AUDITORIALLY EVOKED RESPONSES

A Tool for Assessing the Patient's Ability to Hear during Various States of Consciousness

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Relatively little is known about the alteration of hearing with drug-induced changes in consciousness. An objective technique has been devised, and tested in laboratory animals, which records auditorily evoked potentials either from the exposed cerebral cortex or by means of indwelling brain electrodes. New electronic summating techniques now make it possible to record minute electrical potentials directly from the intact scalp of man. While such responses are easy to record for the visual and somatosensory systems, since cortical portions of these systems are located immediately beneath the calvarium and scalp, the human primary auditory cortex is not directly in contact with the parieto-temporal calvarium. Therefore, electronic summating techniques using scalp electrodes may be less effective for auditory stimuli. However, some electrical potentials in response to auditory clicks can consistently be recorded from the human scalp.

There is considerable disagreement among clinical neurophysiologists as to whether these responses are cerebral in origin or possibly are scalp-muscle artifacts. The purpose of this study is to shed some light on this controversial issue by studying this phenomenon in anesthetized patients, paralyzed with succinylcholine.

METHOD

After establishing a baseline reference with the patient awake an under no drug effect, a preanesthetic medication is administered intravenously consisting of a barbiturate and/or belladonna derivative. Auditorily evoked responses are recorded after each drug is given and the recordings compared with the initial normal responses.

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Subsequently the patient receives an intravenous injection of an ultra-short acting barbiturate to produce loss of consciousness. Auditorily evoked response are recorded during the phase of unresponsiveness and in the course of the awakening. Following this procedure, nitrous oxide and oxygen are administered and the evoked response again recorded with and without succinylcholine induced muscle paralysis.

RESULTS

Similar to our previous studies of visually evoked responses, this experimental design employing audible stimuli proved to allow exploration of auditory input under various states of consciousness. By objectively analyzing the specific deflections of these summated evoked responses, it is possible to assess the effects of anesthetic drugs in suppressing either transmission or reception of the secondary or diffuse projecting auditory stimuli.

With the use of i.v. secobarbital in sleep-producing doses, it was found that the slower components of the auditorily evoked response were consistently depressed during the coma-phase with gradual return to the pre-injection configuration of the summated evoked response during the awakening phase. With nitrous oxide-oxygen mixtures producing light surgical anesthesia similar alterations of the evoked response were recorded. Such changes in the summated evoked response were present with and without succinylcholine-induced muscle paralysis, which appears to indicate that the response is cerebral in origin and not a muscle artifact.

A short color movie without sound was shown to illustrate the technique in detail.