VALUE OF CLINICAL PROVOCATIVE TESTS IN CARPAL TUNNEL SYNDROME

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The value of five provocative tests for the diagnosis of carpal tunnel syndrome (CTS) was assessed in four groups : 54 hands with confirmed CTS, 12 with typical symptoms but normal electrophysiological studies, 16 hands in persons with diabetes and 81 hands in normal controls. Compared to normal controls the Tinel sign and the closed first test are highly specific ; Durkan's compression test is not useful to discriminate between symptomatic patients with and without EMG disturbances. The closed fist test is specific in these situations.

Keywords : carpal tunnel ; EMG ; diagnosis ; hand.
Mots-clés : canal carpien ; EMG ; diagnostic ; main.

INTRODUCTION

Carpal tunnel syndrome (CTS) is a frequently recognized compression neuropathy of the median nerve. The wrist flexion test (Phalen's test) (21), Tinel's sign and the tourniquet test (Gilliat test) (13) and direct compression on the carpal canal (Durkan's test) (9) have become standard assessment tools in the diagnosis of CTS.

Recently the proximal migration of lumbrical muscles into the carpal tunnel during finger flexion was observed ; a "clenched fist"test was suggested as an additional provocative test for CTS (3, 26).

This prospective study evaluated the usefulness of these clinical tests in patients with proven CTS, in patients with CTS symptoms but with a normal electrophysiological (EMG) exploration, in persons with diabetes and in a normal control population.

MATERIAL AND METHODS

Population

Group I (CTS group)

Fifty-four hands in 40 patients in a single surgeon's (LDS) practice during a 2-month period were evaluated. The diagnosis was based on complaints of (nocturnal) paresthesias and numbness in the median nerve distribution and confirmed by abnormal nerve conduction studies. Criteria for EMG diagnosis of CTS were slowing of the conduction velocity to less than 50 m/sec across the carpal tunnel and/or a distal motor latency of at least 4 msec. In all patients Phalen's test and Durkan's test were performed ; in 31 hands Gilliat's test was added and Tinel's sign was sought ; and in the other 23 the closed fist test was performed. There were 3 males and 37 females, with a mean age of 50.8 years (range 23-77 years).

Group 2 (diabetes)

In 18 hands of 9 asymptomatic women, Tinel's sign, Gilliat's test, Durkan's test and Phalen's test were performed.

Group 3 (paresthesia group)

Ten patients had symptoms in 12 hands considered typical of a CTS by one author (LDS). All were evaluated with Phalen's test, Durkan's test and the closed fist test.

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There were 3 males and 7 females with a mean age of 42.8 years (range 22-53 years), all seen during the same period.

Group 4 (control)

Eighty-one asymptomatic hands in 46 women were evaluated with the five tests. Their mean age was 51.0 years, ranging from 34 to 76 years.

Method of assessment

Phalen's test was considered positive when after one minute of maximum active wrist flexion, paresthesias in the median nerve territory appeared (16, 21, 23).

Tinel's sign is present when the patient experiences paresthesias during manual tapping on the palmar aspect of the wrist (1, 12, 16, 20, 22, 24).

Durkan's test is positive when manual pressure on the carpal tunnel provokes paresthesias (9, 25).

The closed fist test was considered positive when, after 60 seconds of active finger flexion, paresthesias appeared in the median nerve territory (3, 26).

The Gilliat test is positive when a suprasystolic pressure with a blood-pressure cuff on the upper arm for one minute provokes paresthesias in the median nerve territory (4, 7, 13).

Statistical methods

Sensitivity, specificity and predictive value of each test were calculated, compared to the normal control group and compared to the paresthesias-with-normal-EMG patients.

The Yates chi-square test and Fisher exact test were used to determine significant differences in test results between groups 1 and 3. The level of significance was set at $p < 0.05$.

Sensitivity of a test is the probability of a positive test given that a patient has CTS. Specificity is the proportion of negative tests in the population without CTS.

Positive predictive value indicates the probability that a patient has CTS given a positive test, while negative predictive value indicates the probability that a patient will not have CTS given a negative test.

