

# Sudden cardiac arrest on the footballfield of play - highlights for sports medicine from the European Resuscitation Council 2015 Consensus Guidelines

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## ABSTRACT

The European Resuscitation Council (ERC) 2015 Guidelines for Resuscitation were published recently. For the first time, these guidelines included a subsection on ‘cardiac arrest during sports activities’ in the section dealing with cardiac arrest in special circumstances, endorsing both the importance and unique nature of this form of cardiac arrest. This paper reviews four critical areas in the management of sudden cardiac arrest in a football player: recognition, response, resuscitation and removal from the field of play. Expeditionary response with initiation of immediate resuscitation at the side of a collapsed player remains crucial for survival, and chest compressions should be continued until the automated external defibrillator (AED) has been fully activated, so that the sideline medical team response to the side of a non-contact collapsed player on the field of play, with AED and defibrillation, occurs within a maximum of 2 min from collapse.

## INTRODUCTION

The European Resuscitation Council (ERC) 2015 Guidelines for Resuscitation<sup>1</sup> were published recently. For the first time, these guidelines included a subsection on “cardiac arrest during sports activities”<sup>2</sup> in the section dealing with cardiac arrest in special circumstances, endorsing both the importance and unique nature of this form of cardiac arrest. Hypertrophic cardiomyopathy and arrhythmogenic right ventricular cardiomyopathy are still regarded as the most common causes of sudden cardiac arrest (SCA) in the under 35-year-old age group, with atherosclerotic coronary artery disease being the single most common cause of SCA in persons aged over 35 years.<sup>3</sup> In athletes aged under 16 years, commotio cordis represents approximately 3% of cases.<sup>4,5</sup> Whatever the cause, in whatever age group of football player, SCA remains the leading cause of death in football.<sup>2</sup> This paper reviews four critical areas in the management of SCA in a football player: recognition, response, resuscitation and removal from the field of play.

## RECOGNITION OF SCA

Non-contact collapse (“sudden and unexpected collapse, not associated with contact or trauma”)<sup>2</sup> in a player on the field of play remains the main initial sign of SCA and “requires rapid recognition..... if the victim is to survive.”<sup>2</sup> Once at the player’s side, further confirmation of SCA is evidenced by unresponsiveness, an abnormal breathing pattern and possible seizure-like movements. The ERC

recommendations affirm that up to 40% of victims in SCA may have agonal breathing patterns (occasional gasps, slow, laboured or noisy breathing) in the first few minutes after SCA and resuscitation initiated when this is present is associated with higher survival rates.<sup>6</sup> Additionally, seizure-like movements of the limbs within the first few minutes after SCA have been affirmed as an important sign and should not be confused or misinterpreted as an epileptic seizure; “immediately following cardiac arrest, blood flow to the brain is reduced to virtually zero, which may cause seizure-like episodes that can be confused with epilepsy.”<sup>7-9</sup>

## RESPONSE

Expeditionary response with initiation of immediate resuscitation at the side of a collapsed player remains crucial for survival. The ERC guidelines emphasise that defibrillation within 3–5 min of collapse can produce survival rates of 50–70%,<sup>10-12</sup> recognising that each minute of delay to defibrillation reduces the probability of survival by 10–12%.<sup>13</sup> This indirectly endorses the FIFA SCA protocol of the sideline medical team response to the side of a non-contact collapsed player on the field of play, with AED and defibrillation within 2 min of collapse.<sup>14,15</sup>

## RESUSCITATION OF SCA

The provision of good quality chest compression cardiopulmonary resuscitation (CPR) remains one of the major determining factors for successful outcomes. The recommended chest compression depth of approximately 5 cm (or at least 5 cm but not more than 6 cm) remains the same,<sup>16,17</sup> with a chest compression rate of 100–120 compressions per minute, allowing the chest to recoil completely after each compression.<sup>18,19</sup> When providing rescue breaths, the time taken for inflation of the chest should be approximately 1 s, with sufficient volume that causes the chest to rise. In standard CPR, the ratio of chest compressions to rescue breaths remains 30:2. Emphasis is placed on minimising any interruption in chest compressions and, if so, to <10 s, whether to provide ventilations, shock the player when required, or transfer the pulseless player from the field of play.<sup>20,21</sup>

