

Neuromonitoring of Acute Spinal Cord Injury – Torino experience

Paolo Costa¹, Alessandro Borio¹, Marta Giacobbi¹, Gianluca Isoardo¹, Giuliano Faccani²
Section of Clinical Neurophysiology (1), Neurosurgery (2), Traumatology Center, Torino, Italy

Background. Nowadays, the prognosis of neurological outcome of patients with the spinal cord injury (SCI) is still made on a clinical bases within 72 hours to 1 month post- trauma and the magnitude of expected neurological recovery is based on physical examination. Neurophysiologic techniques are considered helpful in determining outcome only when used in association with the clinical examination (Kirshblum and O'Connor, 1998). Various animal models of experimental SCI showed that motor evoked potentials (MEPs) and somatosensory evoked potentials (SEPs) are a sensitive measure of post-injury sensory and motor status. Only a few studies have been reported on use of SEPs in evaluation of acute spinal cord injured patients (Halter et al., 1989).

On the other hand, SEPs and MEPs have shown to be reliable in the assessment of the spinal cord functional integrity during spine and spinal cord surgeries. In particular, the combined use of muscle MEPs (m-MEPs) and epidurally recorded D wave (e-MEPs) provide relevant information on motor outcome (Deletis and Sala, 2008).

Objective. To assess the spinal cord functional integrity in subjects undergoing posterior stabilization of the spine after spinal cord trauma, by the intraoperative recording of m-MEPs and e-MEPs along with cortical and epidural recorded somatosensory evoked potentials (e-SEPs) in an effort to predict the neurological outcome of SCI.

Patients and Methods. Intraoperative recording of m-MEPs and e-MEPs along with cortical SEPs and e-SEPs was attempted in 31 patients (14 with a complete SCI, 7 with incomplete with a 4 of them having a central cord syndrome). Ten patients had uncompromised motor status and neurophysiologic data was collected during posterior stabilization of spine due to the spinal cord trauma. Moreover, in order to test any conductivity across the lesion site from any tracts within spinal cord, in a subgroup of 6 clinically complete SCI, an additional test was performed. The spinal cord has been stimulated cranially and caudally to the site of injury by means of epidural catheter electrodes and responses were recorded from the scalp, the peripheral nerves, muscle as well as from the other epidural electrode, cranially or caudally to the lesion site.

Results. All the motor wise uncompromised patients had recordings in the limits of normal values. The typical “neurophysiologic profile” of the SCI patients was the absence of both m-MEPs and e-MEPs caudally to the lesion site associated with a lack of cortical and e-SEPs cranially to the lesion site. None of these patients recovered motor function in the follow up period up to one year. In one patient with central cord syndrome the presence of D wave recorded from the caudal epidural electrode correctly predicted motor recovery. In the subgroup of 6 patients the intraoperative spinal cord stimulation with catheter electrode positively add to the confirmation of the completeness of their lesion.

Conclusions.

1. Neurophysiological testing of SCI patients correctly predict the neurological outcome.
2. Intraoperative testing during early stabilization of the spine of deeply paraparetic SCI patients give us an additional tool to judge about neurological profile.

References.

1. Kirshblum SC, O'Connor KC. Predicting Neurologic Recovery in Traumatic Cervical Spinal Cord Injury. *Arch Phys Med Rehab* 1998 ;79:1456-1466.
2. Halter JA, Haftek I, Sarzynska M, Dimitrijevic MR. Spinal cord evoked injury potentials in patients with acute spinal cord injury. *J Neurotrauma* 1989 Winter;6(4):231-45.
3. Deletis V, Sala F. Intraoperative neurophysiological monitoring of the spinal cord during spinal cord and spine surgery: a review focus on the corticospinal tracts. *Clin Neurophysiol* 2008; 119(2):248-64.