β 2 ADRENERGIC BLOCKADE IMPAIRS CEREBRAL OXYGEN DELIVERY IN ANEMIC RATS.

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INTRODUCTION: Neurological injury in anemic patients may occur by anemia induced cerebral hypoxia. Physiological adaptations to acute hemodilution include active cerebral vasodilation which may optimize cerebral oxygen delivery. We hypothesize that systemic β 2 adrenergic blockade will impair cerebral vasodilation, diminish cerebral cortical blood flow (CBF) and reduce tissue oxygen tension (P_{BrO_2}) following acute hemodilution in rats.

METHODS: With Animal Care Committee approval, isoflurane anesthetized rats underwent tail artery and vein cannulation to monitor mean arterial blood pressure (MAP) and perform hemodilution. A combined oxygen sensitive microelectrode and laser Doppler flow probe (OxyLite and OxyFlo, Oxford Optronix) was placed in the cerebral cortex to measure P_{BrO_2} and CBF. After establishing baseline measurements, a β 2 adrenergic blocker (ICI-118,551, Biomol Int, 10 mg·kg⁻¹ iv) or vehicle was administered, and a second baseline established (n=6 rats/group). Hemodilution was performed by exchanging 30 ml·kg⁻¹ of blood with pentastarch. Measurements were continued for 60 minutes. Total hemoglobin concentrations (co-oximetry) and arterial blood gases were measured (Radiometer). CBF measurements were normalized to the baseline. Data was analyzed by ANOVA and paired t-test (mean $\pm$ SD). Significance was assessed at $p < 0.05$.

RESULTS: No differences in baseline measurements were observed between groups. Following hemodilution, there were no differences in heart rate (380 ± 31 vs 358 ± 29 beat·minute⁻¹) or MAP (108 ± 11 vs 96 ± 7 mmHg) between β 2 blocker and control groups. In control rats, CBF increased by $81 \pm 14\%$ following hemodilution ($p < 0.001$) while the P_{BrO_2} remained comparable to baseline (17.5 ± 7.3 mmHg). In the β 2 blockade group, CBF increased by $43 \pm 13\%$ and the P_{BrO_2} decreased significantly relative to baseline (7.0 ± 2.2 mmHg) ($p < 0.05$). Absolute P_{BrO_2} and CBF in the β 2 blockade group were lower than the control values ($p < 0.05$ for both). Co-oximetry and blood gas data did not differ between groups.

DISCUSSION: Hemodilution increased CBF which maintained cerebral cortical tissue oxygen tension in control rats. β 2 blockade inhibited the post-hemodilutional increase in CBF and reduced cerebral cortical tissue oxygen tension. These data suggest that cerebral hyperemia is mediated by β 2 adrenergic cerebral vasodilation which maintains cerebral tissue oxygen tension during hemodilution (CAS, PSI support).