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**TITLE:** ENDO/EPICARDIAL FLOW RATIO WITH SEVOFLURANE COMPARED TO OTHER VOLATILE AGENTS

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**Introduction:** Blood flow to the endocardium can be compromised in favor of blood flow to the epicardium. The purpose of this study was to quantitate the effects of perfusion pressure, acute coronary stenosis, and anesthetic agent on the ratio of blood flow between the endocardium and epicardium.

**Methods:** After approval of the protocol by the Institutional Animal Care and Use Committee, 26 pigs weighing 21 to 37 kg (27.0±0.9 kg) were randomized to receive one of four anesthetic agents: halothane (4), isoflurane (4), enflurane (5), and sevoflurane (5). After anesthetic induction, pressure transducers were positioned in the left ventricle, the ascending aorta, the right atrium, and a Swan-Ganz catheter was placed in the pulmonary artery. Each pig underwent a 10 min period of coronary perfusion pressures (CPP=DBP-LVEDP) greater than 50 mmHg and less than 40 mmHg, randomly determined. After 10 min, colored microspheres were injected, hemodynamic measurements taken, and arterial and venous blood gases drawn. A modification of the Gerwitz method of creating coronary stenosis was used.<sup>1</sup> An Amplatz coronary artery catheter was placed under fluoroscopic guidance with radiopaque dye injections into the left coronary artery. An angioplasty guidewire was then advanced through the catheter and into the LAD. A small teflon cylinder was advanced over the guidewire by pushing it with an angioplasty balloon catheter to a position in the distal 1/2 to 1/3 of the LAD. The catheter and guidewire were removed, and the teflon cylinder remained to produce a stenosis. Stenosis was confirmed by dye injection. Post-stenosis measurements were made at the same CPP's, again in random order, after 15 min of stenosis. Blood flows to epicardium and endocardium were calculated using the densities of the colored microspheres in each anatomical area at post-mortem. Data were analyzed with repeated-measures ANOVA with significance at p<0.05.

**Results:** Four of the pigs died at placement of the acute stenosis. Technical problems with the flow measurements were encountered in 4 other pigs. Complete data were collected on 18 pigs. Repeated-measures ANOVA revealed that CPP and anesthetic agent significantly affected endo/epicardial flow ratios, while acute stenosis did not. Decrease in CPP was identical for each group. Mean±SEM for high CPP was 61.2±1.5 mmHg, for low CPP 24.5± 1.5 mmHg. Table 1 summarizes the effects of perfusion pressure on endo/epicardial flow for the 4 agents.

**Conclusions:** Sevoflurane and enflurane preserve the endo/epicardial flow ratio at low perfusion pressures. These data provide evidence for an endo-to-epimyocardial blood flow steal with isoflurane and halothane in the presence of low coronary perfusion pressure.

**TABLE 1. ENDOCARDIAL/EPICARDIAL FLOW RATIOS**

	HIGH CPP* >50 mmHg	LOW CPP* <40 mmHg
HALOTHANE (n=4)	1.48±0.31	1.25±0.26 <sup>1</sup>
ISOFLURANE (n=4)	1.03±0.09	0.73±0.12 <sup>1</sup>
ENFLURANE (n=5)	1.10±0.11	1.08±0.08
SEVOFLURANE (n=5)	1.21±0.13	1.23±0.09

\*CPP=DBP-LVEDP

<sup>1</sup>p<0.05, compared to endo/epicardial at high CPP

**References:** <sup>1</sup>Am J Cardiol 47:589-596, 1981

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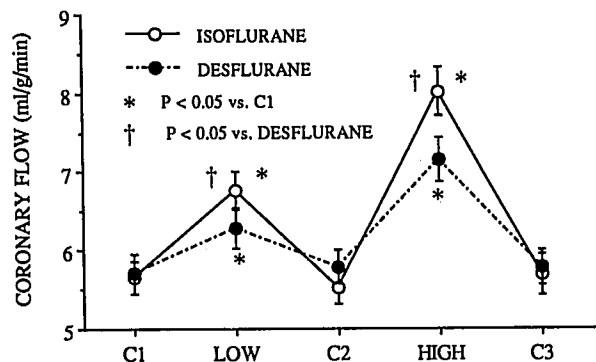
**TITLE:** DIFFERENTIAL EFFECTS OF ISOFLURANE AND DESFLURANE IN ISOLATED GUINEA PIG HEARTS

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Desflurane is a new volatile anesthetic with low blood and tissue solubility. In studies in vivo, desflurane appears to have similar cardiovascular effects to those of isoflurane.<sup>1-3</sup> Studies using an isolated perfused heart model could be more sensitive to reveal potential differences between these two anesthetics, since nervous, humoral, preload and afterload influences can be avoided. This report describes the direct cardiac effects of these anesthetics in vitro.

Hearts (n=12) were isolated and perfused by the Langendorff technique at a constant perfusion pressure of 55 mmHg. Coronary flow, heart rate (HR), AV conduction time, isometric systolic left ventricular pressure (SLVP) and O<sub>2</sub> extraction were measured. Each heart was exposed randomly to low and then high concentration of either anesthetic for 10 min with 15 min washout periods between each level. Anesthetic concentrations in the perfusate were 0.28 ±0.02 and 0.53±0.02 mM for isoflurane and 0.59 ±0.01 and 1.02 ±0.09 mM for desflurane. Calculated vapor concentrations in vol % were: 1.3 and 2.5 for isoflurane and 6.8 and 11.8 for desflurane (approximately 1 and 2 MAC). Data were analyzed by ANOVA and compared by means tests. Coronary flow data are shown in the figure and the other variables are summarized in the table (means±SEM):



		CON 1	LOW	CON 2	HIGH	CON 3
HR bpm	ISO	218±4	205±4 *	218±5	198±4 *	217±5
	DES	219±4	204±4 *	219±4	198±5 *	218±5
AV ms	ISO	64±1	67±2 *	65±2	75±2 *	65±2
	DES	65±2	67±2 *	65±2	76±2 *	64±1
SLVP mmHg	ISO	93±4	82±3 *	90±4	68±3*†	90±4
	DES	93±5	80±4 *	91±4	64±2 *	90±4
O <sub>2</sub> EXT %	ISO	59±3	43±4 *	61±3	28±4 *	59±3
	DES	58±3	46±4 *	59±3	32±4 *	58±3

These results indicate that coronary flow increased in a dose-dependent manner with both anesthetics; however isoflurane caused a significantly greater increase in coronary flow than desflurane. Isoflurane and desflurane also significantly decreased HR, SLVP and % O<sub>2</sub> extraction and prolonged AV conduction time. The high level of desflurane, however, caused a slight but significantly greater decrease in SLVP as compared to isoflurane.

Our study shows that the effects of desflurane and isoflurane on the isolated heart are generally similar at equi-anesthetic concentrations. The most pronounced difference between these two anesthetics was the effect on coronary flow. This difference in flow response is similar that found in vivo in autonomically blocked dogs.<sup>3</sup>

**References:** 1)Anesthesiology 69:303, 1988 2)Anesthesiology 74:568, 1991 3)Anesthesiology 74:539, 1991