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Literature Review

Cardiopulmonary Resuscitation Management for Sudden Cardiac Arrest on Field Sport Activity

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Abstract

Background: Sudden cardiac arrest (SCA) is the most common cause of sudden death in athletes, accounting for 75% of all deaths during activity and sports. In order to preserve athletes' lives, cardiopulmonary resuscitation (CPR) and on-site defibrillation with an Automated external defibrillator (AED) should be undertaken immediately. Thus, observers ought not to hesitate in performing cardiac compression to restore circulation.

Aim: to increase the number of coaches or teams commencing CPR and so improve the opportunities of survival after sudden cardiac arrest.

Material and Methods: By collecting a total of ten studies, this article implements a literature review methodology to evaluate CPR administration in occurrences of SCA among field athletes. CPR administration, on-field sports, SCA, and athletes as subjects are the study's main objectives.

Results: In accordance with the study's results, administering AEDs earlier is more effective. The majority of cardiac arrests in the field aren't treated immediately and accurately, which leads to fatalities. Because a cardiac arrest occurring during the first 10 minutes is critical for the athlete's survival, each minute lowers the athlete's chances of surviving by 7-10%.

Conclusion: SCA in athletes is a serious medical condition that frequently results in death. To save athletes' lives, CPR and on-site defibrillation using an AED must be performed immediately.

Keywords: *CPR Management, On-field Sport, Sudden cardiac arrest*

INTRODUCTION

The World Health Organization (WHO) defines sudden cardiac arrest (SCA) as a sudden, unexpected death that occurs within one hour of the onset of symptoms or within 24 hours of being last seen well. SCA in an athlete while exercising is an unexpected and potentially fatal event, and it has also become the primary cause of sudden death in athletes. It accounts for 75% of all deaths during exercise and sports,[1] 15–20% of all natural deaths in adults in the USA and Western Europe, and up to 50% of all cardiovascular deaths.[2]

Approximately 0.75 out of every 100,000 athletes experience SCA when exercising. Although one retrospective study revealed that 29% of athletes had indications of heart disease prior to cardiac arrest, SCA in young athletes is generally the initial indicator of an underlying cardiac condition. Cardiovascular diseases and conditions that cause SCA are a diverse set of ailments that typically show with no symptoms or warning indications prior to the emergence of SCA. As a result, preparticipation cardiovascular screening is difficult, and the best technique for finding athletes with illnesses at risk of sudden death remains debatable.

Cardiopulmonary resuscitation (CPR) and on-site defibrillation with an Automated external defibrillator (AED) must be performed immediately to save the lives of athletes.[3] Quick recognition is vital, and observers ought not to be hesitant when performing cardiac compression to restore circulation. Time should not be wasted examining and opening the airway because the patient will not be breathing in a dangerous SCA situation. More research regarding its major aspects, such as how prevalent it is in different geographies, risk factors, and individuals who are at risk, is needed to lessen this burden.

MATERIAL AND METHODS

This study applies a literature review methodology for evaluating CPR management in situations of SCA among field athletes. It collects several articles from various journal sources, including PubMed, Science Direct, and Research Gate, by entering a keyword into the search box. The keywords were written in full text without commas. In this review, we found 30 articles that met our goal of How to Manage Cardiopulmunary Resuscitation for Sudden Cardiac Arrest in Athletes, which we then narrowed down to 15 articles based on inclusion criteria such as using English, type of article: original article, randomized control trial, review, search year 2013–2022, with a review of CPR management areas or keywords, field sports, sudden cardiac arrest, and athletes as a subject. The criteria for exclusion included non-English language in the form of textbooks, prior to 2013, not being specialized in field sports, and the subjects being non-athletes. Based on the 15 journals obtained, they are re-selected by reading the abstracts of each journal; if the journal does not contain a CPR procedure in the handling of sudden cardiac arrest in athletes, the journal is eliminated, leaving only 10 journals to be used as study material in this article.

