Credit: BrainLine (Produced by Victoria Tilney McDonough and Brian King)

Dr. Jeffrey Bazarian Talks About Using Biomarkers to Detect Traumatic Brain Injury

Dr. Jeffrey Bazarian: One of the problems I faced as an emergency physician was trying to figure out whether someone who got hit in the head actually had a concussion. This was very vexing to me because I would talk to people, and they would say, I don't know, I got hit in the head, I don't remember if I don't remember. I felt like, well, that's kind of a silly question for me to ask people. Do you remember if you don't remember? And I kind of felt embarrassed about that. But that was the only tool I had for figuring out if someone had a concussion. And it really wasn't very effective.

With children who couldn't talk, they couldn't tell me. Or people who maybe had dementia or who were intoxicated, they couldn't tell me either. So I thought, we need a better way to figure out whether someone has had a concussion. We really need a more objective, diagnostic tool, kind of as if you hurt your leg, I can do an x-ray and say, well, you're got a fracture. It's just a really objective way to say, yes or no, you've had a concussion. So that kind of got me interested in the idea of a blood test of brain injury.

As it turns out, if you get hit in the head and have a concussion, the nerve cells that get damaged release some proteins that can be found in the blood in your arm. We take some blood from you, we can see that. And so we've been looking at several proteins to see how clinically useful are they? Do they really tell us some additional information that we don't already have? Do they predict that patient A is really going to have more symptoms than patient B?

Victoria McDonough: How far along is this research?

Dr. Jeffrey Bazarian: It's progressing pretty rapidly. There is one blood test that actually was pioneered in Europe that is on its way to being available in the United States. It's called S100B. And it's used widely in Europe. If you get a concussion at the Oktoberfest in Munich and you go to one of the hospitals there, they'll do this test on you before they decide whether you need a CAT Scan.

The American Council of Emergency Physicians recently recommended this test be done prior to getting a CAT Scan. Although it's not FDA approved yet in the United States. But that opens the door for it to get FDA approved. So we're on our way. I would say the next year or two, you're going to be seeing some of these proteins in clinical use.

There are other types of biomarkers that could help us diagnose Traumatic Brain Injuries, especially the milder form. Because the more severe form, you know, you can kind of tell someone has got a

Traumatic Brain Injury, they're in a coma, so that's a good presumption that they've got a brain injury. But there are some biomarkers that could help us out with the milder forms of Traumatic Brain Injury. The most popular, I'd say, is neuroimaging some forms of MRI. So MRI, a standard MRI doesn't really show you the kind of cellular injury that we think happens with concussions, but there are some newer forms of MRI. I call them MRI on steroids that can.

The most intriguing is called the fusion tension imaging. And there's been many, many reports, and this may be a great way to see the kind of injury we're looking for. So that's a great biomarker, unfortunately, it's not very practical. It's hard to get MRIs in most hospitals. Some don't even had them available acutely. So it's not very practical. It's a great tool, not very practical. If you have any metal inside of you, you can't have an MRI. If you're claustrophobic, you can't have an MRI. So I think that's a great biomarker. There's some other fancier forms of EEG, brain wave testing. Also not so practical. It takes 45 minutes to perform. You need a really quiet environment. Most emergency departments, not quiet environments. So I think, in terms of practicality, the serum test, the blood test seems to be the most practical. As an emergency physician, I tend to think in very practical terms. But I also think this kind of test could be brought to a battlefield, it could be brought to an athletic field, it could be brought to the scene of a mass casualty, whereas an MRI or an EEG really can't.

I need to mention one other biomarker that is very popular and that's cognitive testing. So there is this train of thought that if we did a brain test on you after you hit your head and it was abnormal, then it would be an indication that you had a brain injury and there are several computer-based programs that allow practitioners to do this. They work the best when people have a test before the injury and then have one after the injury that you can compare them to. So the military is using this and they're asking soldiers before deployment to have one of these tests. Many athletic teams, National Football League, many baseball teams make their players take these tests. Many high school athletic teams now make their folks take these tests. So that, I guess, would also be considered a biomarker.

Cognitive test, they're wonderful actually. They have really--they were the things that really opened the world's eyes to the fact that brain injury does something bad, especially the milder end and the folks that develop them deserve a lot of credit. But these tests are confounded by other factors that you mentioned. So if you're sleep deprived, if you are stressed out, if you are taking any kind of drugs or alcohol, all of those things kind of affect your performance on the test. So you're never really sure whether someone's performance is from the brain injury or from some of these other factors. But if you can control those factors, you're fine. Like some athletes can control some of those factors. But it's not always possible to control all of those factors.

One of the gaps that I see is that we need a more rapid way to accurately diagnose this injury, just like we have rapid ways to diagnose other injuries like fractures, and even stroke. We have a better way of, honestly, to rapidly diagnose that. I think neuroimaging and some of these serum markers are going to help. People seem to be slowly coming to that because I think they have a hard time believing that the brain can somehow be reflected in the blood. But I think we're slowly getting to that point and I think the next step, because so many of these injuries happen in remote areas like athletic fields and battlefields, it's having some portable way to take a drop of someone's blood, almost like a glucometer

for a diabetic, and tell them rapidly whether they've had a brain injury or not and they need to get medical treatment.

Believe it or not, I think that until we have a way of rapidly diagnosing this, we're never going to even begin to treat it, to know how to treat it. Because there is this window of opportunity we have between the time when a brain is injured and between the time that those nerve cells die and we could intervene and stop the nerve cell from dying. It's probably six to twelve hours, which is an eternity when you talk about neurologic emergencies. For a stroke, you have three hours to get the clot-busting medicine into someone to help them after a stroke, three hours. That's a really narrow window. But we have to know how to diagnose it. And then we could start talking about treatment. I want to move faster. Let's put it that way. And I want people to come along with me. So that's the gap, I think, in my mind.