral nerve but different plexus route
Example Study Design: Medial Cord Plexopathy

- Median/ Ulnar Motor
  - Side to side comparison

- Median, Ulnar and Medial Antebrachial Sensory studies
  - Median should be unaffected

- EMG
  - Median: ABP, PT, FCR
  - Ulnar: FDI, FCU
  - Radial: EI, EDC
  - Dorsal Rami: paraspinals
Nerve Root avulsion

- **Ventral nerve root**
  - Clinical: acute weakness
  - Complete paralysis in affected nerve root distribution

- **Significant trauma**
  - High velocity injury
    - Fall
    - Motorcycle
# Nerve Root Avulsion: EMG Changes

<table>
<thead>
<tr>
<th>Type</th>
<th>Duration</th>
<th>Motor NCS</th>
<th>Sensory NCS</th>
<th>Fibs</th>
<th>Pos waves</th>
<th>MUPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperacute</td>
<td>1-3 days</td>
<td>NL</td>
<td>NL</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Acute</td>
<td>7-20 days</td>
<td>absent</td>
<td>NL</td>
<td>0</td>
<td>+/-</td>
<td>None</td>
</tr>
<tr>
<td>Subacute</td>
<td>1-5 mos</td>
<td>Absent</td>
<td>NL</td>
<td>++</td>
<td>++</td>
<td>None</td>
</tr>
<tr>
<td>Chronic</td>
<td>&gt; 6 mos</td>
<td>Absent</td>
<td>NL</td>
<td>++++</td>
<td>++++</td>
<td>None</td>
</tr>
</tbody>
</table>

*Incl: Incl PSP, Inc: Inc PSP*

*Dorsal Rami is involved*
Summary:

- **Radiculopathies**
  - Common referral to EMG laboratory
  - SNAPs should remain intact
  - Careful EMG planning
    - Detect abnormalities in affected root
    - Exclude problems in unaffected roots
Summary: Brachial Plexopathies

- Consider this for any proximal pain/weakness referral
  - In UE: Idiopathic Brachial plexopathy
  - LE: Diabetic amyotrophy
- Must differentiate from radiculopathy
  - Use Sensory studies
  - EMG