DISCUSSION

After completing a literature search in Google Scholar, Research Gate, PubMed, and Science Direct, the researchers discovered 30 journals with the following inclusions: using keywords to search for and collect journals; organizing journals based on inclusion and exclusion criteria; reading journal abstracts; and excluding journals lacking cardiopulmonary resuscitation protocols for SCA in athletes. Following the application of the screening criteria, ten eligible articles were retrieved for examination. The literature research reviews is presented in Table 1 below.

Table 1. *The literature research review*

Author	Study	Journal Title and Year	Result
Jong et al. (2020)[4]	How to Recognize Sudden Cardiac Arrest on the Pitch	British Journal of Sports Medicine (2020)	**Subject:** Young athlete **Causes of SCA:** Hipertrophic cardiomyopathy **Handling method:** Management of patients with SCA on the pitch starts with early recognition, activation of the emergency medical response system, immediate chest compressions, and defibrillation as soon as possible. The dose or ratio used to perform chest compressions is 30 times after that give two rescue breaths and continue again with this CPR ratio. The pads should be placed for rhythm analysis and defibrillation as indicated immediately after AED arrives. **Success rate:** Chest compressions should be started immediately after defibrillation and continued until the victim becomes responsive or the AED reanalysis the rhythm. Survival after SCA in young athletes is >80% when CPR is given and AED is closely accessible.
Kramer et al. (2015)[5]	Sudden cardiac arrest on the football field of play—highlights for sports medicine from the European Resuscitation Council 2015 Consensus Guidelines	British Journal of Sports Medicine; 50:81–83 (2015)	**Subject:** Football athlete **Causes of SCA:** unexplain causes **Handling method :** Resuscitation CPR with depth of ~5cm, with compression rate of 100-120 compressions/minute, allows the chest to recoil completely after each compression; for rescue breath time needed is 1 sec for chest inflation. Chest compression to rescue breath ratio is 30:2, with no interruption. Then collapsed athlete is removed from the field of play for further treatment, and also if player does not respond to three defibrillation attempts players need to be moved for more advanced treatment. **Success rate:** A football player was successfully resuscitated after suffering an SCA on the football field in Nepal, as a result of the FIFA football emergency medicine protocols.
Panhuyzen-Goedkoop et al. (2018)[6]	Early recognition of Sudden Cardiac Arrest in Athletes during Sports Activity	Netherlands heart journal: monthly journal of the Netherlands Society of Cardiology and the Netherlands Heart Foundation 26(12) (2018)	**Subject:** Student-atlhete **Causes of SCA:** Lethal cardiac arrhythmia—i. e. ventricular tachycardia/fibrillation

			Handling method: Cardiac resuscitation should be given as soon as possible to athletes that are experiencing cardiac arrest. Providing the ABC protocol before giving resuscitation with open the airway then check the athlete's response. Followed by giving heart compression should be followed by the next step in the chain of survival—i. e. early defibrillation using an AED. AED deployment resulted in a higher survival rate compared with paramedics performing CPR procedures. **Success rate:** The survival rates of SCA in student-athletes can be high (89%) through early recognition with bystander CPR and AED defibrillation.
Pelto and Drezner (2020)[7]	Design and Implementation of an Emergency Action Plan for Sudden Cardiac Arrest in Sport	*Journal of Cardiovascular Translational Research* volume 13, pages 331–338 (2020)	**Subject:** Rower athletes **Causes of SCA:** SCA in young athletes is usually associated with an underlying structural or electrical cardiac disorder, such as a cardiomyopathy or an ion channel disorder **Handling method:** When treating a fallen athlete, cut open the jersey or shirt to expose the chest area and allow it to dry. In a witnessed collapse, oxygen at blood is still present, then the rescuer should perform manual CPR while AED is retrieved. Manual CPR delivers 100 chest compressions per minute with 5 cm depth. If rescue breaths were added during compression, 2 rescue breaths would be given for every 30 chest compressions. Chest compressions are temporarily stopped while the AED analyzes the heart rhythm. Provide electric shock to athletes using AED. After applying electric shock, chest compressions should be continued immediately. This helps blood to start circulate to myocardium as it begins to contract, reducing the chance of ventricular fibrillation recurring. CPR should be continued until the athlete give responds. If possible, oxygen can be given when the athlete begins to breathe on his own.

