

## CENTRAL MOTOR CONDUCTION IN HUMAN CHAGAS' DISEASE

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**SUMMARY** - The possible involvement of spinal alpha motor neurons, dorsal root ganglia and sensory fibers in human chronic Chagas' disease was previously demonstrated. More recently neuropsychological and sensory evoked potentials studies suggest the existence of central nervous system abnormalities in these patients. We assessed the state of central motor pathways in 46 patients with chronic Chagas' disease and 30 healthy volunteers by means of percutaneous cortical and spinal electrical stimulation. No significant slowness in pyramidal tracts (PT) conduction was found when comparing both groups. Neither any individual patient exhibited abnormally delayed PT conduction values beyond the upper normal limit of the healthy volunteers. These results suggest that, in contrast with other neural systems, the large myelinated PT fibers are usually spared in human chronic Chagas' disease.

**KEY WORDS:** chronic Chagas' disease, central nervous system, motor evoked potentials.

### Conduccion motora central en la enfermedad de Chagas cronica humana

**RESUMEN** - Estudios previos han demostrado que la enfermedad de Chagas cronica (EHC) humana puede comprometer las motoneuronas espinales alfa, el ganglio de la raiz dorsal y las fibras sensitivas perifericas. Mas recientemente otras investigaciones han senalado que algunos de estos pacientes presentan anomalias en pruebas cognitivas y de potenciales evocados sensoriales, sugiriendo tambien la existencia de compromiso central en esta entidad. En linea con estos ultimos hallazgos hemos estudiado el estado de la conduccion motora central en 46 pacientes con EHC y en 30 voluntarios sanos. Para ello se emplearon tecnicas de estimulacion electrica cortical transcraneana y espinal percutanea. No se encontro un enlentecimiento significativo en la conduccion piramidal del grupo con EHC comparado con los voluntarios sanos. Considerados individualmente, en ningun paciente con EHC la conduccion corticoespinal presento valores que excedieran el limite superior normal del grupo control. Estos resultados sugieren que a diferencia de lo que ocurre con otros sistemas neurales, las fibras piramidales mielinizadas de grueso calibre se encuentran usualmente indemnes en pacientes con EHC.

**PALAVRAS LLAVE:** enfermedad de Chagas cronica, sistema nervioso central, potenciales evocados motores.

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Previous investigations have demonstrated that peripheral nervous system involvement frequently occurs in chronic Chagas' disease. When present, this neurological complication mainly targets on alpha motoneurons<sup>8,15</sup> and on sensory fibers or the dorsal root ganglia<sup>16</sup>, as has been shown in clinic electrophysiological studies. Such results are in agreement with those others found in the animal model during the chronic phase of *Trypanozoma cruzi* infection<sup>4</sup>. More recent communications focusing on the central nervous system suggest the existence of central conduction abnormalities in sensory pathways<sup>1</sup> and of cognitive dysfunction in patients with chronic Chagas' disease<sup>5</sup>. On line with these last findings, the aim of this study was to assess the state of the central motor pathways in patients with chronic Chagas' disease by means of transcranial cortical (TCS) and percutaneous spinal (PSS) stimulation techniques.

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## MATERIALS AND METHODS

**Patients.** The study involved 46 patients with the diagnosis of chronic Chagas' disease made at the Instituto Nacional de Diagnostico e Investigacion de la Enfermedad de Chagas in Buenos Aires. They were 25 women and 21 men, aged between 17 and 57 years. Coincidental causes of neurological disorders were eliminated by rejecting patients over 60 years and those with history of toxic, metabolic, genetic or parasitic disease know to induce nervous system damage.

**Subjects.** Thirty healthy volunteers, 12 women and 18 men, aged between 17 and 74 years served as controls.

All patients and subjects gave informed consent to the procedures. The studies were approved by the local Ethical Committee and by the Steering Committee on Chagas' disease (World Health Organization).

**Techniques.** Unifocal electrical TCS and PSS were performed employing techniques that had been widely reported elsewhere<sup>2,6,11-13</sup>. Motor Evoked Potentials (MEPs) were elicited by applying isolated transcranial stimuli over the corresponding cortical motor areas with a maximal intensity of 1000 V and a duration of 75  $\mu$ s each. EMG signals were recorded through surface silver electrodes from the Thenar muscles in all patients, and from the Tibialis anterior muscles in 44 patients, while undergoing a slight voluntary contraction<sup>10</sup>. MEP latencies were obtained by arithmetical averaging 4 to 8 responses in each target muscle. The central motor conduction time (CMCT) in the corticocervical segment (CCS) of the pyramidal tracts (PT) was calculated by subtracting the peripheral conduction time (PCT) and the corticospinal monosynaptic delay (0.5 ms) from the MEP latency. To obtain the PCT, F wave calculations  $[(F + M 1 \text{ ms}) / 2]$ <sup>7,11,13</sup> or PSS were employed.

## RESULTS

Table 1 shows the MEP and CMCT values obtained from 30 healthy volunteers and 46 patients with chronic Chagas' disease. When pooled, patients values did not show any significant prolongation in MEP latency from controls, either with EMG recordings performed in the upper or the lower limbs. CMCT mean values from patients were also not significantly different from these of healthy subjects. If individually considered, none of the patients disclose MEP or CMCT values beyond the upper limit (mean value plus 2.5 SD) of the control group.

## COMMENTS

Early studies on the neurological complications of chronic Chagas' disease found in some patients electrophysiological evidence for spinal alpha motoneuron involvement. Those findings rise the question of whether the anterior horn damage was actually primary, either by direct invasion or remote effect of the *Trypanozoma cruzi*, or perhaps could reflect transynaptic degeneration due to upper motor neuron disease<sup>15</sup>. This study was addressed to investigate the last possibility by assessing the state of central motor conduction by means of TCS. Our results do not show evidence for CMCT abnormalities, suggesting that the PTs are usually spared in chronic human Chagas' disease.

This is in agreement with the results of other authors who failed to find indirect signs of PTs

damage employing several methods, like excitability coefficient<sup>14</sup>, H reflex recovery curve and silent period studies<sup>9</sup>. Nevertheless, it could be argued that, despite CMCT measurement is considered a sensible method to evaluate the central motor pathways<sup>17</sup>, it can only assess the conduction properties of the large PTs fibers. The latter only represent less than 2% of the whole corticospinal tract population<sup>3</sup>. This opens the question about the state of the slow conducting PTs fibers in chronic Chagas' disease.

Table 1. MEP and CMCT values in 30 healthy volunteers and in 46 patients with chronic Chagas' disease

	Controls	Patients
MEP latency in the Thenar muscles	19.41 $\pm$ 0.72 ms (n : 35)	18.34 $\pm$ 1.26 ms (n : 46)
CMCT in the CCS	4.79 $\pm$ 0.63 ms (n : 34)	4.39 $\pm$ 0.56 ms (n : 44)
MEP latency in the Tibialis anterior muscle	28.86 $\pm$ 0.98 ms (n : 17)	24.57 $\pm$ 1.58 ms (n : 44)

MEP, motor evoked potential; CMCT, central motor conduction time; CCS, corticocervical segment.

Further investigation, directed to detect slight degrees of axonal loss in the PTs, will be necessary to get more definitive conclusions regarding this subject.

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