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Review Article

Sudden Cardiac Death in the Young - Are Efficient Cardiac Screenings and Data Registries the Need of the Hour?

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Abstract

This review intends to analyze the current approach of identifying and preventing incidents of sudden cardiac death in young individuals. In this article, we will briefly define sudden cardiac death by discussing etiologies and disease occurrence followed by an exploration of current data registries, disease management, and preventative measures. Additionally, we provide recommendations for addressing gaps in preventative care and discuss the benefits of early screening interventions to reduce disease incidence and mortality.

Keywords: Sudden Cardiac Death; Cardiac Screenings, Routine EKG Testing, Cardiac Data Registries, Preventative Health

Abbreviations

SCD: Sudden Cardiac Death; ROC: Resuscitation Outcomes Consortium; CARES: Cardiac Arrest Registry to Enhance Survival; AHA: American Heart Association; OHCA: Out-of-Hospital Cardiac Arrests; EMS: Emergency Medical Services; CAD: Coronary Artery Anomalies; HCM: Hypertrophic Cardiomyopathy; LV: Left Ventricle; ICD: Intra Cardiac Devices; AED: Automatic Electric Defibrillator; CPR: Cardiopulmonary Resuscitation; EKG: Electrocardiograms

Introduction

It is quite common to hear news regarding the sudden death of young individuals after completing a workout or strenuous physical activity who were previously presumed to be healthy. Sudden cardiac death is defined as the abrupt loss of cardiac function resulting in cardiovascular collapse, either due to a life-threatening arrhythmia (dysfunction of the heart's electrical activity) or a loss of the heart's pumping function which usually occurs within an hour of onset of symptoms [5,10]. Sudden cardiac-related death often seems to occur only in the elderly. Although previously true and more common, this is now a misconception as the incidence of sudden cardiac-related death in youngsters has increased tremendously over the past few years [4]. These events typically occur in athletes and those performing strenuous physical activity, nevertheless they also take place in young non-athletic individuals as well [2]. What could be the reason for this?

Review

There is no well-established surveillance or reporting systems in most countries, including the United States, hence the incidence of sudden cardiac death can only be estimated based on various registries and clinical trials like Resuscitation Outcomes Consortium (ROC), Cardiac Arrest Registry to Enhance Survival (CARES), International Cardiac Arrest Registry, Seattle Cardiac Arrest Surveillance System, etc. However, most of these registries are

concentrated in developed countries with inadequate population coverage [8]. According to the 2022 Heart and Stroke Statistics released by the American Heart Association (AHA), there are more than 356,000 out-of-hospital cardiac arrests (OHCA) annually in the United States with nearly 90% of them being fatal [11]. The incidence of emergency medical services (EMS)-assessed OHCA adults in 2015 was 347,322 based on extrapolation of ROC data. The ROC data illustrated incidence for children was 7,037. CARES also provides data regarding the locations of OHCA occurrence in adults which was more commonly at home or residence (73.9%) followed by public settings (15.1%), and nursing homes (10.9%). For children, occurrences were most often at home (87.5%), followed by a public place (12.2%) [6]. OHCA collapse was not witnessed in 50.1% of cases [6]. This number creates a great impact on the families and communities affected. The devastating effects of SCD make it important for us to understand disease etiology and preventative strategies for the future.

Common etiologies of SCD

SCDs are frequently due to structural heart disease or genetically predisposed electrophysiological problems. A few of the common causes leading to sudden cardiac death in young include:

