EARLY NON-INVASIVE NEUROPHYSIOLOGICAL INTERVENTIONS IN PATIENTS WITH ACUTE BRAIN OR SPINAL CORD LESIONS

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1. Objectives

1. Characterize the pathophysiological mechanisms implicated in the generation of spasticity.

2. Analyse the effects of non-invasive early neurophysiological interventions as a treatment for spasticity and other functional consequences of upper motor neuron syndromes.

2. Results

They are divided into 4 sections:

1) Contributions to the increase in knowledge of basic aspects of motor control and sensory perception

I) The effects of transcranial direct current stimulation on perception of nociceptive stimuli applied to the palm of the hand. Westgeest et al. 2014 showed that there is better central nervous system control of nociceptive sensation from palm than from dorsum of the hand.

II) Facilitation of the motor evoked potential. Brum et al. 2016 have shown the relevance of measuring the motor-evoked potential duration in the evaluation of facilitation by voluntary contraction.

III) The relationship between limb temperature and cutaneous silent period. Kofler et al., 2014 have shown that the inhibitory reflexes of the upper limb are influenced by limb temperature.

IV) The effect of startle on internally generated movements. Castellote et al. 2013 showed that a startle accelerates the execution of movements even if they are internally generated.

V) Preparation for landing after self-programmed fall. Castellote et al. 2012 showed that landing is a pre-programmed action that is already prepared at the time of initiation of the expected fall.

VI) New technique for the study of sensory perception. Medici et al. 2013 developed the technique of dynamic thermotest and published normative values in healthy population and data in patients with small fibre polyneuropathy.
2) Characterization of the disorders that present with spasticity

I) The H wave in patients with spinal cord injury. Kumru et al. 2015 showed that the amplitude of the soleus H wave reflects the severity of the spinal cord lesion. 
II) Sudomotor skin response in spinal cord lesions. Kumru et al. 2014 showed that the autonomic function reappears caudally to the level of spinal cord lesion, indicating plastic changes in the spinal cord. 
IV) Reaction time in multiple sclerosis. Cabib et al. 2015 showed that the programming of a ballistic task is defective in patients with multiple sclerosis with no evidence of clinical alterations.

3) Contributions to the treatment and improvement of function in patients with spinal cord lesion or brain injury

II) The effects of repetitive transcranial magnetic stimulation on gait disorders in chronic spinal cord injury patients. Kumru et al. 2013 showed the improvement of gait with repetitive transcranial magnetic stimulation before training with robotic devices. 

4) Collateral findings

I) Thermal and mechanical hyperalgesia in patients with sequelae of poliomyelitis. Kumru et al. 2013 showed that patients with muscular atrophy due to poliomyelitis experience hyperalgesia in the most affected limbs. 
II) Restless legs syndrome in patients with sequelae of poliomyelitis. Kumru et al. 2014 showed that the restless legs syndrome has larger prevalence in patients with sequelae of poliomyelitis than in the general population.
III) Restless legs syndrome in patients with spinal cord injury. Kumru et al. 2015 showed that patients with spinal cord injury have higher prevalence of restless legs syndrome than general population. Recognition of this entity is likely to avoid unnecessary expenses of the Health System.

IV) Evoked potentials and quantitative sensory testing for characterization of neuropathic pain in patients with spinal cord injury. Kumru et al. 2013 demonstrated that patients with spinal cord injury show sensitization to thermal stimulation at supraspinal levels.

3. Practical implications of the results obtained after the action

The most relevant aspect of the research carried out is the increase in knowledge of functions of the nervous system in the whole human body, including motor behaviour and sensory processing. Our findings do not follow a straight line, as it was not possible to accomplish one of the objectives. On the other hand, we have managed to gather a variety of small innovations and findings that link together in the overall objective of better understanding the motor and sensory functions of the human nervous system. What makes our research homogenous is the practical clinical implications of our findings for the increase in the knowledge of pathophysiological mechanisms of neurological diseases. Some findings will have more practical implications than others but this cannot be known at present and must wait until other researchers use our observations in their research projects.

4. Publications


