Carpal Tunnel Syndrome
A prospective clinical study of one hundred cases

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ABSTRACT
Objectives: To determine the clinical profile, the associated disorders and risk factors of carpal tunnel syndrome (CTS) in Saudi patients and to assess the sensitivity and specificity of the clinical tests described in this syndrome.
Methods: A hundred consecutive patients referred to the clinical neurophysiology laboratory and found to have clinical and electrophysiological unilateral or bilateral CTS were examined prospectively and subjected to a comprehensive questionnaire. Comparative data extracted from community-based studies and adjusted for age and sex were used to establish the risk factors of CTS. Results: Females (n=82) outnumbered males both for unilateral (20/7) and bilateral (62/11) CTS. Tinel's sign sensitivity was 67% and its specificity 78%. For Phalen's sign, the values were 68% and 63% respectively. Most common associated disorders were obesity (84%), diabetes mellitus (30%), osteoarthritis (25%) and hypothyroidism (9%). When the frequencies of these disorders were compared with their prevalence rates in the community, the most important risk factors for CTS development were female gender (Odds' ratio 4.5), diabetes mellitus in men (OR 6.39) and women (OR 3.78) and obesity in women (OR 2.17). Conclusion: CTS was 4.5 times more common in Saudi women than men. Diabetes mellitus and obesity were the most important risk factors. However the presence of diabetes mellitus increased the risk of CTS in men more than in women. The Tinel's and Phalen's signs had similar sensitivity of about 66% in electrophysiologically diagnosed CTS while the Tinel's sign was more specific (78% vs 63%).

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The Carpal Tunnel Syndrome (CTS) was first recognized by Sir James Paget in the mid-19th century, but it was only in 1950, that George Phalen made it well known. Paresthesias of the hand, typically in the median nerve territory is the most common symptom. Clinical signs include Tinel's (wrist percussion) and Phalen's (wrist hyperflexion) signs, decreased sensation over the fingers supplied by the median nerve, decreased muscle strength and wasting of the thenar. None of these signs is, however, constant and their frequency varies from 18 to 70%. Many conditions have been associated with the occurrence of CTS including acute or chronic trauma to the wrist, collagen vascular disorders, degenerative arthritis, trigger fingers, diabetes mellitus, obesity, pregnancy, acromegaly and hypothyroidism. The aim of this study was: 1) to determine the sensitivity and specificity of physical examination findings, mainly the Tinel’s and Phalen’s signs and 2) to determine the disorders associated with CTS in Saudi patients.

Methods. This study was carried out prospectively in the Clinical Neurophysiology Laboratory of the King Fahad National Guard Hospital in Riyadh from October 1992 to January 1996. The inclusion criteria were Saudi patients referred for numbness of one or two hands with or without the other clinical signs and symptoms of CTS and found to have unilateral or bilateral CTS on electrophysiological studies.

All patients were examined clinically for the usual signs of CTS and more particularly for the presence or absence of Tinel’s and Phalen’s signs. The age and sex of the patients, the height, weight and in women the number of pregnancies were noted. Body mass index (weight in kg divided by the square of height in meters) was calculated for each patient.

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The electrophysiological studies were performed at room temperature with a Dantec Neumromatic 2000 electromyography machine and carpal tunnel syndrome was diagnosed according to the Mayo Clinic technique and criteria.2 Median nerve motor distal latency was measured with stimulating and recording cathodes 7 cm apart. Antidromic median nerve sensory potential latency was measured from the wrist to the index finger with the electrodes 13 cm apart. The same distances were used for ulnar nerve studies. Carpal tunnel syndrome was diagnosed by the presence of the following criteria: 1) motor distal latency > 4.5 msec (or absent compound muscle action potential); 2) sensory potential latency > 3.5 msec (or absent sensory potential); 3) absence of signs of more diffuse motor-sensory neuropathy. Cases in which all these criteria were not present were excluded. Cases occurring during pregnancy and disappearing within three months following delivery were also excluded.

Data on prevalence of obesity6,8 and diabetes mellitus9,10 in the community were used to estimate the degree of association of these disorders with CTS. Odds' ratios and their 95% confidence intervals were used for significance of these associations.

**Results.** One hundred cases were prospectively recorded. They consisted of 18 male and 82 female (M:F ratio = 1:4.5). Their age and sex distributions are shown in Figure 1. The mean age ± SD was 50.5 ± 10.9 years in men (range 37-79 years) and 44.6 ± 11.9 years in women (range 21-70 years). The carpal tunnel syndrome was bilateral in 73 cases (11 male, 62 female) and unilateral in 27 (7 male, 20 female). In 23 (85%) of these unilateral cases, it affected the right hand only. Tinel’s sign was present in 116 of the 173 affected hands and 6 of the 27 non-affected hands giving a sensitivity of 67% and specificity 78%. The numbers were respectively 117/173 and 10/27 for Phalen’s sign (sensitivity 68%, specificity 63%). Associations between Tinel’s and Phalen’s signs and the duration and severity of the disorder, as quantified on electrodiagnostic studies, are shown on Table 1. The presence of these two signs appeared to correlate well with the severity of CTS but not with the duration of symptoms.

