

Short communication

Diagnostic Accuracy of Clinical Provocative Tests versus Electrodiagnostic Studies in Carpal Tunnel Syndrome: A Correlation with Intraoperative Findings

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Abstract

Accurate diagnosis of carpal tunnel syndrome (CTS) relies on a combination of clinical provocative tests and electrodiagnostic studies. This study aimed to evaluate the sensitivity of three standard provocative tests (Phalen's test, Tinel's sign, and Durkan's test), compare their findings with nerve conduction velocity/electromyography (NCV/EMG) results, and correlate all diagnostic findings with intraoperative severity grading in patients undergoing open carpal tunnel decompression. A prospective case series of 51 patients undergoing open carpal tunnel decompression via mini-palm incision at Misrata Medical Center in 2018 underwent preoperative provocative testing and NCV/EMG studies, with intraoperative severity graded as mild, moderate, or severe. Durkan's test demonstrated the highest sensitivity (92.16%), followed by Tinel's sign (90.20%) and Phalen's test (86.27%). All 51 patients had positive NCV/EMG findings, and NCV/EMG and operative grading were concordant in 38 cases (74.51%). Cases with mild intraoperative findings had at least two negative provocative tests. Diagnostic accuracy for CTS is maximized by combining clinical provocative tests with NCV/EMG studies. Durkan's test is the most sensitive single provocative test, and the combination of all three tests with electrodiagnostic studies correlates strongly with intraoperative findings and should guide surgical decision-making.

Keywords. Carpal Tunnel Syndrome, Phalen's Test, Tinel's Sign, Durkan's Test, NCV/EMG, Diagnostic Accuracy.

Introduction

Carpal tunnel syndrome is the most prevalent peripheral entrapment neuropathy, yet its diagnosis remains primarily clinical. The standard diagnostic approach combines history and physical examination — particularly provocative testing — with electrodiagnostic confirmation through nerve conduction velocity (NCV) and electromyography (EMG) studies. Three provocative tests are most widely used in clinical practice: Phalen's test (forced wrist flexion), Tinel's sign (percussion of the median nerve at the wrist), and Durkan's test (direct median nerve compression).

Published literature has established relative sensitivity and specificity profiles for each test, with Durkan's test reported as the most sensitive and most specific, Phalen's test as the most sensitive but less specific, and Tinel's sign as the most specific but least sensitive among the three [1]. Electrodiagnostic studies — considered the gold standard for confirmatory diagnosis — carry a reported sensitivity of approximately 90% and specificity of 60%, with a 10% false-negative rate [2].

The correlation between preoperative diagnostic findings and intraoperative severity grades provides a valuable framework for assessing the real-world diagnostic performance of these tools. This study prospectively evaluated this correlation in a consecutive series of 51 patients undergoing open carpal tunnel decompression at a Libyan tertiary care center, contributing data from a setting where published diagnostic accuracy evidence remains limited.

Methods

All 51 patients who underwent open carpal tunnel decompression via mini-palm incision at Misrata Medical Center between January and December 2018, and who completed postoperative follow-up, were included. All patients had preoperative provocative testing and NCV/EMG performed [3].

Three standard provocative tests were performed by the examining surgeon: (1) Phalen's test — elbow maintained in extension, wrist passively flexed; test positive if symptoms reproduced within 60 seconds; (2) Tinel's sign — percussion of the median nerve at the wrist crease; positive if tingling/electric sensation radiates to median nerve-supplied fingers; (3) Durkan's test — direct sustained digital compression of the median nerve for 30 seconds; positive if symptoms reproduced. NCV/EMG was performed by a trained neurophysiologist; studies were classified as moderate or severe CTS according to established criteria (distal motor latency >4.5 ms; sensory latency >3.5 ms) [4,5].

During surgery, the operating surgeon graded the degree of transverse carpal ligament tightness as mild, moderate, or severe, providing the reference standard for this analysis.

Results

The age of the patients ranged from 24 years to 73 years, with a mean of 47.96 years. The majority of the patients were female, with 50 female patients (98.04%) and only 1 male patient.

Most of the patients were housewives, 29 (56.86%), while 21 patients were employers (41.18%), and the only male patient was a construction worker.

The results of the provocative tests vary from patient to another. Table 1 summarizes the results of the three provocative tests across the study cohort. Durkan's test demonstrated the highest sensitivity at 92.16% (47/51 positive), followed by

Tinel's sign at 90.20% (46/51), and Phalen's test at 86.27% (44/51). A total of 11 cases (21.57%) had at least one negative provocative test; of these, three had two negative tests, and only one patient had a negative result for all three tests.