RESULTS

The results of the different tests in the populations studied are summarized in table I. The calculated sensitivity, specificity and predictive values compared with normal controls are indicated in table II, while table III gives the calculated values compared to the group of patients with CTS symptoms but normal EMG's. Compared to the normal population Phalen's test has a high specificity and sensitivity, and both predictive values are high as well; but compared to the paresthesias-only group, specificity and negative predictive values drop remarkably. Durkan's com-

Table I. — Incidence of positive tests in the different groups (ND = not done)

	Group 1	Group 2	Group 3	Group 4
Phalen	49/54	3/18	8/12	4/81
Durkan	34/54	4/18	8/12	4/81
Tinel	14/31	3/18	ND	0/81
Gilliat	24/31	15/18	ND	11/81
Fist	14/23	ND	1/12	6/81

Table II. — Calculated values compared to normal controls

	Phalen	Durkan	Tinel	Gilliat	Fist
specificity (SP)	0.95	0.95	1.0	0.86	0.92
sensitivity (SS)	0.91	0.62	0.42	0.77	0.61
pos.pred.value	0.92	0.89	1.0	0.69	0.70
neg.pred.value	0.93	0.79	0.82	0.91	0.89

Table III. — Calculated values compared to symptoms-only patients

	Phalen	Durkan	Fist
specificity (SP)	0.33	0.33	0.92
sensitivity (SS)	0.91	0.62	0.61
pos.pred.value	0.85	0.81	0.93
neg.pred.value	0.44	0.17	0.55

Table IV. — Differences between group 1 (CTS) and group 3 (symptoms only)

	EMG^+	EMG^-	YATES CHI SQUARE	FISHER EXACT TEST
PHALEN +/-	49+/5-	8+/4-	P = 0.08	0.05
DURKAN +/-	34+/20-	8+/4-	P = 0.52	0.26
FIST +/-	14+/9-	1+/11-	P = 0.009	0.003

Table V. — Tinel's sign (*compared to symptomatic patients)

Author	Year	N	Specificity	Sensitivity
Stewart (24)	1978	51	0.71	0.45
Seror (22)	1987	100	0.55	0.63
Gellman (11)	1986	67	0.94	0.44
Gemers (12)	1979	47	0.86	0.46
Golding* (14)	1986	49	0.8	0.26
Mossman (20)	1987	38	0.89	0.49
Katz* (17)	1990	44	0.67	0.6
Dekrom* (5)	1990	44	0.59	0.25
Durkan (9)	1991	46	0.8	0.56
Williams (25)	1993	30	1.0	0.67
Yii (26)	1994	31	1.0	0.4
Buch* (2)	1994	37	0.56	0.40
De Smet	31	1.0	0.42	

pression test has similar results, but at a lower level. The specificity and positive predictive value of Tinel's sign are high. The same can be said about the closed fist test, which remains high even compared to the paresthesias-only group.

When groups 1 and 3 were compared the difference in the results of Phalen's test was borderline but not significant (Yates Chi square $p = 0.08$ and Fisher exact test $p = 0.05$). The difference demonstrated by the closed fist test was highly significant ($p = 0.009$), but Durkan's test did not show significant differences ($p = 0.52$) (table IV).

In persons with diabetes a higher frequency of positive tests was encountered.

DISCUSSION

Numerous studies have investigated the value of provocative tests for the diagnosis of CTS. If only one test is under investigation it seems that this test is the clue to the diagnosis of all clinically suspected CTS ; however when several tests are investigated simultaneously, the lack of sensitivity and specificity becomes obvious (tables V to VIII).

Phalen's test (16, 27, 23) and Tinel's sign (1, 12, 16, 22, 24) are the most popular clinical tests and the data about their value are substantial and controversial. In general Tinel's sign is more specific.

Table VI. — Phalen's test (*compared to symptoms-only patients)

Author	Year	N	Specificity	Sensitivity
Seror (21)	1988	200	0.8	0.66
Gellman (11)	1986	67	0.8	0.71
Golding* (14)	1986	49	0.86	0.1
Katz* (17)	1990	44	0.47	0.75
Koris (18)	1990	33	/	0.55
Dekrom* (5)	1990	44	0.53	0.48
Durkan (9)	1991	46	0.84	0.7
Heller*(16)	1986	58	0.59	0.67
Williams (25)	1993	30	1	0.88
Yii (26)	1994	31	0.93	0.87
Buch* (2)	1994	37	0.48	0.7
De Smet		54	0.95	0.91
De Smet*		54	0.33	0.91

