

Blood test for brain injuries gains momentum

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A blood test that can help predict the seriousness of a head injury and detect the status of the blood-brain barrier is a step closer to reality, according to two recently published studies involving University of Rochester Medical Center researchers.

News stories about tragic head injuries - from the death of actress Natasha Richardson to brain-injured Iraq war soldiers and young athletes - certainly underscore the need for a simpler, faster, accurate screening tool, said [brain injury](#) expert Jeffrey Bazarian, M.D., M.P.H., associate professor of Emergency Medicine, Neurology and Neurosurgery at URM, and a co-author on both studies.

The S-100B [blood test](#) recently cleared a significant hurdle when a panel of national experts, including Bazarian, agreed for the first time that it could be a useful tool for patients with a mild injury, allowing them to safely avoid a CT scan.

Previous studies have shown the S-100B serum protein biomarker to increase rapidly after an injury. If measured within four hours of the injury, the S-100B test accurately predicts which head injury patients will have a traumatic abnormality such as hemorrhage or skull fracture on a head CT scan. It takes about 20 minutes to get results and could spare many patients unnecessary radiation exposure.

Physicians at six Emergency Departments in upstate New York, including the ED at Strong Memorial Hospital in Rochester, this year will continue to study the accuracy of the test among 1,500 patients. Scientists plan to use the data to apply for U.S. [Food and Drug Administration](#) approval.

"The S-100B blood test is an important part of the tool set we need to improve our treatment of patients with brain injuries," Bazarian said. "It's not the ultimate diagnostic test, but it may make things

easier for patients, and it will help doctors sort through difficult clinical decisions."

The test is used routinely in 16 European countries as a screening device. If a person falls and gets a head injury in Munich, Germany, during Oktoberfest, for example, a neurosurgeon is on duty within 500 meters of the beer tent, ready to administer the blood test, Bazarian said.

But in the United States, the current, accepted standard screening tool for head injuries is still the CT scan, which shows bleeding in the brain but does not detect more subtle injury to the brain's neurons, which can result in lasting neurological defects. In fact, 95 percent of CT scans look normal for patients with a relatively mild but potentially life-altering injury, Bazarian said.

There are more than 1 million emergency visits annually for traumatic brain injury (TBI) in the U.S. The majority of these visits are for mild injuries, primarily the result of falls and motor vehicle crashes. The challenge for doctors is to identify which of these patients has an acute, traumatic intracranial injury, something that is not always evident, and which patients can be observed and sent home.

Widespread use of the blood test could result in a 30 percent reduction of CT scans, according to the report by the national panel of brain experts, which published updated clinical guidelines in the December 2008 *Annals of Emergency Medicine*, and the April 2009 *Journal of Emergency Nursing*.

Bazarian and colleague Brian J. Blyth, M.D., assistant professor of Emergency Medicine at URM, additionally found that the S-100B test can relay critical information about how the blood-brain barrier (BBB) is functioning after a head injury. Blyth was the first author on this study, reported electronically March 3, 2009, in the *Journal of Neurotrauma*.

In the context of head injuries, the BBB acts like a gate between the brain tissue and peripheral circulation. The gate often opens after injury, but not always. Knowing the status of the BBB helps doctors to decide if medications given to repair damage will actually reach the brain. The time between injury and irreversible brain swelling is short - and many drug studies have failed to find a therapy that leverages this time frame and works as designed.

Before the S-100B blood test, the best way to know if the BBB was open was to perform an invasive procedure called a ventriculostomy. (Doctors insert a catheter through the skull and into the brain, withdrawal fluid, and compare the concentration of albumin protein in the cerebrospinal fluid to the concentration in the blood.)

In a pilot study of 20 patients, however, Blyth found that serum S-100B concentrations could accurately predict the function of the blood-brain barrier 12 hours after injury, eliminating the need for the invasive procedure.

The study compared levels of S-100B proteins to the CSF-serum albumin quotient (Qa), the gold standard measurement signaling a brain injury. Researchers compared nine people with a known severe head injury, to 11 people who suffered from non-traumatic headaches.

Blyth and Bazarian believe the research may impact future drug studies. "The disability and death rates from brain injuries have not improved much in the past 20 years," Blyth said. "Many clinical trials for new medications have failed, probably because it was difficult to know if the blood-brain barrier was open and the drugs were reaching its target. Our study shows that any diagnostic test for brain injury should incorporate a way to measure the status of the blood-brain barrier into its design."

Source: University of Rochester Medical Center
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