Title: EFFECT OF HALOTHANE, NITROUS OXIDE ANESTHESIA ON SPINAL VERSUS CORTICAL EVOKED POTENTIALS DURING SPINAL SURGERY

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Introduction. Spinal cord function may be assessed intraoperatively by monitoring evoked potentials (EP), spinal evoked potentials (SEP) or cortical evoked potentials (CEP).[1] Halothane depresses CEP. SEP, on the other hand, are well maintained under halothane anesthesia when assayed epidurally.[2] We used less invasive subdermal electrodes and studied the usefulness of SEP under halothane, nitrous oxide anesthesia in humans.

Methods. Eight patients (12-45 yrs) of either sex, ASA class I, undergoing corrective surgery for idiopathic scoliosis, were studied after approval of the institutional review board. Patients were premedicated with seconal 2 mg/kg and atropine .005 mg/kg I.M.. Prior to induction of anesthesia and baseline EP monitoring, all patients were hydrated with 600 ml of D5LR. The radial artery was cannulated for measurement of blood pressure and blood gases. Anesthesia was induced with 3-4 mg/kg of thiopental; 0.1 mg/kg of pancuronium and the trachea was intubated. Respiration was controlled with a tidal volume of 10 ml/kg at the rate of 8-10 per minute to maintain PCO_2 = 40 ± 2mm Hg. Anesthesia was maintained with 60% nitrous oxide in O_2 and halothane. End tidal concentration of halothane was measured by EMMA (Engström). Esophageal temperature was measured and maintained at 35° ± 2° C. Blood loss was measured and replaced ml for ml. Systolic BP was maintained within 20% of preoperative values. Urine output was kept at 0.5 - 1.0 ml/kg/hr. SEP and CEP were repeated four times for each of the following conditions: control, halothane 0.4%, 0.6%, 0.8% (end-tidal) with 60% nitrous oxide in O_2.

SEP were recorded from C-6 to Fz and CEP were recorded from Cz-Fz by stimulating posterior tibial nerves at the ankle simultaneously via subdermal needle electrodes. Each stimulus was 3X motor threshold applied for 200 µsec at 8.1/sec. Dual ear clips served as a ground. EP were acquired with the Nicolet Pathfinder II signal averager. 500 repititions were used with 80 msec timebase. All recordings were repeated to verify reproducibility. Interpeak amplitudes were measured in microvolts. Peak latencies were measured in milliseconds and converted to conduction velocities (meters/sec) to eliminate the influence of height on latencies.

Results. SEP were not recordable in awake patients due to myogenic activity. CEP could be recorded in all awake patients. Both SEP and CEP were recordable at 0.4% and 0.6% halothane. Only SEP were recordable at 0.8% halothane. Conduction velocities for SEP and CEP (P1 and N1) decreased as halothane concentration increased. Conduction velocities for CEP (P2) were variable. (See Table #1)

HALOTHANE CONCENTRATION	CONDUCTION VELOCITY (meters/sec)			
	Spinal	Cortical (Cz)		
	C-6	P1	N1	P2
0%		46.5 ± 3.8	39 ± 5.1	32.5 ± 4.6
.4%	49.8 ± 3.0	42.3 ± 3.5	34.8 ± 2.8	28.8 ± 4.2
.6%	48.8 ± 2.4	40.7 ± 2.7	33.8 ± 3.1	29.3 ± 4.1
.8%	47.5 ± 2.7	--- ---	--- ---	--- ---

Values Mean ± Standard Error

TABLE #1

SEP amplitudes were depressed by 10% at 0.6% halothane and remained the same at 0.8%. CEP P1-N1 , N1-P2 amplitudes were depressed by 50% at 0.6% halothane and not recordable at 0.8% (See Figure #1)

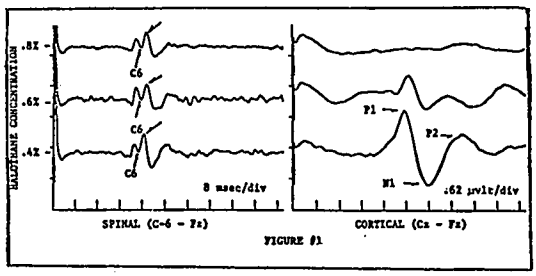

FIGURE #1

Typical wave form of Spinal and Cortical Evoked Potentials; Evoked and recorded by subdermal electrodes.

Discussion. Balanced anesthesia is considered the technique of choice for spinal cord monitoring with CEP. We showed that SEP are assessable under halothane anesthesia, thus adding flexibility in the choice of anesthesia for spinal surgery.

Conclusion. Because SEP are more stable than CEP under halothane anesthesia, they might be useful in monitoring spinal cord function when halothane is the agent of choice.

References.

1. Lueders, H. et al.: Origin of far-field subcortical potentials evoked by stimulation of the posterior tibial nerve. Electroencephalogr Clin Neurophysiol 52:336, 1981.

2. Land, P.D., et al.: Spinal cord vs. somatosensory cortical evoked potentials during halothane anesthesia in dogs. Anesthesiology 57:A318, 1982.