Endovascular Hydrocephalus Shunt

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Mission Statement: Developing a shunt for hydrocephalus patients, with a more reliable, less-invasive procedure, and quicker recovery time

Problem Statement

Hydrocephalus: Buildup of cerebrospinal fluid (CSF) causes the brain's ventricles to enlarge and put pressure on the brain tissue, restricting blood flow and causing damage.

Current solutions:

- Burr hole shunt
- Endoscopic third ventriculostomy (ETV)
- Choroid Plexus Cauterization

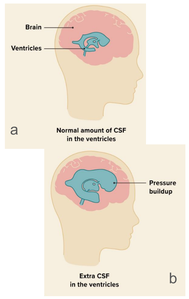

Fig 1. CSF buildup in the ventricles normally (a) and with hydrocephalus (b)

Design Inputs

- Safety
  - Avoiding damage to sensitive brain structures
- Performance
  - Effective CSF drainage

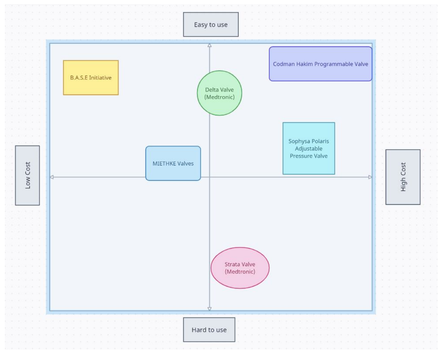

Fig 2.

Product Architecture and Design

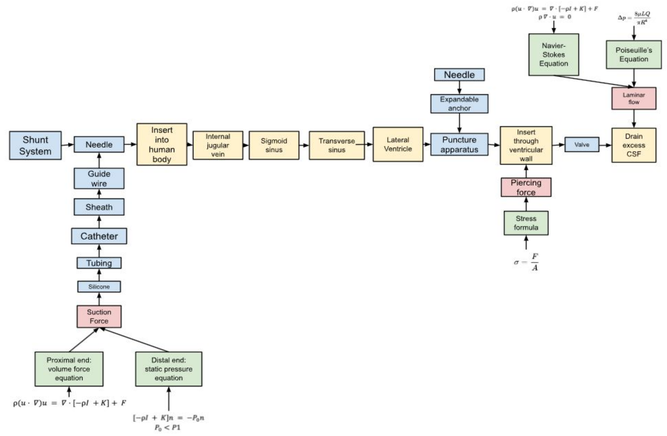

Fig 3. Product Architecture showing subsystems of our system.

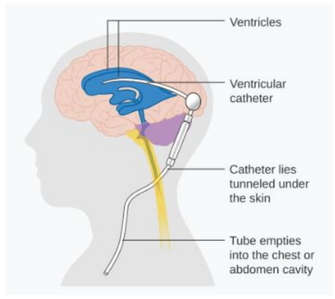

Fig 4. Example of shunt in use. CAD Shunt device will show be be modeled to enter through chosen pathway. [6]

Manufacturing

Part	Cost
Guidewire Introducer Needle	$0.75[1]
Guidewire	$2.50[2]
Large Bore Sheath	$5.00[3]
Flap Valve	$2.00[4]
Microcatheter	$3.75[5]
Total Cost:	**$14 per unit**

Table 1. Breakdown of cost for single unit of device assuming bulk production.

Final Specifications

Need	Specification
Drain Excess CSF	7-15 mmHg
Low Infection Rate	<5%
Doesn't Damage Tissue	Volume Force and Piercing Force
Service Life	10 years
Low Blockage Rate	Navier-Stokes and Poiseuille's Equation (<5%)

Table 2. Top specifications in relation to customer needs

Future Work

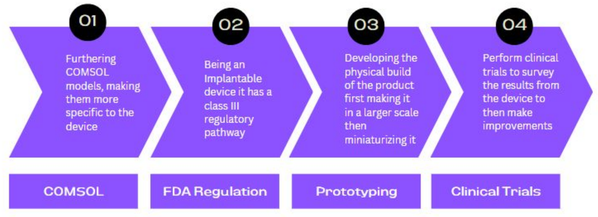

Fig 7. Future Steps to take in Capstone 2

Visual Models of Hydrocephalus

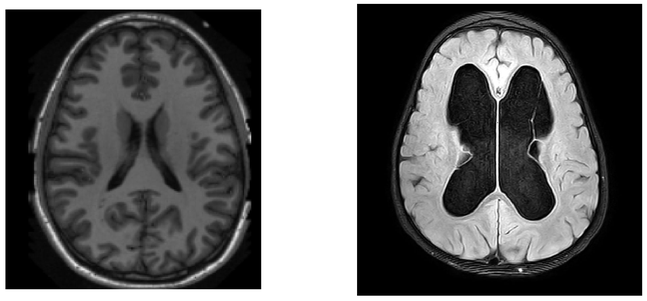

Fig 5. (A) An MRI image on the left, without hydrocephalus **(B)** MRI Image on the right shows an abnormal brain with surplus of CSF build up causing pressure on the rest of the brain.

Technical Models

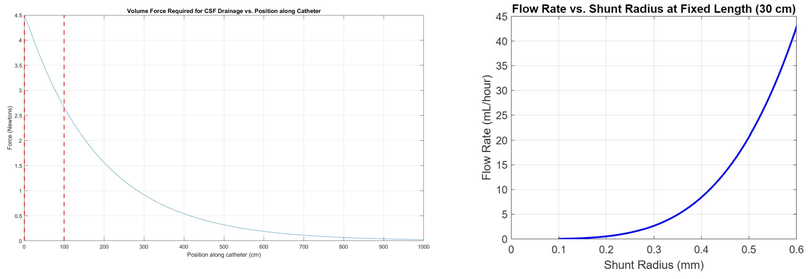

Fig 6. (A) Volume Force equation representing the calculating of the volume force at the proximal and distal end of the catheter. **(B)** Laminar Flow Navier Stokes Equation showing the relationship between flow rate and shunt radius.

Acknowledgments and References

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