THE DIAGNOSTIC UTILITY OF EVOKED SPINAL CORD POTENTIALS DURING SURGERY TO ESTIMATE CERVICAL CORD DYSFUNCTION IN MYELOPATHY PATIENTS

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Introduction: To prevent postoperative neurological deterioration, spinal cord monitoring during operations is very important. However, problems remain regarding the application of evoked spinal cord potentials (ESCP) in clinical practice to estimate cervical cord dysfunction due to the ambiguity of the evaluation method. This study addresses the analysis of ESCP and the establishment of a practical technique to evaluate ESCP considering the clinical stage of patients with myelopathy.

Materials and methods: The subjects were 24 patients with clinical findings and MRI evidence of cervical myelopathy. There were 14 males and 10 females from 45 to 80 years of age (average 62). In all patients, cervical SEP was recorded before surgery. For intraoperative recordings, all patients underwent cervical laminoplasty with the posterior approach. Recordings were made before and after laminectomy. ESCP was recorded from the epidual space at the cervical or dorsal level using a flexible electrode of the cannula type. The reference electrode was inserted into the PVM contralateral to the stimulated side. ESCP was evoked by stimulation of median and ulnar nerves at the wrist. During intraoperative monitoring, rectangular electrical pulses (duration 0.2 msec) were delivered at a rate of 5 Hz. The filter bandpass was 5-1000 Hz. Between 50 and 150 responses were averaged. For SEP recordings, stimuli (4 Hz frequency and 0.2msec duration) were delivered at the wrist using skin electrodes and at motor threshold intensity for nerves at the wrist. During intraoperative monitoring, rectangular electrical potentials on ESCP. These findings are supported by SEP. In patients with spinal N13 which is considered to be generated at the dorsal horn were abnormal, undetectable or without reproducibility of waveforms, segmental evoked potentials of ESCP were significantly diminished.

Discussion: Basic wave shapes of spinal cord potentials recorded from the epidual space at the cervical level show two negative wave components, N1 and N2. N1 is considered to be generated in the primary afferent fiber. N2 is considered to be generated by a synaptic relay of the spinal cord. Usually, ESCP is classified according to the grade classification advocated by Okuma. However, this method was too ambiguous to be used as a standard, because it is based on wave shape only and the results are easily influenced by the subjectivity of investigators. We employed the N2/N1 amplitude ratio to evaluate abnormalities of segmental evoked potentials of ESCP from the lower cervical spinal cord. We consider our method to be very useful. Since a numerical value is used, we evaluated the evoked waveshape objectively. We did not recognize complete negativitation of positive waves at the C6-Th1 levels in any case, so segmental evoked potentials from the lower cervical spinal cord can employ this new evaluating method for all cases. We previously suggested that wave changes of the conductive evoked potentials on ESCP are correlated with the clinical outcome in early postoperative stages. By calculating the rate of conduction block using our evaluation method, it may be clinically more useful to estimate conductive evoked potentials on ESCP. These findings are supported by SEP. In patients with spinal N13 which is considered to be generated at the dorsal horn were abnormal, undetectable or without reproducibility of waveforms, segmental evoked potentials of ESCP were significantly diminished.

Results: There was a highly significant relationship between the N2/N1 amplitude ratio of segmental evoked potentials of ESCP and clinical variables in patients ($r=0.531$, $p=0.01$) (Fig.1). Furthermore, a significant correlation was found between the N2/N1 amplitude ratio of segmental evoked potentials of ESCP and clinical variables (Fig.2). By calculating the rate of conduction block using our evaluation method, it may be clinically more useful to estimate conductive evoked potentials on ESCP. This method was too ambiguous to be used as a standard, because it is based on wave shape only and the results are easily influenced by the subjectivity of investigators. We employed the N2/N1 amplitude ratio to evaluate abnormalities of segmental evoked potentials of ESCP from the lower cervical spinal cord. We consider our method to be very useful. Since a numerical value is used, we evaluated the evoked waveshape objectively. We did not recognize complete negativitation of positive waves at the C6-Th1 levels in any case, so segmental evoked potentials from the lower cervical spinal cord can employ this new evaluating method for all cases. We previously suggested that wave changes of the conductive evoked potentials on ESCP are correlated with the clinical outcome in early postoperative stages. By calculating the rate of conduction block using our evaluation method, it may be clinically more useful to estimate conductive evoked potentials on ESCP. These findings are supported by SEP. In patients with spinal N13 which is considered to be generated at the dorsal horn were abnormal, undetectable or without reproducibility of waveforms, segmental evoked potentials of ESCP were significantly diminished.


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