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Chronic Traumatic Encephalopathy in Elite Athletes

STUDY OF CHRONIC TRAUMATIC ENCEPHALOPATHY IN ELITE ATHLETES

Many elite athletes dedicate their lives to sport. In a high impact game like football, the physical toll of this dedication can be devastating. One example of this is chronic traumatic encephalopathy, a form of brain damage most commonly linked to boxing. Now a group of pro football players and other athletes are promising to posthumously donate their brains for research on this condition. What can we expect to learn from their inspiring gift? You are listening to ReachMD, The Channel for Medical Professionals. Welcome to the Clinician's Roundtable. I am your host, Dr. Mark Nolan Hill, Professor of Surgery and Practicing General Surgeon. Our guest is Dr. Ann McKee, Associate Professor of Neurology and Pathology and Co-Director of the Center for the Study of Traumatic Encephalopathy at Boston University School of Medicine.

DR. MARK NOLAN HILL:

Welcome Dr. McKee.

DR. ANN MCKEE:

Thank you.

DR. MARK NOLAN HILL:

Dr. McKee, what is chronic traumatic encephalopathy?

DR. ANN MCKEE:

It has some similarities to Alzheimer disease. It's a neurofibrillary degeneration of the brain meaning that the nerve cells accumulate these neurofibril, which are composed of tau protein and this protein gradually builds up in the brain and actually kills off the nerve cells and so in this chronic traumatic encephalopathy there is this buildup, this tremendous buildup actually of tau containing neurofibrillary tangles throughout the brain and brainstem.

DR. MARK NOLAN HILL:

And why does this occur from trauma?

DR. ANN MCKEE:

That's what we don't completely understand, but it appears that repetitive trauma and most commonly repetitive trauma that occurs in the teenage years and early 20s somehow that and we think it is multiple sublethal events so a mild trauma, but it has to be repeated in often a concussion or a concussion-like event and somehow these repeated traumas set off a pathologic process that continues to evolve as the person ages. So even though the trauma stops they stop participating in the sport. They no longer play football, they no longer box. Ten-20 years later they come down with this progressive neurologic deterioration, which was a result of the traumatic injuries that they sustained in their youth.

DR. MARK NOLAN HILL:

Now this isn't 3 or 4 incidents. This is multiple, correct?

DR. ANN MCKEE:

Well, you know, I am not sure, I mean, we are looking at people with fewer and fewer concussions. We are looking at people younger and younger and I am starting to wonder this time any concussions is necessary and that's one of the things we definitely need to find out.

DR. MARK NOLAN HILL:

Do you have to have a serious injury like a concussion to add to this or can it be just minor trauma like getting hit in football or mild boxing mishaps?

DR. ANN MCKEE:

Well, you know, I think what people call a concussion is often quite mild. You know, they think its just sort of getting their bell rung or maybe they see lights or stars or something goes black they feel a little foggy. They don't have to lose consciousness and all of those events are probably important.

DR. MARK NOLAN HILL:

Now tell us about this new center that has been established at Boston University.

DR. ANN MCKEE:

Well, what we are doing and I should say that we set up this center with Chris Nowinski, who really has spearheaded this whole effort.

Chris Nowinski is a former Harvard football player who then went into professional wrestling and when he was a football player he sustained a number of concussions, but then actually when he was a professional wrestler he sustained quite a few more and he started having difficulties with his memory and also some headaches and he had a lot of difficulty finding anyone to take him seriously until he met Dr. Robert Cantu and that's another one of the individuals that's very important in this center and Dr. Robert Cantu is a neurosurgeon from Emerson Hospital, who is a world's expert on concussion and its effects and he really was the first one who diagnosed Chris with a postconcussive syndrome and sort of gave him some insight into his condition and actually eventually Chris quit wrestling. So those 2 are key players in this center and the third person is Dr. Robert Stern, who is a neuropsychologist from the Boston University Alzheimer Center. So the 4 of us really have started this center.

