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Exploring the Relationship of Varying Hydrocephalus Severity on CSF Dynamics in a Pediatric Hydrocephalus Rodent Model

Parker R. Fitzgerald
Wayne State University, ge9170@wayne.edu

Grant Zydeck
Wayne State University, grant.zydeck@med.wayne.edu

Jeff Horbatiuk
Wayne State University, jeff.horbatiuk@gmail.com

Enoch Kim
Wayne State University, enoch.kim@med.wayne.edu

Arjun Muralidharan
Wayne State University, GH7699@WAYNE.EDU

See next page for additional authors

Authors
Parker R. Fitzgerald, Grant Zydeck, Jeff Horbatiuk, Enoch Kim, Arjun Muralidharan, and Carolyn A. Harris PhD

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Hydrocephalus causes neurological effects and high intracranial pressure (ICP) in the pediatric condition. Studies observing the relationship between ICP and cerebrospinal fluid (CSF) production in an electrical resistance model have been performed, but less has been done to define this relationship in living organisms. This study explored CSF flow dynamics as a consequence of hydrocephalus severity utilizing a novel model.

The model induced hydrocephalus in rats through injecting 30-50 micrometers of 25% (w/v) kaolin into the cisterna magna to obstruct CSF outflow. After 15-16 days of acclimation, the rats were anesthetized with isoflurane. A Transonic SP200 pressure transducer was inserted into the femoral artery and advanced to the thoracic aorta to measure mean arterial pressure, heart rate, contractility index, and pulse height. While maintaining the probe, a craniotomy was performed and CSF flow was measured via Sensiron SLI 0430 simultaneously to measurement of the cardiac variables. Rats were euthanized for investigation of the degree of ventriculomegaly by Evan's Ratio of the whole brain. The hydrocephalic ventricles were compared to controls that had CSF flow obstructed immediately before measurements to direct flow towards the probe.

Evan's Ratios were compared to CSF flow to see if there were linear relationships, but no significant relationships were observed (R^2=0.182; n=12).

This model was useful in measuring CSF flow and cardiac function, but further exploration of non-linear/multi-regression relationships between these variables is warranted. Confounding variables such as probe placement and environmental conditions, may have impacted outcomes, requiring additional control in the future.