

Title: CARDIOVASCULAR EFFECTS OF HALOTHANE AND SYSTEMIC VASODILATION DURING RIGHT CORONARY ARTERY STENOSIS

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Introduction. Patients with right coronary artery (RCA) disease may receive halothane (HAL) and vasodilators. Accordingly, these studies were performed to examine the effects of HAL alone and those of HAL and systemic vasodilation together on global and regional myocardial function with and without underlying RCA stenosis.

Methods. Our studies were performed in 8 open-chested dogs (27 - 41 kg) anesthetized by continuous infusions of pentobarbital (1 mg/kg/hr) and fentanyl (15 µg/kg/hr), and mechanically ventilated with 50% O₂ in air. After median sternotomy the heart was suspended in a pericardial cradle. We determined pressures (Millar catheters) in aorta (AoP), right (RV) and left ventricle (LV), and flows (electromagnetic probes) in RCA (CBF_R), left anterior descending artery (CBF_L) and aorta (AoF). Regional myocardial function was evaluated by piezoelectric crystals inserted in the LV (L), as well as the inflow tract (IT), within the territory of the RCA, and the outflow tract (OT) of the RV. The ultrasonic signals were analyzed for percent shortening (%) during systole. The experimental protocol was as follows: after baseline measurements (C1), HAL 1.6% was added. After hemodynamic stabilization under HAL, nitroglycerin (TNG, 5 µg/kg i.v. bolus) and Ringer's acetate (RA, 2 ml/kg) were administered in randomized order. Measurements were taken at the time of the lowest AoP induced by TNG or RA. HAL was then discontinued for approximately 40 mins. After repeat measurements (C2), RCA stenosis (S) was induced by means of a micrometer-controlled, spring-suspended snare. In the presence of RCA stenosis, HAL, TNG and RA were again administered in the manner described earlier. All data were analyzed by Wilcoxon signed-rank test (significance level p < 0.05).

Results. These are summarized in the table. There were no differences between C1, C2 and S except for a reduction in CBF_R of approx. 6%. TNG and RA, when given during HAL, consistently lowered AoP and caused increases in L%, AoF, stroke volume (SV) and CBF. IT% and OT% were little affected. In contrast, during RCA stenosis, HAL as well as TNG and RA caused pronounced decreases in IT% and CBF_R. However, even during RCA stenosis L%, AoF and SV increased significantly in response to TNG and RA.

Discussion. TNG and RA given during HAL caused improvement in L%, SV and AoF possibly related to the marked reduction in LV afterload. RA consistently caused profound coronary and peripheral vasodilation. Coronary vascular reserve was preserved during deep HAL: CBF rose despite TNG- and RA-induced hypotension. In the presence of RCA stenosis, however, HAL, TNG and RA caused marked deterioration in regional RV function and coronary hemodynamics despite concomitant increases in SV and AoF during TNG and RA. Regional myocardial deterioration may thus go undetected with routine cardiovascular monitoring and in parallel with overall hemodynamic improvement.

VARIABLE	C1	HAL	HAL+TNG	HAL+RA
	C2 S	S+HAL	S+HAL+TNG	S+HAL+RA
RVP(mmHg)	25±1 26±1 26±1	20±1*	21±1	25±1¶
RVEDP(mmHg)	4.4±0.5 4.9±0.8 4.9±0.8	5.0±0.7	4.9±0.8	6.5±0.8¶
IT(%)	19.7±1.0 18.9±1.7 18.7±1.7	14.1±1.7*	15.0±1.7	14.8±1.6
OT(%)	15.2±1.4 15.3±1.5 15.1±1.6	9.6±0.8*	10.2±1.1	10.5±0.9
CBF _R (ml/min)	17±2 17±2 16±2	13±2*	16±2*	21±2¶
AoP _M (mmHg)	91±4 87±5 87±5	59±3*	39±3*	41±4¶
LVEDP(mmHg)	6.3±0.5 7.0±0.8 7.0±0.8	7.4±0.8	6.1±0.6*	7.3±0.7
L(%)	18.0±1.4 17.7±1.5 17.7±1.6	11.6±1.9*	14.2±1.9*	15.3±2.2¶
CBF _L (ml/min)	36±7 35±6 34±6	25±5*	28±5*	44±8¶
AoF(l/min)	2.6±0.2 2.5±0.2 2.5±0.2	1.7±0.2*	2.1±0.2*	2.1±0.2¶
SV(ml/beat)	24±2 25±2 25±2	16±2*	20±2*	22±2¶
HR(/min)	106±7 101±7 103±7	103±6	105±6	95±5¶

All values are means ± SE. Experimental sequence: C1 = baseline, HAL = HAL 1.6%, HAL+TNG = nitroglycerine during HAL 1.6%, HAL+RA = Ringer's acetate during HAL 1.6%, C2 = post HAL discontinuation, S = post induction of RCA stenosis following C2, S+HAL = HAL 1.6% during RCA stenosis, S+HAL+TNG = TNG during S and HAL, S+HAL+RA = RA during S and HAL. Values for each variable are listed in same order. (See text for further abbreviations.) Symbols indicate significant differences (p < 0.05) within same line: * = when compared to preceding value; ¶ and † = when compared to HAL, or S+HAL, respectively. p < 0.05 between underlined value and value immediately above.