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Concussion

Using a sledgehammer to crack a walnut: the modern management of concussion

P McCrory

Sports concussion is still poorly understood and therefore difficult to prevent and manage

The recent newspaper reports from the USA suggesting the need for legislation to improve the management of sports concussion is to be encouraged, although the scientific basis for these recommendations is probably incorrect and raises a number of disturbing issues.¹

How has this situation arisen? There is no doubt that our pathophysiological understanding of sports concussion is incomplete and our management, at best, empirical. Recent expert consensus statements have led to some degree of uniformity of approach and a move away from anecdotal management; however, it is a moot point as to how widespread these consensus views have been adopted by athletes.^{2–3}

Studies performed in rugby football suggest that, although coaches and parents have a good understanding of the nature and risks of concussion, the athletes themselves seem not to appreciate the potential consequences and, as a result, tend to under-report the injury to medical staff.⁴ How much of that reflects a lack of athlete-specific education, peer pressure to continue, or simply a function of the immature adolescent brain to understand risk behavior is unclear. Studies from other sports similarly demonstrate this under-reporting bias.⁵

The risks of concussion are not entirely clear. Given the frequency of the injury in sport and the tendency for athletes to continue to play while symptomatic, it is

surprising that problems are not encountered more often. This tends to suggest that most injuries are both mild and benign. The caveat here is that the problems may not be picked up by medical staff, as they can affect scholastic performance in young athletes or result in difficulties in the workplace, which are outcomes not usually sought in most sporting situations.

One of the concerns related to the acute concussion injury is the fear of the so-called second-impact syndrome. This fear largely drives the various anecdotal concussion grading scales in the USA and is the principal basis for the arbitrary exclusion periods after injury.⁶ Whether this phenomenon of brain swelling is a consequence of recurrent concussion, as suggested, or an extremely rare (and possibly genetically based) sequela of traumatic brain injury in young athletes remains unresolved.⁷

There is an increasing body of work using sophisticated research tools such as functional MR brain scanning⁸ and neurophysiological studies⁹ to objectively quantify functional changes within the brains of acutely concussed patients. Despite this, our empirical consensus beliefs suggest that the underlying injury is non-structural in nature and that the symptoms and signs are manifest through cell membrane changes rather than destruction of the cells themselves. To some degree the debate between those

who believe in a structural injury and those who support a functional injury has been going on for more than 300 years without definitive resolution.¹⁰

Recent reports have suggested that a long-term consequence of sports concussion may be chronic traumatic encephalopathy (or punch drunk syndrome), which adds a new dimension to the debate.^{11–12} Extensive correspondence has accompanied these case reports, which have criticized both the diagnostic methodology used in the studies and the clinical detail provided in the published reports.¹³ At this time, that debate remains an open question.

Other studies, without neuropathological evidence, have also suggested that recurrent concussion is associated with both depressive symptoms and late life cognitive impairment.¹⁴ Although an interesting association is evident, it is obvious that a number of statistical confounders are likely to be important, given the lifestyle and alcohol/drug use that is common in professional sport. It is also surprising given that no association was noted in this particular athlete population between concussion and Alzheimer's disease given that head injury is a well-studied and recognized risk factor for this condition. Clearly, the issue of potential long-term problems has been highlighted as one of concern and raises issues as to whether this might be prevented.

One of the difficulties in these studies is that other sports that have far higher rates of sports concussion (eg, Australian football, rugby) and are equally well studied do not show the same short or long term problems that seem to be evident in the reports from American football research. Similarly, so-called second-impact syndrome is unknown outside the USA despite being specifically sought.⁷ The reasons for these differences are unclear, but may reflect the different nature of injuries in US sportsmen (eg, helmeted athletes, head contact with artificial turf surfaces and/or protective equipment) or other unrelated confounders (eg, use of ergogenic supplements or anabolic steroids).

So we are in a problematic situation with regard to this particular injury. At this point in time, we do not fully understand the underlying pathophysiology or the risks of injury, and our management remains firmly empirical with no convincing evidence that current expert advice is either safe or effective. We are fortunate that, although common, the injury usually follows a benign and self-limited course, and the vast majority of athletes recover fully and rapidly.

The most recent Prague consensus conference³ suggested that there were probably two forms of injury: a benign injury lasting a few days ("simple concussion"), and a more problematic longer-lasting injury ("complex concussion"). The reason for the difference is not clear and may reflect the severity of impact, biomechanical factors, genetic differences, or other as yet unknown factors. If this difference holds true (as suggested by recent studies), then we may begin to manage the injury more effectively. Simple concussion injuries, which represent about 95% of all cases, can probably be managed by rapid return to play once the patient is asymptomatic. However, complex concussions, if identified early, may need a more conservative management strategy and possible intervention by concussion experts. At this stage, however, we do not fully understand these clinical differences early enough in the course of the clinical injury to institute such recommendations.

The legislative calls in the USA are centered on providing more trained first-aid support at football matches and other

sporting events.¹ Clearly, this is an appropriate and simple recommendation, and one wonders why something so obvious needs to be legislated for rather than being an accepted part of sporting care. The basis of this recommendation, however, in preventing second-impact syndrome or other potential long-term problems is unlikely to be effective.

What else can be done? It has been shown that athletes, especially adolescents, fail to appreciate or report concussion. Further study is necessary here to understand this risk behavior, but athlete-specific education is probably a key component of the remedy. We already have the technology for all athletes, regardless of age or level of competition, to have a preseason computerized cognitive assessment,¹⁵ which enables a more accurate measure of recovery after injury. Although this clinical strategy remains to be validated scientifically, it nevertheless remains a step forward in the objective clinical management of the injury.

We are at the end of the beginning rather than the beginning of the end of our understanding of sports concussion. We have made a few observations, but the difference between knowing the name of something and actually understanding it is a gulf that we still must cross.

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LACUNAE

Escalator incidents linked to popular sandals

Forty people wearing Crocs and imitations of the popular Japanese resin sandal design have reported getting their feet caught on escalators since May, according to Japan's International Trade and Industry Ministry and the National Institute of Technology and Evaluation. In six cases, victims suffered minor injuries, but in one case, a 5-year-old girl broke her middle toe, according to officials. Officials are concerned that children wearing these types of sandals could have similar mishaps, and have called on the public to make sure children take care when riding escalators. The sandals are shaped like a clog and have holes across the instep, and wearers can change the strap's position to taste. Between May and August 2007, 40 people wearing footwear of this design were involved in incidents in which the sandal became caught in the space at the front or side of an escalator step. According to the National Institute of Technology and Evaluation, most of the mishaps are believed to have been caused as a result of children putting their feet beyond the yellow outline painted on escalator steps, where people are advised not to put their feet. As it has yet to be determined whether the incidents are the result of problems with the sandals or the escalators, the institute will continue to investigate the case.