EMG Exam for Brachial Plexus Injuries, etc.
William S Pease, M.D.
Case 1
32 yo F Left Shoulder Pain

- Non-helmeted passenger on small MC hit by SUV at intersection
- Mod TBI
- Sensation-slight decr lateral forearm
- Strength
  - Elb Flex 3+ (brachioradialis prominent)
  - Sh Abd 4
  - Sh Ext Rot 4
  - El ext, Wr ext, hand = 5

9 d post-injury
Differential Diagnosis

- Brain, motor pathways
- Brachial Plexus
- Axillary and/or musculocutaneous nerve
- Cervical radiculopathy (C5, C6)
- Painful shoulder/arm, “giving way”

Case 1
32 yo F Left Shoulder Pain
- Motor-NCS (6 wk post-injury)
- L Musc-Cut (Biceps) No Response
- L Axillary (Delt) 2.5 ms 0.15 mV
Axillary Nerve

- Deltoid response
- Amp=0.15 mV
- Duration ?
Musculocutaneous Nerve Motor

Musculocutaneous Nerve Motor Non-Response

- Increase gain
- Increase stimulus
- “Have to try to get a response!”
- Eventually see triceps response
### Case 1
32 yo F Left Shoulder Pain

#### EMG Summary Table

<table>
<thead>
<tr>
<th></th>
<th>Spontaneous</th>
<th>MEAP</th>
<th>Recruitment</th>
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</table>

- Exam limited by patient cooperation, brain-injury related disinhibition and pre-existing personality
- Have not resolved the C5,C6 radic possibility, but she had no neck pain and a acute CT scan of C-spine was OK
Case 1
32 yo F Left Shoulder Pain

**Repeat exam** 14 weeks post injury
Strength elbow flexion 4-4+, Sh Abd 5-
(Cognition seemed intact during the exam’s interaction)

M-NCS
L Mus-Cut (Biceps) 4.2 ms 0.7 mV

<table>
<thead>
<tr>
<th>Side</th>
<th>Muscle</th>
<th>Nerve</th>
<th>Root</th>
<th>Fibs</th>
<th>Ptw</th>
<th>MUP Amp</th>
<th>Dur</th>
<th>Poly</th>
<th>Rect</th>
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<td>Min</td>
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</tbody>
</table>

Case 1
32 yo F Left Shoulder Pain

- 14 wk post injury
- L Biceps Br
- CMAP
- Strength now
  Elb Flx= 4/5
Case 1
32 yo F Left Shoulder Pain
• S-NCS
• L Lat antebrachial 1.4 ms 6 µV
• Suggests possible neurapraxia
• Others tested were normal
• Poor exam tolerance and behavior (TBI)
  limited exam

Musculocutaneous Nerve Sensory
• Normal values (26)
  (10-cm distance) (n 213)
• Peak latency ≤ 2.6 ms
• Onset to peak
  Amplitude ≥ 3 µV
Case 1
32 yo F Left Shoulder Pain

- 14 wk post injury
- L Biceps Br
- Monopolar 25mm

Video = PolyMUPBrPlnjjHI

Case 1
32 yo F Left Shoulder Pain

14 wk post injury
L Biceps Br
Monopolar 25mm

Video = RecrBicBrPlnjj
Case 1
32 yo F Left Shoulder Pain

- Traumatic left supraclavicular brachial plexus injury
- Upper trunk injury with severe axon loss
- 1st exam demonstrates sparing of some MUPs and that neurotmesis has not occurred
Case 2
58 yo M Right shoulder Pain
- 5 mon h/o Rt hand weakness, paresthesia small finger
- No h/o trauma
- Spurling sign +/- (pain with motion)
- Weakness of hand grasp, pinch and intrinsics
- Normal shoulder and elbow strength
- Normal reflexes

Differential Diagnosis
- C8 Radiculopathy
- Neck pain, osteoarthritis (DJD)
- Brachial Plexopathy
  - Idiopathic plexitis
  - Tumor, eg, Pancoast
- Ulnar neuropathy
Case 2
58 yo M Right shoulder Pain

- S-NCS Lat (ms) Amp (µV)
  - R Median (D1) 2.6 24
  - R Ulnar 2.1 3*
  - R DUC NR
  - R Med AB cut 2.0 20
  - L Med AB cut 1.8 10

Case 2
58 yo M Right shoulder Pain

- M-NCS Lat Amp NCV F lat
  - R Median APB wr 3.5 14.5 30.9
  - Elb 14.3 52.2
  - R Ulnar ADM wr 3.1 8.0 32.5
  - BE 6.1 50.0
  - AE 5.3 50.0
  - R Ulnar FDI wr 3.8 9.7
  - BE 8.8 50.0
  - AE 8.4 55.6
Case 2
58 yo M Right shoulder Pain

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Case 2
58 yo M Right shoulder Pain

- EDX Rt Medial cord including its median motor fibers, but not med antebrachial
- Imp: Infra-clavicular brachial plexus injury
- Dx Ca Right lung upper lobe
Case 2
58 yo M Right shoulder Pain

PET scan, Routine CXR & MR unremarkable

Case 2
58 yo M Right shoulder Pain

• When sensory amplitude reduction is the prominent finding, suspect brachial plexus pathology and root injury as less likely.
• Temporal dispersion of the ulnar motor response, and mild delay of ulnar F wave are also consistent.
• Don’t fixate on finding PSW in paraspinals -this is common and does not exclude additional pathology.
5 Roots, 3 Trunks, 3 Cords, & 5 Nerves

Supraclavicular Plexus

Location According to Sensory Nerve Response (SNAP)

- Normal response in insensate area is bad news.
- Absent response suggests plexus injury.
- Partial response with partial strength is good news.
**Brachial Plexus Trauma Paradox**

- Supraclavicular injuries tend to be more severe and have worse outcomes.
- Upper trunk injuries recover better than lower trunk because distance to muscle is shorter for re-innervation, among other reasons

**Prognosis According to Motor Nerve Response (CMAP)**

- At 10 to 15 days post-injury, Compare with contralateral nerve (or reference value)
- If loss is <50%, Prognosis is Excellent
- If loss is 50-80%, Prognosis is fair to good (more than 20% of axons survive)
- If loss is >90%, Prognosis is poor
Exercise in Rehab
After Nerve Injury

• 1. Maintain motion/flexibility

• 2. Avoid strenuous progressive resistive exercises (no 10RM-DeLorme exercise)
  – No exercise to fatigue
  – Avoid eccentric exercise
  – Adapt to reduce frequency of eccentric work in ADLs

The KEY word
About axon loss

- AMPLITUDE
- AMPLITUDE
- AMPLITUDE
- AMPLITUDE
- AMPLITUDE
Brachial Plexopathy

* Sensory NCS is a key component of assessment
  – Med ABC, Ulnar, Median (3), Radial, Lat ABC
* Motor NCS are less sensitive, but amplitudes give more info about prognosis for motor recovery

Myokymia

* Frequently associated with radiation induced (post-radiation) plexopathy.
* Severe neuropathic pain often accompanies this entity.
* No effective treatment has been identified.
Myokymia

Brachial Plexus References

- Ferrante MA. Brachial Plexopathies:… Muscle Nerve 2004; 30:568
- Jaeckle KA. Neurologic manifestations of neoplastic …Sem Neurol 2004; 24:385