TITLE: SEVOFLURANE REDUCES WHOLE BODY OXYGEN CONSUMPTION MORE THAN ISOFLURANE IN PIGS

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Inhaled anesthetic agents act as general metabolic depressants, but little difference has been shown among agents.[1,3] The purpose of this study was to examine the effects of equipotent doses of isoflurane and sevoflurane on whole body oxygen consumption in the pig.

After approval by our Animal Review Committee, six pigs weighing 24-33 kg (27.5±1.4 kg) were anesthetized with sevoflurane by mask followed by tracheal intubation and controlled ventilation. Transduced catheters were then placed with cutdowns into the left ventricle (via the left common carotid a.), the right atrium (via the left internal jugular v.), and the ascending aorta (via the right femoral a.). Each pig received either 2.5 MAC isoflurane or 2.5 MAC sevoflurane. The MAC of sevoflurane in pigs has been shown to be 2.66 while that of isoflurane is 1.45[2]. Arterial and venous blood gases as well as thermodilution cardiac outputs were measured in order to determine oxygen extraction ratio (O2ER), arterial-venous O2 content difference (AVDO2), and oxygen consumption (VO2). Data was analyzed using Student's grouped t-test with significance defined as $p<0.05$.

Six pigs received sevoflurane and six received isoflurane. The TABLE compares the measures of whole-body O2 consumption for sevoflurane and isoflurane. O2ER, AVDO2, and VO2 were significantly lower in the pigs receiving sevoflurane. There was no difference in cardiac output between the two groups.

Previous studies have shown enflurane, isoflurane, and halothane to be comparable in their ability to reduce whole body O2 consumption in dogs.[3] Sevoflurane reduces whole body O2 consumption more than isoflurane in pigs.

TABLE

	Sevoflurane	Isoflurane
CO (L/min)	2.0+0.1	1.8+0.3
AVDO2 (ml/dl)	6.9+0.9	4.1+0.6#
O2ER	0.48+0.05	0.33+0.03#
VO2 (ML/min)	130+14	74+13#

#Significantly different from isoflurane at $p<0.05$

[1]Anes 38:437-444, 1973.
[2]J Pharm Exper Therap 231:640-648, 1984.
[3]Br J Anes 47:813-816, 1975.

A410

TITLE: COMPARED TO ENFLURANE, ISOFLURANE PRODUCES LESS DEPRESSION OF THE STROKE VOLUME AND AUTONOMMIC RESPONSE OF CANINES GIVEN PHENYLEPHRINE

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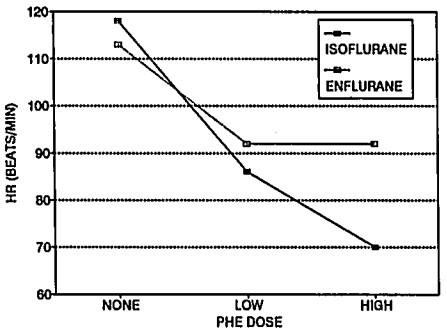
Introduction. Isoflurane has been shown to produce less myocardial depression than enflurane by multiple measures of cardiac function. Isoflurane and enflurane are also known to depress the baroreceptor response. However, different effects of isoflurane and enflurane on the autonomic nervous system have been less well defined. Phenylephrine (PHE) which increases mean arterial pressure (MAP), may decrease heart rate (HR) via the baroreceptor response. In this study we examined the effects of isoflurane and enflurane on autonomic responsiveness to PHE by comparing their ability to block the decrease in HR that follows the increased MAP response to PHE. To control for the effects of preload, we examined this response both with and without fluid challenge.

Methods. Hemodynamic evaluations using femoral and pulmonary arterial catheters were performed in nine 2-year-old purpose-bred beagles weighing 10-12 kg. Each dog received hemodynamic evaluations given two anesthetics (enflurane and isoflurane), three levels of MAC dose (0, 0.75, and 1.25 MAC), three levels of PHE [0 (no PHE), 4 (low dose PHE), and 10 μg/kg/min (high dose PHE)], and two levels of iv fluids (no fluid and lactated Ringer's, 50 ml/kg over 20 min followed by 40 ml/kg/h). The nine dogs were studied with each anesthetic and at various levels of each of the other factors (MAC dose, PHE dose, iv fluids) to complete a randomized partial-factorial design. Each dog was rested at least one week between anesthetics.

Results. MAP increases in response to PHE and iv fluids were similar (p=ns) in dogs given enflurane or isoflurane. The SVI response to isoflurane was significantly greater than the SVI response to enflurane [1.92±0.05 vs 1.75±0.06 (mean±SE); $p\leq0.05$], both with and without fluids and at both doses of PHE. In awake dogs (0 MAC), with increasing doses of PHE, MAP increased and HR decreased correspondingly ($p\leq0.05$). During inhalation anesthesia, without PHE, the HR response comparing the two drugs was inconsistent and differed among dogs. Specifically, six dogs, given no PHE, had a lower HR with enflurane and three dogs given no PHE had a greater HR with enflurane (as compared to isoflurane). As dose of PHE increased during inhalation anesthesia, however, the HR response became more consistent among dogs (8 of 9 dogs had a lower HR with isoflurane). Accordingly, at both low and high doses of PHE isoflurane (compared to enflurane) produced a significantly ($p\leq0.05$) lower HR (see figure). Fluids did not change this relationship among anesthetic drug, PHE, and the HR response (p=ns).



Conclusions. Compared to enflurane, isoflurane consistently produced a greater SVI in all dogs at all MAC doses (with and without PHE and fluids). In contrast without PHE, the HR response to the two drugs varied comparing dogs. With PHE, the HR responses of the dogs became more consistent and isoflurane produced a lower HR. Thus, isoflurane (as compared to enflurane) better preserved the awake (0 MAC) baroreceptor reflex bradycardia response to an increased MAP. Consequently, these data suggest that enflurane, compared to isoflurane at equal MAC doses, produced not only more myocardial depression, but more depression of the autonomic nervous system as determined by the baroreceptor response.