DISTAL VS. PROXIMAL ULNAR NEUROPATHY– CLINICAL PEARLS

THE IMPORTANCE OF FULL ELECTRODIAGNOSIS (EDX): NCV COMBINED WITH NEEDLE EMG
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Hand weakness and numbness

Case Report #1

History: 45 y.o. woman with recent onset of weakness and numbness in the right hand.

Exam: Weakness: FDI and ADQ muscles, but good strength in other muscles including FCU & FDP. Slight sensory loss palmar aspect 5th digit, but negative Tinel sign at the wrist or elbow

What is the suspected site of this lesion? __ __

Answer – Probably ulnar neuropathy at the wrist

Clinical clues – Distribution of sensory symptoms and motor weakness.

EMG/NCS – Confirmed the clinical impression. ↓ amplitude right ulnar FDI and ADQ motor and sensory responses. Needle EMG is critical, showing denervation with reduced recruitment pattern and rapid firing in the FDI and ADQ (pattern (1))

Discussion – Distal ulnar neuropathies are uncommon, but have four distinct patterns of presentation:
1) At Guyon’s canal: Main nerve trunk is affected, thus deficits in both the superficial and deep terminal branches (motor and sensory).  
2) Deep terminal branch proximal to hypothenar branch, thus no sensory loss but weakness of all ulnar intrinsic hand muscles. 
3) Deep terminal branch distal to hypothenar muscle. No sensory loss, sparing of ADM, but weakness of other ulnar intrinsic muscles.
4) Superficial terminal branch only; ulnar territory sensory loss.

Etiology – Uncommon. Causes: External pressure, hemorrhage, lipoma, ganglion cyst, structural anomaly

Case Report #2

History: 50 y.o. woman with diabetes with recent onset of hand weakness, and numbness/tingling of ulnar aspect of the hand.

Exam: Weakness of intrinsic hand muscles; hypoaesthesia ulnar aspect No definite Tinel sign.

What is the suspected site of this lesion? __ __

Answer – Probably ulnar neuropathy at the elbow behind retrocondylar groove or within the cubital tunnel

Clinical clues – Distribution of sensory symptoms and motor weakness

EMG/NCS – Confirmed the clinical impression: Difficulty defining proximal ulnar sensory responses, yet despite only slight ulnar motor conduction slowing across the elbow accentuated by “inching” technique, diagnosis confirmed by active denervation on needle EMG in ulnar innervated muscles with a decrease in the number of functioning units including rapid firing, yet sparing involvement of the FCU, and all other C8T1 muscles tested. No involvement of antebrachial cutaneous sensory responses, with normal median and ulnar “F” waves.

Discussion – Ulnar neuropathies at the elbow are common given superficial location with vulnerability secondary to anatomic relationships: functional angulation, bony prominence, constraining ligaments. Localization of ulnar neuropathy at the elbow is often difficult requiring short segment studies or “inching” technique as routine NCS can be non-localizing, and thus always importance of needle EMG assessing for the degree of axonal/nerve fiber injury and motor unit reorganization to the ulnar distribution vs. abnormalities beyond constraints of the ulnar distribution as seen in plexus and root lesions. Ulnar neuropathies are differentiated by localization:
1) Medial intermuscular septum. 
2) Retrocondylar groove.
3) Cubital Tunnel: Point of entrance of the ulnar nerve through the humero-ulnar arcade formed by the split heads of the FCU.

