The P3a Wave of the Auditory Event-related Potential Reveals Registration of Pitch Change during Sufentanil Anesthesia for Cardiac Surgery

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Background: The N1 and P3 waves of the auditory event-related potential provide information on consciousness and cortical function. The N1 wave is reduced during states of low vigilance. The P3 wave occurs only for stimuli that somehow capture the subject’s attention. There are two types of P3: P3a and P3b. The P3a predominates frontally and probably occurs when the subject simply notices the stimulus. The P3b predominates parietally and indicates conscious awareness of the evoking stimulus. The N1 and P3 were recorded in 12 patients during cardiac surgery under sufentanil anesthesia to search for unintentional awareness. The study was limited to the period before cardiopulmonary bypass.

Methods: After premedication with diazepam, morphine, and scopolamine, sufentanil was used for induction (mean dose, 7.9 µg/kg) and maintenance (4 µg/kg) of anesthesia. No other anesthetics were administered. Recordings were obtained before induction, during induction after loss of consciousness, after tracheal intubation before incision, and before cardiopulmonary bypass.

Results: The N1 was attenuated significantly by sufentanil but was not abolished. The P3b occurred only during preinduction. There was no P3 during induction. There was a P3a during postintubation and cardiopulmonary bypass.

Conclusions: The attenuation of N1 from induction onward reflects a decrease in the level of arousal caused by sufentanil. A P3a during postintubation and cardiopulmonary bypass indicates that pitch discrimination at the cortical level occurs but does not prove that conscious awareness has occurred. Whether or not the P3a reflects the regaining of consciousness is not known. (Key words: Anesthetics, opioids; sufentanil. Complications: awareness. Monitoring: auditory evoked potentials; endogenous event-related potentials; P3; P300. Surgery: cardiac.)

It is difficult to detect unintentional awareness during cardiac surgery.2,4 Opioids often are the principal agent for induction and maintenance of anesthesia because they provide excellent cardiovascular stability.2 The following arguments suggest that high-dose opioid anesthesia may be associated with a high incidence of intraoperative awareness. First, the reliability of opioids for maintaining unconsciousness is not established clearly.2,4 Second, their potent analgesic effect may allow an awake but sedated patient to tolerate surgery without distress. Third, muscle relaxants are required during high-dose opioid anesthesia and may prevent movements that could reveal inadequate anesthesia. Fourth, chronic medications for angina or hypertension can mask the autonomic signs usually associated with inadequate anesthesia. The absence of recall of intraoperative awareness does not prove the absence of awareness.5,6 Means for reliably detecting awareness, therefore, are needed.

The N1 and P3 waves of the auditory event-related potential (ERP) vary with the level of conscious-