Motor Evoked Potential Monitoring for Spinal Cord and Brain Stem Surgery

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With 17 Figures

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Abstract

Intraoperative Neurophysiology (ION) has established itself as one of the means by which modern neurosurgery can improve surgical results while minimizing morbidity. The advent of motor evoked potential (MEP) monitoring represents a landmark in this recent progress.

ION consists of monitoring (the continuous “on-line” assessment of the functional integrity of neural pathways) and mapping (the functional identification and preservation of anatomically ambiguous nervous tissue) techniques. In this chapter we have attempted to critically review the evolution of MEP use during monitoring and mapping techniques for neurosurgical procedures in the brainstem and the spinal cord, providing the neurophysiological theoretical background and practical aspects of clinical applications. According to the experience from our and other groups involved in ION, we suggest the following:

1) ION is mandatory whenever neurological complications are expected as predicted by a known pathophysiological mechanism. It is therefore advisable to perform ION when dealing with brain stem and intramedullary spinal cord lesions.

2) MEP monitoring after transcranial electrical stimulation is today a feasible and reliable technique for use under general anesthesia. MEP monitoring is the most appropriate technique to assess the functional integrity of descending motor pathways in the brainstem and, foremost, in the spinal cord.

3) Mapping of the corticospinal tract at the level of the cerebral peduncle as well as mapping of the VII, IX–X and XII cranial nerve motor nuclei on the floor of the fourth ventricle is of great value with which to identify “safe entry zones” into the brainstem.

4) Other techniques, although safe and feasible, still lack rigorous validation in terms of prognostic value and correlation with the postoperative neurological outcome. These techniques include mapping of the corticospinal tract within the spinal cord and monitoring of the corticobulbar tracts. These techniques, however, are expected to open new perspectives in the near future.

Keywords: Motor evoked potentials; intraoperative neurophysiology; spinal cord monitoring; brain stem surgery; spinal cord surgery.

Introduction

The last decade has seen the introduction of a number of innovative techniques throughout different fields in the Neurosciences. Intraoperative Neurophysiology (ION) has established itself as one of the means by