Arq Neuropsiquiatr 1999;57(2-A):195-197

COMPARISON OF NERVE CONDUCTION TECHNIQUES IN 95 MILD CARPAL TUNNEL SYNDROME HANDS

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ABSTRACT - Electrodiagnosis of carpal tunnel syndrome (CTS) were prospectively studied in 95 hands. The following techniques were studied in all hands and when at least one abnormal value was found (onset-measured), it was included on results: 1. wrist-index finger latency (WIF), abnormal ≥ 2.8 ms, 140 mm; 2. palm-wrist latency (PW), abnormal ≥ 1.8 ms, 80 mm; 3. comparison median/ulnar palm-wrist latency (CPW), abnormal ≥ 0.4 ms; 4. comparison median/ulnar latency, wrist-ring finger (CMU), abnormal ≥ 0.5 ms, 140 mm; 5. comparison median/radial latency, wrist-thumb (CMR), abnormal ≥ 0.4 ms, 100 mm. All 95 CTS hands selected have the WIF ≤ 3.5 ms (mild CTS). We found the CMR (97.8%) technique the most sensitive for mild CTS electrodiagnosis and the only comparative method with all potentials recordable when compared to CPW (88.4%), PW (84.2%), CMU (72.6%) and WIF (68.4%).

KEY WORDS: carpal tunnel syndrome, compression neuropathy, median nerve, electrodiagnosis, nerve conduction studies.

Síndrome do túnel do carpo leve: comparação de técnicas de condução nervosa em 95 mãos

RESUMO - Eletrodiagnóstico da síndrome do túnel do carpo (STC) foi estudado prospectivamente em 95 mãos sintomáticas. As técnicas estudadas foram realizadas em todas mãos com latência medida no ínicio dos potenciais e pelo menos uma delas estava anormal dentro dos limites descritos: 1. Latência punho – II dedo (PD), anormal ≥ 2,8 ms, 140 mm; 2. Latência palma-punho (PP), anormal ≥ 1,8 ms, 80 mm; 3. Comparação de latência palma-punho mediano-ulnar (CP), anormal ≥ 0,4 ms, 80 mm; 4. Comparação de latência mediano-ulnar, punho – IV dedo (CMU), anormal ≥ 0,5 ms, 140 mm; 5. Comparação de latência mediano-radial, punho – I dedo (CMR), anormal ≥ 0,4 ms, 100 mm. Todas 95 mãos selecionadas tiveram PD ≤ 3,5 ms (STC leve). Concluiu-se que a CMR foi a técnica mais sensível para STC leve (97,8%) e o único método comparativo com todos potenciais de ação obtidos; seguiram-se CP (88,4%), PP (84,2%), CMU (72,6%) e PD (68,4%).

PALAVRAS-CHAVE: síndrome do túnel do carpo, neuropatia compressiva, nervo mediano, condução nervosa.

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy in upper limbs. Nerve conduction studies (NCS) are very sensitive and specific for the diagnosis and several studies have reported sensitivity in the range of 80 to 92%[1]. Comparison of the sensitivities of the various NCS techniques for CTS diagnosis had demonstrated that median sensory is better than median motor and "routine" median sensory in wrist-digit segment (130 - 140 mm) is less sensitive than techniques which evaluate median mixed latency palm to wrist (70 - 80 mm) or comparison sensory nerve latency median/ulnar or median/radial in the same hand[2].

The purpose of this study was to compare five sensory and mixed NCS techniques in 95 mild CTS hands and evaluate the percentage of abnormality when at least one of them was abnormal.

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METHODS

Electrodiagnosis of CTS were prospectively studied in 69 patients (95 hands) between February 1995 to December 1996. The average patient age was 46.6 years (SD ± 10.2 years; range 28-67 years), 88.4% women. The exclusion criteria were cases with previous CTS release, cases with more than one NCS and cases with possible peripheral neuropathy on NCS (bilateral sensory nerve action potential < 15 uV and/or motor conduction velocity < 50 m/s in ulnar nerve). The room temperature was around 28°C most of the time and in a few cases hands were warmed in hot immersion water for 2 minutes.

The including criteria were at least one symptomatic hand (nocturnal pain, numbness and/or paresthesia), antidromic median sensory latency ≤ 3.5 ms (onset-measured, wrist-index finger, 140 mm) to select only mild cases and hands with all the five techniques performed and at least one abnormal among them.

The five techniques and the upper limit of normality (ULN, 2 SD) of them, cited on Jackson & Clifford[3], all onset-measured, are: 1. Antidromic median sensory latency to index finger, 140 mm, ULN ≥ 2.8 ms (WIF); 2. Median mixed palm to wrist latency, 80 mm, ULN ≥ 1.8 ms (PW); 3. Comparison median/ulnar mixed palm to wrist latency, 80 mm, ULN ≥ 0.4 ms (CPW); 4. Comparison antidromic median/ulnar sensory latency to ring finger, 140 mm, ULN ≥ 0.5 ms (CMU); 5. Comparison antidromic median/radial sensory latency to thumb, 100 mm, ULN≥ 0.4 ms (CMR).

