

TITLE: RESUSCITATION FLUIDS FOR THE TREATMENT OF HEMORRHAGIC SHOCK IN DOGS: EFFECTS ON MYOCARDIAL BLOOD FLOW

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The efficacy of plasma substitutes in restoring circulating volume following acute blood loss has been well documented. However, the hemodilution caused by these fluids results in a decrease in oxygen carrying capacity and thus to a potential for reduced oxygen transport to the myocardium. The purpose of this study is to investigate the effects of several plasma substitutes on myocardial blood flow as measured by the radiolabeled microsphere technique following hemorrhage in dogs.

Forty-one mongrel dogs weighing 20-25 kg were anesthetized with pentobarbital (30mg/kg), paralyzed with pancuronium (0.1mg/kg), intubated and ventilated with 100% oxygen to maintain a PaCO₂ between 35-40 mmHg. A pulmonary artery thermodilution catheter was inserted via the right external jugular vein. Cardiac output was measured in triplicate by thermodilution. The right femoral artery was cannulated for withdrawal of reference samples during injection of radioactive microspheres while a left atrial catheter placed through a left thoracotomy was used for injection of microspheres. The right carotid artery was cannulated with a large bore canula and attached to a heparinized Wigger's reservoir for the collection of blood. Animals were bled to maintain a mean arterial pres-

sure of 35 mmHg for 90 min. Animals were resuscitated with one of five fluids: Gelofusine, Haemaccel, Hespan, lactated Ringer's solution or shed blood. Blood flow measurements were made following 30 min. stabilization (control), following 90 min. controlled shock (90 shock), resuscitation to control capillary wedge pressure (0 resus) and after maintenance of resuscitation for 90 min. (90 resus). Animals were then sacrificed and heart tissue harvested. Results are shown in Table 1.

This study suggests that the artificial colloids Gelofusine, Haemaccel and Hespan compensate for the reduced oxygen carrying capacity caused by hemodilution by increasing perfusion to the myocardium, thus maintaining adequate oxygen delivery to the myocardium. Lactated Ringer's solution did not increase myocardial perfusion resulting in a decrease in myocardial oxygen supply.

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Reference:

1. Surgery 89:434, 1981

Table 1. Myocardial Oxygen Transport (ml/min/g)

	Gelofusine	Haemaccel	Hespan	LRS	Blood
Control	0.48*	0.34*	0.37*	0.40*	0.37
90 shock	0.11	0.12	0.13	0.19*	0.13*
0 resus	0.36	0.37	0.35	0.25*	0.31
90 resus	0.24	0.23	0.26	0.19	0.19

* p<0.05 vs control

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A DOSE RESPONSE STUDY COMPARING THE CORONARY CIRCULATORY EFFECTS OF ISOFLURANE AND ENFLURANE IN THE NORMAL DOG

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INTRODUCTION: Recent investigations related to the propensity of the volatile anesthetics to induce "coronary steal" have focussed on a dog model of critical coronary stenosis^{1,2}. However, a paucity of normative data exists regarding the coronary vasodilatory potencies of the volatile agents in the coronary steal models. Accordingly, we performed a dose response study to determine the coronary hemodynamic effects of isoflurane versus enflurane in the normal dog to provide this reference normative data.

METHOD: 23 mongrel dogs were anesthetized with enflurane (N=10) or isoflurane (N=13) and ventilated with 100% oxygen after institutional approval was obtained. All animals received a narcotic base of morphine 2-3 mg/kg. Catheters were placed in the femoral artery and vein. The hearts were paced at 140/min. Myocardial blood flow was measured by Doppler flow velocity probes placed on the proximal left anterior descending artery (LAD) and circumflex coronary artery. The coronary hemodynamic effects of isoflurane and enflurane were compared at 0%, 1 MAC, 1.5 MAC and 2 MAC end tidal doses. Blood pressure was adjusted to within 10% of baseline with phenylephrine infusion as required. Results were analyzed by analysis of variance and linear regression.

RESULTS: Doppler flow velocity measurements of coronary blood flow revealed a significant increase in LAD and circumflex blood flow in the isoflurane treated dogs p=.0282 and p=.009, respectively as compared to enflurane treated dogs. Mean arterial blood pressure or heart rates were not significantly different between isoflurane and enflurane treated dogs.

CONCLUSIONS: Isoflurane compared to enflurane resulted in increased coronary blood flow in the normal LAD and circumflex artery as measured by Doppler flow velocity probes. In contrast, enflurane did not result in significant changes in coronary blood flow.

We conclude that isoflurane results in dose dependent coronary vasodilation in the normal canine coronary circulation and is a more potent coronary vasodilator than enflurane.

References:

1. Anesthesiology 66:280-292, 1987.
2. Anesthesiology 69:72-93, 1988.