Siebert and Drezner (2018)[8]	Sudden Cardiac Arrest on The Field of Play: Turning Tragedy Into a Survivable Event	Netherlands Heart Journal (2018)	**Subject:** Athlete **Causes of SCA:** The cardiovascular diseases and conditions that precipitate SCA comprise a heterogeneous group of disorders that usually exhibit no symptoms or warning signs prior to the sentinel event of SCA **Handling method:** Without moving the athlete, CPR should begin immediately after their arrest because doing so will delay treatment. Before starting CPR, protective clothing, clothing, or other equipment obstructing CPR must be removed. CPR begins with chest compressions. In order to allow the chest to fully recoil, chest compressions should be performed at a rate of 100–120 per minute and should be five–six cm or two inches deep. Until the AED is used and the athlete's heart rhythm is examined, CPR should be performed continuously. If defibrillation is available, chest compressions should continue as soon as the shock is delivered. Until additional life support personnel take over or the victim starts moving, CPR should be continued if shock is not advised. Up until spontaneous circulation returns or until the receiving facility declares the patient dead, high-quality CPR should be performed. **Success Rate :** Access to early defibrillation also improves survival in young athletes with SCA. In a 2-year prospective observational study of 2,149 high school campuses, student-athletes with SCA survived 89 % of the time if prompt CPR and defibrillation were provided.
Solberg et al. (2016)[9]	Sudden cardiac arrest in sports – need for uniform registration: A Position Paper from the Sport Cardiology Section of the European Association for Cardiovascular Prevention and Rehabilitation	European Journal of Preventive Cardiology (2015)	**Subject:** Competitive and recreational athletes **Causes of SCA: C**ardiac load, relative intensity of exertion, duration and haemodynamic and neuro-adrenergic load, factors that may be important for triggering SCA. **Handling method:** The likelihood of bystander CPR increasing, the time to defibrillation decreasing, and the likelihood of surviving SCA in the sports environment are all

			improved by a comprehensive emergency response plan for SCA that includes quick public access to an Automated External Defibrillator (AED). Successful emergency response plan programs require a planned and practiced reaction, a reliable communication channel to activate the local emergency medical services system, and rescuers who are qualified and equipped to do CPR and defibrillation. **Success rate:** Reports from schools with an on-site AED programme sustain an improved survival rate for young athletes with SCA if early defibrillation is achieved. Rapid defibrillation has led to increase in survival rates if bystander CPR is provided and defibrillation occurs rapidly, although the underlying disease also is an important factor.
Tanaka et al. (2017)[10]	CPR Performance in the Presence of Audiovisual Feedback or Football Shoulder Pads	BMJ Open Sport & Exercise Medicine (2016)	**Subject:** Athletes **Handling method :** When an athlete has a heart attack at a sporting event, we must administer CPR very quickly. The 2010 American Heart Association (AHA) (Newman, n.d.) guidelines outline several elements for high-quality CPR, including a compression rate of 100–120 cycles per minute (cpm), a compression depth of 5–6 cm, a full chest recoil after each compression, minimizing interruptions in compressions, and avoiding over-ventilation. Iatrogenic damage will occur if the compression is applied deeper than 6 cm. **Success rate:** The highest survival rate was found when the CPR providers gave 45.6 mm chest compressions.
Vancini et al. (2019)[11]	Prevention of Sudden Death Related to Sport : The Science of Basic Life Support-From Theory to Practice	J Clin Med. (2019)	**Subject:** Athletes **Causes of SCA:** Sports, physical exertion, and pre-existing illnesses can all cause sudden CA. **Handling method:** BLS is a set of procedures designed to keep blood flowing to essential organs. Early detection of sudden cardiac arrest, activation of the Emergency Medical System (EMS), early CPR, and quick defibrillation are essential to increasing victim survival and

