

Addressing the risk factors and prevention of Sudden Cardiac Death in young athletes: a case report

Steven Piper, BSc (Hons), DC*

Brynne Stainsby, BA, DC, FCCS(C)**

Background: Mandatory prescreening for the identification of risk factors and prevention of sudden cardiac death (SCD) is a widely debated topic within academic literature. In addition, the effective emergency management of sudden cardiac arrest (SCA) has reported lower survival outcomes (9% with bystander CPR, 24% with AED application) although improvements, such as strategic placements of AED units and Hands-Only (compression only) CPR, are being made.

Purpose: This case will outline the importance of establishing a true SCD incidence rate and the increased need for trained personnel with proper equipment available to deliver immediate emergency cardiac management.

Conclusion: Given the lack of overall expert consensus and the low survival outcomes associated with SCD, a true incidence rate will need to be determined prior to developing a widely accepted policy. Since pre-screening all young athletes does not

Contexte : le dépistage obligatoire pour l'identification des facteurs de risque et la prévention de la mort subite par arrêt cardiaque est un sujet largement débattu dans la documentation spécialisée. En outre, la gestion efficace des urgences d'un arrêt cardiaque soudain s'est traduite par des taux de survie plus faibles (9 % avec les RCP de spectateurs, 24 % à l'aide de DEA) bien que des améliorations, comme les placements stratégiques des unités DEA et des RCP manuelles (pression uniquement), soient effectuées.

Objectif : ce cas va souligner l'importance d'établir un taux d'incidence réel des morts subites par arrêt cardiaque et le besoin accru de personnel qualifié doté d'équipement adéquat accessible pour assurer une gestion d'urgence immédiate des arrêts cardiaques.

Conclusion : compte tenu de l'absence de consensus global d'experts et les faibles taux de survie associés aux morts subites par arrêt cardiaque, il faut définir un taux d'incidence réel avant d'élaborer une politique largement acceptée. Étant donné que le dépistage

* Corresponding author
Sports Sciences Residency Program
Canadian Memorial Chiropractic College
6100 Leslie St, Toronto, ON, M2H 3J1
416.482.2340
spiper@cmcc.ca

** Faculty – Undergraduate Education
Canadian Memorial Chiropractic College
6100 Leslie St, Toronto, ON M2H 3J1

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appear to prevent all SCD's, having properly trained personnel and easily accessible equipment at sporting venues, especially in remote locations, appears to be key.

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KEY WORDS: Sudden cardiac death, prevention, athletes

Introduction

Sudden cardiac death (SCD), a manifestation of electrical instability resulting in ventricular fibrillation or tachycardia, is defined as death occurring within 1 hour of symptoms.¹ Prescreening, a form of primary prevention of SCD, has been highly debated. In addition, secondary management through the use of cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) to improve survival outcomes reports low success rates.² Regardless of whether any and/or all athletes receive prescreening for cardiovascular risk factors, the necessary emergency training and equipment will need to be provided immediately if a life is to be saved.

Case Report

A 23-year-old professional hockey player collapsed during a recreational hockey game. There were no previous symptoms, contact or trauma reported with the collapse. Two other players began first aid. Due to the absence of pulses, they immediately began CPR, instructed bystanders to contact emergency medical services (EMS) while another player brought an AED to the scene. The AED was applied and discharged three times. The paramedics arrived 12 minutes after the onset of CPR and immediately transferred the patient to the local hospital. Following assessment, he was air transported to a major cardiac centre.

Upon admission to the intensive care unit (ICU), he was intubated and underwent hypothermic protocol. He had excellent recovery in the ICU and was subsequently transferred to the critical care unit for further monitoring. He underwent two echocardiograms; the first was per-

préliminaire de tous les jeunes athlètes ne semble pas empêcher toutes les morts subites par arrêt cardiaque, il semble qu' avoir un personnel bien formé et du matériel facilement accessible sur les sites sportifs, en particulier dans les régions éloignées, est essentiel.

