There is no known cure.

Hydrocephalus Overview

- Hydrocephalus is a chronic medical condition that affects over 1 million people in the United States, with the highest prevalence among children. It can also occur in adults, particularly those over 60.

- Hydrocephalus can be classified into two main types: communicating and non-communicating hydrocephalus.

- Communicating hydrocephalus occurs when the normal flow of cerebrospinal fluid (CSF) is obstructed due to blockages in the ventricular system or the subarachnoid space.

- Non-communicating hydrocephalus is characterized by an accumulation of CSF within the ventricles or subarachnoid space without obstruction to its flow through the cranial structures.

Hydrocephalus Symptoms

- Headaches
- Nausea
- Vomiting
- Fatigue
- Dizziness
- Vision problems
- Loss of coordination
- Memory problems

Causes of Hydrocephalus

- Congenital (cleft lip, palate, or neural tube defects)
- Traumatic injury to the head
- Infection (meningitis)
- Tumors
- Traumatic brain injury
- Aneurysm
- Venous sinus obstruction

There is no known cure.

An Investigation of Diagnostic and Treatment Methods for Patients Suffering from Arachnoid Cysts

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Subarachnoid Space Modeling

- Most head models were developed to study traumatic brain injury (TBI) or CSF flow patterns through the head.
- The majority of these studies used simplified models to model the subarachnoid space. While this assumption will likely produce acceptable results when studying impact loading, this type of model will not capture the effects of hydrocephalus.

- To accurately model the local and global effects of arachnoid cyst obstruction, a more detailed model of the subarachnoid space is required as well as integration of a parallel flow model.

Biomechanical Material Models

- Model development of the head is challenging due to the many different biomechanical material properties required.

- Material properties span many different material types including fluids, solids, and neuromeres.

- Material types include brain matter, blood, meninges, CSF, and bone, each having its own characteristics. Not only is each material type drastically different from the others, but many different material properties are available in the literature for each material type.

- The only way to validate material properties is through clinical investigation. And even if precise data is acquired through experimentation testing in vivo is still challenging to measure.

We collected and compared models for the most promising materials needed to build a head model that includes a detailed representation of the subarachnoid space.

Research Conclusions

1. The occurrence of arachnoid cysts in the population should be determined using modern imaging on a larger sample size.

2. Improved models and methodology are essential to determine the effects of arachnoid cysts on local and global pressure for accurate diagnosis of symptoms.

3. Head models must include a detailed representation of the subarachnoid space to capture effects of increased local pressure on surrounding neural structures and possible effects of this obstruction on global pressure and CSF flow.

4. The optimized design of shunts should include the effects of fluid structure interaction and account for the probabilistic nature of the input parameters.