			prognosis. Athletes on the field who require CPR or BLS must maintain these procedures until Advanced Life Support (ALS) personnel arrive and transfer the patient to a specialized unit. **Success rate:** "The Survival Chain" advocated by AHA and BLS techniques may contribute to decrease mortality from heart disease and sudden CA, which may precipitate sudden death events that could be triggered by physical activity and sport.
Verjee et al., n.d.[12]	Sudden Cardiac Arrest in Football	Journal of Emergency Medicine, Trauma and Acute Care (2022)	**Subject:** football athletes **Handling method:** Resuscitate Initiate CPR immediately, using hand-only compression with hard and fast push on the chest. Look for the nearest Automated External Defibrillator (AED) and follow its instruction. If no AED is located, continue CPR until the ambulance arrives. **Success rate:** CPR resulted in a survival rate of 85% with the use of an Automated External Defibrillator (AED).
Corrado et al. (2022)[13]	Shocking Insights on Resuscitation After Sports-Related Cardiac Arrest	European Heart Journal (2022)	**Subject:** Athletes **Handling method:** If an athlete falls to the ground and doesn't answer questions, even if he or she appears to be breathing or moving, quickly grab the AED, activate it, place a bandage over the chest, and listen only to voice prompts. If shock is not advised, start assessment and treatment according to the standard resuscitation algorithm.

From the review study result, ten journals about cardiac arrest which frequently occurs in young athletes at the height of their physical fitness were analyzed and authors conclude that cardiac arrests occuring during sporting events dramatic and surprising.[14] SCA is one of the deadliest diseases in the world. When an athlete experiences sudden cardiac arrest, immediately give CPR with a ratio of 30 chest compressions and 2 rescue breaths. The compression depth is as deep as 5–6 cm with a compression rate of 100–120 compressions per minute which says that

when SCA occurs, immediately give CPR followed by the administration of an AED, so that the athlete's survival rate can increase. However, there are also journals that say athletes with SCA in the field must be given AED immediately without prior administration of CPR.

RESULTS

CPR is an intervention that aims to maintain the vital functions of human organs, namely the patient's heart, which has stopped breathing and has no heartbeat. The intervention given is in the form of chest compressions and breathing assistance.[15]

This study discussed CPR management for athletes suffering from SCA. Athletes who suffer cardiac arrest frequently pass away. This situation tends to be triggered by a lack of knowledge and awareness about the early management of cardiac arrest patients among athletes, coaches, and sports medical teams. It is also exacerbated by a scarcity of people who are capable of providing CPR quickly and precisely in the field, including trainers, the majority of whom lack CPR knowledge. As a result, the majority of cardiac arrests in the field are not managed immediately and precisely, resulting in fatalities. Because a cardiac arrest occurring during the first 10 minutes is important for the athlete's survival, every minute reduces the survival chance by 7–10%.

Sudden Cardiac Arrest

SCA is defined as the abrupt loss of heart function as an occurrence without physical contact (absent commotio cordis). SCA is a major global public health issue, accounting for up to 20% of deaths in Western societies. The WHO defines SCA as a sudden, unexpected death within 1 hour of symptom onset or within 24 hours of having been last seen well. Certain types of arrhythmias can inhibit the heart from pumping blood, which can cause a heart attack, especially when the heart suddenly stops beating. As a result, blood flow to the brain and other important organs is cut off.

Sudden death due to cardiac arrest in athletes, or sports SCA, is a big challenge for those who have a career in sports, both coaches, players, and other officers.