Currently, the FIFA SCA protocol recommends that immediate chest compression-only CPR should be started immediately after unresponsiveness and lack of normal breathing has been identified in a non-contact collapse player. “When blood flow stops after cardiac arrest, the blood in the lungs and arterial system remains oxygenated for some

minutes (especially in exercising athletes). To emphasise the priority of chest compressions, it is recommended that CPR should start with chest compressions. The ERC recommends that CPR should be continued while a defibrillator or AED is being brought on-site and applied.<sup>22</sup> Chest compressions should be continued until the AED has been fully activated, the AED pads applied to the player's bare chest and the AED voice prompt commands: 'analyzing—do not touch the patient'.

Although hands-only chest compressions are endorsed by the ERC for those who do not know how to, or do not wish to, perform mouth-to-mouth rescue breathing,<sup>23 24</sup> hands-only chest compression remains the initial FIFA SCA method of field-of-play CPR for the first few minutes of resuscitation. However, once an appropriate airway and breathing device is available, usually located inside the official FIFA Medical Emergency Bag (FMEB),<sup>15</sup> the airway adjunct should be inserted, attached to a manual resuscitator with asynchronous, continuous chest compressions and rescue ventilations undertaken. "In the absence of personnel (namely physicians) skilled in tracheal intubation, a supraglottic airway (SGA) (eg, laryngeal mask airway, laryngeal tube or i-gel) is an acceptable alternative."<sup>25 26</sup> All FMEBs have laryngeal mask airways as well as manual resuscitator bags.

Currently, no medications are recommended for SCA management on the field of play as none have been shown to improve hospital discharge or neurological outcome. ERC recommendations indicate that the use of "Adrenaline has been shown to increase Return of Spontaneous Circulation (ROSC) (pulse) but not survival to discharge. Furthermore there is a possibility that it causes worse long-term neurological survival."<sup>26–29</sup> "Therefore the FIFA SCA protocol will continue to recommend that no medications be administered to the collapsed player in SCA unless it is prescribed by a physician experienced in advanced cardiac life support in line with ERC protocols to combat the likely cause of the SCA, where indicated."

A new recommendation that has arisen in the 2015 ERC guidelines concerns the development of SCA in a patient who is actively being monitored, such as during transport via road or air ambulance or in a cardiac cauterisation laboratory. In this situation, it is recommended that the patient be administered three stacked defibrillation shocks, where necessary, and chest compressions only begun if the set of shocks do not successfully revert the shockable rhythm: 'If a shockable rhythm (ventricular fibrillation/pulseless ventricular tachycardia) (VF/pVT) is recognised in a monitored patient and defibrillation can be accomplished rapidly, immediately give up to three-stacked shocks before starting chest compressions. In a USA study, 33% of patients achieving Return of Spontaneous Circulation (ROSC) following defibrillation did not require any chest compressions'.

"In this special setting with immediate response to monitored ventricular fibrillation (VF), defibrillation without preceding chest compressions is recommended. As the patient is early in the electrical phase of a cardiac arrest, in contrast to the guidelines for unmonitored and OHCA's (Out of Hospital Cardiac Arrest), the result of defibrillation (VF termination and ROSC) can be determined before chest compressions are started. If needed for failed defibrillation or immediately recurring VF, immediate defibrillation may be repeated up to two times. If VF persists after the initial three shocks or ROSC is not immediately established with certainty, chest compressions and ventilations must be initiated without further delay."<sup>26</sup>

