

CORRESPONDENCE

Predictive value of nerve conduction studies

EDITOR,—We read with interest the study of Werner *et al*¹ on the value of nerve conduction studies (NCS) for predicting future carpal tunnel syndrome (CTS) and we think that it deserves comment. Schottland *et al*² and Bingham *et al*³ have shown that in a pool of job applicants, screening with NCS was able to identify pre-existing median nerve abnormalities among a considerable portion of asymptomatic people. These findings were independent of NCS technique or critical value used. The work of Werner *et al* also identified nerve abnormalities in a population of asymptomatic workers; these findings were independent of critical value used.¹

Werner *et al* studied 108 initially asymptomatic workers with a specific but insensitive measurement of median nerve function (14 cm sensory median-ulnar difference). After a mean follow up of 17 months, they found that seven cases and six controls (n = 13 workers in total) developed specific, recurring, or persistent hand or wrist symptoms. There was no significant difference in the development of symptoms between the cases and controls, suggesting that pre-existing nerve abnormalities do not predict the development of CTS. As discussed by the authors, the few subjects and positive outcomes (n = 13) limit the statistical power of this study.

Werner and his coinvestigators have contributed to the scant body of literature on this subject, but we are concerned that the limited findings from their study will be generalised to imply that NCS are not valuable for predicting future hand or wrist symptoms and CTS. We wonder what the authors would have found had they used a more sensitive NCS measurement such as the 8 cm sensory latency or the maximum latency difference,^{4,5} or if they had used an objectively confirmed case definition of CTS?

In their discussion, the authors state that "to date, there are no studies which define or characterise the natural history of median nerve function and hand symptoms among active workers." Over the past 10 years, we have published a series of articles that have considered this subject.⁵⁻⁹ One conclusion of our published five year and as yet unpublished 11 year follow up studies of active industrial workers is that NCS are the most reliable predictor of future persistent specific hand or wrist symptoms and CTS.

People who develop NCS abnormalities do not inevitably develop characteristic hand or wrist symptoms and clinical CTS, but we have found that asymptomatic subjects with NCS abnormalities are much more likely to develop CTS than asymptomatic subjects without NCS abnormalities. For a dichotomous comparison as used by Werner *et al* (initial NCS normal *v* abnormal), we found an odds ratio of 4.3 (OR (361×15)/(70×18); P = 0.000) for 464 initially asymptomatic hands after 11 years. Interestingly, for a comparison of continuous variables (direct linear correlation between probability of future de novo CTS and initial maximum latency difference value), we found a highly signifi-

cant direct, linear relation (R=0.275, P=0.000) and an odds ratio of 20.1 (OR (129×7)/(3×15); P = 0.000) comparing hands with maximum latency difference of >0.52 with <0.28 ms.

We encourage investigators to expand their studies to include more subjects, more sensitive NCS techniques, an objective case definition of CTS, and a longer follow up period. The findings from such more comprehensive studies should be useful in helping to determine whether there is a role for electrodiagnostic screening tests in the workplace.

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Author's reply—We appreciate the comments made by Nathan *et al* regarding our recent article on the use of nerve conduction to predict future symptoms of carpal tunnel syndrome (CTS).¹ Their group has done similar work but with some distinct differences. Their study population had a very low average participation rate² (26% compared with 81% in ours) and thus is subject to potential selection bias. The main focus of their longitudinal studies was to evaluate the predictive value of abnormal median nerve conduction in determining future signs and symptoms of CTS regardless of initial symptoms.^{2,5} Considering their entire population of workers, an abnormal median nerve conduction study was predictive of symptoms consistent with CTS five years later. Many of

the workers with an abnormal median nerve conduction were diagnosed as having CTS in the first evaluation (41%) and not surprisingly still had symptoms five years later.³ This is very different from our study of asymptomatic workers with an abnormal median nerve conduction compared with matched asymptomatic workers with normal median nerve conduction. They briefly considered the issue of workers with abnormal median nerve conduction who initially were not thought to meet the clinical definition of CTS but who went on to be classified as having clinical CTS five years later. These workers were not necessarily asymptomatic; they could have hand or finger symptoms but did not initially meet their clinical definition for CTS. They reported that 10% (n=14) of these workers went on to develop signs or symptoms consistent with their clinical diagnosis of CTS.³ This is almost identical with the incidence we found in our study. Unfortunately, they did not report or evaluate an age, sex matched cohort of asymptomatic workers with normal median nerve conduction for comparison. In our matched control group with normal median nerve conduction, we found an almost identical incidence of symptoms consistent with CTS.

Also, their analysis was done on a per hand instead of per person basis. This analysis is inappropriate as it contradicts the assumption of independent observations; a person's hands are not independent of each other and are exposed to the same genetic foundation, body mass index, diet, and other health related factors.

Nathan *et al* comment that we did not use an electrodiagnostic technique as sensitive as theirs for diagnosing a median mononeuropathy. We maintain that that is precisely what is wrong with some forms of electrodiagnostic testing—namely, sensitivity is increased at the expense of specificity. We found a 15% false positive rate for carpal tunnel syndrome with standard electrodiagnostic techniques and yet Nathan *et al* argue that we should have been using a more sensitive technique; a suggestion that would only serve to increase the false positive rate. We also analysed the data to look at the more severe cases of median mononeuropathy to see if these workers were more likely to develop symptoms of CTS. This subset of workers were slightly less likely to develop subsequent symptoms than matched controls.

In regard to their concern that we did not use a standardised definition of CTS in our follow up survey, we maintain that a worker with no complaints of numbness, tingling, pain, or burning in the hand or fingers would not be classified as having CTS even if a Tinel's or Phalen's sign was present. We did not repeat nerve conduction studies or physical examinations on our follow up study but this would not have increased the incidence of CTS.

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