Brainstorm: Head Injuries and the NFL, Part 13: End of Regulation Play

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In my last column I talked about my skepticism about the relationship between head injuries, CTE, and mental illness. I promised that in this, my last installment in the series, I would elaborate on some of the gaps that need filling. As I endeavor to fulfill that promise, I'll also provide some perspective for future research.

Perhaps the epicenter for the work examining CTE and the brains of NFL players is Boston University’s Center for the Study of Traumatic Encephalopathy. The center is headed by Ann McKee, professor of neurology and pathology. Dr. McKee is also involved the NFL's “Brain Bank,” located at Bedford VA Medical Center in Massachusetts and funded by the NFL. Dr. McKee is probably not only the world's authority on the relationship between brain damage and an NFL career, but she is also the authority on the gaps that need filling.

What then are those gaps? They can be summarized as four concerns, which also suggest future experiments, many of which are already underway.

Concern No. 1: The size of the sample

As you may know from basic statistics, the larger the sample size you examine, the better your numbers become. Right now, the examined sample size is not very large. Consider how some results from McKee’s group were interpreted by nonscientific audiences. The study in question was the autopsy results of 15 brains of retired NFL football players. She found that 14 of them had CTE. The media was abuzz with statements like "playing football causes CTE" and "NFL players should be worried about psychiatric disorders."

Is 15 a big enough sample size to derive anything meaningful about the entire league? And do you really mean all NFL players, or only those retired? What about those currently playing? What about NCAA football players? High school athletes? That’s way too much pressure to put on McKee’s work. The brains
of 15 retired NFL players are not enough to provide an accurate picture of the association between gridiron-induced brain injury and suicidal behavior.

**Concern No. 2: Selection bias**

There has been no randomized selection of the brains to be studied. Indeed, all of 15 brains mentioned above were donated to McKee’s lab. And they came from just one population of athletes: retired NFL players. Because of this lack of randomization, the study is subject to what we call “selection bias,” which means you can’t make very many — read *any* — conclusions about the prevalence of the disease.

**Concern No. 3: Lack of healthy brains**

Perhaps the most-needed bridge has to do with the controls. To what should you compare the current crop of 15 brains, and to the next? You need randomized sample of healthy brains from players of all ages — who have had a broad swath of experiences — and especially the brains of non-players (not just middle-aged NFL veterans), to make the research meaningful. Until you can get those controls, you do not have a healthy denominator — and you do not have a result.

**Concern No. 4: Associative is not causal**

Most all of the findings in humans are associative data, which simply means one variable correlates to another. But as Science 101 teaches us, correlation is not causation. There is plenty of causal work done on lab animals, and they show a definitive relationship between head injury and the pathologies described. But mice don’t play football. And even if they did, a lab animal brain and a human brain are not the same thing. Nothing wrong with associative data — they make great flashlights for future causal work. But they do not, in and of themselves, say anything at all.

Of course, to be fair, Dr. McKee and her talented shop know all of this; these objections — and others — are currently being attended to with a great deal of care and activity. McKee’s lab has received brain-donation commitments from many different sources, for example, and the autopsies are proceeding on more donated organs, from a wider variety of sources, every day.

That does not mean I think the linkages are all fake; your reading of this blog series has not been a waste of time. You might be interested to know that I feel there is something aversive going on in the heads of athletes who repeatedly suffer closed-head injuries. The tragic ends of Seau and Duerson and other colleagues in other sports — and soldiers not involved in sports at all — did not occur randomly. We just don’t know what exactly has happened. Until we’ve done a lot more research, it will be very difficult to determine what it did.

And that brings us full circle.
The brain was never designed to suffer through closed-head injuries as someone's regular occupational experience. And it is clear something is going on every Sunday afternoon in the brains of athletes playing a game I have loved since I was a little boy. It is just that these days, I approach my enthusiasm with mixed feelings. It is possible that the NFL is doing the same, evidenced perhaps by their willingness to fund Dr. McKee's work. One cannot ignore these things, love of the game notwithstanding. As the deaths of Duerson and Seau illustrate, the cost is simply too high.

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