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JA Symposium

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Monitoring of the central nervous system; June 13, 2008, Yokohama, Japan

Opening remarks

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We selected the title of the JA symposium held this year as "Monitoring of the Central Nervous System." Advances in monitoring during anesthesia have contributed to the progress of clinical anesthesia, as well as contributing to the development of new anesthetics, anesthesia-related drugs, and devices. Anesthesia should provide safety and relief to patients who receive noxious stress during surgery, and it should provide the best operating field where surgeons can execute their ability. Fulfilling this purpose of anesthesia, monitoring gives us, anesthesiologists, information for the assessment of the state of the patient, and we can appropriately adjust the doses of drugs. In the field of anesthesia, the monitoring of vital organs and systems, brain and spinal cord (nervous system), heart (circulatory system), and lungs (respiratory system) is mandatory. Monitoring regarding circulation and respiration has greatly progressed in recent years, and we and our patients are blessed in this regard in clinical practice. However, monitoring of the central nervous system (CNS) has not reached a satisfactory level, because the functions and mechanisms of the CNS are not yet sufficiently elucidated.

In this symposium, motor-evoked potentials (Kawaguchi et al. [1]), monitoring in awake craniotomy (Sato and Kato [2]), electroencephalographic monitoring (Morimoto [3]), and cerebral oxygen saturation were selected for the monitoring of the CNS (Yoshitani and Ohnishi [4]).

Motor-evoked potentials are measured for the assessment of CNS motor functions in brain and spinal surgeries. Sensory functions are generally monitored with somatosensory-evoked potentials and auditory-evoked potentials. In the measurements of motor functions, muscle responses to electric or magnetic stimuli applied to the cerebral motor cortex are measured. The muscle responses in peripheral sites are depressed by the depression of motor neurons in the anterior horn of the spinal cord induced by general anesthetics, particularly by inhalational anesthetics, and by the blocking of transmission at the neuromuscular junction by neuromuscular blocking agents. This depression of muscle responses leads to difficulty in the monitoring of motor-evoked potentials. Kawaguchi et al. [1] approached this problem by using post-tetanic potentiation, which is well known in the monitoring of neuromuscular function. They described this method in this symposium.

Awake craniotomy was introduced for the mapping and resection of convulsive foci in medically untreatable convulsive disorders. While stereotaxic brain surgery has been popular, variability in brain function mapping between individuals has been elucidated. Awake craniotomy is required for the resection of brain tumors with the preservation of brain functions, and brain function mapping is established during the awake state. For the anesthetic management of awake craniotomy, attention in addition to that required for usual neurosurgery is required, regarding factors, such as

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sufficient analgesia, rapid emergence from anesthesia, inhibition of body movements, relief of patients' anxiety, and respiratory management. Sato and Kato [2] described the guidelines of anesthetic management for awake craniotomy by the Japanese Society of Neuroanesthesia and Critical Care, and discussed these.

Morimoto [3] described and discussed electroencephalographic monitoring during general anesthesia. General anesthesia is composed of two components, loss of consciousness (hypnosis) and analgesia. It is clear that the electroencephalogram (EEG) has a major role for assessing the degree of hypnosis. Monitoring hypnosis using EEG has been popular in clinical practice, using parameters such as the bispectral index (BIS), power spectral analysis, entropy, and auditory-evoked potentials. However, changes in the EEG are not uniform between different individuals, agents, and stimuli. Therefore, monitoring methods based on analysis of the EEG have pitfalls similar to raw EEG for the assessment of hypnosis. However, this symposium did not address the monitoring of analgesia, the other component of general anesthesia. We can observe brain responses to noxious stimuli using magnetoencephalography, functional magnetic resonance (fMR), or positron emission computed tomography (PET/CT), but these methods are still in the stage of basic research, and have not reached levels suitable for clinical use as bedside monitors. In clinical anesthesia, we still observe sympathetic responses such as increases in heart rate and blood pressure. The development of new methods for assessing analgesia during general anesthesia is required.

Yoshitani and Ohnishi [4] described and discussed near infrared spectroscopy for the monitoring of cerebral oxygen saturation. Brain ischemia is a major complication of cardiac and aortic surgeries. Clinically, we use near infrared spectroscopy as a noninvasive and continuous monitor; however, there are several problems in using it. Yoshitani and Ohnishi [4] precisely discussed the basics of this monitoring and its future as a bedside monitor.

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