There is no known cure.

Hydrocephalus Symptoms

- Symptoms can be debilitating and cause extreme patient suffering.
- Symptoms result from compression of neural structures due to increased intracranial pressure.
- Symptoms include:
  - Macrosedation
  - Headache
  - Nausea
  - Fapahoeza
  - Seizures
  - Learning disabilities, cognitive decline
  - Motor skills impairment

Causes of Hydrocephalus

- Hydrocephalus can be either congenital or acquired.
- There are two main causes of hydrocephalus:
  1. Non-communicating (caused by an obstruction):
    - Leaks such as arachnoid cysts, tumors, or hematomas
  2. Communicating (caused by poor absorption):
    - Related to excessive venous pressure
    - Infection from infections such as meningitis, or swelling from injury

Hydrocephalus Overview

• CSF is produced in the choroid plexus and moves through the ventricles. It circulates within the ventricular system and the subarachnoid space. It is reabsorbed through the arachnoid villi (95%), and is removed by the lymphatic system.
• CSF has several purposes in the brain:
  - It helps to cushion the brain and spine.
  - It is a medium for waste removal.
  - It is responsible for nourishing the brain.
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Prevalence of Hydrocephalus

- Hydrocephalus is a serious medical condition that affects over 1.6 million people in the US every year.
- In the US, there are approximately 700,000 babies born with hydrocephalus each year.
- Hydrocephalus is the most common reason for brain surgery in children.
- There are approximately 370,000 adults in the US over 65 suffering from “Normal Pressure Hydrocephalus.” This number could be much higher due to the lack of recognition by patients and physicians. Because hydrocephalus is often misdiagnosed as normal aging or drinking.
- The economic burden of hydrocephalus treatment in the US approaches $4 billion annually.

Material types include brain matter, blood, membranes, CSF, and bone, to name a few. Not only is each material type distinctly different from the others, but many different material properties are available in the literature for each. The best way to validate material properties is through a clinical investigation. And even if a proven safe and approved through FDA, testing in vivo is still material is challenging if not impossible. We collected and compared models for the prominent materials needed to build a head model that includes a detailed representation of the subarachnoid space.

The Complexity of Modeling the Subarachnoid Space

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

1. Improved models and methodology are essential to determine the effects of arachnoid cysts on local and global pressure for accurate diagnosis of symptoms.
2. Head models must include a detailed representation of the subarachnoid space to capture effects of increased local pressure on surrounding neural structure and possible effects of this obstruction on global pressure and CSF flow.
3. The optimized design of shunts should include the effects of fluid structure interaction and account for the probabilistic nature of the input parameters.