HEAD INJURY AND FOOTBALL:

A Changing Playing Field

WRITTEN BY **MICHAEL POWERS**

When the autopsy of Owen Thomas, a co-captain of the University of Pennsylvania football team who committed suicide last April, showed signs of brain damage, it set off a national media firestorm. His autopsy revealed the same brain disease found in a number of deceased N.F.L. players, moving the issue of head injury in football from the professional ranks to an urgent concern facing both amateur and professional athletes, and their families, across the nation.

The disease gaining national attention is chronic traumatic encephalopathy (CTE), a neurodegenerative disorder that, according to the National Institutes of Health, is linked to repetitive trauma to the brain, such as concussions, over a long period of time.

CTE involves a key brain protein called tau that eventually kills brain cells and is involved in other neurodegenerative diseases, including Alzheimer's disease and frontotemporal dementia. CTE, although its own distinct condition, shares some of the same key features with these other types of diseases. It is a form of dementia with mainly neurobehavioral symptoms such as poor decision making, impaired memory, erratic behavior, use of drugs and alcohol, depression and suicide.

CTE is not a new disorder; it had been known since the 1920's as dementia pugilistica, which is Latin for fighter, because it was thought to be isolated to boxers. Since, scientists have identified it in the brains of players of other contact sports, including football.

To date, as of September 2010, autopsies have confirmed 13 cases of CTE in former football players, all involving athletes in the college or professional ranks. Although the research into CTE in other athletes is still in its infancy, the link between head trauma and brain disease has caused ripples throughout the world of football.

"Everyone in our profession [is] very concerned about this issue," said Andy Coen, head coach of the football team at Lehigh University in Bethlehem, PA.

Likewise, Chris Yeager, head coach of the football team at Mountain Brook High School, Mountain Brook, AL, has seen a similar transformation at the high school level.

"There aren't many coaches left with an old school attitude towards concussion," he suggested.

Each year, 1.6 million to 3.8 million sports-related concussions occur in the United States, according to estimates by the Centers for Disease Control and Prevention.

Coaches appear to have reason to be concerned about them: a 2005 peer-reviewed study by the University of North Carolina's Center for the Study of Retired Athletes found that 597 retired N.F.L. players, or 24 percent, reported sustaining three or more concussions during their professional career; and, based on self-reporting, these players had five times the risk of mild cognitive impairment and a three-fold prevalence of reported significant memory problems versus their counterparts without a history of concussion. Physicians had diagnosed 33 players with Alzheimer's disease.

While the data suggested a trend toward earlier onset of the disease, there was no link between previous concussion and lifetime onset of Alzheimer's disease. And the disease was only slightly more common among former players, versus the American male population, at age 65 and the same rate at age 75.

In September 2009, the issue blew wide open when a study commissioned by the N.F.L. (and not peer-reviewed) reported that former players appeared to have been diagnosed with Alzheimer's disease or similar memory-related diseases at a rate 19 times higher than the norm for men aged 30 to 49.

Although football has borne the brunt of the criticism, most competitive sports carry risk for concussion and head injury. Leading the pack of sports-related head injuries treated at hospital emergency rooms are those that result from cycling, followed by football, baseball and softball. A 2007 study published in the Journal of Athletic Training found that female high school soccer players suffer a concussion 77 percent as often as high school football players, for example.

Robert Cantu, M.D., chief of neurosurgery service and director of sports medicine at Emerson Hospital, Concord, MA, and co-founder of the Sports Legacy Institute, has treated athletes from a range of sports.

"Parents are shifting their kids into [soccer, but this also] has a high rate of concussive head injury," Cantu said. "Not all concussions occur on athletic fields. Kids get concussed on the weekends, falling off bikes."

Experts agree that policymakers, coaches, parents and players themselves need to be proactive across the spectrum of athletic activities.

"Although the risk of sports-related concussion does not outweigh the many benefits of sports participation, preventive interventions should be implemented to decrease concussion rates to the lowest possible levels," concluded the authors of the study in the Journal of Athletic Training.

The increased publicity surrounding concussion has helped push forward a number of new laws to protect high school athletics. The first was the Lystedt Law adopted in Washington in 2009; it requires that athletes who are suspected of suffering a concussion must be removed from play and not allowed to return until being seen by a licensed healthcare provider trained in concussion management. The law is named for Zackery Lystedt, a high school student who suffered a catastrophic brain injury when he returned to a game after a concussion. The Lystedt Law provided the template for similar laws in nine other states: Connecticut, Massachusetts, New Jersey, New Mexico, Oklahoma, Oregon, Rhode Island, Texas and Virginia. Several other states are investigating the issue.

