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CHRISTOPHER LYN TANGEN: My name's Chris Tangen, and I did family medicine and then sports medicine fellowship. So the role in which I see concussions sort of two or three-fold. I do some urgent care work as well. So I get to see folks with head injuries from the urgent care setting. In my primary care clinic, I see mainly the adults. And then the high schools and colleges, I take care of. I get to see them in the training room setting. So I see patients in a different setting depending on the day. So that's my experience in regards to concussion care.

Before I get into these introductions slides, Alan stole a little of my thunder. So what I want to do is talk about how the care-- and you guys have probably had patients like this. One of the patients I saw yesterday was very excited that I was giving this talk today and wanted her story to be told. She's 18 now, 19-year-old high school student that was at a church function, and she was in one of those bubble things.

And she ran at another person in the bubble, and she flew backwards and hit her head and suffered a head injury and a concussion. And her recovery was very, very lengthy. She actually needed to take F's the rest of her senior year of high school and average out with a C. She did not enter college. She had temperature regulation problems. She was seen by pediatric neurology, pediatric endocrinology. We tried physical therapy and had her see Chris Bailey in neuropsychology.

But she still wasn't getting better. So her family actually took her to this specialist in Louisiana who put her in a hyperbaric oxygen chamber. And she actually suffered some oxygen injury from going down to Louisiana for hyperbaric oxygen treatment. So finally, we got her back up here, and she was doing a little better. This whole time, I was trying to get her into see psychology because she was having some problems interacting with friends. And Jeff does a great job, so I'm sure it wasn't Jeff.

But the first time she saw psychology, she was pretty upset and didn't want to talk about her feelings. Finally, she calmed down about that and is doing really well with psychology now. But that's just a story to illustrate the multidisciplinary care that sometimes we get to see. Hopefully, that's not the majority of the patients. But sometimes, I'll get to see exciting patients like that.

To go into some introduction about concussion stats, there's over a million concussions seen every year. Almost half a million are sports-related concussions. Half the concussions don't seek medical care. So the ones that we're seeing are of a different variety. I think the classic example is I see a lot of adults that are from motor vehicle accidents that go to the emergency department. And usually, there's two people. One person hit somebody. The other person gets hit. And I very rarely see the person that does the hitting-- it's mainly the person that got hit-- is who I see in the clinic.

And then concussions and mild traumatic brain injuries account for the majority of concussion-related hos-- sorry-- TBI-related hospital visits. And I think this next point is a big one that you guys are seeing out there as well. There's a \$17 billion impact on the economy based off of disability and missed time at work. And I think that's one of the challenges that I'll speak about later when Susan and I give our talk about return to learn, return to work. And most of the ER sports-related head injuries are kind of in the adolescent population. So just some stats on concussions.

What is a concussion? Alan talked about it. But basically, a sports-related concussion is a force that is applied to the head, neck, or face area that causes this impulsive force to the head. And there's usually rapid within one or two days changes in either cognition or physical somatic complaints, such as headache. And these symptoms usually resolve on their own without any specific intervention.

Again, there's largely, if you make the diagnosis of a concussion, no need for a CT scan or an MRI at initial or subsequent follow up. And most of these concussions do not involve a loss of consciousness. If there is a brief loss of consciousness, largely, it's not predictive of recovery, unless it's maybe a longer five-minute loss of consciousness, so not necessarily a hallmark of concussions.

Alan talked about this, but basically, what happens is there's neuronal injury, which causes that indiscriminate release of neurotransmitters. Later on down the line, there is the mitochondrial injury. But basically, the idea is that the cells in the brain need glucose or energy to fix that sodium potassium imbalance. And this is one of Chris Bailey's slides. So I'm so nervous about doing this one. I'm so nervous. OK, all right, OK, I'm ready.

When we think about an injury to the brain, we think about an energy crisis where the brain is trying to recover with glucose and blood flow. Think of your favorite device, which is obviously a cell phone. If the the battery is a little on the lower side, someone has a concussion, a lot of the processes in the phone run differently, run more slowly, drain the battery, there's fatigue.

However, if we're able to rest and improve the concussions and, basically, plug our cell phone in, get to a full charge. That's a great analogy, which I clearly am stealing from Chris. But basically is a good analogy how I think about dealing with concussions and getting people back to their baseline before sending them back to work or sending them back to school too early.

We'll talk about the timing of that a little bit more later on. But in regards to recovery of concussions, another thing I stole from Chris is I tell patients now that they have a great prognosis to get back after their concussions. A lot of them come, and they're dismayed after a car accident or something much more sinister. And they're very nervous about if they're ever going to be normal again. And I always tell them that they will recover. It's just a matter of time. And that seems to go really well when I give education to patients.

Basically, 7 or 10 days is typical of a return to activity, whether it's sports-related or returning to work. But there are 10% to 20% of adults, a lot that I see, that do take more than four weeks to recover. Non-sports populations tend to take a little bit longer to recover than athletes. Sometimes, that's motivation to get back to your sport. People get a little better maybe a little faster different motivations.

But again, rest is the best treatment. And this is not complete rest. This is relative rest after the head injury. And again, we'll talk a little bit more about the timing of rest later on. The most important thing is to avoid a second head injury while you're recovering from your initial head injury. A lot of the original data was they would take a weight and drop it out of mouse's head and see how long it took them to recover. And if they dropped weight on the mouse's head before they were completely recovered, the recovery was much longer.

Back in the day, we used to talk about second impact syndrome where the brain could potentially swell and cause herniation and death. We don't generally use that as a way to scare folks. But we do talk about if you do suffer another head injury before you're fully recovered, it's going to take you a much longer time to get back. And that has been proven.

Basically, how to get people back is a progressive return to work or return to learn stepwise approach. Also, in recovery, most of these symptoms when they first see you are going to be your predictive measures on how long they're going to recover. If somebody comes into you and has-- out of the 22 symptoms, 22 listed. They're all six out of six in severity. That patient will probably take a little longer to get better. They're probably somatizing their symptoms a little bit more than the other patients. Pre-injury depression is a risk factor for prolonged recovery.

And let's see here, let's talk about the future of concussion. One of the cool things that we're doing in our concussion center is doing research on certain biomarkers. Chris is sort of leading the charge, more of a sports-related study looking at AMPA receptor and AMPAR study to see if there's a biomarker that we can even test with a finger stick to see if there was a concussion or not. And then a lot of research is emerging in regards to overlapping symptoms and concussion and what does it mean, whether it's anxiety, depression-related, fatigue, headache history, or visual or balance symptoms.

And then the last slide I have is talking about diet as a potential treatment. There are some animal models that show some promise with B vitamins and Omega-3's. And then in regards to exercise, again, we talk about resting in the patients. But there's a lot of studies, especially coming out of University of Buffalo with Dr. Leddy, that show that it's safe to exercise a patient on a treadmill after their head injury.

And that's one of the next things. How do we identify these patients that we want to rest a little longer? How do we identify patients that we want to get up and moving, whether it's on a treadmill in a measured, safe way or whether it's getting them back to their activities? So more on the horizon.