Although exercise can improve a person's health, physical fitness, and quality of life, intense physical exercise can trigger sudden cardiac arrest. Even though the incidence of sudden death due to a heart attack in athletes is lower when compared to cases in the general population, when this happens, it will cause concern for the community. Because it is unacceptable if a healthy person dies because of training on the field.

Sudden death related to exercise and sports can be defined as an unexpected death that occurs during or after physical exercise (1-3 hours). Intense physical exercise can trigger cardiac arrhythmias, which can cause sudden death. Unforeseen events in the absence of pathological factors, such as emotional or physicological stress or heart concussion, and misuse of doping and performance-enhancing drugs can also trigger CA.

Patient survival after cardiac arrest (CA) is approximately 3.4% to 22.0%, with only a small percentage of patients returning home alive, and this is often accompanied by neurologic damage and a poor quality of life.

Therefore, knowledge of the Basic Life Support (BLS) technique can contribute to reducing mortality in CA (cardiac arrest) cases. BLS is a series of actions that aim to maintain blood flow to vital organs. Early recognition of CA, activation of emergency medical systems, early CPR, and rapid defibrillation are the keys to improving survival and the victim's prognosis.

CPR is comprised of chest compressions, management of the airway, and rescue breathing. For good procedures for performing CPR, there are several

guidelines, namely compressing at a rate of 100–120 contractions per minute (cpm), and some other journals, 100 per minute. CPR is performed by giving two rescue breaths for every 30 chest compressions. For chest compressions, the depth is between 5 and 6 cm, whereas in sports such as American football, where they use shoulder protectors (football shoulder pads), the depth of compression is shallower.[16] Chest compressions have the greatest impact on survival, but many rescuers fail to push hard or fast enough. Whereas it is the greatest chance to save the life of an athlete.[17]

Regarding CPR and BLS for athletes on the field, they must be continued until Advanced Cardiac Life Support (ACLS) arrives and the athlete is transferred to a special unit.

Early recognition SCA

SCA experienced by non-contact collapse athletes is further confirmed by unresponsiveness, an abnormal breathing pattern (agonal breathing pattern), and possible seizure-like movement (due to reduced blood flow to the brain).

The study by Peterson et al.[18] examined autopsy reports, death certificates, and medical records to learn the cause of sudden cardiac arrest or death (SCA/D) in competitive athletes in the United States (mean age 16.7 (11-29) years). In this prospective analysis, arrhythmogenic cardiomyopathy (6%), Long QT Syndrome (LQTS) (5%), and commotion cordis (5% each) were the most common causes of SCA/D across all age groups, followed by idiopathic left ventricular hypertrophy (LVH) (13%), coronary artery abnormalities (12%), AN-SUD (10%), and HCM (21%).

As evidenced by the high survival rates observed in settings with systematic emergency response protocols and timely deployment of AEDs, education of the coach and athlete as well as access to AEDs at a sports arena are essential in minimizing the occurrence of sudden cardiac arrest and death.[14]

Early identification of the emergency, willingness to start CPR, and knowledge of how to use an AED are all necessary for out-of-hospital resuscitation to be successful. The emergency response system, CPR, and early defibrillation can all be delayed or even fail if first responders fail to recognize SCA in time. Resuscitation may be delayed for several reasons, including reluctance to perform it or the possibility that SCA will be misdiagnosed as a seizure or another type of collapse. Young athletes with SCA have a higher probability of surviving, according to reports from schools with an on-site AED program, if early defibrillation is achieved. Survival rates have increased when bystander CPR and defibrillation are carried out early, despite the fact that the root cause of the illness plays a substantial role.

Guideline for handling SCA first aid

Previous studies suggested that intense physical exercise was the cause of sudden cardiac arrest in athletes. Meanwhile, it has been reported in other journals that there are numerous other factors that cause sudden cardiac arrest in athletes, including the presence of hereditary factors and other factors such as the use of illegal drugs and doping abuse. Early cardiopulmonary resuscitation (CPR) and defibrillation are the most important determinants of survival and neurological prognosis in individuals who suffer from SCA.

