

## Ventriculoperitoneal shunting and endoscopic third ventriculostomy with choroid plexus cauterization in a piglet model of infantile communicating hydrocephalus

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### Background

Large, clinically-relevant animal models of hydrocephalus in which neurosurgical devices and novel procedures could be tested are lacking. To meet this unmet need, we developed a porcine model of juvenile communicating hydrocephalus, in part to test safety of the Microbot Self-Cleaning Shunt (SCS), and report our experience in performing ventriculoperitoneal shunting (VPS) and endoscopic third ventriculostomy with choroid plexus cauterization (ETV-CPC) on this model.

### Materials and Methods

Hydrocephalus was induced in 30-day old piglets by percutaneous intracisternal injection of kaolin. Pre- and post-kaolin and pre- and post-treatment anatomic MRIs were obtained to document ventriculomegaly and guide the neurosurgical procedures. VPS was performed with standard Medtronic (n=4) or experimental Microbot SCS (n=5) systems. Terminal ETV-CPC (n=4) was performed using a frontal approach, visualization of the foramen of Monro (FoM), and opening the floor of the 3rd ventricle with balloon expansion. Animals survived 1-84 days (median 41) post-kaolin untreated and 5-30 days (median 12.5) post-shunt. Cytopathology was evaluated with histology and immunohistochemistry.

### Results

Lateral ventricle volumes progressed from 1291±188 mm<sup>3</sup> SEM pre-kaolin to 2455±1067, 2821±1139, 2280±1836, and 3538±2043 at post-kaolin days 1-5, 8-15, 22-29, and 42-69, respectively. Ventriculomegaly continued to progress post-shunt (mean 4051 mm<sup>3</sup>). ETV-CPC was performed successfully and the path through the FoM, and the ETV-CPC could be confirmed grossly with minimal damage to adjacent tissue.

### Conclusions

The juvenile piglet represents a clinically-relevant large animal model of communicating hydrocephalus, with moderate-severe ventriculomegaly, ependymal disruption and reactive astrogliosis. VPS and ETV-CPC can be performed with clinical instrumentation and hardware. This model can be used

for a variety of studies, including the physiological effects of removing the choroid plexus.