Not all amateur and professional football coaches have waited for legal mandates to reform the handling of concussions and have dramatically changed policies since they became aware of the short-term and long-term risks. Ten years ago, concussion induced confusion was often referred to as "cobwebs," and players were encouraged to "shake it off." Five years ago, the N.F.L. did not require baseline cognitive testing or formal return-to-play protocols.

CONCUSSION SIGNS AND SYMPTOMS

1. **Thinking/Remembering:** difficulty thinking clearly, feeling slowed down, difficulty concentrating, difficulty remembering new information
2. **Physical:** headaches, fuzzy or blurry vision, nausea or vomiting (early on), dizziness, sensitivity to noise or light, balance problems, feeling tired
3. **Emotional/Mood:** irritability, sadness, more emotional, nervousness or anxiety
4. **Sleep:** sleeping more than usual or less than usual, trouble falling asleep

According to the Centers for Disease Control and Prevention

In December 2009, the N.F.L. announced that it would enact stronger rules on managing concussions, requiring players who exhibit any significant sign of concussion to be removed from a game or practice and barred from returning the same day. Starting in the 2010 season, every N.F.L. locker room must display a poster on concussion in sports that clearly spells out facts, symptoms and course of action.

A position statement on sports concussion issued by the American Academy of Neurology (AAN) last November calls for any athlete who is suspected of having a concussion to be removed from play until the athlete is evaluated by a physician with training in the evaluation and management of sports concussion.

"While the majority of concussions are self-limited injuries, catastrophic results can occur, and we do not yet know the long-term effects of multiple concussions," said Jeffrey Kutcher, M.D., MPH, chair of the AAN's sports neurology section, which drafted the position statement.

At Lehigh, Coen said, "Every year, our trainers and I send out letters to parents of our players explaining our protocol for mild head injuries. We lay out the protocol. Every kid has their baseline tested so if the trainers suspect a concussion, he has to get back to baseline before he's permitted to do any activity."

Symptom-free players are not allowed to return to contact immediately. Rather, once they have been cleared for play, they must complete a five-day evaluation period of increasing exercise intensity without reoccurrence of symptoms, he said.

Yeager has instituted a similar return-to-play policy. But because he coaches high school players with younger, more vulnerable brains, he has instituted a minimum five-day waiting period before a player who has suffered a concussion will even be sent for a return-to-play evaluation, and then, once cleared, must go through the five-day phase-in.

Despite increased awareness of this issue, some parents might encounter coaches who do not understand the significance of the risk associated with a concussion.

According to Yeager, the best way to enact change at the high school level is to go directly to the administration and

target the overall athletic program. Parents should arm themselves with as much information as possible and approach the athletic director or principal with an eye toward a schoolwide policy.

"The issue is the safety of all of the kids, not just one sport," he said. "I wouldn't target a specific coach…There are concussions in every sport. If you single out one coach, there is an insinuation that the coach or sport is callous towards player safety, which can make the coach defensive."


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Cantu of the Sports Legacy Institute believes parents must become educated about head injuries in help protect their children on the field.

"We would like parents to understand what a concussion is, what the symptoms are, and the need to not allow their children to physically exert and definitely not practice or play a sport until they have cleared the symptoms," he said.

Only 3.9 percent of concussions among high school athletes are accompanied by a loss of consciousness, so many concussions will often go unnoticed unless self-reported, according to the study in the Journal of Athletic Training.

"If a kid is complaining about headache, dizziness, nausea, light, sleep, or is acting more or less emotional, parents should have their child evaluated by someone who is trained to diagnose a concussion," said James Robinson, M.D., medical director for the University of Alabama's athletic department and head team physician for the university's football team.

Parents should be mindful that, even though teams are implementing stringent concussion management policies, players often hide their concussions so that they can stay on the playing field. Underreporting also stems from players being unaware of having suffered a concussion or underestimating the extent of the injury. Consequently, experts say parents can play an important role in catching undiagnosed concussions by emphasizing to their children the importance of reporting an injury.

According to Yeager, "Players who don't want to report their concussions is often the bigger issue. They don't want to sit out. At this age, their whole identity is tied into being invulnerable. That's the type of person who is drawn to football."

Even in professional sports when a player is diagnosed with a concussion, the athlete may push to return too soon. When Ben Noll played for the St. Louis Rams, he suffered a concussion in 2004 during a scrimmage against the Chicago Bears.