DR. MARK NOLAN HILL:

Now how are you studying this condition? I mean it's all done after they die?

DR. ANN MCKEE:

Well, that's we are doing now because there are lot of parallels in this disease to other diseases like Alzheimer disease. First of all we need to understand what this disease is and really I have searched the literature looking for cases like this and believe it or not before we started looking at cases there were only 46 cases with neuropathology in the literature. So we are really in sort of our infancy in terms of understanding this. We are looking at the brains of individuals who have died because that's one way to define the disease. We are starting to understand where the brain is affected first, what the spectrum of abnormalities is, and in essence we are just beginning to understand exactly what this is by looking at unfortunately people that have died. What our goal is though is to evaluate living athletes and get history, how many concussions when they had them, how far apart with their concussion, and to follow them with serial neuropsych testing, serial MRI, and also some other evaluations to try to get a handle on all the questions that you just asked me. How many do you have to have and what should I worry about.

DR. MARK NOLAN HILL:

Wouldn't boxing have many more cases than football?

DR. ANN MCKEE:

Absolutely, absolutely. This is best known in the world of boxing. In fact, I think if you look at those 46 cases something like 42 of them were boxers. So that's the disease it's really associated with. What we are starting to understand now though is that other situations that caused head injury can be associated with this disease and that would be includes football and wrestling. It's also been in chronic epileptics, who have lot of grand mal seizures. It's been seen in sometimes mentally subnormal people that have head banging behavior. So it's a lot of different things that it can be found in.

DR. MARK NOLAN HILL:

What are the key symptoms?

DR. ANN MCKEE:

The key symptoms usually are quite subtle to begin with, their behavioral and personality changes sometimes its an irritability or some slight confusion, might be memory lapses, but its often sort of aggressive behaviors and a lower ability to restrict yourself, so sort of heightened aggression and more violent outburst.

DR. MARK NOLAN HILL:

And when do they show these symptoms? How soon after all these repeated injuries?

DR. ANN MCKEE:

Well, in about a third of them some of the symptoms are coming out as they retire from the sport, but most people don't really experience these symptoms until they are well out 10-20 years later and then they start to come down with the sort of vague symptoms, personality behavioral changes, and then as they age the disease progresses, but it's very slow to progression, then they develop much more severe memory changes, dementia. They can get parkinsonian, they can develop speech abnormalities and gait abnormalities so that they would require probably institutionalization. So it can get quite severe, but the initial stages can be subtle.

DR. MARK NOLAN HILL:

If you have just joined us you are listening to the Clinician's Roundtable on ReachMD, the Channel for Medical Professionals. I am your host, Dr. Mark Nolan Hill and our guest is Dr. Ann McKee, Associate Professor of Neurology and Pathology and Co-Director of the Center for the Study of Traumatic Encephalopathy at Boston University School of Medicine. We are discussing the study of chronic traumatic encephalopathy in elite athletes.

Dr. McKee, Muhammad Ali, that great boxer certainly has changed greatly since his heyday. Is his parkinsonian-type syndrome related to possibly a form of chronic traumatic encephalopathy?

DR. ANN MCKEE:

Well, I know that Muhammad Ali believes that he has idiopathic Parkinson disease, but not knowing him, just looking at the symptoms I think it is definitely possible that he has a traumatic encephalopathy.

DR. MARK NOLAN HILL:

For patients who get this is there any relationship to genetics or anatomical makeup or other factors that contribute to this?

DR. ANN MCKEE:

Well, we definitely think there are. We don't think it's everybody that gets banged in the head is going to develop this syndrome, but we really don't understand the genetic risk factors at this point. We know that the inheritance of something called the apolipoprotein E4 allele, which is a genetic marker that is actually also associated with a greater risk of Alzheimer disease we think that people that have that allele that inherit that E4 allele they may be at greater risk for developing this, but that's really so far our only genetic marker

although we think that with greater study we are going to find what distinguishes a person, who is susceptible to this from a person who is not.

