

Sport-related concussion (SRC). Current challenges and implications for team doctors

La conmoción cerebral relacionada con el deporte (SRC). Problemática actual e implicaciones del médico deportivo

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Sports-related concussion (SRC) is defined in the 6th international consensus statement on concussion in sport (Amsterdam, 2022¹) as a traumatic brain injury caused by a direct blow to the head, neck or body resulting in an impulsive force being transmitted to the brain that occurs in sports and exercise-related activities. This initiates a neurotransmitter and metabolic cascade, with possible axonal injury, blood flow change and inflammation affecting the brain. Symptoms and signs may present immediately, or evolve over minutes or hours, and commonly resolve within days, but may be prolonged. These symptoms and signs may not involve loss of consciousness. No abnormality is seen on standard structural neuroimaging studies although abnormalities may be present on functional, blood flow or metabolic imaging studies¹.

SRC occurs most often in such contact sports as boxing, football, ice hockey or rugby, reaching an incident rate in the latter of up to 17.1 concussions per 1,000 hours of play².

SRC can have short-, medium- and long-term consequences on the athlete. In the acute stage, it has been associated with greater risk of muscle injuries stemming from reduced motor control after a concussion³ and the risk of a fatal outcome can even increase were a second concussion to occur within a short time frame⁴. In the medium term, some athletes can continue to show symptoms over a period of time in excess of two weeks, with headaches being the main symptom, and can even present with post-concussion headaches for over three months⁵. In terms of the long-term effects of SRC, repeated concussions in the same person has been linked to chronic traumatic encephalopathy. However, this link has not been entirely demonstrated⁶.

Early diagnosis of SRC and proper management allows recovery time to be accelerated and the risk of complications or other brain and musculoskeletal injuries to be reduced⁷. The lack of objective image testing makes diagnosing this injury more complicated. The diagnostic criteria for mild traumatic brain injury were published recently⁸, not only

for traumas in the field of sport but also in civilian and military situations, establishing different criteria that would help to perform a differential diagnosis. These criteria include: 1) the mechanism of injury; 2) acute symptomatology; 3) clinical examination and laboratory findings; 4) neuroimaging tests; and 5) ruling out any symptomatology that could be better explained by other possible causes⁸.

Various complementary tests are being designed that could be applied for the diagnosis, prognosis, recovery markers and possible complications of SRC: analysis of biomarkers in bodily fluids (microRNAs, glial fibrillary acidic protein (GFAP), total Tau, microneurofilament light chains (NFL) etc.), advanced neuroimaging (functional MRI), EEG, pupillometrics, etc. All these tests might enable the detection of persistent biological abnormalities after clinically observed recovery. Nonetheless, these techniques are not included in regular clinical practice given that the majority of them are currently at the research stage and, moreover, it is unknown whether the possible abnormalities revealed are pathological, adaptive or benign. The data produced to date are also insufficient for linking the neurobiological change to the clinical indicators of recovery⁹. Hence, SRC continues to be a mainly clinical diagnosis at present. In light of this problem, various international expert consensus events continue to take place with a view to designing standardised tools capable of helping sports medicine physicians treat SRC. The *Sport concussion assessment tool - 6* (SCAT6)¹⁰ was recently published, with a separate version for children (Child SCAT6). This tool enables a multi-modal assessment of athletes with suspected SRC to be conducted, including an immediate on-field assessment in several steps: establish alarm signals (red flags), the Glasgow coma scale, an assessment of the cervical spine, a coordination test, an oculomotor exam and a memory test. An off-field assessment is subsequently performed that includes a history of the athlete, the assessment of symptoms, the cognitive testing, the coordination and balance test and deferred memory in order

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to finally enable a decision to be reached. It is a tool designed for use in the acute stage, ideally within 72 hours and up to seven days after the injury. SCOT6¹¹ is recommended for an assessment several days later, which would include the assessment of neurological symptoms and signs, cognitive function, balance, orthostatic blood pressure and heart rate, cervical spine assessment, oculomotor function and sight, a standardised stress test for concussion and the psychological and neuropsychological study⁹.

In light of all the above, it is clear that the diagnosis and treatment of SRC is complex and occasionally requires multi-disciplinary teams. In practice, it represents an added problem for the sports medicine physician, who needs to perform a diagnosis on-field and in the shortest time possible. Various international federations have therefore designed action protocols in response to suspected SRC.

World Rugby — a pioneer in this field — uses a protocol for treating head injuries in rugby (HIA)¹². This protocol is divided into four stages: HIA 1) Off-field assessment, which is performed via direct assessment and viewing the video. If a player meets the criteria for immediate removal, no further assessment methods would be necessary before removal (criteria 1). The doctor responsible for performing the assessment will have at least 12 minutes to complete this protocol, in which the player cannot return to the field (criteria 2). HIA 2) This is performed three hours after the match ends and the SCAT6 tool may be used. HIA 3) This is performed 36-48 hours after the event and the SCAT6 tool is recommended, as well as a computerised neurocognitive tool (chosen by each team). HIA 4) Full authorisation to return to play after completing rehabilitation, noting the recovery time in the medical history of the athlete.

FIFA also has a protocol for treating SRC in football¹³, which is divided into eight stages: 1) Observation and recognition; 2) Initial (on-pitch) examination, these stages are also performed via direct assessment and viewing the video; 3) and 4) Off-pitch/quiet-area examination; 5) to 7) Post-match examinations and observation, between 18 and 72 hours after the event; and 8) Graduated Return-to-Football Programme.

In all cases, the team doctor is responsible for treating and monitoring SRC, who, on most occasions, lacks the necessary resources to follow the diagnostic protocols (video assessments, among others). This increases the difficulty of treating SRC and its early on-field diagnosis. Although all tiers of sport agree that the doctor has authority to force the player to be removed from the field of play in the event of suspected SRC, it must be realised that the athlete often appears to be well and both he and the team specialists see no reasons for the player to be forced to retire. This only adds more pressure to the decision-making process. For these reasons, there is a certain degree of controversy at present regarding the on-field treatment of concussion. On the one hand, sports organisations defend temporary substitution to be allowed,

which would give the doctor time to perform a more complex examination. However, on the other hand, were the examination to produce a false negative, the risk to the player would be increased. This is why other organisations prefer permanent substitution without the option to return to play, even though the result could be negative.

As a result, the greatest limitation faced by the sports medicine physician, on-field, lies in not having objective markers for the immediate diagnosis of SRC. Hence, in any case, it is desirable for all the professionals involved in sport (experts, players, referees, the media, etc.) to work together in treating this issue. That would facilitate the work of healthcare staff and would be beneficial to minimising the possible consequences of SRC in the short, medium and long term.

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Índice

Foreward
Presentación
1. Introducción
2. Valoración muscular
3. Valoración del metabolismo anaeróbico
4. Valoración del metabolismo aeróbico
5. Valoración cardiovascular
6. Valoración respiratoria
7. Supuestos prácticos
Índice de autores

Índice

Introducción
1. Actividad mioeléctrica
2. Componentes del electrocardiograma
3. Crecimientos y sobrecargas
4. Modificaciones de la secuencia de activación
5. La isquemia y otros indicadores de la repolarización
6. Las arritmias
7. Los registros ECG de los deportistas
8. Términos y abreviaturas
9. Notas personales

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