CPR management steps include the first step of notify emergency medical services immediately if a person is unconscious with absent or abnormal breathing. then perform chest compressions as soon as possible. Chest compressions are performed on the lower half of the sternum (in the middle of the chest). CPR procedures include performing compressions at a rate of 100–120 chest compressions per minute

(cpm) or 100 chest compressions per minute (cpm). CPR is performed by inhaling two rescue breaths for every 30 compressions of the chest. Allow the chest to fully recoil after each compression; don't lean on the chest. Aim for a depth of 5 cm to 6 cm when doing chest compressions, whereas in other sports, such as American football, where special shoulder protectors (football shoulder pads) are used, the depth of compression is shallower. This, however, has no bearing on the quality of CPR. Iatrogenic injuries will occur if the compression is applied beyond 6 cm.

The act of performing CPR is continued with the use of an AED or defibrillator. The AED's function is to continue analyzing the heart's rhythm and determining whether it can be shocked or not. Aside from that, having an AED on hand allows the person performing CPR to rest. However, before using an AED, make sure the patient is unconscious, not breathing properly, and has no pulse. According to Siebert and Drezner (2018), AEDs are more effective when administered earlier. It can then be continued for 2 minutes using CPR.

The way to deal with someone experiencing cardiac arrest is to start CPR on people who are unresponsive or have abnormal breathing. Slow, heavy breathing (agonal breathing) is considered a sign of a heart attack. Brief seizure-like movements may occur early in cardiac arrest. Reassess the person after the seizure has stopped; if unresponsive and with absent or abnormal breathing, start CPR.

If artificial respiration (resuscitation) cannot be delivered, continue the chest compressions. Turn on the AED as soon as it arrives or when one is available at the cardiac arrest site. Attach the electrode pads to the victim's bare chest according to the position indicated on the AED or on the pads. If more than one rescuer is available, continue CPR while the AED pads are in place.[19]

However, if an AED is not available or the situation is still waiting for AED to arrive, CPR must be continued until an AED is available. If you are still unresponsive but breathing normally, place yourself in the recovery position. However, if the patient is unresponsive with absent or abnormal breathing, prepare to restart CPR immediately. Pull the athlete from the field for further treatment, and if the athlete does not respond to three attempts at defibrillation, the player needs to be transferred for more advanced treatment or referred to a hospital.

The efficacy of CPR as SCA's first aid

Automatic external defibrillators can improve survival times in critical conditions, particularly when they are associated with bystander CPR. Early initiation of chest compression is crucial for the rapid restoration of some coronary and cerebral blood flow, which is an important part of the 'Chain of Survival'.[20] Bystander CPR performed prior to the arrival of the ambulance improves the survival rate by 2-3 folds. After early CPR, defibrillation usage is the next link in the chain of survival, and a delay in defibrillation could lead to poor survival. Therefore, the availability of automated external defibrillators in public places is an important part of the integrated response to prevent a poor survival rate.[21]

The urgency of CPR education for athlete teams

A CPR bystander is someone on duty at the scene who volunteers to help victims provide cardiopulmonary resuscitation to restore a heartbeat.[22] Cardiac arrest can happen anywhere and at any time, including throughout a competition. So it is very important for coaches and athletes to know the procedures for how to perform CPR because the moment while giving CPR is known as the golden time, meaning that the first three minutes are counted from the stop of the heartbeat.[23] Chest compressions in

CPR can really help save the lives of anyone who needs them. This technique can help to provide sufficient oxygen to the brain and vital organs so that they can restore their normal function before the final medical treatment is given to restore a regular heart rhythm.

