Brachial Plexus and Plexopathy

Andy Brown, MD
Overview

• 1. Anatomy
• 3. Case presentations
• 4. Summary
Anatomy

• The plexus is formed by the union of the ventral rami of the C5-C8/T1 spinal nerves
  • Sometimes the C4 is involved (pre-fixed)
  • Sometimes the T2 is involved (post-fixed)

• The plexus forms the three major (median, radial, ulnar) and several lesser nerves (i.e. musculocutaneous and suprascapular,)
ANTERIOR PRIMARY RAMI

SEGMENTAL NERVE

POSTERIOR PRIMARY RAMUS

ANTERIOR PRIMARY RAMUS
Anatomy: supraclavicular plexus

- The ventral rami of C5/6 fuse to form the upper trunk
- The ventral rami of the C8/T1 form the lower trunk
- The ventral rami of the C7 form the middle trunk
- This occurs above the level of the clavicle
  - The supraclavicular plexus is composed of the roots and the trunks
  - The anatomy at this level maintains a segmental pattern
Anatomy: retroclavicular plexus

• The trunks separate into 6 divisions
• Each trunk divides into an anterior (three total) and posterior division
Anatomy: infraclavicular plexus

• The three posterior divisions fuse to form the posterior cord
• The anterior divisions of the upper and middle trunk form the lateral cord
• The anterior division of the lower trunk continues to become the medial cord
• Pathology at or below the infraclavicular plexus is sorted into patterns
Anatomy: Below the cords

- Below the cords the named nerves arise
- The median nerve forms from the fusion of the branches of the lateral and medial cords
- The musculoutaneous nerve arises from the lateral cord
- The axillary and radial nerves come off the posterior cord
- The ulnar nerve comes off the medial cord
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Common Etiologies of Plexopathy

• Trauma: Newborn, Operative, Compression, Dislocation
• TOS: Thoracic Outlet Syndrome
• Neoplastic
  • Primary: Shwannoma, neurofibroma, perineuroma
  • Secondary: Metastatic
• Radiation:
• Immune: Neuralgic Amyotophy (parsonage-turner)
• Hereditary: HNPP, Hereditary plexopathy
• Ischemic: Medial Brachial Fascial Compartment syndrome
• Infectious: Zoster, Lyme
• Toxic: Heroin
Case 1: The student with the slippery right hand
Slippery right hand

• MS is an 18 year old right handed woman who presents for evaluation regarding the slow development of a right hand muscle wasting and weakness. She was unsure of the exact onset, however her boyfriend noticed that her hand became, “slippery,” and was difficult to hold about six months prior. At the same time her teachers noticed her handwriting was changing and she complained of pain with writing. Three weeks prior she was in her pediatricians office for a stomach ache and the right hand was noticed and she was sent for a neurological consultation.
Slippery right hand

- Past Medical History: ADHD
- Past Surgical History: None
- Allergies: None
- Medications: None
- SH: She is a good student without any admitted use of alcohol, drugs or tobacco.
- FH: Diabetes and hypertension
- ROS: Intermittent numbness of the hand on several occasions
Slippery right hand

• Neurological Examination
• MS: Normal
• CN: Normal
• Motor: There was decreased bulk in the right ABP, FDI, and all intrinsic hand muscles to a severe degree. There was absent movement in the ABP, 1/5 in the FDI, 3/5 in the EIP. Deltoids, biceps, triceps, EDC were all 5/5. The FPL was 2/5. The left upper extremity and bilateral lower extremities were within normal limits.
Slippery right hand
Slippery right hand
Slippery right hand

• Sensory Examination: There was decreased sensation in the medial forearm in addition to the medial palm, 4\textsuperscript{th} and 5\textsuperscript{th} digits and dorsal hand below the 4\textsuperscript{th} and 5\textsuperscript{th} digits with decreased sensation also in the 4\textsuperscript{th} and 5\textsuperscript{th} digits.