DR. MARK NOLAN HILL:

Can you see that it's different than let's say pathophysiology thinking about someone who deals with a local hypoxic area, trauma with hemorrhage, and subsequent fibrosis?

DR. ANN MCKEE:

Well, we don't see any evidence of old hemorrhage in these brains. I think that's one of the key features these concussions that's really just microscopic injury so you don't see macroscopic changes in their dura like they haven't had a history of a subdural hematoma or an epidural hematoma. They haven't had a brain hemorrhage. They have had fairly subtle changes and I think that's we are just starting to understand is that these microscopic changes that we don't see on a routine CT scan are actually something that we really need to pay attention to and when an individual does get a concussion they need a lot of rest in order for the nerve cell and its axon to repair itself and to go back into its normal state and that if you have a second concussion during this at least month long period of those neuron and the axon recovering you are much more susceptible to some catastrophic event.

DR. MARK NOLAN HILL:

So then is this changing when we see youngsters and young adults have injuries and mild concussions that I see very frequently in my office? Should I keep them from doing any significant physical activity for at least a month?

DR. ANN MCKEE:

You know, yes, I do think you should and I know that sound sort of shocking but I do think that you really need to rest them for a month. In fact, there was a recent article in Archives of Neurology that recommended a month of rest after a concussion and we are just seeing so many changes that persist for at least a month on a very microscopic level, metabolic level that I think that would really be my recommendation and the other thing is I think party to problem with this is that we are dealing with something inside the head that has symptoms like headache, dizziness, may be some memory lapses, but you can't really see it. It's sort of an invisible injury. It's not like your knee or your leg that isn't working very well and so we tend to sort of pooh-pooh it, but we actually should be paying more attention to it because that's obviously a part of the body that we really need to protect.

DR. MARK NOLAN HILL:

Now many players that you studied are pro football players, but the National Football League, the NFL on some level has deflected discussion here, yes.

DR. ANN MCKEE:

That's true, that's true.

DR. MARK NOLAN HILL:

Why do you think that is?

DR. ANN MCKEE:

I think there are lot of parallels to the story between say what happened with cigarettes and some of the major tobacco manufacturers, I mean, this is not going to be news that is necessarily welcome.

DR. MARK NOLAN HILL:

Let me ask you a question. With all the concerns with the added protection, better neck protection, better head protection, better helmets, better face guards, things like that, has that helped at all or is that really just not a factor?

DR. ANN MCKEE:

You know, I can't say for sure if that's helped or not. Truth of the matter is there are so many variables changing at the same time. All of those things that you said are true, but players are also bigger, they are faster, theirs hits are harder, I mean, you know, so those things are changing in the opposite direction at the same time.

DR. MARK NOLAN HILL:

Now if you look at this from a common horse sense perspective and you watch a pro football game, certainly when I see some of these guys getting hit I am amazed that they get up meaning that they are not killed, but are we talking about only that type of trauma or are we talking about the trauma that our youngsters do in high school and then perhaps college in not necessarily organized sports.

DR. ANN MCKEE:

Well, you know, I think we are doing it at all these levels and I think it actually may be more important than either lesser injuries occurring in our teenagers and kids in their 20s. Those actually may be more important than the injuries that are occurring in the older professional players. There is something about the young brain that hasn't quite finished maturing and maturation of the brain takes a long time, probably doesn't finish until like the early 20s. You read about it all the time, kids with a concussion and then they have second concussion shortly afterwards. They sometimes die.

DR. MARK NOLAN HILL:

I want to thank our guest, Dr. Ann McKee. We have been discussing new research on chronic traumatic encephalopathy in elite athletes. I am Dr. Mark Nolan Hill and you have been listening to the Clinician's Roundtable on ReachMD, The Channel for Medical Professionals. Be sure to visit our web site at ReachMD.com, featuring on demand podcast of our entire library, and thank you for listening.

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