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MOTS CLÉS : mort subite par arrêt cardiaque, prévention, athlètes

formed almost immediately post-arrest and demonstrated decreased left ventricular function. The second however, demonstrated a normal left ventricular ejection fraction with moderate dilation of the right ventricle. Magnetic resonance imaging revealed some dilation of both ventricles, however, this may be secondary to his career as a professional athlete. According to the 2010 Revised International Task Force Criteria,³ there was no evidence of arrhythmogenic right ventricular dysplasia/cardiomyopathy (ARVD/C). Additionally, there was no evidence of myocardial infarction, fibrosis, or scarring. Finally, angiography revealed normal coronary arteries.

The patient was diagnosed with sudden cardiac arrest (SCA) of idiopathic origin, and was recommended genetic testing follow up regarding the potential for non-structural channelopathies. Family history reveals the patient's father had successful triple bypass surgery otherwise previous history for heart conditions was unremarkable. The patient received an implantable cardioverter-defibrillator; correct QRS pattern was verified on electrocardiography and proper connection was confirmed. He was discharged with no medication and advised to follow up with the arrhythmia clinic and his family doctor. Since discharge, all testing has been unremarkable and he has not experienced recurrences of accelerated rhythms. It is important to note that due to the patient being a professional level athlete, he reports being pre-screened including a heart rate, blood pressure and electrocardiograph testing at the beginning of every season without any abnormalities observed.

At the current time, the patient has not been cleared to return to professional hockey. He was allowed to participate in physical activity although intense, vigorous

activity was to be avoided. It is not known to the authors whether this hockey player will ever return to the competitive level.

Discussion

The incidence rates of SCD in athletes from the ages 12-30 years old vary in the literature with a range of 1-3.6 per 100,000 athletes per year.^{1,4} In a major prospective study conducted in the Veneto region of Italy, the incidence rate of SCD in athletes was 1.9:100,000.⁴ The Corrado et al. study was significant as it was the first to observe a nation wide, mandatory reporting of sudden death. The study confirmed the cases of SCD using autopsy, considered the gold standard of SCD diagnosis.⁴ North American sporting bodies have yet to implement a mandatory reporting database although the National Collegiate Athletic Association (NCAA) does collect information as part of health and safety reports.⁶ Although SCD appears rare, the true incidence rates of SCD in athletes will remain elusive so long as sporting bodies do not have a national database to report confirmed cases of SCD. The current case presents the difficulties in reporting for sport governing bodies. The incident did not occur during an official team practice or game; therefore recording the incident in an official sport registry would prove difficult.

Given the reported rarity of the event and the public attention received from high profile cases, improved reporting will be necessary before any conclusions on the risk of SCD in young athletes can be made. In addition, since a true measure of risk has yet to be ascertained and the events often appear spontaneous, the focus on secondary prevention through emergency management is paramount.

The survival rates of children and young adults under the age of 35 years old experiencing sudden cardiac arrest (SCA), considered to be cardiac arrest without progressing to sudden death, are reportedly low.⁵ In a long term retrospective study, the overall survival rates of SCA in the general population under the age of 35 was 40.2%.² The main factors associated with improved survival rates were: witnessed arrest, initial rhythm of ventricular fibrillation or tachycardia, bystander CPR, and a public location of the event.² When an AED is used conjunction with CPR the survival rates improve significantly. In a large heterogenous population based study, the survival rates improved from 9% with just CPR alone to 38% with the

use of an AED.² It should be noted that the study involved the entire population and one could speculate that the survival rates would be significantly higher at a sporting event where a trained individual with access to an AED unit is on site for the sole purpose of providing emergency management. Secondary prevention or emergency management within the sporting environment and academic literature has received much less attention than the role of primary prevention or prescreening. The importance of beginning secondary management immediately is reflected in the recent changes to CPR protocols. The American Heart Association (AHA) guideline on CPR and emergency cardiovascular care now recommends chest compressions to begin immediately.⁶ Instead of proceeding with ABC's (Airway, Breathing, Chest compressions) assessment the new guidelines suggest C-A-B (Chest compressions, Airway, Breathing).⁶

The current case is an example of how effective properly trained individuals providing immediate emergency management can help save lives regardless of whether the athlete has been prescreened several times. It is also an indication of how remote environments such as recreational ice hockey games can increase the risk of SCD if a trained provider and AED is not available.