• Coordination: Normal

• Reflexes: 2+ in the bilateral biceps, triceps, br, knee and ankle jerks. Bilateral down-going toes. Intact finger flexors on the left. Absent finger flexor reflex on the right.

• Gait: Intact
UMN vs LMN

• Question 1:

  • A. Upper Motor Neuron (UMN)
  • B. Lower Motor Neuron (LMN)
  • C. Both
Slippery right hand

• Question 2: The primary site of this patient’s pathology is:
  • A. The cervical spinal cord
  • B. The right C8 root
  • C. The median nerve at the wrist on the right
  • D. The left sensory cortex
  • E. The right ulnar nerve above the elbow
  • F. The lower trunk of the right brachial plexus
Slippery right hand

Question 2: Based on your localization for this patient’s lesion, please explain the significance of the patient’s distribution of weakness?

________________________________________________________________________

________________________________________________________________________
Slippery right hand

• Please select from the following the best first/s test to order in the patient and in the space below explain your rationale. Chose only one

• A. MRI of the Cervical Spine
• B. EMG/NCS of the right upper extremity
• C. MRI of the Brain
• D. EMG/NCS of the bilateral upper extremities
• E. MRI of the right brachial plexus
Slippery right hand

• NCS/EMG: There was electrophysiological evidence for a right sided lower trunk brachial plexus lesion
Lower Trunk Brachial Plexus lesion

Andy Brown, MD
## Sensory NCS

<table>
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<tr>
<th>Nerve / Sites</th>
<th>Rec. Site</th>
<th>Onset ms</th>
<th>NP Amp μV</th>
<th>Segments</th>
<th>Distance cm</th>
<th>Velocity m/s</th>
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**Needle EMG (Ch 2)**

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<td>1+</td>
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Slippery right hand

- Pathology: Sclerotic Perineuroma
Case 2
Case 2

• DV is a 31 year old man with a past history of schizophrenia, hypertension and morbid obesity who presented for evaluation due to severe shoulder/neck pain and weakness.

• He explained that while lifting weights 4 months prior he noticed a severe pain in the right shoulder for several days followed very quickly by significant atrophy of the muscles of the shoulder.

• Nothing helped his pain despite Vicodin and Flexeril
Case 2

- Past Medical History: hypertension, Schizophrenia, Morbid Obesity
- Past Surgical History: Laser eye surgery
- Allergies: None
- Medications: Geodon
- SH: ½ PPD smoking for 12-15 years, No ETOH, No Drugs
- FH: hypertension
- ROS: Intermittent numbness of the hand on several occasions with certain positions
Case 2

• Neurological Examination
• MS: Normal
• CN: Normal
• Motor: There was decreased bulk in the right infraspinatus and supraspinatus with severe weakness 1/5. The left upper extremity and bilateral lower extremities were within normal limits.
Case 2

- Sensory Examination: Normal
- Coordination: Normal
- Reflexes: Normal
- Gait: Intact
EMG/NCS

• The Nerve conduction study was normal
• The EMG was consistent with a right sided suprascapular neuropathy.
MRI
Muscle signal abnormality involving the supraspinatus and infraspinatus muscle bellies
Acute Brachial Plexus Neuropathy=
Neuralgic Amyotrophy= Parsonage
Turner Syndrome
Acute Brachial Plexus Neuropathy

• Can occur at any age
• The pain is usually:
  • Acute
  • Severe
  • Continuous
  • Worse with movement
  • Many will develop musculoskeletal pain
  • The pain usually lasts for 4 weeks
  • Can only last 4 hours
• The weakness can appear with 24 hours or take up to a month to occur
  • Any muscle can be involved but the serratus anterior, infra/supra spinatus, biceps and deltidoid are most common
• Sensory abnormalities are generally much less pronounced.
Treatment

- Oral vs IV steroids has been shown to decrease pain and improve recovery if administered within the first 31 days
- Physical Therapy