Table VII. — Durkan's test (*compared to symptoms-only patients)

Author	Year	N	Specificity	Sensitivity
Mossman (21)	1987	38	0.87	0.23
Durkan (9)	1991	46	0.9	0.87
Williams (25)	1993	30	0.97	1.0
Yii (26)	1994	31	1.0	0.8
Buch* (2)	1994	37	0.29	0.59
De Smet		54	0.95	0.62
De Smet*		54	0.33	0.62

Table VIII. — Gilliat test (*compared to symptoms-only patients)

Author	Year	N	Specificity	Sensitivity
Golding* (14)	1986	49	0.87	0.2
Gellman (11)	1986	67	0.9	0.65
Dekrom* (5)	1990	44	0.59	0.25
Docquier (7)	1987	32	0.9	0.97
Buch* (2)	1994	37	0.44	0.61
De Smet		31	0.86	0.77

In 1991 Durkan (9) published the compression test as a new test with high specificity and sensitivity. These data have been confirmed by Williams *et al.* (25) and Yii (26). Mossman (20) examined this test in 1987 and found much lower sensitivity. In our patient group the value of this test can be questioned. Compared to patients with CTS symptoms this test is not significantly different in those with and those without EMG confirmation of the diagnosis. Buch and Foucher's results are similar (2).

Gilliat's test gives variable results, and except for one author (7) it seems not to be a useful test. In recurrent or unresolved CTS postoperatively, a positive Gilliat's test with a negative Phalen's test is an indication of incomplete (distal) release of the flexor retinaculum (6).

Recent cadaver experiments have demonstrated

the proximal migration (incursion) of the lumbrical muscles during finger flexion (3). Based on this observation a new test was developed. Yii (26) published the first results (specificity 0.93 and sensitivity 0.97), and in the present survey the high specificity was confirmed.

There are marked differences among the authors in the composition of their control groups. Not only is there a substantial difference in the numbers of individuals, but some authors investigated asymptomatic volunteers, others used the asymptomatic contralateral hand of a patient with unilateral CTS and finally for some the control group consisted of "symptomatic" patients without EMG alterations.

However the basic question i.e. whether we can omit electrophysiological studies for the diagnosis of CTS, remains unanswered. There have been reports of successful treatment of CTS despite normal EMG (15, 19) and in a national survey in the USA only 33% of the surgeons systematically use electrophysiological studies (8).

A positive Tinel sign and a positive closed fist test provide strong indications, but they may perhaps appear only in the later stages. In the more discrete forms, in early cases, in atypical presentations or populations and in medicolegal litigation, EMG remains the gold standard.

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SAMENVATTING

L. DE SMET, A. STEENWERCKX, G. VAN DEN BOGAERT, P. CNUDDE, G. FABRY. Klinische uitlokkingstests voor carpal tunnel syndroom.

De waarde van 5 uitlokkingstesten voor carpal tunnel syndroom (CTS) werd bestudeerd in 4 populaties : 5 handen met bewezen CTS, 16 diabetici, 12 handen met symptomen maar normale electrofysiologische onderzoeken en 81 normale controles.
Het teken van Tinel en de gesloten vuist test zijn zeer specifiek, doch alleen de laatste blijft het als de symptomatische patiënten met en zonder EMG afwijkingen worden vergeleken. De carpal tunnel compressietest is niet significant verschillend in deze twee patiëntengroepen.

RÉSUMÉ

L. DE SMET, A. STEENWERCKX, G. VAN DEN BOGAERT, P. CNUDDE, G. FABRY. Valeur des tests de provocation dans le syndrome du canal carpien (SCC).

Nous avons étudié 5 tests de provocation dans le syndrome du canal carpien (SCC) chez 4 groupes : 54 mains avec SCC prouvé, 16 mains chez des diabétiques, 12 mains avec des symptomes typiques mais sans confirmation étectrophysiologique et 81 mains chez des témoins.
Par comparaison avec les témoins, le signe de Tinel et le test du poing fermé ont une spécificité élevée. La compression du canal carpien ne permet pas de faire la distinction entre les patients avec ou sans perturbations électrophysiologiques. Le test du poing fermé reste spécifique dans ces cas.