Radiculopathy vs. Peripheral Neuropathy

What to do with arm pain?

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Defining Arm Pain

- **Timing**
  - Acute
  - Chronic

- **Location**
  - Generalized
  - Specific

- **Types**
  - Aching
  - Burning
  - Lancinating

Arm Pain

- Is it from the cervical spinal nerve roots?
- Is it from the brachial plexus?
- Is it from peripheral nerve entrapment?
- Are weakness and sensory loss present?
What Do We Mean by Peripheral Neuropathy?

- Peripheral neuropathy is a disorder of the nerves that carry information to and from the brain and spinal cord. This can produce pain, loss of sensation, and weakness.

- Most peripheral nerves have motor and sensory functions.

- Peripheral neuropathy may affect a single nerve (mononeuropathy) or multiple nerves (polyneuropathy).

What Do We Mean by Radiculopathy?

- Radiculopathy – a condition in which one or more spinal nerves, e.g. C6, are affected and do not function properly.

- The emphasis is on the spinal nerve root (Radix = "root").

- This can result in radiating pain (radicular pain), weakness, numbness, decreased reflexes, or difficulty controlling specific muscles.

Causes of Peripheral Neuropathy

- Injury
  - Compression
  - Laceration

- Systemic disease
  - Diabetes

- Infection, inflammation
  - AIDS

- Exposure to poisonous substances
  - Sniffing glue
  - Excessive alcohol use

- Drugs
  - Chemotherapy
What Causes Arm Pain?

Diagnosis and Treatment Relies Upon

- Identification of the nerve affected
- Site of injury
- Severity of the injury

Anatomy - Cervical Root

- The cervical nerves are the spinal nerves from the cervical spinal cord.
- There are eight cervical nerves (C1-8).
- Posterior distribution includes the paraspinal muscles.
- Anterior distribution leads to the brachial plexus (C5-C8/T1).

Anatomy - Brachial Plexus

- The brachial plexus is a complex network of nerves extending from the spinal nerve (roots) into the neck and down into each arm.
- This nerve network controls movement and sensation in the
  - Shoulder
  - Arm
  - Wrist
  - Hand
  - Fingers
Anatomy - Brachial Plexus

- 5 Roots (C5 – T1)
- 3 Trunks
  - Superior/Upper
  - Middle
  - Inferior/Lower
- 6 Divisions
  - 3 anterior
  - 3 posterior
- 3 Roots
  - Lateral
  - Posterior
  - Medial
- 6 Terminal Branches/Peripheral Nerves
  - Musculocutaneous
  - Axillary
  - Radial
  - Median
  - Ulnar

Anatomy - Terminal Branches

- Musculocutaneous Nerve (C5,6,7)
- Axillary Nerve (C5,6)
- Radial Nerve (C5,6,7,8,T1)
- Median Nerve (C5,6,7,8, & T1)
- Ulnar Nerve (C8 & T1)

What Causes Arm Pain?
Diagnosis and Treatment Relies Upon

- Identification of the nerve affected
- Site of injury
- Severity of the injury
Anatomy - Nerve Injury

- **Neurapraxia**
  - Interruption of the nerve conduction without interruption of nerve or its myelin sheath

- **Axonotmesis**
  - Interruption of the axon with interruption of the myelin sheath but no interruption of the nerve itself

- **Neurotmesis**
  - Most severe form of nerve injury – interruption of the axon along with encapsulating connective tissue and or transection of the nerve

Principles Based on Anatomy

- Each peripheral nerve is composed of fibers from more than one spinal nerve root.
- Each spinal nerve contributes to more than one peripheral nerve.

Peripheral Nerve Anatomy Implies

- Weakness and severe atrophy of muscles innervated by a specific peripheral nerve
- “Hard” borders of sensory disturbances in the distribution of a specific peripheral nerve
Cervical Root Anatomy Implies

- Weakness – of muscles innervated by that nerve root
- Pain – in the distribution of that nerve root, dermatomal sensory disturbances and neck pain
- Sensory changes – numbness and tingling / paresthesias outlined by that specific dermatome
- Decreased reflexes – affected by that nerve root

Sensory Distribution
Peripheral Nerve vs. Dermatome

How to Clinically Diagnose the Cause of Arm Pain

- Understand the Relevant Anatomy
- Listen to the Patient
- Directed Physical Exam
History

- Quality and timing of injury/symptoms
  - Motor disturbance – onset, location, severity
  - Sensory disturbance – onset, location, severity
  - Paresthesias – type, location
  - Pain – onset, location, severity, type

Physical Examination

- Inspection
- Vascular
- Range of Motion
- Motor
- Sensation
- Reflexes
- Tinel’s

Physical Examination: Inspection

- Bruises / abrasion / laceration
- Swelling
Physical Examination: Inspection
- Atrophy
- Horner’s syndrome

