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TITLE: EFFECTS OF SEVOFLURANE AND ISOFLURANE ON REGIONAL BLOOD FLOW DISTRIBUTION IN RATS

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Sevoflurane is a promising new volatile anesthetic agent with a low blood/gas partition coefficient and hence rapid recovery from anesthesia. Studies comparing regional hemodynamic effects during sevoflurane with other presently used anesthetics are not available, until now. Effects of sevoflurane and isoflurane on cardiac function and circulation were almost identical. This would render isoflurane the appropriate reference against which to compare sevoflurane. This study was designed to assess systemic hemodynamics and regional blood flow distribution of sevoflurane in comparison with isoflurane.
Methods: Experiments were performed in 15 Sprague-Dawley rats during general anesthesia with i.v. chloralose and controlled ventilation (p_aO_2 100-120mmHg; pCO_2 35mmHg). Catheters were inserted into the abdominal aorta, the vena cava superior, the left ventricle and the tail artery. Determination of regional blood flow was performed by radioactive microspheres (diam: 15µm) injected into the left ventricle and a reference sample technique. Concentrations of sevoflurane (S) and isoflurane (I) were applied to lower mean arterial pressure to 70 and 50 mmHg for 20 minutes. Control recordings were obtained during chloralose anesthesia without an anesthetic gas. The sequence of experimental steps was randomized.
Results: Mean arterial pressure was reduced to 70 and 50 mmHg by 1.7 and 3.9 vol% S and 1.0 and 2.4 vol% I, respectively. Major results are summarized in the table.

	control	Sevo 70	Sevo 50	Iso 70	Iso 50
MAP	91±3	70±0	50±1	70±0	50±0
HR	429±9	382±7	355±8	395±8	365±5
CO	114±8	95±6	80±6	95±5	93±5
CBF	108±12	94±8	106±7	119±9	132±7
MBF	641±62	498±43	443±37	576±62	571±85
RBF	436±24	432±18	353±23	453±22	362±37

Abbreviations: MAP, mean arterial pressure, mmHg; HR, heart rate, bpm; CO, cardiac output, ml/min. CBF, cerebral blood flow; MBF, myocardial blood flow; RBF, renal blood flow: all ml/min/100g.

The rate-pressure product of the left ventricle decreased identically with both anesthetics.
Discussion: The results show that at identical mean arterial pressures S produces less pronounced vasodilation than I in cerebral and myocardial vascular beds, while effects on renal blood flow are comparable. This was also evidenced from the fractions of CO to brain and heart which increased more markedly during I, while there was essentially no change in the renal vascular bed. Comparison of left ventricular blood flow with the rate pressure product as a measure of oxygen demand reveals overperfusion of the myocardium with I while S is less potent in this respect. Due to peripheral vasodilation in combination with less pronounced negative inotropic effects I maintains cardiac output better than S.

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TITLE: SPLANCHNIC BLOOD FLOW DURING SEVOFLURANE AND ISOFLURANE IN RATS

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Sevoflurane (S) is a rapid acting, pleasant smelling, and potent new volatile anesthetic agent. Its low blood gas partition coefficient enables rapid recovery from anesthesia. It has been shown that cardio-circulatory effects of S are almost identical to those of isoflurane (I), making I an appropriate agent for comparison. Detailed studies of total hepatic blood flow and the distribution of splanchnic flow during S and I are not available. This study was designed to assess systemic hemodynamic and regional splanchnic effects of both inhalational anesthetics.
Methods: 15 Sprague-Dawley rats were investigated during basal anesthesia with i.v. chloralose. Controlled ventilation was set to maintain normal blood gases. Catheters were inserted into the abdominal aorta, the vena cava superior, the left ventricle and the tail artery. Determination of splanchnic blood flow was performed by radioactive microspheres (0 15µm) injected into the left ventricle using a reference sample technique. Concentrations of S and I were adjusted to lower mean arterial pressure (MAP) to 70 and 50 mmHg for 20min. Control recordings were obtained during i.v. anesthesia without a volatile anesthetic. The sequence of experimental steps was randomized.
Results: MAP was reduced to 70 and 50 mmHg by 1.7 and 3.9 vol% S and 1.0 and 2.4 vol% I, respectively.

	control	Sevo 70	Sevo 50	Iso 70	Iso 50
MAP	91±3	70±0	50±1	70±0	50±0
CO	114±8	95±6	80±6	95±5	93±5
HABF	37±6	36±5	26±3	40±5	25±3
PVBF	167±12	154±10	136±8	160±10	146±6
THBF	204±16	190±12	163±40	200±14	173±9
Spleen	293±44	259±37	200±25	345±40	120±17
Stom.	83±6	75±6	78±7	78±6	100±7
S. Int.	176±14	174±16	151±10	182±14	164±14
L. Int.	138±9	122±5	112±9	126±8	131±8
Panc.	105±12	79±7	93±10	82±11	139±8

Abbreviations: MAP, mean arterial pressure, mmHg; HABF, hepatic arterial flow; PVBF, portal venous blood flow; THBF, total hepatic blood flow; Stom., stomach; S. and L. int., small and large intestine; Panc., pancreas: all ml/min/100g.

Discussion: Identical arterial pressures were maintained by concentrations of the inhalational anesthetics that were also equianesthetic (MAC principle). Due to a more pronounced peripheral vasodilation, cardiac output was better maintained with I, while heart rate decreased comparably with both anesthetics. S and I reduced THBF dose dependently. While HABF was well preserved at MAP 70, yet even slightly increased with I it decreased at MAP 50 with both anesthetics. Maintainence of HABF was due to a decreased hepatic microvascular resistance as also evidenced from an increased fraction of CO. The total hepatic fraction of CO was increased over its control value during all experimental steps with volatile anesthetics. I decreased portal flow at both concentrations slighty less than S. An unexpected finding was that pancreatic perfusion was well preserved even with the high concentrations of the anesthetics. Therefore, S and I had comparable effects on splanchnic blood flow, albeit I maintained THBF and CO slightly better.