"I don't remember the play, but I do remember throwing up that night and the next morning. I was sent for a CT scan, and they sat me out for two days," recalled Noll, who has since retired. "I had no idea that I should have stayed out for longer. But if I hadn't come back to play, I was concerned that I wouldn't make the final roster, and my dreams would have been over. When I went back to play, I was excited to get back on the field and compete. I wasn't thinking all that clearly, but I just wanted to play."

Athletics teach young people toughness because success requires enduring physical pain. However, athletes need to understand the difference between being tough and jeopardizing their health, according to Coen of Lehigh University.

"Good kids play through pain because it is part of the game, but there is a difference between pain and injury. I make it loud and clear that I would rather you miss a couple of days than try to tough it out and miss two or three weeks," he said.

There are steps parents and players can take to reduce the risk for concussion, particularly regarding equipment. Improperly secured chinstraps and underinflated air bladders reduce helmet effectiveness, so encouraging players to check their equipment on a daily basis can reduce their risk of concussion.

Despite the concerns about the long-term effects of head trauma in athletes, some experts suggest putting the issue in perspective.

A 2009 report, "The Annual Survey of Football Injury Research," prepared for the American Football Coaches Association, the National Collegiate Athletic Association and the National Federation of State High School Associations, notes seven fatalities directly related to football during the 2008 season, all in high school football. Of the five brain injuries, two were diagnosed as second impact syndrome, in which players received an initial concussion and returned to play before being fully healed.

But the report called the rate of direct fatal injuries "very low" on a 100,000 player exposure basis: the rate of direct fatalities was 0.39 percent per 100,000 participants for the approximately 1.8 million football players at all levels, from junior high school through professional.

Likewise, Robinson of the University of Alabama encourages people to view the 13 confirmed cases of CTE among football players as part of a much bigger picture.

"There is no epidemic of [amateur and professional] football players suffering from dementia. If you look at the number of concussions that occur each year versus the number of patients with CTE, the numbers are disproportionate," according to Robinson.

Richard Powers, M.D., chairman of the Alzheimer's Foundation of America's medical advisory board and chief of the Bureau of Geriatric Psychiatry at the Alabama Department of Mental Health and Mental Retardation, Tuscaloosa, AL, pointed out an additional factor.

"The cause of CTE is unclear, though it seems related to chronic trauma," he said.

"There may be a dose dependence, meaning how often did you get hit and how severely did you get hit combined with a genetic predisposition. That may explain why we are seeing it in professional athletes and not in amateur athletes, because of duration of play and severity of impact."

Both Robinson and Powers observed that there may be other factors in addition to concussions that put athletes at risk for CTE. Many of the documented cases of CTE involved athletes with evidence of vascular disease, which can be related to the health consequences of obesity. Plus, most were offensive linemen, a group that has a relatively low rate of concussion compared to linebackers or running backs. Robinson suspects that the linemen's high rates of cardiovascular disease and narrowing of cerebral blood vessels affected the health of their brains.

Head trauma is not the only risk factor for dementia facing football players. Recent studies have found that 20 percent to 45 percent of college offensive linemen suffer from metabolic syndrome during their playing careers. Metabolic syndrome is a disorder common among the overweight and obese that increases the risk for heart disease, stroke and dementia.

Weight problems are no secret among former players.

According to Noll, "The majority of the kids that I played offensive line with in high school have gained between 40 and 50 pounds, so the problem is not exclusive to the professional level. Most of my teammates from college have either gained or lost no weight. About 10 percent lose weight, about 40 percent stay the same weight, and about half the guys gain weight after playing."

Powers said the weight issue is significant, noting: "We know that metabolic syndrome is a risk factor for accelerated vascular disease with aging. We know that football players have an increased risk for metabolic syndrome, and people with metabolic syndrome have an increased risk for dementia. If you follow this chain of thought, it would be a good idea for players to manage their weight and hypertension after they stop playing."

In general, he concluded, "The chances of having a healthy brain as you grow older are probably increased by making wise choices throughout your life. Healthy brain choices include making prudent decisions if you play contact sports when you are younger and being attentive to important health concerns, such as reducing risk factors for metabolic syndrome, when you are older."

CONTACT SPORTS CHECKLIST

Here are some safety-related questions to consider. For a complete checklist, visit www.afateens.org.

1. Does the team have a team doctor trained in sports concussion?
2. Do coaches follow national published recommendations on playing injured athletes?
3. Does the athlete understand the importance of telling the coach about a head injury during play?
4. Does the team have a standard medical protocol for evaluating head injuries and concussions?

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