All tests were done by the authors at the same EMG instrument (DANTEC, Cantata); percutaneous stimuli were delivered until supramaximal response obtained; pulse duration were 0.05/0,1 ms for sensory and mixed nerve stimulation; filters were set at 20 Hz and 2 kHz; the sweep speed was set at 2 ms per division; one-centimeter disc recording, either platinum or disposable electrodes, were used for mixed nerve studies and ring electrodes for sensory studies; either disposable or Velcro around the forearm were used as ground.

RESULTS

On the basis of including electrophysiological criteria, symptomatic hands and at least one abnormal technique among the five tested, we found 97.8% abnormal hands for CMR (all potentials recordable), 88.4% abnormal hands for CPW (1 hand with unrecordable potential), 84.2% abnormal hands for PW (all potentials recordable), 72.6% abnormal hands for CMU (12 hands with unrecordable potentials) and 68.4% abnormal hands for WIF (all potentials recordable). The percentage of abnormal recordable potentials was calculated from the total, including unrecordable, that were considered as possible normals to avoid false increase in the results (Table 1).

If the unrecordable potentials were considered as abnormal, the most sensitive would be CMR (97.8%), followed by CPW (89.4%), CMU (85.2%), PW (84.2%) and then WIF (68.4%).

Table 1. Comparison of five NCS techniques for CTS diagnosis in 95 hands.

Technique	Abnormal*	Unrecordable
CMR	97.8%	none
CPW	88.4%	1 hand
PW	84.2%	none
CMU	72.6%	12 hands
WIF	68.4%	none

*abnormal recordable potentials from total.
CMR, comparison sensory median/radial latency; CPW, comparison mix-palmar median/ulnar latency; PW, median mixed palm-wrist latency; CMU, comparison sensory median/ulnar latency; WIF, median sensory wrist to index finger; NCS, nerve conduction studies; CTS, carpal tunnel syndrome.

DISCUSSION

Our results clearly demonstrated that the comparison (CMR, CPW and CMU) and absolute (PW) techniques are better than the "routine" WIF for CTS electrodiagnosis, as stated by AAEM Quality Assurance Committee[2]. The three most sensitive techniques considering unrecordable potentials as possible normals were CMR, CPW and PW, all above 84%. The three most sensitive techniques considering unrecordable potentials as possible abnormals were CMR, CPW and CMU, all above 85%.

The abnormal percentage described in the literature for the techniques has a wide variation and there is no consensus about which one is the best or gold standard. Reports of abnormal percentage for CMR are described by Jackson &

Clifford (44%)[3], White et al. (58%)[4], Carrol (59.6%)[5], Pease et al.(87.2%)[6], Cioni et al.(89%)[7], Andary et al.(90%)[8] and Johnson et al.(100%)[9]. Reports of abnormal percentage for CPW are described by Jackson (30%)[3], Kim (57%)[10], Mills (60%)[11] and Andary et al.(61%)[8]. Reports of abnormal percentage for CMU are described by Andary (42%)[8], Jackson & Clifford (44%)[3], Uncini et al. (78%)[12], Lauritzen et al.(87%)[13], Pease et al. (88.6%)[6], Monga et al. (93%)[14], Cioni et al. (99.2%)[7], Charles et al. (100%)[15] and Johnson et al. (100%)[16]. The possible causes of variability in the results could be due to selecting patients: are the symptomatic hands due to CTS? Is there nerve compression with structural lesion or just ischemic reversible initial abnormalities? Are there other causes? Is the "routine" median sensory nerve conduction normal or near normal? If the purpose of the work is to know which technique is the most sensitive, we should establish the ULN of each one and after that include in the results at least one abnormal. This prevents more efficiently other causes of hand symptoms or even possible CTS without structural lesion on median nerve. It could be argued that some patients were false positive because the ULN used in this work could be find in some normal individuals according to population selection[1]. Another thing is to include just hands with normal or near normal "routine" median sensory nerve conduction in order to select only mild cases and prevents high percentage of abnormality. Probably in 100% of cases the more sensitive techniques will be abnormal if the "routine" WIF has conduction velocity less than 40 m/s.

In our study the CMR technique was the most sensitive among the five ones tested and the only comparative method with all potentials recorded. It should be emphasized that our results do not represent the real sensitivity of the electrodiagnosis tests in CTS because of we always include hands with at least one technique abnormal; the purpose was to compare the most sensitive among them. Also, we believed that when only one abnormal comparative technique is found together with normal "routine" WIF it should be better consider possible or incipient CTS with NCS follow-up. If more than one comparative technique is found above ULN even with normal "routine" WIF the CTS electrodiagnosis is more confident.

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