Title: CORONARY SINUS BLOOD FLOW DURING HYPOTENSION INDUCED BY SODIUM NITROPRUSSIDE OR ADENOSINE TRIPHOSPHATE INFUSION

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Introduction: Adenosine and related adeny compounds have been implicated as endogenous regulatory substances in local control of organ blood flow. Recently adenosine triphosphate (ATP) has been found to be an effective hypotensive agent similar in effect to sodium nitroprusside (SNP). The purpose of this study was to examine and compare the effects of both SNP and ATP on coronary sinus blood flow (CSBF), myocardial O2 consumption, and circulating plasma catecholamine levels in the dog.

Methods: Anesthesia was induced in six healthy dogs with sodium thiopental (15-20 mg/kg). The animals were instrumented while anesthetized with 1.5% inspired halothane in oxygen. Ventilation was adjusted to maintain normal PaCO2. Central venous pressure (CVP) and thermodilution cardiac output were measured through a Swan-Ganz catheter. Coronary sinus blood flow was determined by thermodilution with a Webster catheter. Arterial blood pressure (ABP), heart rate (HR), CVP, and ECG were recorded continuously. Blood oxygen contents were determined by a Lex-O2-CON and plasma norepinephrine (NE) and epinephrine (Epi) concentrations by high performance liquid chromatography. The dogs were maintained on 1.0% end-tidal halothane in 40% O2 after instrumentation was complete. Following a control period, MABP was decreased to 50% of control by infusion of either ATP or SNP and samples were taken as shown below.

Results: Hypotension induced by both SNP and ATP resulted in marked increases in CSBF; however, ATP-induced hypotension resulted in levels significantly (p < 0.05) higher than those caused by SNP during the first sixty minutes (figure). The infusion rate of SNP necessary to maintain a 50% reduction in MABP over the 120 minute hypotensive period increased while that of ATP generally decreased. Similarly, HR increased with SNP while it decreased for ATP (figure). CO increased or stayed the same for both ATP and SNP induced hypotension. Circulating plasma catecholamines increased, (control NE=135±5 & Epi=26±5; 120 minutes NE=425±157 & Epi=470±198 pg/ml) for SNP and remained relatively constant for ATP. Coronary pO2 increased maximally 142±7% for ATP and 63±8% for SNP, while myocardial oxygen consumption decreased maximally 61±15% for ATP and 40±10% for SNP.

Discussion: CSBF increased markedly during drug-induced hypotension under halothane anesthesia in normal dogs. However, the flow increase was greater and occurred more quickly with ATP than SNP. ATP resulted in a decrease or no change in HR and required little adjustment of dose throughout the 120 minute hypotensive period. Reflex sympathetic activation was apparent during SNP hypotension as evidenced by the increase in HR and in catecholamines. Tachyphylaxis to SNP was indicated by the increase in the dose necessary to maintain this level of hypotension (correlating (p<.01) over time with the increase in CSBF).

Conclusion: During controlled hypotension (50%) induced by either ATP or SNP, CSBF was significantly elevated and myocardial O2 consumption decreased. The resulting oxygen perfusion, evident in the coronary sinus oxygen tension, was much greater with ATP than SNP.