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Sport-Related Concussion: A Call for Evidence and Perspective Amidst the Alarms

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Sport-related concussion (SRC) has received considerable popular and scientific attention in recent years. Unfortunately, much of this attention has reflected an inadequate appreciation of the natural clinical history of SRC, its risks, and the paucity of evidential support underlying various management approaches. In fact, 2 of the most popular beliefs about how SRC should be managed are largely devoid of sound rationale and empirical support.

**NATURAL CLINICAL HISTORY**

In the first days after SRC, neurobehavioral changes can be pronounced. The largest effects are typically seen for self-reported symptoms and on balance and cognitive tests. In most cases, these problems resolve spontaneously and quickly, such that prospective controlled studies with teenage and older athletes consistently fail to identify clinical findings in these domains after 7 to 10 days. The atypical risks of SRC have been recently characterized using American football as a model.2 The primary short-term risks are delayed recovery and repeat concussion, both of which occur relatively infrequently. Potential long-term risks include the earlier expression of a late-life neurodegenerative disorder, such as Parkinson or Alzheimer disease, or the onset of a yet-to-be-defined neuropathological process, such as chronic traumatic encephalopathy. These long-term risks remain speculative. The number of concussions and/or amount of cumulative subconcussive trauma necessary to produce such pathology is not yet known, and no reasonable basis exists to predict which athletes might be at risk other than perhaps to identify very broadly those involved in sports with exposure to repeated high-impact forces to the head (eg, boxing, American football).

**SECOND IMPACT SYNDROME**

The specter of “second impact syndrome” is often raised when young athletes are being considered for return to play. As typically described, this condition involves a second blow to the head while an athlete is still recovering from a previous concussion, triggering diffuse edema (in the absence of structural injury), increased intracranial pressure, brain herniation, and severe neurologic injury or death.

Essentially, no good evidence exists to support the claim that the diffuse brain swelling described above is attributable to a second impact, a remarkable fact given the amount of concern this so-called syndrome generates. Identified cases come, implausibly, only from North America. The vast majority of incidents do not involve verified second impacts, and only 2 probable cases have occurred outside boxing.5 A more likely explanation for at least some of the supposed cases of second impact syndrome is malignant brain edema, which is a well-described phenomenon in the neurosurgical literature and occurs in youth after a single minor head injury. In the sports setting, isolated brain edema of any kind is exceptionally rare; catastrophic outcomes are many times more likely to result from subdural bleeding.5,6

Regardless of underlying pathology, the risk of a catastrophic outcome after SRC is very low. Each year, tens of millions of young people participate in organized sports, and

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death from sport-related head trauma, although devastating in every case, occurs less often than death by a host of other causes, including sport-related cardiovascular events and lightning strikes (Table). All athletes and parents need to be counselled that catastrophic outcomes from head injuries are an extremely rare, but inherent, risk of contact sports. Suggesting that such an outcome will be eliminated by simply preventing repeat concussions or “second impact syndrome” is grossly misleading. Successful management of a catastrophic response depends on quick recognition of neurobehavioral deterioration after any head injury and access to immediate medical attention and neurosurgical intervention.

TOTAL BRAIN REST

As often as athletes are warned of second impact syndrome, they are now seemingly being told that total brain rest is the key to successful recovery. At its most extreme, this idea is represented by “cocoon therapy,” which entails postinjury sensory deprivation for an athlete (www.stamfordadvocate.com/default/article/Local-doctor-has-novel-approach-to-concussions-190953.php). Even mainstream SRC guidelines have begun to focus on complete rest. One of the most popular guidelines, for instance, states that the cornerstone of concussion management is “physical and cognitive rest until symptoms resolve.” The first step of the associated return-to-play protocol involves “no activity” until asymptomatic.

A reduction in activity in the days after concussion is not unreasonable because athletes are often quite symptomatic during this period, and some experimental work suggests that rodents who exercise too soon after brain injury may have more protracted recoveries. However, the idea that the rest needs to be “complete” and last until an athlete is entirely asymptomatic is without theoretical grounding or evidential support.

Complete rest is conceptually impossible, not to mention impractical: How does one engage in no physical or cognitive activity? Adherence to this recommendation also leads to the nonsensical idea that any athlete who is reporting persistent postconcussive symptoms, which are well known to be nonspecific, be restricted indefinitely from all physical activity (and academic and social activity for that matter). Substantial evidence indicates that exercise and participation in organized sports have positive benefits for youth (eg, improved physical health, psychological adjustment, and academic achievement), so eliminating such activity, especially for long periods, can be expected to clearly affect athletes negatively.

Importantly, no empirical data exist to show that physical or cognitive rest after SRC exacerbates concussive injury or improves clinical outcomes. Indeed, studies with athletes suggest that reengaging in activities in the days after injury is likely to have no detrimental effect or even a beneficial one, consistent with findings that total bed rest is generally contraindicated for most medical conditions. An overemphasis on extensive rest can also worsen expectations for recovery, which have been well demonstrated to affect the perception and reporting of postconcussive symptoms. Finally, in the face of persistent symptoms, promising empirical data exist to support psychosocial and “active” rehabilitation approaches over prolonged rest.

CONCLUSIONS

We find much value in the recent attention to SRC. Concussions, by definition, are a brain injury and must be taken seriously, particularly in young athletes and those who have sustained previous concussions. At the same time, an emphasis on “second impact syndrome,” total brain rest, and other questionable concepts is fraught with the potential for pronounced iatrogenesis. The management of SRC should reflect a solid understanding of the science and good clinical judgment. Return-to-play decisions are not yet evidence based, so rigid adherence to a particular idea or protocol, regardless of its popularity, is still much less useful than conducting an individualized analysis of an athlete’s presentation, history, and circumstances, and carefully considering the known and potential risks of SRC balanced against the demonstrated benefits of continued physical activity and sports participation.

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