This 'monitored' situation is not dissimilar to the sideline medical team which is located on either side of the centre line

with the primary function of 'monitoring' the field of play, recognising any player who collapses, and responding to the player's side, with recognition and initial management of SCA within 120 s. This has been further entrenched by the recent change in FIFA Rules of the Game<sup>30</sup> which mandates entry onto the field of play without the referee's permission for any non-contact player collapse. It is therefore not unreasonable to extrapolate from the monitored patient in a medical environment to a monitored non-contact collapsed player on the field of play and allow consideration by experienced team physicians, emergency physicians, advanced life support paramedics and equivalent experienced medical professionals to administer a series of three stacked defibrillation shocks during initial SCA treatment on the field of play. This consideration will largely be dictated should the time to first defibrillation be rapid and equivalent to a monitored patient in a medical setting and a manual defibrillator present or an AED that has been so configured for stacked shocks. The shared point of emphasis is that with a witnessed SCA the major priority is to achieve first defibrillation as soon as possible. On the field of play, it is most likely that the medical team can provide chest compressions prior to first defibrillation while the AED is prepared. The choice of a single shock followed by immediate chest compressions versus three stacked shocks will be the decision of the treating physician or paramedic based on experience and the equipment available.

#### REMOVAL FROM FIELD OF PLAY

The FIFA SCA protocol places great emphasis, and hence practical training, on the removal of the collapsed player, both with ROSC (pulse) or pulseless requiring CPR, from the field of play. The ERC makes reference to the removal of a player with ROSC from the field of play: "(The)...field of play is often an open arena and in major competition may be on view to many thousands of spectators and a television audience. Although treatment must not be compromised, moving the collapsed athlete to a quieter and more private site for continued treatment may be considered."<sup>2</sup> However, if the collapsed SCA player does not respond to initial resuscitation; "and there is an organised medical team, this move (from the field of play) could be accomplished after three defibrillation attempts on the rationale of providing the highest efficacy of defibrillation in the first three shocks. The move, if decided, should be agreed and may need to be accomplished in stages to allow for near continuous chest compressions."<sup>2</sup> Importantly, transfer of the player from the field of play should not occur at the expense of timely defibrillation when available.

This transfer recommendation is in line with the current FIFA SCA protocol, which describes in detail the process of removal of the pulseless player from the field of play in order to maximise effective hard and fast chest compression and adequate rescue ventilation while simultaneously minimising resuscitation interruptions to <10 s intervals. These interruptions would occur when the medical team is actively moving the pulseless patient from the field of play or when instructed by the AED not to touch the patient: 'Delivery of rescue breaths, shocks, ventilations and rhythm analysis lead to pauses in chest compressions. Preshock and postshock pauses of <10 s, and chest compression fractions >60% are associated with improved outcomes. Pauses in chest compressions should be minimised, by ensuring CPR providers work effectively together'. The ERC recommends, additionally: "Where there is no medical team or a defibrillator is not immediately, and then CPR must continue until advanced care arrives."<sup>21 31</sup>

Likewise, the ERC endorses the FIFA SCA protocol of transporting the collapsed player to the nearest, most appropriate cardiac centre for definitive treatment, under the supervision and care of experienced advanced life support paramedic and medical professionals who will be able to adequately diagnose and treat any cardiac arrhythmia that may occur en route: "If the athlete responds to resuscitation then they must be transported immediately to the nearest cardiac centre for further evaluation and treatment. As there is a possibility of the rhythm reverting, this transportation must be under the supervision of a healthcare professional that is equipped and capable of administering resuscitation and further defibrillation."<sup>2</sup>

Current FIFA protocols make use of the long spinal board and/or Stokes basket stretcher for immobilisation and transfer of a player from the field of play. Practical training includes appropriate and effective patient placement, immobilisation and transfer, with or without minimally interrupted CPR. The ERC acknowledges the use of a long spinal board and cautions: "If a back-board is used, take care to avoid interrupting CPR and dislodging intravenous lines or other tubes during board placement."<sup>32-34</sup>

It is understood that owing to the ERC recommendations being very broad based regarding sports in general, various recommendations have not been included, for example, summoning the ambulance onto the field of play or spinal injury prevention and immobilisation, which may be relevant.

## CONCLUSION

FIFA and its academic institution F-MARC (FIFA Medical Assessment and Research Center) endorse fully the ERC, while introducing and implementing the FIFA SCA protocol for all FIFA trainings and competitions as an example to be followed at the level of national competitions. The introduction of the FIFA Medical Emergency Bag,<sup>15</sup> which includes the AED to all Member Associations of FIFA, was a major step and awareness campaign towards prevention of SCD. The slogan 'no AED, no Match, no Training' is promoted by the FIFA Medical committee.

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