Medical Devices

FUSCLEAN: Non-invasive cleaning of cerebrospinal liquid in hydrocephalus patients

A research group of the Andalusian Public Health System in collaboration with the University of Seville, has developed a pre-prototype non-invasive cleaning device of cerebrospinal liquid in hydrocephalus patients

Oficina de TRANSFERENCIA DE TECNOLOGÍA
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Description

Hydrocephalus is one of the most frequent brain disorders, consisting of an abnormal accumulation of cerebrospinal fluid in the brain cavities. This condition affects 1 out of 200 people over 65 years and almost 1 out of 1000 new-borns. Treatment primarily relies on shunt systems to extract the liquid (figure 1), but it usually presents complications on the long term, occlusions being the most frequent. Preventive technologies and protocols are still to be developed, implying that most complications require a surgical procedure to replace the shunt system.

The presented technology consists of an innovative method that merges three leading technologies in physics: optical imaging, thermal imaging and focused ultrasound to prevent shunt obstructions in hydrocephalus patients, with potencial therapeutic applications. The proposed solution will avoid the complications of shunt replacement procedures, presenting a cost-effective solution based on commonly available technologies and components, with potential extension for the cleaning of other implanted devices for fluid drainage, medication delivery or pain control.

The system applies three main technologies:

- Focused ultrasound beam, which will perform the mechanical break of the element occluding the shunt and will be generated by piezoelectric transducers and applied to the target through electronic (phase) control.
- Optic imaging guidance + Thermal imaging guidance, this will allow a precise and accurate application of the ultrasound beam, reducing the impact on surrounding tissues and optimizing the effect of the US.

Combining both optic and thermal guidance, the obstruction will be well delimited, and the US beam will be administrated optimally in order to clean the shunt without affecting any other zone.

The system is now on a TRL 3-4. It has been tested using 3D computational models and has been validated in a physical laboratory. Results in the laboratory show the correct removal of obstructions both in physical and computer models. Clinical and cadaveric trials have been delayed due to the COVID-19 pandemic.

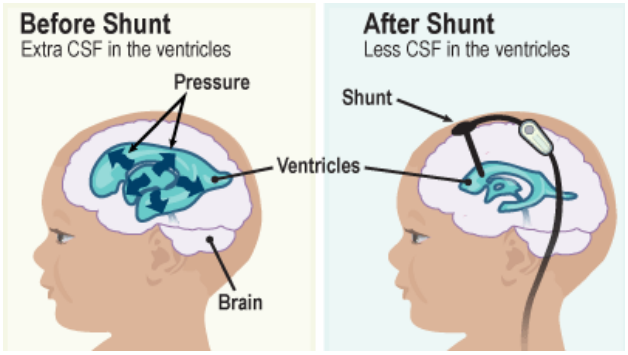

Figure 1: Shunt system schem

Advantages

- Optimizes shunt systems usage, increasing its product life and usability.
- Cost-effective solution, as it reduces time, employs less resources and is easy to adapt to existing health infrastructures.
- The procedure can be adapted to highly prevalent existing diseases in which catheters, drug release or pain control systems are being involved, which comprises a high number of disorders.

Intellectual Property

This technology is covered by an international patent application (PCT).

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