Post-traumatic Entrapment Neuropathies

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Definitions

• Entrapment = compression
  – Nerve dysfunction secondary to focal compression
  – Sensory symptoms
  – Motor symptoms
• Symptoms do not always follow their atraumatic analog
  – Pain is primary symptom of ulnar n. entrapment at the elbow
• Acute carpal tunnel syndrome
• Forearm fx and nerve entrapment
• Elbow trauma
  – Compression
  – Incarceration
  – Tardy ulnar nerve palsy

Seddon Vs. Sunderland

<table>
<thead>
<tr>
<th>Seddon</th>
<th>Sunderland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuropraxia</td>
<td>1º – conduction block</td>
</tr>
<tr>
<td>Axonotmesis</td>
<td>2º – axon damage</td>
</tr>
<tr>
<td>Neurotmesis</td>
<td>3º – endoneural damage</td>
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<tr>
<td></td>
<td>4º – perineural damage</td>
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<tr>
<td></td>
<td>5º – epineural damage</td>
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</tbody>
</table>

Seddon, 1943
Post traumatic entrapment neuropathy

- Recognition
  - Establish a baseline status
  - ‘NVI’ does not count
  - MUST assess pre-intervention
  - This is a distinct condition from a traumatic injury/palsy
- Assessment
  - Examination
  - Judicious application of diagnostic studies
- Treat
  - What is the natural history??
  - Could be observation
  - Could be surgical

Acute Carpal Tunnel Syndrome (aCTS)

- Open at both ends
  - Behaves like a closed compartment
- Trauma leading cause
  - Distal radius fx
  - Carpal fx/dis
  - Index/Long CMC fx/dis

- Risk Factors
  - Initial fracture displacement (translation > 50%)
  - Ipsilateral upper extremity injury
  - Immobilization in flexion (Cotton-Loder position)
    - >40° flexion = 47mmHg
- Diagnosed almost exclusively on history alone
  - Progressively worsening paresthesias
  - Sensory threshold vs 2-point discrimination (>15mm)
  - Thenar intrinsic weakness

aCTS- distal radius fx


aCTS- …or Contusion?

<table>
<thead>
<tr>
<th></th>
<th>aCTS</th>
<th>Contusion</th>
<th>Premorbid CTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onset of symptoms</strong></td>
<td>Delayed</td>
<td>Immediate</td>
<td>Predate</td>
</tr>
<tr>
<td><strong>Natural course</strong></td>
<td>Progressive &amp; worsens</td>
<td>Stable &amp; improves</td>
<td>Can progress</td>
</tr>
<tr>
<td><strong>Pressures</strong></td>
<td>Elevated</td>
<td>Not elevated</td>
<td>?</td>
</tr>
</tbody>
</table>

Always consider compartment syndrome

Mack, et al, 1986

aCTS- treatment

- Urgent decompression
  - Delay > 14-40 hours associated with poor outcome
- How?
  - Closed reduction
  - Neutral immobilization
  - Loosen splint/cast
  - Surgery
  - Single incision approach for volar plating is possible
- Patients treated promptly for aCTS recover well


Forearm fractures & ulnar nerve

- Ulnar nerve runs between FCU and FDP down middle/distal 1/3 forearm
  - Scar entrapment
  - Distinct from ulnar n palsy from impaling spike of ulna or post-reduction entrapment
- Progressive signs
- Often warrants neurolysis

Elbow trauma & nerve entrapment

- Late ulnar nerve entrapment
  - Presenting weeks after injury and treatment
    - Pain at the medial elbow with loss of movement!!
    - Neurological signs and symptoms not always present
    -Electrodiagnostics may demonstrate entrapment
    - 'Inching' NCS/EMG best
- Incarceration post reduction of dislocation
  - Ulnar and median nerve
  - Immediate recognition may allow for neurolysis alone
- Tardy ulnar nerve entrapment (cubitus valgus/varus)


Median n entrapment post elbow dislocation & reduction

Tardy ulnar nerve palsy

- Cubitus varus
  - Pediatric supracondylar or medial condyle
  - Ulnar n. pushed forward by triceps
  - Olecranon closer to medial epicondyle
    - Compression between medial intermuscular septum & medial epicondyle
    - Compression at the FCU aponeurosis
  - Pain and neurological symptoms
- 10-15 years after deformity
  - Not related to severity of the deformity

Tardy ulnar n.- Rx

- Electrodiagnostics generally positive
- Treatment is surgical
  - Neurolysis of ulnar nerve with transposition
    - Resect distal medial intermuscular septum
  - Consider corrective osteotomy
  - Consider treating the medial triceps
    - Corrective osteotomy can correct
    - Excision portion against the nerve
    - Lateral transposition
    - Medial epicondylectomy


What about nerve tests?

- Understand the two components
  - NCS tells you about speed/amplitude
    - Important for entrapment
  - EMG tells you about innervation integrity
- You may not have the luxury of obtaining
  - aCTS & rapidly evolving entrapment
- Be picky about the study you order
  - ‘Inching’ study for ulnar nerve?
- More important in assessing traumatic injury

So…what to do with fractures and nerve entrapment/compression?

- Make pre & post assessments
  - Distinguish from ‘known’ palsies
- Explore early if...
  - Progressive symptoms begin within first hours/days
    - There is no data supporting conservative mgmt.
- Explore later if...
  - Symptoms manifest after days/weeks
    - Utilize electrodiagnostics
- Surgical tips
  - Role of artificial nerve guards?
Thank you