

Title: ISOFLURANE AND OXY-HEMOGLOBIN DISSOCIATION

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Introduction. Many inhalational anesthetics have been shown to shift the oxy-hemoglobin dissociation curve to the right (1,2). The effect of the new inhalational anesthetic, isoflurane (Forane®) on the oxy-hemoglobin dissociation curve is not reported. The purpose of this study is to examine the effect of isoflurane on the oxy-hemoglobin dissociation curve of fresh heparinized human blood drawn from twelve different non-smoker volunteers.

Methods. Ten ml of venous blood was drawn into a heparinized syringe from each of the twelve informed non-smoker human volunteers. 5 ml of the blood was equilibrated in an IL 237 Tonometer with gas mixtures containing 3.75% and 4.5% oxygen, 5.6% carbon dioxide, and the balance nitrogen at 37°C. The remaining 5 ml of blood sample was equilibrated with similar gas mixtures containing 1.25 percent isoflurane. Total hemoglobin and percent oxygen saturation and percent carboxy-hemoglobin were obtained with an OSM2 Hemoximeter®. The blood gases were measured in a 168 Corning pH/Blood Gas Analyzer. The measured PO₂ data were corrected to pH 7.40 by using the IL PO₂/pH nomogram. Since the uniform carbon dioxide in the gas mixtures gave a normal PCO₂ of 40 mmHg and the blood gas measurements were made at 37°C, no PCO₂ or temperature corrections were needed. The two point saturation curve was plotted in the linear portion of the oxy-hemoglobin dissociation curve by using the IL P-50 sheet and P-50 was obtained from the saturation curve for both control and isoflurane treated samples.

Results. Table I contains the mean values of corrected PO₂, percent oxygen saturation and P-50 of control and isoflurane treated samples. All of the blood samples had a hemoglobin between 11-15 g/dl and a carboxy-hemoglobin of less than 1.0%.

Discussion and Conclusions. P-50 is one of the key factors that control the oxygen availability and its release to the tissues. P-50 is usually defined as the partial pressure of oxygen at which 50% of the hemoglobin is saturated at a pH of 7.4, and a temperature of 37°C. The normal P-50 is approximately 27 mmHg. Hemoglobin releases more oxygen to the tissues at any given PO₂ when P-50 is shifted to the right and vice-versa. When available oxygen to the tissues is decreased as in patients with anemia a shift to the right is advantageous.

The effect of other inhalational anesthetics on P-50 have been investigated. Halothane and other

inhalational anesthetics shifted the P-50 to the right (1,2). The mechanism of shift of this curve to the right caused by inhalational anesthetics has not been elucidated. Like the other inhalational anesthetics, the newer inhalational anesthetic isoflurane, shifted the P-50 to the right 2.62 0.40 mmHg (p < 0.005) at a vapor tension approximately one MAC.

References.

1. Gilles IDS, Bard BD, Norman J. The effect of anesthesia on the oxy-hemoglobin dissociation curve. *Brit J Anaesth* 42:561, 1970.
2. Smith TC, Solton ET, Behar MG. Does anesthesia alter the hemoglobin dissociation? *Anesthesiology* 35:5-10, 1970.

Table I

	Mean	S.D.	S.E.	†*	
CONTROL SAMPLE					
3.75% O ₂					
PO ₂ , mmHg	26.35	0.47	0.14		
O ₂ Sat, %	48.75	1.32	0.38		
4.5% O ₂					
PO ₂ , mmHg	31.63	0.57	0.16		
O ₂ Sat, %	60.67	0.91	0.26		
P-50, mmHg	26.93	0.51	0.15		
ISOFLURANE TREATED SAMPLE					
3.75% O ₂					
PO ₂ , mmHg	26.53	0.34	0.10	1.08	NS
O ₂ Sat, %	42.79	1.30	0.38	11.14	HS*
4.5% O ₂					
PO ₂ , mmHg	31.71	0.26	0.07	-0.44	NS
O ₂ Sat, %	55.19	1.50	0.43	10.91	HS*
P-50, mmHg	29.54	0.75	0.22	-9.96	HS*

NS = Not significant

*HS = Highly significant, beyond 99.95% confidence level.

* Paired t-test used.