Title : ANEMIA, ANESTHESIA AND DISTRIBUTION OF MYOCARDIAL BLOOD FLOW.

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Introduction. A sufficiently large decrease in left ventricular supply demand ratio produces decreased subendocardial blood flow relative to subepicardial flow, i.e. a decreased inner/outer (I/O) flow ratio.[1] Both severe anemia[2] and large increases in rate pressure product (RPP)[3] produce this decreased flow ratio. Because narcotic-relaxant and halothane anesthesia may produce opposite effects on RPP,[4,5] we investigated the effect of these two anesthetic techniques on the I/O ratio of dogs whose myocardial oxygen supply: demand ratio was decreased by acute normovolemic anemia.

Methods. We anesthetized and instrumented ten dogs, five with thiopental 10 mg/kg and 1.5% end tidal halothane, and five with thiopental 10 mg/kg and morphine sulphate 1.5 mg/kg. Both groups received succinylcholine 1 mg/min and were mechanically ventilated with oxygen. Arterial PCO_2 was maintained between 35 and 40 torr. Acute normovolemic anemia was produced by replacing whole blood with dextran 75 without changing CVP from control levels. Myocardial blood flow distribution was measured using the radioactive microsphere technique.[6] Measurements were made at control hemoglobin levels and at four subsequent degrees of anemia.

Results. Control RPP values were similar in both groups. Control I/O ratios were normal in both groups (1.0 ± .2). Below 5 gm/dl hemoglobin the RPP's of the morphine group were significantly higher than those of the halothane group. ($P < .05$), and both groups had significantly decreased I/O ratios, 0.828 ± .188 (mean ± SD) for morphine and 0.761 ± .219 for halothane. There was no significant difference between the groups at these low hemoglobin levels. Similarly, both groups showed significantly lowered I/O ratios when the supply: demand ratio fell below a critical value of 1.4, with no difference between the two groups.

Discussion. Higher RPP values of the morphine group might decrease I/O ratios at higher hemoglobin levels than the halothane group. This was not seen. It is possible that undetected changes in the other two major determinants of myocardial oxygen demand, contractile state or left ventricular wall tension, could account for this observation. It is further possible that there were different interstital myocardial pressures in the two groups, resulting in different myocardial perfusion pressure gradients and hence different oxygen supply values. There is evidence that such changes can occur in some disease states such as polycythemia[7] and at low coronary perfusion pressure.[3]

We conclude that subendocardial ischemia does not occur until less than 5G hemoglobin is present, and that morphine and halothane anesthesia do not differ in this regard.

This study was supported by Anesthesia Center Grant #GM15571-12 and the R. Samuel McLaughlin Foundation.

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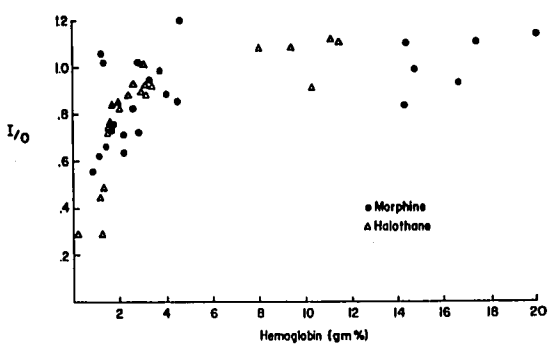

I/O ratio vs. hemoglobin concentration during morphine and halothane anesthesia. There is no difference between I/O ratios at control and below 5 mg% hemoglobin concentrations.