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Title: **The Effect of Succinylcholine on Intracranial Pressure, Cerebral Blood Flow Velocity & Electroencephalogram in Patients with Neurologic Disorders**

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Introduction: It is controversial whether succinylcholine causes an increase in intracranial pressure (ICP) in humans with intracranial lesions, and if so the pathophysiology of this increase remains uncertain. We studied changes in middle cerebral artery blood flow velocity (Vmca), intracranial pressure (ICP), and electroencephalogram (EEG) on five patients with increased ICP given intravenous succinylcholine.

Methods: The protocol was approved by the human subjects committee and informed consents were obtained. Of five subjects ages 34-53 (mean=45) studied, all had increased ICP; four following subarachnoid hemorrhage and one had diffuse cerebral edema. All patients were monitored with a Camino ICP monitor, intra-arterial catheter, electrocardiogram, 2-channel processed electroencephalogram (Lifescan), and Vmca was measured with a Transpect transcranial Doppler (TCD). All patients were mechanically ventilated to maintain normocapnia during the study. One patient was conscious at the time of study. Concurrent medications given included morphine, lorazepam, and diphenylhydantoin but none was administered within 1 hour of the study. Additionally, none had received muscle relaxants in the previous 12 hours. All patients served as their own controls and following a 0.05 ml/kg bolus of preservative-free normal saline, mean blood pressure(MAP), Vmca, ICP, heart rate, ECG, and EEG were monitored to obtain a baseline for 5 minutes prior to a bolus of 1mg/kg of succinylcholine (0.05ml/kg) and monitoring of the above parameters for fifteen minutes.

Results: Saline had no effect on any of the variables measured. As shown in the table, succinylcholine caused no significant change in ICP, Vmca or MAP. EEG assessed by activity edge(the frequency which contains 80% of the power) was similarly unchanged. Transient increases in ICP were noted in two patients during periods of agitation.

TIME	0 m	1m	3m	5m	7m	9m	11m	13m	15m
ICP	18±2	18±2	18±2	17±1	17±2	18±2	18±2	18±2	17±1
Vmca	69±13	72±15	71±13	64±10	71±14	66±11	64±11	68±14	68±12
MAP	99±3	105±6	99±7	97±5	97±5	97±4	96±5	96±5	95±4

all values are mean±sem. ICP in mmHg, V_{mca} in cm/sec, MAP in mmHg

Discussion:In several animal and human studies succinylcholine and/or its preservatives have been implicated in causing ICP increases. White et al, however reported no change in ICP in patients with head trauma. Lanier demonstrated EEG changes in dogs and postulated that succinylcholine stimulates gamma- motor neurons resulting in EEG activation and secondary increases in cerebral blood flow (CBF) and ICP. Changes in CBF and EEG with succinylcholine have not been demonstrated in humans. Our results are consistent with those reported by White, et al. They demonstrate that in brain-injured patients under the conditions we studied there was no cerebral stimulation or increase in Vmca or ICP with succinylcholine.

References. 1) Anesth Analg 62:1006-9,1983 2) Acta anesth Scandinav 3: 155-161.1959 3) Anesthesiology 57:242-4, 1982 4) Anesthesiology 64:551-9, 1986

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TITLE: INFLUENCE OF TISSUE LAYERS ON NONINVASIVE MEASUREMENT OF BRAIN OXYGENATION WITH NEAR-INFRARED SPECTROSCOPY

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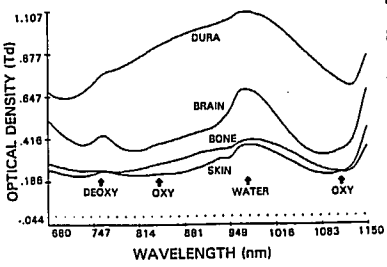
Near-infrared (IR) spectroscopy (NIRS) is an important new clinical monitor developed for noninvasive determination of brain oxygenation.[1,2] Because the instrument is designed to measure brain oxyhemoglobin (oxy Hgb) and deoxyhemoglobin (deoxy Hgb), we evaluated NIRS in patients undergoing craniotomy to assess the influences of the different cranial tissue layers on IR spectral contours.

Five patients undergoing craniotomy were studied after consenting to an IRB approved protocol. Spectral measurements of diffuse tissue absorbance (Td) were made at the skin, bone, dura and brain levels during surgical exposure using the 6250 model microprocessor-controlled scanning spectrophotometer (Pacific Scientific, Silver Spring, MD). Absolute, normalized and first derivative absorbances were analyzed by ANOVA.

IR spectra from skin, bone, dura and brain surfaces all demonstrate oxy Hgb, deoxy Hgb and water characteristics (Figure). Differences among spectral absorbances from the same site represent offsets, not changes in peak heights. However, the relative absorbance for oxy and deoxy Hgb change dramatically with surface level. Normalization of absorbance data reveals the deoxy peak (760 nm) to be significantly ($p \leq .05$) higher on the brain surface (0.046 ± 0.006) as well as the dura surface (0.111 ± 0.025) compared to skin (-0.009 ± 0.012). The first derivative of absorbance found the oxy peak (830 nm) to be significantly higher in dura (0.022 ± 0.003) and brain (0.016 ± 0.001) compared to skin (0.004 ± 0.003) and the oxy trough (1040 nm) to be significantly lower in dura (-0.048 ± 0.007) and brain (-0.043 ± 0.004) compared to skin (-0.027 ± 0.003). Absolute absorbance demonstrated consistent differences only for dura (vs. skin).

IR spectra from all tissue surfaces demonstrate oxy Hgb, deoxy Hgb, and water characteristics. IR spectra from the skin surface differ from those obtained from the brain surface. Normalized and first derivative analyses reveal significant relationships not apparent from original spectra and appear to compensate for absolute offsets among spectra. Clinically useful instruments that monitor oxygenation will need to correct for skin, bone and dural influences on spectral shape.



Typical absolute absorbance spectra of skin, bone, dura and brain surfaces obtained from a single patient undergoing craniotomy. Characteristic deoxy, oxy and water absorbances are indicated.

1. Science 198:1264-1267, 1977.
2. Hospimedica 8:39-47, 1990.