Prescreening is considered a primary prevention tool for preventing SCD in young athletes; however the protocols are debated in the literature. Some experts suggest a mandatory history and physical while others suggest a mandatory ECG in addition to a history and physical.⁷ In 2005, the European Society of Cardiologists (ESC) published a consensus statement on mandatory prescreening in young athletes.⁷(Table 1) Based on expert opinion, the consensus statement recommends all young competitive athletes be screened for cardiac abnormalities with a 12-lead ECG in addition to a history and physical.⁷ In 2007, the AHA also published a consensus statement based on expert opinion.⁸ The statement also recommends a targeted history and physical evaluation involving 12-key elements to be completed by a qualified examiner.⁸ (Table 1) Although the two consensus statements differ in screening process (Figure 1), they agree a nation-wide screening protocol is necessary. The two statements also recommend a 2-year follow up after the initial screen. The statements do not however discuss the outcomes of false negatives and false positives. Given that athletes have albeit low risks for SCA and/or SCD, position statements

Table 1:

Detailed pre-participation cardiovascular screening protocols in athletes, of the European Society of Cardiology (2005) and the American Heart Association (2007). A positive finding in any of the screening criteria, as judged at the discretion of the examiner, clinically warrants further evaluation. Differences are denoted in bold font.

Preliminary Examinations		
	European Society of Cardiology	American Heart Association
Family History	- Premature cardiac death of any close family member (<50 for males, <65 for females)	- Premature cardiac death of any close family member <50 years
	- Heart disease disability of any close family member (<50 for males, <65 for females)	- Heart disease disability of any close family member <50 years
	- Knowledge of cardiac conditions of family members: cardiomyopathy, Marfan syndrome, arrhythmia, long QT syndrome, Brugada syndrome	- Knowledge of cardiac conditions of family members: cardiomyopathy, Marfan syndrome, arrhythmia, long QT syndrome
Personal History	- Chest Pain - Unexplained syncope or near-syncope - Unexplained dyspnea/fatigue out of proportion with exertion - Palpitations or irregular heart beat	- Chest Pain - Unexplained syncope or near-syncope - Unexplained dyspnea/fatigue out of proportion with exertion - Prior recognition of murmur - History of elevated systemic blood pressure
Physical Exam	- Physical findings suggestive of Marfans - Diminished femoral pulses - Presence of heart murmurs - Elevated brachial blood pressure - Abnormal cardiac rate and/or rhythm - Abnormalities in ECG	- Physical findings suggestive of Marfans - Diminished femoral pulses - Presence of heart murmurs - Elevated brachial blood pressure

