Medical Xpress

Brain Fluid Sensor May Improve Hydrocephalus Treatment

July 16 2010

(PhysOrg.com) -- Hydrocephalus, or "water on the brain" as it is often called, is a condition that is diagnosed in tens of thousands in the U.S. every year, causing symptoms from mild gait problems to life-threatening seizures.

A surgically implanted shunt system that diverts excess cerebrospinal fluid from the brain to a part of the body where it can be absorbed -- usually the abdomen -- has long been the preferred treatment. But shunts are unreliable and often fail after implantation. The devices have remained virtually unchanged for more than a half century.

Nearly a decade ago Andreas Linninger, associate professor of bioengineering at the University of Illinois at Chicago, attended a talk by a physician who challenged scientists to think up new ways to treat hydrocephalus. Linninger took up the challenge and just received an additional $423,000 grant from the National Institute of Neurological Disorders and Stroke to begin testing in an animal model a patented volume sensor he developed to better regulate fluid flow in hydrocephalus.

"One of the biggest problems with shunts is they either drain too much -- so brain ventricles, or cavities, completely collapse -- or drain too little," Linninger said.

"Either way, it's not the best outcome for patients."

Linninger's aim is to develop a measurement that always knows accurately the ventricular size, and keeps it constant using an active feedback control mechanism.

Linninger, graduate student Sukhi Basti and undergraduate Tim Harris have used their mathematical and engineering skills to better understand flow in the brain ventricles where fluid accumulates. They developed a microelectronic sensor to accurately regulate this flow and have begun testing it on laboratory rats with hydrocephalus.

"We've done acute, or short-period, experiments to measure the volume of fluid removed over a few hours. The more important next step is assessing the animal over several weeks to see if we can properly track ventricular size after shunting," Linninger said.

Linninger ultimately hopes to combine a volume sensor with an actively controlled micro-pump to maintain optimal fluid levels. Shunts used now are passive and rely on pressure to discharge fluid. They are affected by posture, activity and even altitude, Linninger said.

Linninger's team hopes the animal tests will validate the procedure, which may lead to a start-up company and a commercial developer to create a device for use in patients.

Provided by University of Illinois at Chicago

Citation: Brain Fluid Sensor May Improve Hydrocephalus Treatment (2010, July 16) retrieved 26 April 2024 from
https://medicalxpress.com/news/2010-07-brain-fluid-sensor-hydrocephalus-treatment.html

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