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TITLE: COMPARISON OF CORONARY BLOOD FLOW DURING HALOTHANE AND ISOFLURANE ANESTHESIA (WITH AND WITHOUT N_2O) IN CHRONICALLY INSTRUMENTED DOGS

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INTRODUCTION: There are no previous reports comparing the effects of halothane (H) and isoflurane (I), with and without N_2O, on coronary blood flow (CBF) in the same dog. We therefore compared CBF at different levels of LV work during 1 and 2MAC (inspired) H and I alone (H1, H2 and I1, I2 respectively) and during 2MAC volatile/66% N_2O combination (H3, I3) in chronically instrumented dogs with normal coronary arteries.

METHOD: Six chronically instrumented beagles (15-21 kg) were studied on 33 randomised occasions. Dog-MAC equivalent concentrations of agents were used throughout. Only one agent was studied on each day with a 4-7 day interval between studies. Each dog was studied during awake, 1 and 2MAC volatile alone and 2MAC volatile/66% N_2O combination. To allow for anesthetic equilibrium, a 35 min interval was allowed between phases. Temperature was held at pre-induction level throughout. Four sets of measurements were obtained in each anesthetic phase to increase sample size (spontaneous rhythm and 127, 152, 163 paced rate). Left circumflex (LC) flow was measured using a cuffed doppler flowmeter. LV hemodynamic variables (HR, LVEDP, LVSP, LV.dp/dt) were recorded using a Koningsberg micromanometer. CO was determined by dye-dilution and SVI (stroke volume index) was calculated. Arterial and coronary sinus blood were sampled for blood gas analysis and for measuring O_2 content. Data analysis were performed using the principal component technique for within groups and between group comparisons. This technique is used to compare the effect of H and I on CBF in relation to LV hemodynamic indices that represent myocardial demand (HR, LVEDP, LVSP, SVI, LV.dp/dt max). Information obtained from the five indices are summarised in a single index. This index can then be used to relate the five indices to CBF, and by means of a dummy variable, comparisons of various anesthetics on mean CBF can then be made[1].

REULTS: The result of the statistical analysis shows that for a given LV work, CBF during I1 , I2 and H2 was significantly higher than awake ($P<0.001$, $P<0.005$ and $P<0.005$). Also H3 and I3 CBF was significantly higher than H2 and I2 ($P<0.005$, $P<0.001$). It also shows that CBF in the I treated dogs was significantly higher than in the H treated dogs ($P<0.001$, $P<0.005$, $P<0.01$).

CONCLUSION: Our data demonstrate that I (with or without N_2O) produced myocardial hyperperfusion compared to H. This finding together with the marked decrease in O_2 extraction ratio and the increase in coronary venous O_2 content with isoflurane is suggestive that I compared to H is a significant coronary vasodilator in dogs. N_2O substitution for equal MAC of both H and I compared with volatile alone produced similar findings. Our data also suggests that at higher concentration (2MAC), H also causes myocardial hyperperfusion.

[1] Statistical Methods in Medical Research, P. Armitage and G. Berry, 2nd Ed (1987), Oxford, Blackwell, P327-333.

A504

Title: EFFECTS OF HALOTHANE AND ISOFLURANE ON CORONARY COLLATERAL CIRCULATION IN CHRONICALLY INSTRUMENTED DOGS

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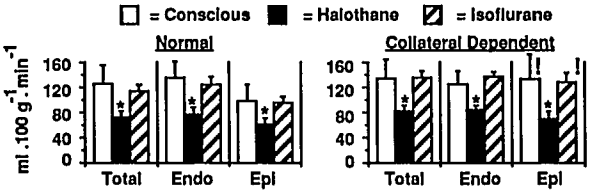
Isoflurane (I) is a more powerful vasodilator of intact coronary arteries than halothane (H).(1) The comparative effects of both anesthetics, however, on the perfusion of collateral dependent (CD) myocardium remain controversial. Vascular resistance of collateral arteries is high and the responsiveness of these vessels to vasodilators is unknown.(2) We compared the consequences of H and I anesthesia on regional myocardial perfusion in normally supplied (NL) and CD myocardium in a canine model of single vessel occlusion.

Five dogs were chronically instrumented to obtain measurements of aortic blood pressure (ABP) and heart rate (HR). An ameroid constrictor and pulsed Doppler flow probe were placed around the circumflex (Cx) coronary artery to induce and document progressive occlusion. Regional blood flow was measured using 15 μ Tracer Microspheres (TM), injected through a left atrial catheter. Experiments were started four to five weeks following ameroid implantation (i.e. an average of 2 weeks after complete occlusion). On separate days, regional myocardial perfusion was measured in conscious dogs and during H and I anesthesia (1 MAC in oxygen-air). During anesthesia, the lungs of all animals were mechanically ventilated to maintain normoxia and normocapnia. Data are presented as mean ± SEM and were analyzed using repeated measures ANOVA followed by Student's t-test (modified Bonferroni).

H and I decreased diastolic ABP from 78 ± 4 to 55 ± 3 and 54 ± 4 mmHg respectively. HR was slightly higher during I (108 ± 8 bpm) but did not statistically differ from HR during control (89 ± 5 bpm) or H (93 ± 4 bpm).
Fig. 1 shows that total and subendocardial (ENDO) blood flow to CD myocardium were equal to NL myocardium in conscious dogs. Subepicardial flow (EPI) in the NL myocardium was lower when compared to CD flow.
H reduced coronary blood flow both in the CD and the NL myocardium, whereas during I, NL and CD flows were maintained at the awake level. During I, but not during H, EPI flow remained higher in the CD than in the NL myocardium.

Fig. 1 Regional blood flow distribution in normal and collateral dependent myocardium



Mean ± SEM ; p< 0.05;* =vs Conscious ;! =Normal vs Collateral dependent myocardium.

We conclude that both H and I preserve intercoronary and transmural flow distribution during moderate hypotension in dogs with single vessel occlusion. The more pronounced vasodilating properties of I, when compared to H, remain present in collaterally supplied myocardium.

References

1. Anesthesiology 68 ; p 21-30
2. Circulation Research 39 ; p 371-377