

Title: RELIABILITY OF BRAINSTEM AUDITORY EVOKED POTENTIAL MONITORING IN 54 NEUROSURGICAL OPERATIONS

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We examined the feasibility, sensitivity, utility and reliability of monitoring brainstem auditory evoked potentials (BAEP) during 54 operations in the cerebellopontine angle. A quantitative criterion for warning the surgeon of change in BAEP was developed.

Methods. BAEP were monitored during 54 operations in 50 adult patients, using the methods previously described.¹ Hearing was clinically assessed before and after operation by members of the neurosurgical team. Audiograms were obtained preoperatively in 44 patients, postoperatively in 32. BAEP were recorded in the audiology laboratory before operation in 37 patients, after operation in 29.

Anesthesia was with thiopental, nitrous oxide, fentanyl and pancuronium. Halothane was used in 8 cases, enflurane in 1, isoflurane in 3. BAEP were recorded prior to induction of anesthesia, then continually until the end of anesthesia. The latency of Peak V was measured in the operating room, and wave forms were stored on disk for subsequent additional measurements. Feasibility was assessed by examining time constraints and the incidence of technical difficulties that prevented monitoring. Events associated with BAEP alterations reflected sensitivity; warnings to the surgeon and therapeutic interventions on the basis of BAEP data reflected utility. We assessed reliability by determining the accuracy with which intraoperative BAEP predicted postoperative auditory function.

Results. No recovery of BAEP occurred in the three patients who were deaf prior to surgery. **Feasibility.** Preparation for surgery was lengthened approximately 30 minutes, and technical difficulties prevented monitoring in 3 cases.

Sensitivity. BAEP changes were seen during 37 operations. Associated factors included surgical retraction (n22), operative manipulation (n3), combined hypocarbia and modest arterial hypotension (n2), and positioning of patients for retromastoid crainectomy (n6). BAEP deteriorated during closure of the dura in two patients. In one, the dura was reopened and a small clot was removed from the eighth nerve. In the other, BAEP alterations were transient and no interventions were made. **Utility.** Interventions were made in response to BAEP alterations during 22 operations. In 19 of these, wave forms improved after

intervention and hearing was preserved. In 3, BAEP did not recover but the auditory nerve was deliberately divided later in the operation. Interventions included removal or repositioning of retractors (n11), modification of operative manipulation (n6), expansion of intravascular volume (n5), alteration of ventilatory patterns (n5), and increase in the inspired concentration of oxygen (n1). Two or more interventions were made during 8 operations. In 13 other operations, BAEP changes resolved after maneuvers performed as a usual part of the operation rather than in response to BAEP changes. BAEP recovered after 5 to 177 minutes of virtual obliteration.

Reliability. Operations were divided into four categories according to intraoperative BAEP findings: I -- no change; II -- change short of obliteration with recovery; III -- obliteration with recovery; IV -- obliteration with no recovery. All patients in categories I, II and III, but none in category IV, could hear postoperatively.

On the basis of BAEP changes that prompted warnings to the surgeon in 21 early cases, we derived a criterion for intraoperative warning of BAEP change: an increase in the latency of Peak V of greater than .07 msec per minute. This criterion was tested subsequently in 10 patients. Four warnings were given on the basis of this criterion, and no warnings were given when this criterion was not met. In one case, the cumulative prolongation just short of the warning criterion resulted in a considerable increase in latency of wave V so that an additional warning criterion was added: increase in Peak V latency of 1.5 msec beyond anesthesia baseline values, regardless of the time course of change.

Conclusion. Monitoring of BAEP is feasible, sensitive, reliable and useful during operations in the posterior cranial fossa. Quantitative criteria for warning the surgeon facilitate intraoperative monitoring of BAEP.

This work was supported in part by Grant Number 27942, NICMS.

Reference.

1. Grundy BL, Lina A, Procopio PT, Jannetta PJ: Reversible evoked potential changes with retraction of the eighth cranial nerve. *Anesth Analg* 60:835-838, 1981