

Key:

B = Dr. Brody

B: Hi, my name is Dave Brody. I'm a neurologist here at the Uniformed Services University and also a scientist working at the National Institute of Health just across the street. And I've been asked to talk to you all about a traumatic brain injury today. So, this is an area that I've been involved with since 2004. Just when I finished my residency, I started the traumatic brain injury clinic at Washington University in St. Louis. And I've been involved in a lot of cases involving people that have had traumatic brain injuries and then have been involved in criminal activities and have had lawsuits involved in a lot of military work, involved in professional sports, the National Football League case that as you know, is going through the system at the moment. So, I've been asked to tell you about a few things related to traumatic brain injury. Okay, so first question is, what is traumatic brain injury? Traumatic brain injury is anytime there is an acute physical force applied to the head that causes damage to the brain. And that could be a car accident, a fall, an assault, a blast injury, sports concussion, a wide variety of slings and arrows of outrageous fortune in our lives occur that cause damage to the brain. Not every hit to the head or every force causes brain injury. I mean, luckily, our scalp and our skull and our fluid inside of our head does a pretty good job of protecting our brains from a lot of the things that happen to us but unfortunately, not everything. And so sometimes the forces are enough to cause damage to the brain. How do we know that the brain is damaged? Well, we know that because there's a change in the brain's function. That could be the person is knocked out unconscious, that's the most obvious, but sometimes it's not quite so obvious. Sometimes they have a gap in their memory, sometimes they have problems with balance or coordination, sometimes they're really disoriented, sometimes we see this a lot in professional sports, the person staggers and falls and can't get back up. Normally, these are elite athletes, they have terrific balance but after an injury, their balance is impaired, that's because of damage to their brain. Or they're disoriented they go back into the wrong huddle; they are on the opposite team that's because of damage to their brain. So those are examples of damage that's caused by a concussion of which concussion is a mild form of traumatic brain injury. Now I use the word mild, it's not always mild to the person who has it, it's actually can be quite significant to the person who has it but we use the term mild to differentiate it from moderate or severe brain injuries. So mild traumatic brain injuries such as concussion, as those are synonyms involve patients who have loss of consciousness for less than 30 minutes or amnesia or change in mental status or confusion for less than 24 hours. If they're unconscious more than 30 minutes or have amnesia or memory problems for more than 24 hours, then it becomes something more serious. If it's a moderate injury that may mean they have some bleeding in the brain or they have more severe

impairments. And then a severe traumatic brain injury, these are people that are in coma, they need to be in the intensive care unit, they may need to have surgery performed by neurosurgeons to relieve pressure, they may need to have monitoring in place. We use something also called a Glasgow Coma Score, which ranges from three which is the worst to 15 which is the normal, all of us would have a Glasgow Coma Score of 15, hopefully. Three to eight is considered severe and those are people that are in profound coma. And nine to 12 is considered moderate, those are people that are significantly impaired but not in a profound coma and 13 to 15 is in the, quote, 'mild range'. The purpose of the Glasgow Coma score was just to say whether the person is likely to need immediate neurosurgery. It isn't really a particularly accurate prediction of how well they're going to do in the long term. Some people who have had concussive or mild traumatic brain injuries can still have significant impairments over the long term and some people who've had severe injuries where they were in coma and in the ICU and had surgery can still make a very good recovery over the long term. So, it's not as predictive as we would like. But that's one of the things we use a lot is this Glasgow Coma Score as well as the duration of loss of consciousness, if they're any, the duration of amnesia, the duration of confusion or changes in mental status, duration of changes in balance and coordination. So some of the things that people have long term problems with after traumatic brain injury include; thinking and memory, emotional regulation problems, which is especially relevant for medical legal and legal issues, changes in other behaviors, again, quite relevant, things like the way they interact with people, changes in personality, changes in the way they sleep, changes in headache, can often have very severe headaches and long term effects are neurodegenerative disease. When I say that, what is neurodegenerative disease? A neurodegenerative disease is a disease of the brain that causes progressive worsening over time. This is interesting, right? Because after a traumatic brain injury people are bad initially have severe problems initially oftentimes, but then they recover over time the natural course for all injuries brain and otherwise is to make some recovery over time and normal people do make some recovery, maybe not completely but make some recovery over time. A neurodegenerative disease is getting worse and worse over time. So one of the things we've observed is that people will have an injury and they recover over time and sometimes they make a good recovery, their whole lives have no problems but sometimes they have late life deterioration getting worse and worse. There's two big areas of neurodegeneration that are important that occur more often than we would expect in people that have had traumatic brain injury. The first one is Alzheimer's disease. People that have had either moderate or severe traumatic brain injury at younger ages are at higher risk of developing Alzheimer's disease later in life and at earlier ages than they might have been expected. Like maybe other people in their family might have developed Alzheimer's disease in their 80s after a severe traumatic brain injury they might be more likely to develop Alzheimer's disease in their late 60s or

