TITLE: CORONARY MICROVESSEL DIAMETERS AND CORONARY HEMODYNAMICS DURING NITROUS OXIDE IN DOGS

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Introduction: It was shown recently by angiography, that nitrous oxide (N_2O) constricts porcine epicardial arteries (1). However, the relevance of this finding for overall coronary hemodynamics remained obscure. To find out, whether the small arterioles and large arteries would react similarly, we investigated the behaviour of coronary microvessels, as well as of global coronary hemodynamic parameters during N_2O.
Methods: 6 mongrol dogs (mean b.w. 25.5kg) were studied, so far, during general anesthesia with a narcotic. Artificial ventilation was set to maintain arterial pO_2 at 120mmHg and pCO_2 at 35mmHg. Catheters were placed in abdominal aorta, pulmonary artery, coronary sinus and left atrium. Access to the left ventricular surface was through a left sided thoracotomy. Left ventricular blood flow was measured by radioactive microsphere technique (diameter 15µm).Plasma was stained by FITC labelled Dextrane (MW 150000 Dalton). Microscopic images were recorded by a high sensitivity TV camera and stored on videotape for off-line analysis. Recordings were obtained at control (C; narcotic only) and during 65% N_2O with the narcotic infused at an unchanged rate (N_2O). Deliberate hypotension was induced by halothane and the recordings were repeated with (Hal+ N_2O), and without (Hal) N_2O. The sequence of experimental steps was randomized. Because of the limited number of experiments, statistical analyses were not performed, yet.
Results: The data in the table are given as mean values ± SEM. Diameter measurements were performed in a total of 120 microvessels with diameters from 20-400µm.Systemic hemodynamic parameters and microvascular dimensions were comparable at C and N_2O.
Deliberate hypotension by Hal and Hal+N_2O decreased left ventricular blood flow; coronary vascular resistance remained unchanged. Microvessel dimensions were slightly higher during deliberate hypotension. Again, there was no obvious difference between Hal+N_2O and Hal. The average end-exspiratory concentrations of halothane required to reduce MAP to 60 mmHg was 1.0 ± 0.1Vol% during Hal and during Hal+N_2O.

	C	N_2O	Hal+N_2O	Hal
Hemodynamics				
HR	82 ± 7	75 ± 6	83 ± 5	78 ± 3
MAP	93 ± 5	89 ± 6	58 ± 1	58 ± 1
PO_{2cv}	30 ± 1	33 ± 2	34 ± 3	30 ± 2
LVBF	107 ± 10	104 ± 13	66 ± 12	63 ± 5
LVO_2C	9.2 ± 0.9	8.5 ± 1.5	4.6 ± 0.3	5.6 ± 0.4
CVR	0.8 ± 0.1	0.7 ± 0.1	0.8 ± 0.1	0.8 ± 0.1
Arteriolar Diameters (µm)				
20-40	26.8 ± 1.5	27.2 ± 1.3	32.1 ± 4.6	30.3 ± 3.3
40-60	47.8 ± 2.7	45.9 ± 6.0	53.4 ± 11.3	48.7 ± 0.7
60-100	79.9 ± 3.9	67.2 ± 5.2	65.4 ± 7.2	74.3 ± 5.7
100-150	120.7 ± 3.9	110.5 ± 4.3	117.3 ± 7.6	117.1 ± 3.1
150-200	182.0 ± 0.6	170.0 ± 8.0	193.3 ± 16.2	178.7 ± 3.2
> 200	267.6 ± 51	283.5 ± 78	268.3 ± 35	275.8 ± 46

Legend: *HR = heart rate (min^{-1}); MAP = mean arterial pressure (mmHg); PO_{2cv} = coronary venous PO_2 (mmHg); LVBF = left ventricular blood flow ($ml*min^{-1}*100g^{-1}$); LVO_2C = left ventricular oxygen consumption ($ml*min^{-1}*100g^{-1}$); CVR = coronary vascular resistance ($mmHg*min*100g*min^{-1}$).*