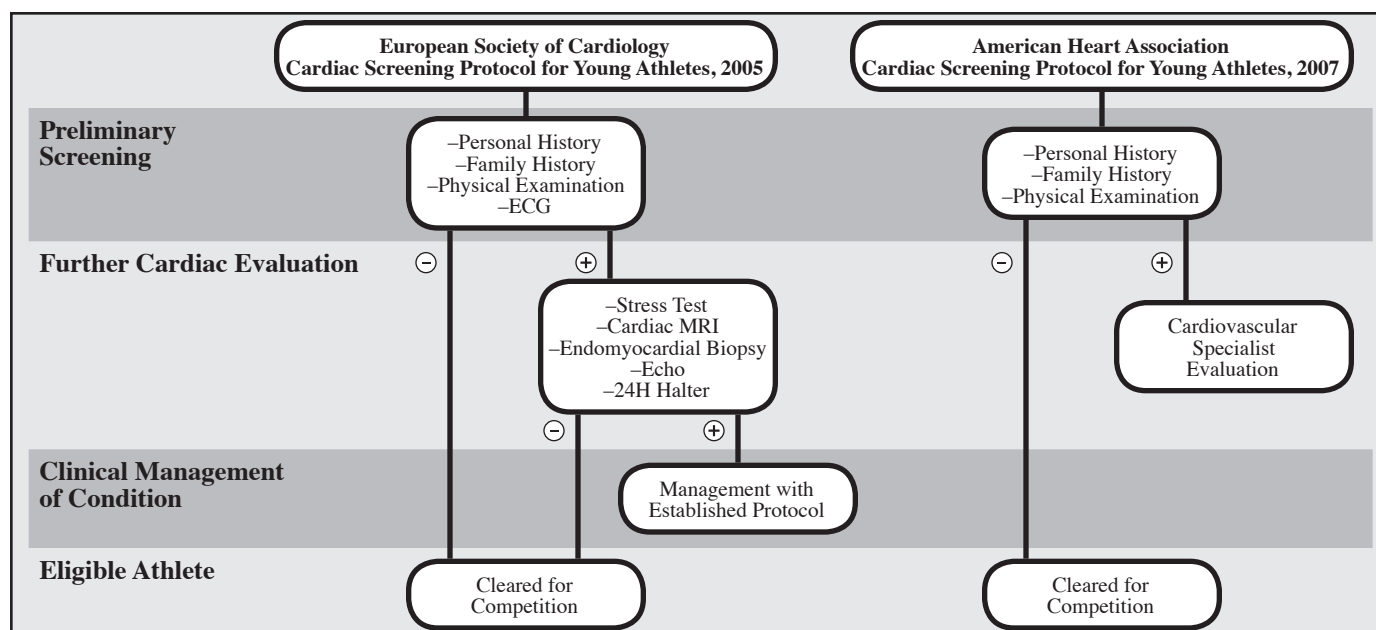


Figure 1

Flow chart comparison between 2005 consensus statements published by the European Society of Cardiology and the 2007 American Heart Association.

offered by governing bodies in sport indicates the importance of the issue. The American College of Sports Medicine (ACSM) currently recommends following the pre-participation screening supported by the AHA, although the ACSM also acknowledges that rigorous testing on pre-screening has yet to be completed.⁹ The Canadian Academy of Sports Medicine (CASM) does not currently offer a position statement with respect to pre-participation cardiovascular prescreening. In the current case report it is possible that the athlete may not have been identified as 'at risk' for a cardiac abnormality using the above consensus statements. Prior to the cardiac emergency, the athlete participated in mandatory pre-screening each year provided by the league that included a cardiac pre-screen. He reported the pre-season screening involved a 12-lead ECG, history and physical for which he passed. Furthermore, after the incident occurred, the athlete's diagnosis was officially SCA of idiopathic origin.

Currently, the academic debate on mandatory pre-screening continues while the focus on secondary care survival outcomes involving CPR and AED within literature involving cardiovascular emergencies in young athletes at sporting events appears to be limited. As health-care providers begin to participate more and more in on-field care and acute emergency management, they will need to be prepared for SCA with possible progression to SCD. Advanced training in emergency first responder and the purchase of an AED unit is highly recommended and often a mandatory requirement of sport specialty fellowships.

Future studies need to identify the true incidence of SCD in athletes. A mandatory national-based reporting system that does not use media reports and are confirmed by autopsy needs to be established. Long-term athlete follow up is also necessary. Future studies will also need to address varying degrees of risk factors involved in SCD. For example, a case-control study may wish to examine the level of vigorous physical activity in individual sport. The amount of physical exertion required to participate may identify higher risk groups, however an absolute risk will be more difficult to elucidate.

Conclusion

In conclusion, SCD is a rare, however tragic, event that affects young, otherwise healthy, athletes. Given the low incidence rates of SCD in North America and the lack of

clear supportive evidence in the role of primary prevention of SCD, secondary management with CPR and AED appears critical.¹ As observed in the current case, cardiac pre-screening did not prevent the cardiac emergency from occurring however the emergency on-site management may have effectively saved the athlete's life.

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