early 70s. So quite a bit earlier than would have been expected. Not all of them do but the increased risk is about four times the risk after a severe traumatic brain injury. Even concussive traumatic brain injuries the milder side, if they occur in older adults, that is to say people over 65 years of age it does also increase the risk of developing Alzheimer's disease. That's pretty well known, and it can be an important factor for all of us that are managing. The second neurodegenerative disease that we see after people have had multiple hits to the head, such as people that are in professional sports or military service members, people have had many, many, many injuries over their lifetimes is called chronic traumatic encephalopathy. This has been in the news a lot recently, especially in national football, it's actually something we've known about since the 1920s. In boxers it was called dementia pugilistica affecting boxers. And this has two different pathways. The one is occurring at younger ages in like 40s and 50s and has a lot of emotional regulation problems, changes in personality, behavioral manifestations, many of these individuals can't work anymore, they get fired from their jobs, many of them are divorced, estranged from their families. And it's not characteristic of their personalities these are people who were not like that before. And it gets progressively worse over time every year is worse than the year before. Many of these people die from suicide, many of these people commit crimes even silly, foolish crimes where they get caught easily, they were not well thought out, where they're impulsive activities. And then the second part of chronic traumatic encephalopathy is very much similar to Alzheimer's disease, where there's memory problems and apathy and increased agitation and problems with bowel and bladder function. People really do require being in a nursing home at that point when they have that and that often occurs in the 60s and 70s and 80s, later in life. While people are alive, we cannot tell whether they have chronic traumatic encephalopathy or Alzheimer's disease. That's something after they die, we look at their brains under the microscope and we can say, "Yeah, that's chronic traumatic encephalopathy," or, "Oh, that's Alzheimer's, or actually can have both." Some people do have both at the same time. One of the things that's important takeaway is that we know these things exist, but we cannot make a definitive diagnosis while somebody is alive. We can say we suspect they have chronic traumatic encephalopathy, or we suspect they have Alzheimer's disease but we can't say for sure. What we can say is that people who have had traumatic brain injuries are at increased risk. And so when we see somebody who has memory loss or has personality changes or has been fired or has committed a crime and has had a history, a long well documented history of multiple concussive traumatic brain injuries in their lifetime, we say, "Oh, okay, this is a mitigating circumstance, this may not be that they are just a plain regular criminal, this may be a sign of brain damage." Another complicating factor is that many of these people are placed on medications by their physicians in order to help mitigate their symptoms. So, like for example, if one of my patients is having a lot of problems with headaches, I'm going to give that patient medications to help with their headaches.

Sometimes these medications can have side effects, sometimes they're taken as directed they still have side effects, sometimes they're not always taken as directed. Patients don't always do exactly what they're supposed to especially if they have memory problems, they don't always remember how to take their medicines we work very hard at this, but we don't always get it right. Sometimes excessive doses of medications or withdrawal from medications, if they've been taking it for a while and they stopped suddenly, the withdrawal from the medication can cause behavioral symptoms. Like for example, one of the features of chronic traumatic encephalopathy include symptoms that are pretty similar to Parkinson's disease where people move slowly, they shuffle, they're stiff, they slur their speech, their face is very mass, they don't have much expression on their face. And we give them medications that are similar to the medications we use for regular Parkinson's disease. And in excess, sometimes those medications can cause psychosis, hallucinations, delusions, bizarre behavior and we know it's a side effect of the medication. As soon as we stop the medication, the side effects wear off over time but nonetheless, people can do pretty bizarre things while they're taking those medications. So when we see somebody that has, for example, one of my patients broke into a neighbor's house, broke the plate glass window and was just walking around in the neighbor's house with bare feet, feet all cut up in the glass of the broken window, and was just staring straight ahead and kind of mouth was twitching a little bit. It was very bizarre behavior, but he was on an overdose, he was on an excessive dose of this Parkinson related medication and it was clear psychosis. He got picked up by the police and brought in, but it was clearly related to his brain injury and his medications that he was taking. And as soon as the medications were off, he cleared up and he had no memory of any of this activity. Anyway, one of the important points that I'd like to make is that there's a lot more that we don't know about traumatic brain injury than what we really do. So, we've been studying this problem for a long time, Hippocrates knew about traumatic brain injuries, they're in ancient Egyptian medical textbooks but nonetheless, there's still an enormous Gulf in our knowledge. The brain is the most complex organ, every traumatic brain injury is unique, it's very hard to make generalizations because every single person is different, every injury has a different trajectory, damages different parts of the brain. We have some good technology for scanning the brains and assessing injury but there's still a lot of people who clearly have had traumatic brain injuries, but our scans look normal. So, a negative scan does not mean the patient has not had traumatic brain injury, they still could very well have real traumatic brain injury just the scan is negative. And we know this because then when they die and come to autopsy, we can see it very clearly under the microscope, it's just that the scan was wrong. We take the scans; we use them when they're useful, but we don't take them too seriously if they're negative. And even if they are positive, even if there is something on a scan that you can see, that may be just the tip of the iceberg, there may be a lot more injury in the patient's brain

than there really is that you can see on the scan. We take very seriously what we think is the most useful is collateral source information so what the family members say, the co-workers, the friends, the neighbors, people who have known the person for a long time, before and after their injury to assess what the effects of the injury were. So, what were they like before their injury, hardworking, honest, reliable, truthful. And then after the injury, they became lazy and dishonest and can't remember anything and confused and agitated and violent. That's pretty clearly related to the traumatic brain injury unless there's something else that was happening at the same time. Even if the scan was negative, we still take that collateral source very seriously, especially if it's an unbiased collateral source. To summarize, traumatic brain injury can affect people's memory, thinking, personality and every aspect of who we are. The brain fundamentally is who we are and so injury to the brain can change who we are. But there's a lot that we know and there's still a lot that we don't know, and every case is unique and needs to be evaluated very carefully in a specific fashion. I'll stop there.