Concussion and traumatic brain injury in sport

Conmoción cerebral y traumatismo craneoencefálico en el deporte

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Epidemiology and sports have the greatest incidence

Sport and physical exercise have become increasingly popular over the last few years and so injuries are also on the rise. Although traumatic head injuries (TBI) represent a small proportion of all sporting injuries, their short- or long-term consequences mean that they are an important cause for concern, with possible implications for sports. The main focus within TBI is Cerebral Concussions (CC) that are thought to represent 80% of visits to the emergency room related to traumatic head injuries. There is a suspicion that, in many cases, the CC is not diagnosed or not assessed by medical professions[1], although as evaluation tools have developed that include neuropsychological tests, neuroimaging and analysis of balance and gait, there has been an improvement in the diagnosis and care for patients with this pathology[2].

Traumatic head injuries

Traumatic brain injury (TBI) is an important health issue as it affects millions of people all over the world every year with high mortality and morbidity incidence. 75% of TBI are due to traffic accidents, affecting young people under 25 more. According to some research, TBI are among the three main causes of death due to traumatic injuries and a high percentage of survivors of these injuries end up with disabling after-effects[3].

Recent estimations indicate that around 69 million people experience a TBI every year[4]. A review a few years ago on incidence in various European countries found 235 cases (adding together hospital admissions, people going to A&E and deaths) for every 100,000 inhabitants and year[5] and a more recent study found an incidence rate between 47 and 850 cases per 100,000 inhabitants per year and a mortality rate between 3 and 28 cases per 100,000 inhabitants and year[6]. The worldwide incidence rate varies from one set of statistics to another depending on age, geographic location and exposure to other risk factors.

In Spain, the overall incidence is 47.3 per 100,000 inhabitants per year (one of the lowest in Europe),[7] although other studies talk about 150-250 cases/100,000 inhabitants per year[8] and, although it is the cause of 1% of all deaths, 80% of cases are mild and recovery is good.

TBI are much less frequent in sport than other types of injuries, although their repercussions and consequences can be more severe and their incidence is rising worldwide, because participation in sport is increasing and there is better knowledge and medical control of it.[9]

The annual hospital incidence of sport-related TBI lies between 3.5 and 31.5/100,000 athletes per year, although other sources present much higher incidence figures. This represents 20% of all TBI and more than half occur in children and teenagers[10]. Between 60 and 80% of hospitalisations related to sport are due to TBI[11].

Sports that imply the greatest risk of TBI are rugby, American football, ice skating, football, horse-riding, cycling, some water sports, etc. On most occasions, the mechanism is usually contact between players or due to the sports equipment used[12]. Incidence is greater in sports which require the use of a helmet, possibly because the risk is higher.

In terms of gender, they affect men more (66-75%) although there is a greater risk for women, at least in some sports, fundamentally due to body constitution[13].

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TBI are more frequent during competition than in training and both incidence and severity are fundamentally influenced by the type of sport, the position of the player and the age[9].

Concussion

Cerebral concussion (CC) or mild traumatic brain injury (mild TBI) is the most common type of TBI, representing 70-90% of all of them. According to some statistics, this affects over 6/1,000 persons a year, of which between 1 and 3/1,000 require medical attention[14].

Sporting injuries are among the most frequent causes of concussion; in fact, CC accounts for between 5 and 9% of sports injuries[15]. In a wide-ranging survey in Canada, it was found that over 54% of all CC were sport-related[16] and it is estimated that there are between 1.6 and 3.8 million secondary sport-related cases in the USA every year[15,17].

In a meta-analysis carried out 10 years ago, it was found that the CC incidence rate related to 12 high-risk sports among children and teenagers (≤ 18 years old) was 0.23/1,000 exposures, and the sports with the greatest incidence were rugby, ice hockey and American football (with rates of 4.18, 1,2 and 0.53/1,000 exposures respectively)[18], and another analysis carried out on 25 high-risk sports found an incidence of 0.45 CC/1,000 exposures[19].

The risk of suffering a CC in sport is going to depend on the type of sport and almost all studies agree that it is greater in contact sports, including ice hockey, American football, rugby, football, lacrosse, and boxing, horse riding, wrestling, skiing, martial arts and cycling[15,20].

A recent study among young athletes (11-17 years old) assessing 27 sports revealed an average CC rate of 0.39/1,000 exposures. The highest rate was in American football (0.92)[21] and in a systematic review focused on sports with the highest risks of CC, higher incidence was found in rugby (3-3.9 CC/1,000 hours of exposure). The study looked at American football, rugby, ice hockey and football (with the lowest incidence: under 2.5 CC/1,000 hours)[13].

CC are more frequent during competition than in training. Consequently, when analysing various sports, Zuckerman *et al*[19]. find a rate of 1.28 cases/1,000 exposures during competitions compared to 0.26 during training. On most occasions (over 70%), the mechanism is usually contact between players, or the equipment used (15%)[12].

In relation to age, the majority of sport-related CC affect young people (school children and university students) due to less experience and because participation is higher in this age range; every year there are between 1.1 and 1.9 million sport-related CC among under 18s in the USA[17] which represents 8.9% of sports injuries in secondary school and 5.8% of university injuries[20].

Some studies observe a greater incidence of concussion in university-aged athletes, affecting more than 12% during the school year[9,21], while for others, the incidence is greater among younger athletes (school age)[22]. The difference probably lies in differing study protocols, varying the exposure time, the sports, etc.

In terms of gender, results are conflicting though most studies demonstrate that women are at greater risk of concussion[12,21,19]; the most frequently repeated opinion is that in sports governed by the same rules, women are usually at greater risk, and it has been found in some sports, such as football or basketball, women have a relative CC risk 1.5-2 times higher than men[9].

This greater incidence among women is due, among other reasons, to the fact that women have a weaker cervical musculature than men, which reduces the stability and rigidity of their neck[12]. In women's sport, CC seem to be more frequent in football (due to elbowing, cracking heads or ball) followed by ice hockey, lacrosse and basketball[13].

Evidence indicates that athletes with a history of CC are at greater risk (three to five times higher) of suffering additional concussion in the future. Recurring cases are estimated to be 9%[19].

A study carried out among 2,552 NFL players found that more than 60% had presented one or more concussions in their playing career and 24% reported that they had suffered three or more CC[23].

However, it should be considered that mild TBI in sport is more usual than the statistics might lead us to believe as in many cases they do not report it to medical services and so it goes undiagnosed (up to 50% according to some statistics) either due to lack of knowledge (only 10% incur loss of consciousness) or due to the belief that the injury is not serious or to avoid being taken out of play. On the other hand, the US Emergency Department recognises that less than 13% of sport-related TBI are assessed in the emergency room[24].

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