Investigating the Relationships Between Oedema and Cerebrospinal Fluid Flow and Pressure Following Spinal Cord Injury in a Large Animal Model
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Purpose
The interrelated roles of intrathecal pressure, CSF flow, and edema in the secondary processes of spinal cord injury (SCI) are not well understood and this limits innovation in surgical treatments and therapeutics. An intrathecal pressure (ITP) differential between the SCI site and caudal to it has been observed clinically (Werndle 2014), ITP differentials between rostral and caudal compartments are only sometimes resolved by decompression (Jones 2012, and ITP is elevated at the injury site and not always reduced by decompression (Werndle 2014; Saadoun 2017). These data suggest cerebrospinal fluid (CSF) flow is interrupted by spinal cord swelling resulting from edema and other secondary responses.

Hypothesis
The spatial and temporal response of ITP and CSF flow to edema-related spinal cord and dura morphology changes following SCI will be quantitatively related to injury severity, time after injury and functional outcome.

Method of Research
A pre-clinical model is vital to interrogate the edema-CSF flow-ITP relationship because frequent ITP and CSF flow measurements are beyond standard clinical practice, and human SCI is variable and only bluntly quantified by motor and sensory testing. We will use our pre-clinical model of contusion SCI, with surgically placed intrathecal catheters enabling serial measurement of ITP, clinical imaging modalities, functional assessment and histology, to assess the relationships between injury severity, intrathecal biomarkers and functional outcome.

Expected Results
The aim of this study is to explore the spatial and temporal response of ITP and CSF flow to SCI-mediated changes in spinal cord and dural morphology at the injury site. This study will provide basic understanding of secondary processes and inform interventions targeting edema, ITP and CSF flow.