We are delighted to announce the arrival of our newest Associate, Dr. Hui Wang!
The Neurometrix NC-stat nerve conduction-testing platform has been on the market since 2000. It was originally developed as a screening tool which could be used in simple cases such as CTS in an occupational setting, for monitoring of diabetic patients with neuropathy, and possibly as an aide in monitoring peripheral nerve function in drug trials. The CEO of the company recognizes this technology as in development to be used as a screening tool, and best not for most orthopedic and neurosurgical issues upon which surgical decisions are made, and that traditional Electrodiagnosis (EDX) combining NCS and EMG is the “gold standard”. There is acknowledgement that Neurometrix is of limited value assessing root, particularly cervical root, or plexus lesions as Neurometrix is absent the valuable information gained by needle EMG in the context of NCS findings. The expense of Neurometrix electrodes is quite high as it requires utilizing only disposable proprietary biosensors which allow study of only select pre-prescribed motor and sensory preparations, and thus only if the patient has a problem for which an existing biosensor is available with no ability to modify motor and sensory testing as the clinical situation unfolds, something that is a common occurrence for the EDX physician. An additional concern is that Neurometrix is primarily performed by technicians with limited neurophysiologic training or understanding of differential diagnosis. Because the same motor and sensory billing codes are being used for screening as when full EDX becomes necessary, the cost to the consumer and health care essentially doubles. The reasons for the escalating cost of NCS codes is being reviewed by the insurance industry and Medicare. While there has been attempts by Neurometrix to further NCS diagnostic capability in root lesions utilizing “F” wave analysis by multivariate regression, and we applaud this exploration as a possible aide to the diagnosis of radiculopathy, in our opinion, this remains investigational for L5S1 radiculopathy and not likely useful for cervical root lesions. Therefore, there is still no substitute for thorough needle EMG study. The results of Neurometrix often raise more questions than it answers and provides limited diagnostic information compared to full EDX. EDX is best viewed as an extension of the specialty physician’s history and physical examination and holds its diagnostic value for neuromuscular diseases only when performed by an appropriately trained physician.

Limitations of Neurometrix
1. Restriction of this device to only a few major motor and sensory nerves, primarily distal latencies, for which there are available biosensors is a distinct limitation precluding the ability to modify a study to what is clinically necessary as the presentation unfolds to an alternative nerve or branch. One cannot employ “inching” technique to localize neuropathic block as is common for the EDX physician.
2. Up to 20%+ patients have dual or multiple neuromuscular diagnosis. Neurometrix has distinct limitations evaluating “double crush syndromes” - peripheral entrapment neuropathy in the presence of developing or established neuropathy, entrapment neuropathy complicated by plexus or root lesions, or symptoms mimicking entrapment neuropathy that in reality are secondary to root or plexus lesions, or other serious neuromuscular diagnosis.
3. EMG is not a capability of the Neurometrix system although of vital importance when evaluating for the presence, acuity, severity and location of axonal/nerve fiber injury and/or loss, particularly true in evaluation of all proximal nerve, plexus and root lesions as is recommended by AAN&EM standards.
4. Some patients may not tolerate >40 supramaximal shocks, a requirement of Neurometrix system.
5. One cannot consider anomalies of the hand and foot when only performing distal latencies such as Martin-Gruber Anastomosis (15-32% of normal population), or Accessory Deep Peroneal Nerve (20-28% population) which can cause misinterpretation of data when proximal conductions are not done.
6. A high percentage of the population has abnormal or atrophied extensor digitorum brevis (EDB) with advancing age (15-20% of the population has abnormal needle EMG in this muscle). One should be cautious making the diagnosis of L5 radiculopathy with Neurometrix device by small EDB motor response and F-wave study alone.
7. Neurometrix device produces a computer-generated report of data (primarily distal latencies and F-waves) but has no ability to correlate the clinical presentation with the electrophysiological findings for interpretation.
8. Use of Neurometrix by technicians with limited training of electrophysiology and neuromusculoskeletal diagnosis performing only distal latencies is a concern for missed diagnosis with poor awareness of EDX pitfalls and differential considerations.

Conclusion
We believe use of Neurometrix alone has distinct disadvantages compared to traditional EDX combining NCS with EMG. There is concern for expanding false positives and negatives particularly for diagnosis of root and plexus lesions. Dual diagnosis and alternative neuromuscular conditions will be missed, and thus Neurometrix lowers the bar for quality of care with concern for delayed and inappropriate diagnosis or need for surgery. While it holds promise as an adjunct to the routine Electrodiagnostic examination, additional independent clinical study is recommended.