Table 1. Results of clinical provocative tests (N = 51).

Provocative Test	Positive N (%)	Negative N (%)	Sensitivity
Phalen's Test	44 (86.27%)	7 (13.73%)	86.27%
Tinel's Sign	46 (90.20%)	5 (9.80%)	90.20%
Durkan's Test	47 (92.16%)	4 (7.84%)	92.16%

All of the fifty-one patients (100%) had positive NCV/EMG studies. Of these, 27 patients (52.94%) were graded as severe CTS and 24 cases (47.06%) as moderate CTS on the electrodiagnostic report.

Intraoperatively, 31 cases (60.78%) were graded as severe (severely tight TCL), 17 (33.33%) as moderate, and 3 (5.88%) as mild. The cases that were intraoperatively graded as mild were those with the highest rates of negative provocative tests, as two of the mild cases had at least two negative provocative tests.

Overall concordance between NCV/EMG severity grading and intraoperative findings was 74.51% (38/51 cases). Discordance patterns were as follows: 7 cases (13.73%) graded moderate on NCV/EMG but found severe intraoperatively (under-grading by electrodiagnosis); 3 cases (5.88%) graded severe on NCV/EMG but found moderate intraoperatively; and 3 cases (5.88%) graded moderate on NCV/EMG but found mild intraoperatively. The negative test result was obtained across 11 patients. The test result with NCV/EMG cross tabulation summarized in Table 2.

Table 2. Cases with at least one negative provocative test — cross-tabulation with NCV/EMG and intraoperative findings (N = 11).

Case	Phalen's	Tinel's	Durkan's	NCV/EMG	Operative
I	Negative	Positive	Negative	Moderate	Mild
II	Positive	Negative	Positive	Moderate	Moderate
III	Negative	Negative	Negative	Moderate	Mild
IV	Negative	Positive	Positive	Severe	Severe
V	Negative	Positive	Positive	Severe	Severe
VI	Negative	Positive	Positive	Severe	Severe
VII	Positive	Negative	Positive	Severe	Severe
VIII	Positive	Negative	Negative	Moderate	Moderate
IX	Negative	Positive	Positive	Moderate	Severe
X	Positive	Negative	Positive	Moderate	Moderate
XI	Negative	Positive	Negative	Moderate	Moderate

Discussion

This study provides prospective clinical data on the diagnostic performance of three standard provocative tests and NCV/EMG in CTS, correlated against intraoperative findings as the reference standard. Our results confirm Durkan's test as the most sensitive single provocative test (92.16%), consistent with published literature establishing its superiority over both Phalen's test and Tinel's sign in sensitivity and specificity [1,6]. Phalen's test, though conventionally regarded as the most sensitive, demonstrated the lowest sensitivity in this cohort (86.27%), possibly reflecting variation in examiner technique or patient-specific anatomical factors.

The 100% positivity rate on NCV/EMG in this series reflects a cohort selected for surgery on clinical grounds, representing moderate-to-severe CTS. The overall NCV/EMG-to-operative concordance rate of 74.51% is clinically meaningful. The most notable discordance pattern — 7 cases (13.73%) graded moderate on NCV/EMG but found severe intraoperatively — suggests that electrodiagnostic studies may underestimate disease severity in a subset of patients, potentially related to anatomical variability, limb volume, or patient compliance during neurophysiological testing.

The finding that mild intraoperative disease was consistently associated with multiple negative provocative tests has practical clinical implications: cases with two or more negative provocative tests in the context of otherwise supporting NCV/EMG findings warrant careful clinical review before proceeding to surgery, as they may represent milder pathology where conservative management has not been exhausted [7].

A key strength of this study is the prospective design with standardized intraoperative grading by a single surgeon, reducing interobserver variability. Limitations include the relatively small sample size, single-centre setting, and the absence of a non-operative control group, which precludes formal specificity calculation.

Conclusion

The combination of all three standard provocative tests with NCV/EMG studies provides the most accurate preoperative diagnostic assessment of CTS severity, with the highest correlation to intraoperative findings. Durkan's test is the most sensitive individual provocative test. NCV/EMG concordance with intraoperative findings reaches 74.51%, with under-

grading being the most common discordance pattern. Cases with multiple negative provocative tests and mild-to-moderate electrodiagnostic findings should be reviewed carefully before surgical intervention is offered.

Conflict of Interest

The author declares no financial, personal, or professional conflicts of interest.

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