Intracavitary Neuroprotection Following Intracerebral Hemorrhage: A Proposed Ovine Model to Demonstrate the Safety and Efficacy of Novel Therapeutic Strategies

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Disclosure

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Introduction

- **Intracranial hemorrhage (ICH)** is a devastating disease that occurs spontaneously or as a consequence of a wide range of pathologies, occurring 5 million times annually worldwide.

- ICH is the deadliest form of stroke with over **30-50% mortality within 30 days** of the primary insult if not treated surgically.

- **Minimally invasive surgical (MIS)-ICH evacuation** involves the direct removal of the hematoma through a burrhole in the skull.

- This novel method of treating ICH patients provides a vector for intracranial device deployment that was previously unfeasible. However, **there is no published large animal model to test for feasibility or safety outcomes to further develop this promising treatment paradigm.**
Methods

The following is the protocol framework for development of an ovine model of MIS-ICH evacuation. The ICH model employed is a double lobar autologous blood injection.

- Sedation (mixture of ketamine & midazolam)
- Intubation
- Ventilation with isoflurane in 100% oxygen.

- A cranial burr (1.5mm) will be drilled 1 cm to the left of the sagittal suture and 1 cm anterior to the coronal suture.
- A 20-gauge sterile plastic catheter cut to 14 mm will be placed stereotactically into the left frontal white matter at the level of the caudate and cemented in place.
- The 20-gauge catheter will then be connected to a 300mm-long silicone elastomer tubing which will be connected to a pressure-controlled IVAC infusion pump loaded with a 10 ml syringe with arterial blood drawn from the femoral arterial line of the sheep.

ICH will be induced in each subject by pressure controlled infusions of 1.7mL autologous blood into the right frontal hemisphere white matter over 15 minutes.
Methods

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Induced ICH will be evacuated 3 hours after induction.

Stereotactic Intracerebral Hemorrhage Underwater Blood Aspiration (SCUBA) technique

Intraoperative cone beam CT

The surgical goal is to achieve a 70% reduction in hemorrhage volume.
Results

Key parameters for analysis of proposed model:

**BASELINE**
(no device)
- Mortality
- Adverse event rates
- Neurological score
  - $\Delta$ evac %
- Adverse event rates

**SAFETY METRICS**
(experimental treatment)
- Mortality
- Adverse event rates
- Neurological score
  - $\Delta$ evac %
- Adverse event rates

**EFFICACY**
(experimental treatment)
- Deployment
- Removal
- Immunohistochemical tissue analysis
- PHE
- Tissue transcriptomics
- BBB breakdown
Discussion & Summary Points

❖ MIS-ICH is a promising solution for treating the most deadly form of stroke
❖ As this procedure grows in popularity, additional tools and treatments will need to be developed to optimize clinical outcomes
❖ The development of a large animal model will facilitate rapid innovation and development of novel treatments
❖ The authors are currently seeking institutional approval to conduct the described protocol
Summary Points