The carpal tunnel syndrome was idiopathic in 41 cases and associated with osteoarthritis only in another 7. Other associated disorders are listed in Table 2. Figure 2 shows the distribution of the patients according to their gender and body mass index. The mean BMI was 30 ± 5 kg/m² (range 19-45 kg/m²). Seventy-two percent of males and 87% of females were either overweight (BMI 25-29) or obese (BMI >29). There was no significant difference in the percentage of overweight and obese patients with idiopathic CTS (36 cases/41 = 88%) or CTS associated with other disorders (49 cases/59 =
83%). Finally, the mean number of pregnancies ± SD found in the women was 6.5 ± 2.8 (range 0-12). Table 3 compares the patients with CTS with age and sex matched groups extracted from community-based studies in regard to obesity, diabetes mellitus and number of pregnancies. Female gender appeared to be one of the strongest risk factors for CTS (OR 4.55). The presence of diabetes mellitus multiplied the risk of CTS by more than six-fold in men and by approximately 4-fold in women. Obesity appeared to be significantly associated with CTS in women. Obesity appeared to be significantly associated with CTS in women only in whom it multiplied the risk of CTS by more than two.

Discussion. Carpal tunnel syndrome (CTS) is suspected on the basis of clinical symptoms and confirmed after physical examination that defines median nerve entrapment. However, as mentioned previously, the Tinel’s and the Phalen’s signs have a wide range of sensitivity (25-75%) and specificity (70-90%),\(^1\) probably reflecting variations in diagnostic criteria and the subjective nature of the clinical signs and symptoms. We used the more objective electrophysiological diagnosis to confirm CTS in order to assess the utility of these common signs, and identified conditions associated with CTS in Saudi patients.

The mean age of our patients was slightly lower than what is reported from western countries\(^4\) but a decade higher than what was recently reported by Al-Sulaiman and Ismail from the Eastern Province of Saudi Arabia.\(^1\) Except for the female gender, diabetes mellitus was the most important associated factor for CTS in our patients. It not only had high association but it also multiplied the risk in men by a factor of six and in women by a factor of around four. This is particularly relevant because of the high prevalence of diabetes in the Saudi population. A prevalence of diabetes of more than six percent has been found in the Riyadh region of Saudi Arabia\(^10\) where this CTS study was conducted. Diabetes mellitus was also the most important associated disorder in the study performed in the Eastern Province where 13% of the CTS patients were diabetic.\(^12\) De Krom et al\(^13\) did not observe any increased risk from diabetes in their Dutch population, perhaps because of the relatively low prevalence of diabetes in the Netherlands. Enhanced ischemia of the nerves in diabetics would explain their increased risk for CTS.\(^14\) As various neuropathies occur in diabetes, an electrophysiological diagnosis as we had in our patients is necessary to avoid confusing CTS with other diabetic neuropathies.

Obesity was another important contributing factor but less so than diabetes. Overweight and obese individuals having a BMI of 25kg/m\(^2\) or more, constituted more than 70% of males and 85% of females. In a cross-sectional study by Werner et al\(^15\) the risk ratio for CTS in obese men was 11.7 and for obese women 2.11 when compared to the slender individuals with CTS in a non-racially classified group in USA. Curiously the contribution of obesity was minimal in the Dutch study\(^16\) but with those on slimming courses having a higher risk than the presently obese subjects. Prior nerve damage, self image and perception in the reporting of symptoms may be possible explanations.

Most studies have emphasized the female gender as a major risk factor for CTS\(^14\) but this differs from Werner et al’s data\(^15\) where males have almost as high a risk as women suggesting a significant contribution of job related injuries to the wrist. In our population where women do a substantial amount of work at home it is not surprising that the female gender predominance is even more enhanced (OR 4.55) and was the highest risk factor for CTS in our Saudi patients. We excluded pregnancy associated CTS within three months of parturition because such CTS is known to spontaneously disappear after delivery.\(^14\) It is however possible that with a mean pregnancy rate of 6.5 ± 2.8 in our patients, repeated pregnancy-associated CTS could become permanent.
and be a contributor to the high risk in our female patients.

Other known risk factors which were observed but could not be quantified because of the lack of comparative population analysis were hypothyroidism (11% men, 8% women with CTS), osteoarthritis (16% men, 27% women), and double crush syndrome (11% men and 7% women).

It must be emphasized that the study was done on electrophysiologically diagnosed CTS. Milder cases or cases involving small myelinated and unmyelinated fibers might not have been included. Although the American Academy of Neurology has suggested in its algorithm for CTS that it is possible to diagnose “definite CTS” without electrophysiological tests, comparative studies should still depend on objectively confirmed diagnosis. In such patients we were able to give the sensitivity of the Tinel’s sign as 67% and of the Phalen’s sign as 68%. Their specificity were 78% and 63% respectively. These figures are not very different from those reported from western countries but higher than those found by Al-Sulaiman and Ismail. Tinel’s and Phalen’s signs correlated with the severity of the disease in our study. The inclusion of less severe and transitory cases in that Eastern Province study could therefore explain the discrepancy.

References

3. Phalen GS. Reflections on 21 years experience with carpal tunnel syndrome. JAMA, 1970; 212: 1365-1367.