Vasopressor Effect on Cerebral Blood Flow in a Swine Model of Pediatric Critical Care
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**Background**

In the anesthetic and critical care management of children with traumatic brain injury, it is crucial to consider effects upon cerebral blood flow (CBF) to minimize secondary ischemia and hyperemia. The current literature focuses on patients exposed to inhaled anesthetics, despite the fact that Isoflurane has been described to uncouple the cerebral metabolism-CBF relationship. Within a common intensive care sedation plan, it is unclear if all hypertension has a similar effect upon CBF, or if different vasopressor receptors may have differential effects upon mean arterial pressure (MAP), intracranial pressure (ICP) and/or thermal exposure.

**Materials and Methods**

After IACUC approval, 4 week old female piglets were tracheally intubated after induction with IM Ketamine, IM Xylazine, and Isoflurane. Femoral venous and arterial access was obtained via cut-down. Mechanical ventilation was titrated to \(\text{paCO}_2 38-45\text{mmHg}\) and \(\text{paO}_2 > 90\) mmHg. ICP and CBF via thermal diffusion monitors were placed and monitored continuously. After which sedation was transitioned to a total intravenous sedation with Fentanyl (100 mcg/kg/hr) and Midazolam (1mg/kg/hr). After a period of stabilization and 20 ml/kg normal saline bolus, the order of exposure to three vasopressors was randomly assigned. Baseline CBF, MAP, ICP data was obtained before administration of each vasopressor. Average starting doses of Phenytoin (PE) (0.46 – 0.5mcg/kg/min), Arginine Vasopressin (AVP) (0.0045 – 0.01 units/kg/min), and Norepinephrine (NE) (0.018 – 0.025 mcg/kg/min) were subsequently doubled until systolic BP exceeded 145 or predetermined maximum dose was reached (PE 7.5 mcg/kg/min, AVP 0.07 units/kg/min, and NE 1 mcg/kg/min). After a period of wash out, second and third vasopressor response was recorded.

**Results**

Comparison of 8 pigs showed a significant increase in MAP from baseline with NE and PE (\(p=0.0093\) and \(p=0.0087\), respectively by 2 tailed T-test). AVP did not display a statistically significant rise in MAP from baseline (\(p=0.051\)). Upon comparisons of CBF, there was not a statistical significant change in values compared to baseline for NE (\(p=0.29\)), AVP (\(p=0.34\)), or PE (\(p=0.98\)).

**Conclusion**

In uninjured animals, sedated with common ICU sedation, the apparent effect upon CBF was evaluated in reference to different vasopressors. Doses of NE and PE previously noted in the literature displayed the most robust hypertensive responses. Yet, all animals maintained constant CBF, maintaining autoregulation; regardless of vasopressor choice. This has implications for future studies involving therapeutic hypertension in the immature brain.