Physical Examination: Vascular
- Pulse
- Swelling
- Color

Physical Examination: Range of Motion
- Passive Range of Motion (PROM)
- Active Range of Motion (AROM)
- Contractures
Physical Examination: Motor Function

- Voluntary movement
- Power
- Characteristic postures
- Reflexes

Physical Examination: Sensation

- Paresthesia (numbness, tingling, pricking, pins and needles of a limb)
- Allodynia (pain resulting from a stimulus which would not normally provoke pain)
- Anesthesia (sensation blocked)

Physical Examination: Tinel’s Sign

- Is a way to detect irritated nerves.
- Is performed by lightly tapping (percussing) over the nerve to elicit a sensation of tingling or “pins and needles” in the distribution of the nerve.
- Takes its name from French neurologist Jules Tinel.
So, What is the Cause of Arm Pain?

- Cervical radiculopathy
  - C6

- Peripheral (entrapment) neuropathy
  - Median Neuropathy / CTS

- Brachial plexopathy
  - Upper Trunk

Cervical Radiculopathy

- Incidence of cervical radiculopathy is about 85/100,000.
- Cervical radiculopathy is a dysfunction of a cervical nerve root.
- C7 radiculopathy ~ 60%
- C6 radiculopathy ~ 25%

C6 Cervical Radiculopathy History

- Neck pain – acute or chronic
- Radicular pain – exacerbated by movement, specific posturing of the neck
- Weakness in the distribution of myotome
C6 Cervical Radiculopathy
Physical Examination

- Motor deficit – elbow flexion, wrist extension
- Sensory deficit – in C6 dermatome/ the thumb/ neck pain from the paraspinals
- Decreased reflexes – Biceps brachii, brachioradialis

Peripheral Neuropathy
Median Neuropathy
(Carpal Tunnel Syndrome)

- Incidence - 50/1000 in the US; women > men 3:1; age 45-60
- Etiology - compression of the median nerve in the carpal tunnel.

Carpal Tunnel Syndrome
History and Physical Examination

- Nocturnal pain and paresthesia relieved by "flicking"
- Symptoms evoked by hyperflexed wrist and repetitive motion
- Motor – weakness and atrophy of the thenar eminence
- Sensory - pain, numbness and tingling in radial 3 ½ fingers
### C6 Radiculopathy

| Motor deficit: | Motor - deficit weakness /atrophy of thenar eminence (the thumb) |
| Sensory deficit: | Sensory deficit - pain, numbness and tingling in radial 3 ½ fingers |
| Decreased reflexes: | Nocturnal pain and paresthesia relieved by “flicking” |
| Decreased reflexes: | Symptoms evoked by hyperflexed wrist and repetitive motion |

### Peripheral Neuropathy

#### Brachial Plexus

- **Upper Trunk Brachial Plexus Palsy**
  - C5, C6 - Roots affected
  - Decreased shoulder abduction
  - Decreased elbow flexion
  - Decreased forearm supination
  - Fingers and hand function normal

### Brachial Plexus Injury – Variable Signs and Symptoms

- **Motor**
  - Weakness - variable distribution and severity because of the complexity of the brachial plexus
  - For example: mild weakness in biceps and profound weakness in the hand
- **Sensory**
  - Variable: hypesthesia, paresthesia, anesthesia and pain
- **Reflexes**
  - Lost or decreased
Brachial Plexus Palsy

History of Birth
- 7 lb 4 oz
- Hand movement only at birth
- Uncomplicated pregnancy

Initial Evaluation
- 3 months of age
  - Minimal shoulder activity
  - Minimal external rotation
  - No elbow flexion
  - No supination of the hand
Ancillary Studies

- Electrophysiologic studies
  - EMG
- Radiologic studies
  - CT – myelogram
  - X-ray
  - U/S

Graft Repair

C5 - suprascapular nerve
C5 - posterior division of upper trunk
C6 - anterior division of upper trunk

BP Post - Surgical Management

- Splint to protect repair / reconstruction
- Assist and promote normal function of the child within limits of the splint
- Parent education with respect to splint care
- Continue OT/PT after braced is D/C(6-8 wks.)
Summary
Diagnosing PN Lesions vs. Radiculopathy

- Knowledge of motor and sensory distribution of the cervical nerve roots and peripheral nerves is essential in order to correctly diagnose and treat arm pain.
- Careful, directed physical examination is the most useful diagnostic test.
- Do NOT rely on imaging alone.
- Obtain ancillary (electrophysiologic, radiologic) studies when needed.
Take Home Points

- Muscle atrophy / severe weakness is often more prominent with peripheral nerve lesion than with radiculopathy.

- Boundaries of peripheral nerve sensory deficits are “harder” and more exact than those of cervical radiculopathy.

Thank You!

Resources