Field of play medical teams have been advised to ensure not only the presence of the FMEB (FIFA Medical Emergency Bag) at the sideline but to undergo training and thus develop competence in using the FMEB (FIFA Medical Emergency Bag) for a variety of field of play medical emergencies, including SCA. This includes (1) the need for immediate recognition of a SCA on the field of play; (2) an expeditious response on the field in accordance with the rules of the game; (3) the initiation of cardiopulmonary resuscitation (CPR) and the use of an AED within the critical period of time to promote success; and (4) the appropriate and safe transfer of the player with a SCA from the field of play, before or after restoration of a spontaneous pulse.[16]

So, some experts suggested that the sports club staff attend BLS/AED training, thereby increasing awareness of SCA and familiarity with BLS/AED. This applies to teammates, coaching staff, referees, members of the jury, and especially medical support and paramedical professionals. Referees and members of the jury are part of the competition and are closest to potential victims. As expert opinion suggests, every sports club, facility, organization and school should have a written emergency action plan accessible onsite. Training programs should also address the mental status of bystanders, including medical and paramedical professionals, to ensure adequate emergency response during stressful SCA situations.[24] This can be achieved, for example, by organizing sport-specific CPR training.

CONCLUSION

Sudden cardiac arrest (SCA) in athletes is an unpredictable and life-threatening event. Cardiac arrest occurs when the heart suddenly stops pumping. When this happens, blood stops flowing to the brain and other vital organs. The rate of sudden cardiac arrest during exercise in competitive athletes is approximately 0.75 per 100,000 athletes per year.[25]

Recognition of sudden cardiac arrest, activation of the emergency medical system, early CPR, and rapid defibrillation are the keys to improving survival and the victim's prognosis. Cardiac arrest can occur anywhere and anytime. Including the athletes who are competing. It is very important for coaches and athletes to know the procedures for performing CPR. Chest compressions in CPR can really help save the lives of anyone who needs them. This technique can help to provide sufficient oxygen to the brain and vital organs so that they can restore their normal function before the final medical treatment is given to restore a regular heart rhythm.

CPR is still uncommon to the general public and sports club staff such as players and coaches, so it must be handled by public medical personnel. This can be overcome by providing education and knowledge about emergency rescue methods, including the CPR method for ordinary people. Education can be provided to the community as early as possible, for example, to schoolchildren and youth, and can target the general public and sports structures such as players, coaches, and others.

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REFERENCES

1. Carrington M, Providência R, Chahal CAA, et al. Cardiopulmonary Resuscitation and Defibrillator Use in Sports. *Front Cardiovasc Med*; 9. Epub ahead of print 15 February 2022. DOI: 10.3389/fcvm.2022.819609.

2. Zimmerman DS, Tan HL. Epidemiology and risk factors of sudden cardiac arrest. *Curr Opin Crit Care* 2021; 27: 613–616.

3. Kinoshi T, Tanaka S, Sagisaka R, et al. Mobile Automated External Defibrillator Response System during Road Races. *N Engl J Med* 2018; 379: 488–489.

4. de Jong JS, Jorstad HT, Thijs RD, et al. How to recognise sudden cardiac arrest on the pitch. *Br J Sports Med* 2020; 54: 1178–1180.

5. Kramer EB, Serratosa L, Drezner J, et al. Sudden cardiac arrest on the football field of play—highlights for sports medicine from the European Resuscitation Council 2015 Consensus Guidelines. *Br J Sports Med* 2016; 50: 81–83.

6. Panhuyzen-Goedkoop NM, Wellens HJ, Piek JJ. Early recognition of sudden cardiac arrest in athletes during sports activity. *Netherlands Hear J* 2018; 26: 21–25.

7. Pelto HF, Drezner JA. Design and Implementation of an Emergency Action Plan for Sudden Cardiac Arrest in Sport. *J Cardiovasc Transl Res* 2020; 13: 331–338.

