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

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Hydrocephalus Overview

- Hydrocephalus is a condition where there is too much CSF in the brain, leading to increased intracranial pressure (ICP) and potential damage to brain tissue.

Diagram of the Head

Hydrocephalus Symptoms

- Nausea, vomiting
- Headaches
- Macrocephaly
- Paroxysmal signs
- Nervous system symptoms
- Learning disabilities
- Cognitive decline
- Motor skills impairment
- Death if left untreated

Causes of Hydrocephalus

- Malformation or abnormality of the brain's normal anatomy
- Obstruction of CSF pathways due to tumors, blood clots, or infections
- Blockage of the ventricles by scar tissue

Arachnoid Cysts

- Arachnoid cysts are fluid-filled sacs that occur in the meninges, the protective membranes that surround the brain and spinal cord.

MRI of Arachnoid Cysts

The Occurrence of Arachnoid Cysts

- Arachnoid cysts are relatively common, with an incidence ranging from 0.05% to 0.2% of the population.

Flow chart tracing published articles containing the 1% statistic back to the original source, Robinson 1971

Subarachnoid Space Modeling

- Model development of the head is challenging due to the complex biomechanical properties of human tissues and the need for accurate simulation of the brain's response to injury.

3D model using solid elements. Figure from Tabacu (2013)

Biomechanical Material Models

- Model development: the head is challenging due to the different materials that make up the brain and its surroundings.

Model of pulsatile flow lines through the venous and subarachnoid space. Figure from Kurganski (2012).

Research Conclusions

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