Nerve Conduction Studies for Carpal Tunnel Syndrome: Gold Standard or Unnecessary Evil?

To the Editor:

Dr Fowler, in his recent guest editorial,1 espouses the popular orthopedic view that a clinical diagnosis of carpal tunnel syndrome (CTS) based only on history and examination is both definitive and sufficient for subsequent management of the patient. He contends that, in the future, electrodiagnosis will be compared with medieval practices such as bloodletting as a treatment. I would first remind Dr Fowler that, were it not for the advent of electrodiagnostic testing, surgeons would still be resecting first ribs of patients with the clinical syndrome of CTS. However, now that the pathophysiology of the disorder is well understood, it is incumbent on those of us who practice electrophysiology to demonstrate that our tests do contribute to patient management.

First, to address the role of nerve conduction studies (NCSs) in the diagnosis of CTS. Nerve conduction studies do not absolutely define the presence of CTS. All medical investigations have false-positive and false-negative rates, and it has been amply demonstrated from Bayes theorem that when the prior probability of CTS is either very high or very low, then neither a normal nor an abnormal NCS result is likely to alter the diagnosis.2 However, there are significant numbers of patients in whom the diagnosis is less clear, and these are not confined to those in whom there is other confounding pathology. In such cases, the NCS result does significantly increase or decrease the probability that the patient has CTS. Arguing over the exact incidence of false-positive and false-negative results is sterile in the absence of a true gold standard for comparison, and values can be cherry picked from the literature to support any view. There is an equal lack of quality data on the false-positive and false-negative rates of clinical diagnosis, but only the arrogant believe clinical diagnosis to be 100% reliable.

However, in most cases, NCSs are not “diagnostic” but a source of information about the patient that is not available from any other source. Using the results rationally requires a detailed understanding of the relationship among NCS results, examination findings, and treatment outcomes. Outcomes of carpal tunnel surgery are clearly better if the nerve is decompressed before marked axonal loss has occurred. Clinically, severe CTS with a poorer prognosis is marked by thenar wasting and weakness3 and fixed sensory deficit.4 If NCS results are reported using a modern grading scheme, it can be seen that very severe NCS abnormalities are also associated with poorer outcomes.5 It turns out that clinical signs of severe median nerve damage are strongly correlated with grade 5 and grade 6 NCS results. Unfortunately, by the time these clinical and neurophysiological findings are evident, it is too late. Pressure on the median nerve should be alleviated before these features appear. Nerve conduction studies are currently the only tool that can quantitatively reveal the deterioration in median nerve function that takes place as CTS evolves from grade 1 to grade 4, as patients in these grades are clinically indistinguishable.

If it were simply the case that all patients with diagnosed CTS needed surgery, then this would not matter greatly. However, it is obvious from the literature that not all cases do require surgery,6 and surgery has not only medical and social costs but also a complication rate that is not insignificant. If it is reserved for patients in NCS grade 3 and above and for those in whom conservative measures have failed, then overall costs of treating CTS and surgery rates fall while patient outcomes improve.

All of this is without considering the supplementary roles of NCSs in detecting other unsuspected pathology and aiding in the assessment of patients who have not gained the desired result from surgery. Finally, needle electromyography is not necessary to measure the severity of CTS. This can be done perfectly well with NCSs alone, reducing both the cost and the discomfort of electrodiagnosis.

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REFERENCES

Reply:

I thank Dr Bland for his comments. I whole-heartedly agree that it is incumbent on all of us, not just those who practice elec-
trophysiology, to demonstrate that our tests and treatments make a positive impact on the care of our patients. I again assert that, for most patients with carpal tunnel syndrome (CTS), the addition of nerve conduction studies (NCSs) does not add significant information and therefore does not make a positive impact on patient care. I clearly stated in the guest editorial that the “routine” use of NCSs is not supported by the literature. I agree (and stated in the guest editorial) that there are times when the diagnosis is not clear and when NCSs may find an unexpected diagnosis. However, I think that those cases are relatively rare, and I would be interested to see a “number needed to treat” for how many patients with “classic” CTS must be tested to find an unexpected diagnosis that positively affects patient care. The flip side to that is how many patients will we treat, with either splint, injection, therapy, or surgery, who did not truly have CTS but rather had asymptomatic slowing of the median nerve across the wrist? I know that Dr Bland has performed a truly impressive amount of research regarding the electrodiagnostic evaluation of CTS. I encourage him to query his Canterbury database to try to calculate the number needed to treat.

According to Dr Bland, “Nerve conduction studies do not absolutely define the presence of CTS.” I would argue that many proponents of NCSs and also many physicians and surgeons incorrectly assume that NCSs do define the presence of CTS. My impression is that the average physician or surgeon in practice just looks at the NCS report and if it shows slowing of the median nerve across the wrist, considers it diagnostic for CTS. Dr Bland’s depth of knowledge and experience allows him to “see the whole picture.” I especially appreciate his stating, “Using the results rationally requires a detailed understanding of the relationship among NCS results, examination findings, and treatment outcomes.” I do not feel that I was arguing over the rate of false-positive and false-negative results but rather just pointing out that, in certain clinical scenarios, NCSs may not be as “accurate” as some might think. In addition, I was not at all implying that clinical diagnosis is correct 100% of the time but merely that the addition of NCSs did not appear to change the outcome of carpal tunnel release.2

The cut-off values used for a positive diagnosis of CTS on NCSs can vary greatly between laboratories, and there is no universal standard. In a recent review, Chen et al3 noted that of the 1111 articles published on the distal motor latency of the median nerve, only 1 article met their criteria for high statistical and methodological standards and was performed with normal, healthy controls. This highlights the lack of high level of evidence studies despite a large volume of research. Chen et al found that a distal motor latency of 4.5 milliseconds for the medial nerve was the upper limit for normal, healthy controls. In my review of the literature, I have noted that nearly all studies use a cut-off value well below 4.5 milliseconds for a positive diagnosis of CTS. I concede that looking only at one cut-off value greatly reduces the diagnostic accuracy of NCSs and should not be used as the sole diagnostic criterion in clinical practice. However, the lack of standardization and that many laboratories use values well below this cut-off value are concerning.

I would be careful concluding that patients can or should be indicated for surgery based on the results of NCSs. Although I agree that, anecdotally, patients with more severe disease, based on either history and physical examination or NCS, may be more likely to be offered surgery, my review of the literature has found little evidence that this strategy improves patient outcomes. I base my surgical indications mostly on a failure of nonoperative treatment. If patients do not experience symptomatic and clinical improvement with a course of splinting, activity modification, and/or injections and are not satisfied with continued nonoperative treatment, then they are offered surgery. Many patients who have mild disease, from both a clinical standpoint and a NCS standpoint, do not get better with nonoperative treatment, are offered surgery, and do well with carpal tunnel release.

It is an honor to have a true expert in the field such as Dr Bland respond to my guest editorial and share his thoughts. I find it incredibly interesting that, despite literally thousands of articles having been published on the diagnosis, treatment, and prognosis of CTS, many questions remain unanswered. I hope that high-level research will be conducted that helps to answer some of these questions and improve patient care.

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