Title: INOTROPIC EFFECTS OF ISOFLURANE ON THE HYPERTROPHIED LEFT VENTRICLE IN DOGS

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INTRODUCTION: Left ventricular hypertrophy (LVH) is reported to be associated with myocardial depression (1). The depressed or failing myocardium is especially sensitive to anesthetic agents with negative inotropic effect (2). Since halothane and enflurane induce depression of contractility in normal hearts, it can be expected that the total depression exerted by these agents on the hypertrophied myocardium is greater than on the normal myocardium. Isoflurane is reported to depress left ventricular performance to a lesser extent than halothane and enflurane (3) and would, therefore, appear to be a superior anesthetic agent for cases with LVH. This study examines the effects of isoflurane on the contractile state of the hypertrophied dog heart model.

METHODS: Chronic concentric valvular LVH was produced by the method of noncoronary cusp obliteration in 5 healthy puppies at 8 weeks of age. The actual studies were performed 10 months following the operative procedure. Specific anatomic measurements in our laboratory, at the time of studies, have shown 1) an increase in LV/body weight ratio of approximately 50% in the dogs at the time of study, 2) normal coronary artery perfusion pressure that was equal to aortic pressure, and 3) that the site of the stenosis was at the aortic valve. Seven to ten days prior to each study the dogs were instrumented with epicardial ultrasonic dimension transducers to measure directly the anterior-posterior minor axis diameter of the left ventricle. Pneumatic occluders were positioned around the superior and inferior venae cavae. Balanced micromanometers were passed at the time of study into the left ventricle and pleural space to measure left ventricular transmural pressure. Left ventricular pressure and dimension data were recorded and computer analyzed during transient vena caval occlusions in the awake, control state, and following general anesthesia with isoflurane 1.25% and 2% end-tidal in oxygen. Ventricular inotropic state was assessed by the slope of the end-systolic pressure-length relationship: Pes = Ees (Les - Ld), where Pes and Les are the end-systolic left ventricular pressure and diameter, respectively, Ld is the length axis intercept and Ees is the slope of the relationship. An increase in the inotropic state is reflected as an increase in the Ees slope; a decreased slope is seen at a lower inotropic state.

RESULTS: Group mean data are summarized in the table. Isoflurane at 1.25% end-tidal produced no depression of the end-systolic pressure-volume relationship (Ees), but caused significant depressions of LV peak pressure and dP/dt. At 2% end-tidal isoflurane, Ees was significantly depressed, and LV peak pressure and dP/dt were further lowered from their 1.25% levels. Maximum fiber length shortening (-dL/dt) showed no significant changes with exposure to isoflurane. End-diastolic pressure was deliberately kept at approximately 10 mm. Hg. throughout the study.

DISCUSSION: The results show no deterioration in contractility (Ees) at 1.25% of isoflurane (1 MAC). This observation suggests that isoflurane at moderate concentrations may be safely used for general anesthesia in patients with stable LVH. On the other hand, the negative inotropic effect of 2% isoflurane may be detrimental and requires further study. The results also show that conventional measures of contractility, i.e., LV peak pressure, dP/dt and -dL/dt, do not necessarily reflect the true inotropic state of the heart and, must therefore, be interpreted with caution.

TABLE:

	Control	1.25%	2.0%
LV peak pressure	200.0 ± 23.7	145.8 ± 26.1*	108.2 ± 12.8*
dP/dt	2990 ± 280	1976 ± 273*	1363 ± 197*
-dL/dt	52.0 ± 11.9	35.2 ± 21.1	46.4 ± 12.7
End-diast. pressure	11.0 ± 2.1	8.8 ± 0.8	9.0 ± 2.9
Ees	20.1 ± 2.5	20.1 ± 4.2	14.3 ± 2.0*

Mean ± SD
* $p < 0.01$

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