

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

Seddon

Sunderland

- Neuropraxia ↔ 1^o – conduction block
- Axonotmesis ↔ 2^o – axon damage
- 3^o – endoneurial damage
- 4^o – perineurial damage
- Neurotmesis ↔ 5^o – epineurial damage

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

Szabo, et al, 1983; Gelberman, et al, 1983; Szabo & Chidgey, 1989; Jhattu, et al, 2012; Tosti & Ilyas, 2012



aCTS- distal radius fx

- 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


Gelberman, et al, 1984; Mack, et al, 1986; Dyer, et al, 2008; Jhattu, et al, 2012



aCTS- ...or Contusion?



	aCTS	Contusion	Premorbid CTS
Onset of symptoms	Delayed	Immediate	Predate
Natural course	Progressive & worsens	Stable & improves	Can progress
Pressures	Elevated	Not elevated	?


Always consider compartment syndrome

Mack, et al, 1986 

aCTS- treatment

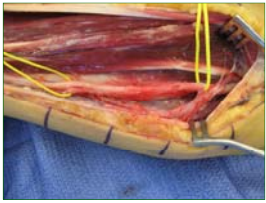
- Urgent decompression
 - Delay > 14-40 hours associated with poor outcome
- How?
 - Closed reduction
 - Neutral immobilization
 - Loosen splint/cast
 - Surgery
 - Single incision approach for volar plating is possible
- Patients treated promptly for aCTS recover well





Ford & Ali, 1986; Mack, et al, 1994; Pency, et al, 2010; Gwathmey, et al, 2010; Chauhan, et al, 2012) 

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



Stahl, et al, 1997; Suganuma, et al, 2012 

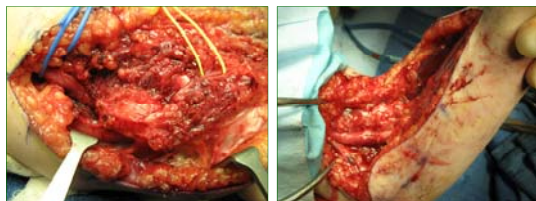
Elbow trauma & nerve entrapment

- 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)

Rao & Crawford, 1995; Fairman, et al, 2001; Hamdi, et al, 2008; Reed 2012



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



Ogino, et al, 1986; Abe, et al, 1995; Spinner, et al, 1999; Jeon, et al, 2006; Shimizu, et al, 2011



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

Ogino, et al, 1986; Abe, et al, 1995; Spinner, et al, 1999; Jeon, et al, 2006



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?

