Title: EFFECT OF HALOTHANE AND FENTANYL ON MYOCARDIAL INFARCT SIZE AND REGIONAL BLOOD FLOW DISTRIBUTION.

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Introduction: Increasing numbers of patients, who may be at risk from previous or impending myocardial infarcts, have submitted to surgery under general anesthesia during the last two decades. For these patients with impaired myocardial function, the synthetic narcotic fentanyl seems to be well tolerated. Halothane, however, lowers myocardial oxygen consumption and causes a dose related decrease in the heart's work.(1) Hypothetically, halothane may be the anesthetic agent of choice for these patients. To test this hypothesis, fentanyl was compared with halothane, during induced myocardial infarct and reflow upon a range of physiological parameters of cardiovascular performance in twenty mongrel dogs.

Methods. After left thoracotomy, each canine's left mid circumflex or large obtuse marginal coronary artery was ligated, inducing infarct. Occlusion was maintained for ninety minutes, followed by reflow for an additional ninety minutes after removal of ligatures. Two groups of ten dogs each were thus treated; fentanyl was used for one group and halothane for the other. The mean administered anesthetic dosages were: fentanyl 100 µg/kg intravenous loading dose given over fifteen minutes and 27 + 4 µg/kg/hr for maintenance of anesthesia; halothane 0.89 + 0.2% end-tidal concentration. All animals were ventilated with an air-oxygen mixture to maintain blood gases within normal limits.

Relative blood flow distributions in myocardium were assayed during infarct and reflow, via a (15-micron) radioactive microsphere technique.(2) Area-of-risk and area-of-infarct were outlined by injection of silicone rubber (Microfil) into the patent coronary arteries of the excised heart and subsequent differential staining (NBT-negative technique) of myocardial slices.(3) Discrete areas-of-infarct and area-of-risk were established from color photographs submitted to computerized digitizer techniques.(4) Area-of-infarct and area-of-risk were correlated with regional myocardial blood flows.

Results. All listed values are significant for $p<0.05$ unless otherwise noted.

The mean area-of-risk was not significantly different between the two anesthetics, indicating that the average size of the coronary artery selected for occlusion was identical in both experimental groups. Mean area-of-infarct under halothane (49 + 3%) was significantly larger, compared to Fentanyl (28 + 6%).

Regional blood flow within the area-of-infarct was very low for both anesthetics: 9 + 1% of normal flow under fentanyl, 3 + 0% under halothane. Reflow within the area of infarct was also significantly greater under fentanyl (58 + 3%) than under halothane (47 + 3%). The regional blood flow with the area-of-risk during ligation showed fentanyl (61 + 3%) again significantly greater than halothane (39 + 4%). Reflow into the area-of-risk under halothane (105 + 3%) was greater than under fentanyl (82 + 1%). However, flow to normal myocardium was 100 + 2 ml/100gm/min under halothane and 107 + 3 ml/100 gm/min under fentanyl, which is not statistically different.

Differences in mean physiological parameters also showed statistical significance. Arterial blood pressure under fentanyl (142/91 + 2mmHg) was higher than under halothane (111/81 + 1 mmHg). Cardiac index under fentanyl (4.1 + 0.1 L/min/m^2) was higher than under halothane (3.7 + 0.1 L/min/m^2). Heart rate under fentanyl (104 + 2 beats/min) was lower than under halothane (132 + 1 beats/min). Left Ventricular Minute Work Index under fentanyl (5712 + 142 g-m/min was greater than under halothane 4224 + 107 g-m/min.

There was no significant difference between the anesthetics' Mean Rate Pressure Products: Fentanyl was 14589 + 305 and halothane was 14620 + 191. Therefore, RPP may be an inappropriate clinical parameter for estimation of infarct risk.

Discussion. Fentanyl resulted in a smaller area-of-infarct than did halothane. Regional myocardial blood flow within the area-of-risk infarct was greater under fentanyl than under halothane. Normal myocardium, given the same amount of blood flow under each anesthetic, performed more work under fentanyl than it did under halothane. The hypothesis that halothane anesthesia decreases myocardial workload and therefore, is the anesthetic of choice in patients at high risk of infarction was proven inaccurate. The myocardium was less efficient under halothane. The possibility of infarction, for patients with increased cardiac risk under general anesthesia, appears to be greater under halothane than under fentanyl.

References.

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