Machanic BI, Sanders RJ. Medial Antebrachial Cutaneous (MAC) Nerve Measurements to Diagnose Neurogenic Thoracic Outlet Syndrome (NTOS). Ann Vasc Surg 2008;22:248-254.

Design: Diagnostic case series

Population/sample size/setting:

- 41 consecutive patients (9 men, 32 women, age 15-62) with clinical diagnoses of NTOS examined in an independent EMG laboratory at Rose Hospital in Denver
- 19 healthy volunteers (5 men, 14 women, age 28-62) examined in same EMG lab
- NTOS clinical criteria included pain in neck, shoulder girdle, and/or upper extremity, hand paresthesias, and occipital headaches, with at least 4 positive responses to diagnostic maneuvers that included upper limb tension test; most NTOS patients also had positive scalene muscle block—clinical diagnosis of NTOS was the "gold standard" for the nerve conduction studies which were the focus of the study
    - Eight physical exam maneuvers were done on all patients: the upper limb tension test, 90° abduction in external rotation, scalene muscle and pectoralis minor tenderness, Tinel's sign over the brachial plexus, neck rotation and head tilt to the opposite side, and sensation to very light touch

Main outcome measures:

- Principal goal of study was to establish values for medial antebrachial cutaneous (MAC) nerve conduction in NTOS
- C8 nerve stimulation conduction velocities, for which normal values were previously established as 56m/sec or greater, were also studied in NTOS patients' affected side but not in unaffected side nor in volunteers
- MAC latency values were reported in 2 ways: as absolute measurements in msec and as side-to-side differences in latency in msec
- MAC latency cutoff of 2.5 ms or more yielded a sensitivity of 73% and a specificity of 99%
- MAC side-to-side latency difference of 0.2 ms or more yielded a sensitivity of 63% and a specificity of 89%
- MAC amplitude of 10 microvolt or less yielded a sensitivity of 97% and specificity of 68%
- Side-to-side MAC amplitude ratio of 2.0 or more yielded a sensitivity of 61% and specificity of 100%
- Authors also reported that 10 of the 41 NTOS patients had electrodiagnostic confirmation of carpal tunnel syndrome; 2 patients also had cuboid [sic] tunnel syndrome; NTOS surgery was followed by improvement in wrist and elbow symptoms in these patients
- Only one NTOS patient had normal findings for all 4 MAC tests: both latency tests and both amplitude tests

- C8 nerve root stimulation was abnormal (56m/sec or less) in 20/37 patients in which the symptomatic side was tested
- Patient interview 3-24 months after surgery reported that 37/41 patients had significant symptom improvement; 35 of these were followed for 6-24 months, and 5 of these had return of at least some symptoms
- Postoperative electrodiagnostic studies were done on 10 patients, 8 who reported improvement and 2 who did not. Clinical improvement was accompanied by changes in MAC latency and amplitude in the direction of normal; the 2 patients who did not improve clinically did not improve MAC conduction studies

Authors' conclusions:

- A diagnosis of NTOS can be established on the basis of history, physical exam, and scalene muscle block; the fact that 90% of the patients in this series improved after surgery is evidence of this capacity
- MAC and/or C8 nerve root stimulation confirmation in all but one NTOS patient also supports the thesis that NTOS can be diagnosed clinically
- Carpal tunnel syndrome frequently occurs with NTOS; when hand and forearm symptoms predominate and electrodiagnostic tests are positive, decompression of carpal tunnel should be considered as a first intervention
- Techniques of MAC conduction and C8 stimulation are operator-dependent, and each lab needs to establish its own normal ranges
- Combining MAC measurements and C8 stimulation should provide more confidence in selecting suspected NTOS patients for surgery

Comments:

- The tests appear not to have been blinded with respect to their interpretation being done by an observer unaware of whether the participant had the clinical diagnosis of NTOS
- The conclusions appear to represent MAC measurement as a confirmatory test, but it is not clear that it is required, since the authors also state that the clinical examination identifies NTOS patients well enough to select patients likely to benefit from surgical intervention; it may be optional but it is not necessarily required for patient selection for operation
- The controls were a combination of healthy volunteers (in whom the test would not be considered in clinical practice) and asymptomatic sides of symptomatic TOS patients, raising the risk of spectrum bias
    - The asymptomatic sides of the TOS patients would seem to be a better comparison to avoid spectrum bias
    - The latencies (Fig. 1) and amplitudes (Fig. 3) are presented as bar graphs, and it is difficult to separate the controls from the nonoperated side from the controls who were healthy volunteers
    - However, visual inspection of Fig. 2 and 3 suggest that the cutoff of 2.4 ms for latency and of 10 microvolt for amplitude are likely to separate NTOS from non-NTOS

- Presumably, “cuboid tunnel” refers to the cubital tunnel (“cubital” also appears in the text and “cuboid” is a typo)
- C8 stimulation was not done on the non-symptomatic side, nor on healthy volunteers; its technically demanding nature and the lack of comparison data would suggest that it could be omitted from the electrodiagnostic evaluation

Assessment: adequate to support evidence that a latency in the MAC nerve greater than or equal to 2.4 ms and an amplitude less than 10 microvolts may confirm a clinical diagnosis of NTOS, but need not be a required part of the diagnostic evaluation; inadequate for evidence that it is a robust diagnostic test for NTOS (lack of blinding, uncertain that spectrum bias has been avoided); however, it does not appear to be represented as a robust diagnostic test, since the clinical examination can select patients for surgery even if electrodiagnostic testing is optional