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 Title : CEREBRAL OXYGENATION DURING DELIBERATE HYPOTENSION  
 Authors : D. E. Longnecker, M.D.; J. Radke, M.D.; H. D. Schenk, M.D.; and H. Sonntag, M.D.  
 Affiliation: Departments of Anesthesiology, University of Virginia Medical Center, Charlottesville, Virginia 22908 and University of Göttingen, West Germany

**Introduction.** Deliberate hypotension may be induced by deep anesthesia with one of the potent inhalation anesthetics or by the administration of the vasodilator, sodium nitroprusside (SNP). Both deep anesthesia and SNP are reported to increase cerebral blood flow, but their relative effects on brain oxygen tension are not well defined. In this study, deliberate hypotension was induced in dogs by either deep enflurane anesthesia or by the intravenous infusion of SNP. Cerebral hemodynamics and brain cortical oxygen tensions were measured to test the hypothesis that cerebral oxygenation was similar during identical reductions in blood pressure produced by either SNP or deep enflurane anesthesia.

**Methods.** Eight mongrel dogs (28 ± 2 kg body weight) were anesthetized with enflurane while cannulae were placed in the femoral artery, the pulmonary artery (Swan-Ganz catheter), and the superior sagittal venous sinus. A polarographic oxygen microcathode (tip diameter approximately 1.5 μm) was placed in the frontal cerebral cortex through a small burr hole in the calvarium. The experimental protocol consisted of the following sequence: (a) a normotensive control period during light (approximately 1 MAC) enflurane anesthesia, (b) enflurane-induced deliberate hypotension to a mean arterial pressure of 50 percent of the control value, (c) a 60-minute recovery period of light (approximately 1 MAC) enflurane anesthesia (i.e., a second control period), and (d) SNP-induced deliberate hypotension, again to a mean arterial pressure of 50 percent of the control value. Animals were ventilated mechanically and maintained at 37°C throughout the experiments. The following values were measured and/or calculated from data obtained in each animal: mean arterial pressure (MAP), heart rate (HR), cardiac output (CO), PaO<sub>2</sub>, PaCO<sub>2</sub>, CaO<sub>2</sub>, CvO<sub>2</sub> (sagittal sinus), cerebral perfusion pressure (CPP; MAP - sagittal sinus pressure), cerebral blood flow (CBF; obtained from the inert gas uptake method using argon as the tracer gas), cerebral vascular resistance (CVR), cerebral oxygen consumption (CMRO<sub>2</sub>), and cortical tissue oxygen tension (PtO<sub>2</sub>). Data for the two hypotensive techniques (enflurane vs. SNP) were compared by Student's t-test for paired data.

**Results.** Results (Mean ± SD) are summarized in the following table. Normotensive control values are included for completeness (since there were no significant differences between values during the two control periods, these data were pooled for statistical analysis). Relative brain oxygen tension is reported since the absolute values depended on electrode location in each animal (the average control value for PtO<sub>2</sub> was 25 ± 20 torr).

	HYPOTENSION		
	CONTROL	ENFLURANE	vs SNP
MAP (torr)	105±19	50±11	51±5
HR (beats/min)	109±10	112±12	* 159±20
CO (liters/min)	3.3±0.4	2.1±0.6	* 3.8±0.5
PaO <sub>2</sub> (torr)	117±27	114±20	103±23
PaCO <sub>2</sub> (torr)	38±7	36±4	40±4
CBF (ml/100g/min)	49±11	58±13	62±10
CPP (torr)	78±11	33±7	35±8
CVR (CPP/CBF)	1.6±0.3	0.6±0.1	0.6±0.1
CMRO <sub>2</sub> (ml/min/100g)	2.4±1.1	3.4±1.3	2.9±0.6
Ca-vO <sub>2</sub> (vol %)	4.6±1.1	5.8±1.4	* 4.4±0.9
PtO <sub>2</sub> (% of control)	100	52±30	* 110±3

\*p < 0.05; enflurane vs SNP

**Discussion.** The striking finding in this study was the markedly reduced brain oxygen tension observed during deliberate hypotension produced by deep enflurane anesthesia. Increased oxygen extraction by the brain was evident during enflurane-induced hypotension also, but was not present during SNP infusion. Brain oxygen tension was not altered by SNP-induced hypotension during light levels of anesthesia, a finding which is consistent with results obtained during deliberate hypotension produced by SNP in cats.<sup>1</sup> A reduced brain oxygen tension during deep enflurane anesthesia cannot be explained by either inadequate total cerebral blood flow or by increased total cerebral oxygen consumption, since CBF and CMRO<sub>2</sub> values were similar during both methods of deliberate hypotension. Rather, these data suggest that enflurane-induced deliberate hypotension may produce inhomogeneous perfusion of the brain, resulting in areas of cerebral cortical hypoxia. The results suggest that deliberate hypotension induced by deep enflurane anesthesia may result in cortical brain hypoxia, while brain oxygenation is unaltered by SNP-induced deliberate hypotension.

#### References.

1. Maekawa T, McDowall DG, Okuda Y: Brain-surface oxygen tension and cerebral cortical blood flow during hemorrhagic and drug-induced hypotension in the cat. *Anesthesiology* 51:313-320, 1979

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