- Coronary artery anomalies (CAD) - The inherited abnormalities in the structure of the coronary arteries which supply blood to the heart are compromised, especially in times of increased physical activity. Previously, CAD was known to be the most common cause of SCD in young, however according to recent studies, this has decreased because of changes made in reducing the modifiable risk factors of CAD including improved basic life support and placements of automated defibrillators [9].
- Hypertrophic cardiomyopathy (HCM) - This involves an abnormal thickening of the left ventricle (LV) which prevents the heart from pumping blood efficiently with varying hemodynamic and clinical manifestations. It is most commonly due to genetic mutations of proteins within cardiac sarcomere and follows an autosomal dominant transmittance pattern. The two most common genes affected are β-myosin heavy chain and myosin binding protein C. The risk of SCD with HCM increases with LV thickness > 30mm, family history of SCD, unexplained syncope, and abnormal blood pressure response to exercise. According to the HCM risk-SCD calculator, out of every 16 Intra Cardiac Devices (ICD) in HCM patients, an episode of SCD at 5 years will be prevented in one patient [1,7].
- Arrhythmogenic right ventricular cardiomyopathy - A condition that weakens the muscular wall of the heart. It shows no symptoms in the early stages, thereby increasing the risk of sudden death, especially during strenuous exercises.
- Arrhythmias - A condition of undetected arrhythmias due to an undiagnosed underlying genetic disease causing electrical dysfunction in the heart. This leads to a disorganized or chaotic heart rhythm.
- Myocarditis - Infections of the heart wall causing cardiac dysfunction.
- Primary ion channelopathies (E.g.- Brugada Syndrome) - A genetic condition that disturbs the normal rhythm of the heart.

Preventative measures

According to data available, only half of men and one-third of women have a diagnosed cardiac disorder or warning signs before the sudden cardiac episode [2]. Therefore, it is important to bring about preventive measures in the general population which include:

- Lifestyle modifications - Important modifications to consider include avoidance of smoking, maintaining a healthy body weight, avoiding a sedentary lifestyle, regular moderate exercise, managing stress, and consuming a healthy diet. These changes create a substantial reduction in the incidence of sudden cardiac deaths by preventing the worsening of underlying undiagnosed heart conditions.
- Family history of cardiac disease - Genetically predisposed heart conditions are one of the common causes of SCD in young populations. The advancements made in the field of molecular genetics help us tackle this problem. Post-mortem genetic testing aids with the effective diagnosis and treatment of other surviving family members. It is important to be informed and collect family history of any cardiac disorders in the immediate family members (parents, siblings, uncles, aunts, nieces, nephews, etc). This allows for

exploration of screening options and early detection of heart diseases and evaluation of risk factors.

- Life support training and installation of Automatic Electric Defibrillator (AEDs) - The disastrous effects of SCD make it a major public health issue which deems health policy changes such as training the public in delivering basic life support, which includes performing cardiopulmonary resuscitation (CPR) and early defibrillation using portable automatic defibrillators. Installation of adequate AEDs in public places like train stations, airports, gyms, etc. stands as a prerequisite.
- Knowledge about warning signs - Warning signs like sudden chest pain and fainting episodes during exercise could be early signs of an underlying heart disease which invites further investigations. Proper patient education regarding prodromal symptoms is crucial for better outcomes.
- Adequate data collection on SCD - Although there are multiple national and international registries, along with ongoing clinical trials to better understand SCD, the data regarding the incidence and epidemiology of SCD in young populations is inadequate. This illustrates the need for public health policies to set up multiple registries covering an adequate population.

Conclusion

Currently, there are no guidelines in place for performing routine screening tests like Electrocardiograms (EKG) in individuals with no risk factors, as it is deemed cost-ineffective and could lead to over-diagnosis [3]. Healthy lifestyle modifications, genetic screening, and teaching information regarding the warning signs of sudden cardiac death remain the mainstay in reducing sudden cardiac deaths in young individuals. We believe the time has come to implement early cardiac screening measures, such as EKGs, to improve patient outcomes related to SCD. Additionally, current lack of sufficient data registries continues to hinder our ability to better address SCD to improve patient outcomes and reduce mortality rates. Together, application of early cardiac screening measures and identification of warning symptoms along with revised public policies to broaden data registry collection will allow for optimal disease understanding, management and prevention moving forward.

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