8. Siebert DM, Drezner JA. Sudden cardiac arrest on the field of play: turning tragedy into a survivable event. *Netherlands Hear J* 2018; 26: 115–119.

9. Solberg E, Borjesson M, Sharma S, et al. Sudden cardiac arrest in sports – need for uniform registration: A Position Paper from the Sport Cardiology Section of the European Association for Cardiovascular Prevention and Rehabilitation. *Eur J Prev Cardiol* 2016; 23: 657–667.

10. Tanaka S, Rodrigues W, Sotir S, et al. CPR performance in the presence of audiovisual feedback or football shoulder pads. *BMJ Open Sport Exerc Med* 2017; 3: e000208.

11. Vancini, Nikolaidis, Lira, et al. Prevention of Sudden Death Related to Sport: The Science of Basic Life Support—from Theory to Practice. *J Clin Med* 2019; 8: 556.

12. Verjee MA, Reimann TA, Alinier G. Sudden Cardiac Arrest in Football. *J Emerg Med Trauma Acute Care*; 2022. Epub ahead of print 15 January 2022. DOI: 10.5339/jemtac.2022.qhc.4.

13. Corrado D, Cipriani A, Zorzi A. Shocking insights on resuscitation after sports-related cardiac arrest. *Eur Heart J* 2023; 44: 193–195.

14. Fanous Y, Dorian P. The prevention and management of sudden cardiac arrest in athletes. *Can Med Assoc J* 2019; 191: E787–E791.

15. Hardisman. *Gawat Darurat Medis Praktis*. Yogyakarta: Gosyen Publishing, 2014.

16. Kramer EB, Dvorak J, Schmied C, et al. F-MARC: promoting the prevention and management of sudden cardiac arrest in football. *Br J Sports Med* 2015; 49: 597–598.

17. Panchal AR, Bartos JA, Cabañas JG, et al. Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*; 142. Epub ahead of print 20 October 2020. DOI: 10.1161/CIR.0000000000000916.

18. Peterson DF, Kucera K, Thomas LC, et al. Aetiology and incidence of sudden cardiac arrest and death in young competitive athletes in the USA: a 4-year prospective study. *Br J Sports Med* 2021; 55: 1196–1203.

19. Perkins GD, Gräsner J-T, Semeraro F, et al. Corrigendum to "European Resuscitation Council Guidelines 2021: Executive summary" [Resuscitation (2021) 1–60]. *Resuscitation* 2021; 163: 97–98.

20. Rao P, Kern KB. Improving Community Survival Rates from Out-of-Hospital Cardiac Arrest. *Curr Cardiol Rev* 2018; 14: 79–84.

21. Bohm P, Meyer T, Narayanan K, et al. Sports-related sudden cardiac arrest in young adults. *EP Eur* 2023; 25: 627–633.

22. Smith SM, Wallace E, O'Dowd T, et al. Interventions for improving outcomes in patients with multimorbidity in primary care and community settings. *Cochrane Database Syst Rev*. Epub ahead of print 15 March 2016. DOI: 10.1002/14651858.CD006560.pub3.

23. Panhuyzen-Goedkoop NM, Wellens HJ, Verbeek ALM, et al. Immediate Bystander Cardiopulmonary Resuscitation to Sudden Cardiac Arrest During Sports is Associated with Improved Survival—a Video Analysis. *Sport Med - Open* 2021; 7: 50.

24. Pratiwi GS, Falakhi MN, Juwita NA, et al. Pengaruh Edukasi kepada Kelompok Masyarakat tentang Cardiopulmonary Resuscitation dalam Menghadapi Kesiapsiagaan Bencana: Literatur Review. *BIMIKI (Berkala Ilm Mhs Ilmu Keperawatan Indones* 2022; 10: 44–51.

25. Aschieri D, Penela D, Pelizzoni V, et al. Outcomes after sudden cardiac arrest in sports centres with and without on-site external defibrillators. *Heart* 2018; 104: 1344–1349.