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Scientists developing device that will help diagnose brain injuries on the battlefield

By Sandra Jontz, Stars and Stripes
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ARLINGTON, Va. — It might be no bigger than a Palm Pilot, but with a single dose of blood, a new device being developed by military and civilian scientists could determine the severity and extent of brain trauma in the field.

"This could be so important in the battlefield … because it will help corpsmen in triaging injured soldiers and giving those who need it top priority," said Kevin Wang, Ph.D., an associate professor of psychiatry and neuroscience at the University of Florida, one of two centers undertaking the research.

"These medics are not highly trained surgeons, and this could give them the needed objective guidance on how badly a soldier is injured and what they need to do with the injured. Do they send them back to the front line? Does the soldier need specialized care?"

The Defense Department is spending $2.2 million over the next four years to help some military and civilian scientists develop the diagnostic tool, as yet unnamed. Research is taking place at the University of Florida's McKnight Brain Institute in Gainesville, Fla., and the Walter Reed Army Institute of Research in Silver Spring, Md.

Brain injuries account for roughly 30 percent of battlefield injuries, and there is no effective way to diagnose them short of a brain scan, said Wang, working in the field for 15 years.

"A brain scan is very costly and they aren't found on the battlefield," Wang said, referring to CT scans and Magnetic Resonance Imaging, or MRIs. "We envision that this device, with a blood test, will give rapid analysis and let it be the immediate step in treating a soldier."

Test needed 'yesterday'

"The current engagement in Afghanistan is very real to us," Army Dr. (Col.) Geoffrey Ling, a neurologist, said in a statement. "Right now, we have soldiers on the front lines getting injured. We needed this test yesterday.

"Sometimes you have to determine who will live through the helicopter ride [to a treatment facility.] At the front, we don't have a CT scanner, we don't have a neurosurgeon. But if we have a few drops of blood and can use that to determine whether someone is mildly, severely or moderately injured, that would be a huge contribution to decision-making."

When brain cells are injured or die, proteins "leak" out of nerve cells and flow into the cerebral spinal fluid and eventually into the bloodstream, Wang explained. He and Ronald Hayes, Ph.D., director of the Center for Traumatic Brain Injury Studies at the McKnight Brain Institute, have identified some of these proteins and call them "biomarkers." They published their findings about two years ago in the Journal of Neurochemistry, he said.

The type and concentration of biomarkers found in blood can tell medical personnel the severity and location of the brain trauma, he said.

"We have experienced this in rodent models, and the presence of the biomarker in the blood goes up within the first hour," he said. "In humans, we suspect it might be sooner."

However, the scientists have a long way to go. They have labeled six biomarkers of the potentially hundreds they think the brain would produce, Wang said.

The Florida scientists are studying trauma injuries while those at Walter Reed conduct a complementary study on brain injuries caused by a lack of blood flow to the brain, similar to what might happen during a stroke, Wang said.

In the Florida lab, rats are anesthetized and hit with a piston to cause a brain injury, he said. "We cannot use a human head to do the injury experiment and the rodent is a reasonable model."

Part of their research does include collecting and analyzing blood samples from head trauma patients in surrounding hospitals in Gainesville and Jacksonville.

Medics will be trained

Combat medics will be trained to use the device, and it won't be difficult to teach them to read the outputs, Wang predicts.

"Combat medics … are trained as soldiers and trained to save a fellow soldier at all costs," Frank Tortella, Ph.D., chief of neuropharmacology and molecular biology at Walter Reed, said in a statement.

"In the austere environment of combat, a biomarker diagnostic would give them an objective measure to make a decision on how to handle an injured soldier."

The first diagnostic device might be available in three years, but it won't be the

battlefield model, Wang said.

“The military device will take longer — four or five years — because we want to minimize it, make it smaller.”

The initial products, which could be the size of a laser printer, will likely complement existing machines called Elisa Platereaders, used to measure substances such as toxins, cancer cells or antibodies in the body.

Two pounds of help

Devices for the battlefield will likely weigh no more than 2 pounds. Tortella has no idea how much the device might cost, but figured a test might cost $175 per application, versus $1,000 per brain scan.

The diagnostic device could also test for brain damage after a drug overdose to sports injuries or strokes and aneurisms.