Conclusion: Neither N_2O superimposed to a narcotic nor as a supplement to halothane changed coronary hemodynamic parameters or microvascular dimensions markedly. These results were obtained at comparable systemic hemodynamic conditions (C/N_2O or Hal+N_2O/Hal). Albeit N_2O may act as a constrictor of large epicardial arteries, we conclude that this is not the case in the flow regulating microvessels.
1 Pettis et al., Anesthesiology 71, A533, 1989

TITLE: rCBF AND FORMATION OF BRAIN EDEMA IN THE PRESENCE OF A FOCAL LESION - INFLUENCE OF ISOFLURANE, FENTANYL OR THIOPENTAL

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Anesthetic agents may influence brain injury by modifying cerebral blood flow and O_2-supply. We have currently analyzed the effect of different anesthetic methods on the course of rCBF and the development of brain edema from a focal cerebral lesion in rabbits.
Methods: Three groups of 6 albino rabbits each were anesthetized with isoflurane (I) (2.1 vol %), fentanyl (F) (cont. infusion of 1.0/0.5 µg/kgb.w. x min), or thiopental (T) (32.5 mg/kg b.w. x hr). In animals with isoflurane, angiotensin II (mean 0.15 µg/kg b.w. x min) was infused to maintain a normal blood pressure. MABP, Hct and blood gases were monitored throughout the experiment. The left cerebral hemisphere was exposed and 4 Pt-needle electrodes were impaled at various distances from a focal lesion (cold inury) into the cerebral cortex for measurement of rCBF by H_2-clearance. rCBF was assessed during control conditions prior to trauma as well as at 20 min-intervals until 6 h after lesion. The brain was rapidly removed then and frozen for determination of specific gravity (SG). SG was assessed by a linear density column (Percoll) in multiple specimen sampled from white and grey matter close to and distant from the lesion. The data were compared with corresponding specimen of the contralateral hemisphere.
Results: Arterial pCO_2 and Hct remained unchanged in all experimental groups, while MABP was 78, 86, or 72 mm Hg in groups I,F, or T, respectively. Cerebral hyperemia involving the entire hemisphere for approximately 1 hour was found in all experimental groups after trauma. The response was most pronounced in groups I and F. Thereafter, in the vicinity of the trauma rCBF fell in all groups to 65 - 85 % of control. Distant to the lesion, secondary hyperemia was observed in group I, while cerebral perfusion remained subnormal in group F (Fig. 1). rCBF remained largely unchanged in animals with thiopental. Close to the lesion, SG averaged of white matter samples was significantly reduced indicative of brain edema (Fig. 2). Differences in the development of brain edema were, however, not observed between the various forms of anesthesia.
Discussion: Isoflurane is employed for neurosurgical procedures, although studies in patients with space occupying lesions have shown a considerable increase of intracranial pressure (1). The present results demonstrate marked cerebral hyperemia under isoflurane, although MABP was even lower than in the other experimental groups. rCBF was reduced or largely unchanged in animals with fentanyl, or thiopental, respectively. On the other hand, no evidence was obtained on an anesthesia dependent enhancement or attenuation of brain edema. This would confirm former findings using isoflurane, or barbiturates (2). It is concluded that modification of the hyperemic blood flow response in the vicinity of a cerebral lesion by anesthesia does not influence formation of perifocal brain edema.
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References: 1. Grosslight et al, Anesthesiology 63: 553, 1985
2. Kaieda et al, Anesthesiology 71: 571, 1989

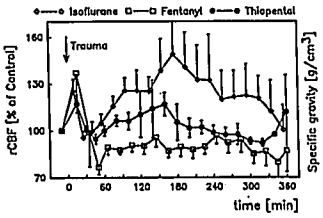

Fig. 1

Influence of different anesthetics on rCBF in focal brain injury.

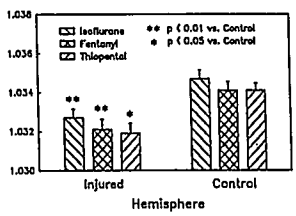

Fig. 2

Specific gravity of white matter samples of focally injured brain (left) and in the contralateral brain hemisphere (right).