

Modulation of Myocardial Oxygen Delivery in Response to Isovolemic Hemodilution

Blake R Simon¹, Hana E Baker², Conner C Earl¹, Adam G Goodwill², Sam Luebbe¹, Johnathan D Tune²

¹Indiana University School of Medicine, ²Indiana University School of Medicine, Department of Cellular and Integrative Physiology

Background and Hypothesis: Prior studies have established that progressive increases in coronary blood flow are sufficient to maintain myocardial oxygen delivery in response to reductions in arterial oxygenation. However, the precise mechanisms responsible for anemic coronary vasodilation remain poorly understood. This investigation tested the hypothesis that autonomic neural pathways contribute to the maintenance of myocardial oxygen delivery in response to graded reductions in arterial hematocrit.

Experimental Design: Experiments were conducted in open-chest anesthetized swine while assessing coronary blood flow and coronary arterial and venous blood gases in response to progressive hemodilution. Isovolemic hemodilution was achieved via simultaneous removal of 250mL of arterial blood and addition of 250mL of a synthetic plasma expander (Hespan) in swine that received either vehicle or a combination of atropine (0.5mg/kg) and propranolol (1mg/kg) (Atro/Pro).

Results: Relative to vehicle control swine, treatment with Atro/Pro increased heart rate by $\sim 50 \pm 4$ beats/min and arterial pressure by $\sim 10 \pm 1$ mmHg. However, Atro/Pro did not significantly alter increases in coronary blood flow in response to isovolemic hemodilution (hematocrits ranging from $\sim 35 \pm 1\%$ to $\sim 15 \pm 1\%$). Coronary venous PO_2 , an index of myocardial oxygenation, was also unchanged by hemodilution in both vehicle and Atro/Pro treated swine.

Conclusion and Potential Impact: These data suggest that autonomic neural pathways do not play a significant role in the maintenance of myocardial oxygen delivery in response to graded reduction in arterial oxygen content. Understanding of how myocardial oxygen supply is ultimately sensed and regulated in response to reductions in tissue oxygenation remains elusive.