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Introductory Chapter: Cardiac Disease - Plague in the Modern World

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1. Introduction

Medicine has been recognized as an art of understanding and healing human illnesses and injuries for thousands of years. Warfare, economic turmoils, and all kinds of socioeconomic factors affect medical knowledge and practice in cardiac diseases, mostly prominent in the last centuries.

After 1960s, breakthrough changes and innovations in cardiac biomarkers, electrocardiographic monitoring, defibrillation, therapeutic temperature management (TTM), capnography, and some other instruments have been launched, and these have been thought to mitigate the burden of cardiac diseases. Nowadays, it is obvious that electrocardiography, defibrillation, and cardiopulmonary resuscitation (CPR) are far from its current format in the 1950's and 1960's world.

Out-of-hospital cardiac arrest (OHCA) remains a major death scenario in the middle-aged population all over the world. Despite all new major advances, survival for OHCA is, on average, approximately 10%, but substantial variability is visible among emergency medical services systems even in the most developed countries. Four kinds of fatal arrhythmias (ventricular fibrillation-VF, pulseless ventricular tachycardia, asystole, and pulseless electrical activity) result in a loss of cardiac function and sudden cardiac death.

VF is one of the most deadly cardiac arrhythmias and certainly the most common one. It can be described as erratic, disorganized firing of impulses from the ventricles, producing no palpable pulses in the periphery. Literature data have shown that the earlier defibrillation and bystander CPR have been commenced, the lower is the patient mortality. Since considerable differences can affect people's lives in this context, the role of medical command bears utmost importance to direct these patients to facilities with discrete capabilities [1].

Another aspect of the emergency life-saving interventions in these patients comprises **urgent coronary revascularization**. Since most patients presenting with OHCA and refractory VF suffer from an acute thrombotic coronary artery lesion, urgent coronary angiography with revascularization is critical.

1.1 Alternative approaches to VF

Although the majority of patients with refractory VF do not respond to conventional therapy, recent trials of novel strategies demonstrate encouraging results [2]. For example, some recent reports pointed out that **double sequential defibrillation** can be a viable alternative to the classical approaches for the management of shock-refractory VF [3]. Certainly, further study is warranted before widespread practice of this technique.

Recent advances in extracorporeal life support and point-of-care ultrasound imaging, both in-hospital and out-of-hospital, may offer a therapeutic solution in some systems for patients with refractory cardiac arrest rhythms. Similarly, modern improvisations have brought drones into use to fetch automated external defibrillators to the scene of an OHCA, advances in digital and mobile techniques to improve bystander response, and wearable life detection technologies may increase survival [4].

Creating a system of care for OHCA is challenging the medical community. It must be a multifaceted approach that encompasses a variety of teams from call takers, to bystanders, to emergency medical service (EMS) personnel, and to hospital personnel [5]. Implementation of these concepts in one's system of care for OHCA will result in a greater number of survivors returning to reproductive life.

Most of the up-to-date treatment recommendations for increasing survival from cardiac arrest revolve around improving the quality of CPR. A focus on delivering therapeutic techniques proved useful and administration of these treatments reliably, using measurement, monitoring, and implementation of quality-improvement strategies, will provide a basis, and in this way, future developments in resuscitation care can be contemplated [6].

As a result of these fundamental developments, post-cardiac arrest syndrome has been intrigued in more detail. Namely, therapeutic temperature management is becoming the standard of care in most institutions in order to give the highest chance of recovery without major sequelae after return of spontaneous circulation [7].

2. New horizons

2.1 Therapeutic temperature management

TTM has been trying to improve survival of cardiac arrest patients in the modern medicine, with contradicting results for decades. Following the successful resuscitation, TTM is postulated to mitigate neurologic damage by reducing cerebral oxygen consumption and biochemical damage. Through a variety of mechanisms, TH affects several pathways at the same time to alleviate death rate of the brain cells in OHCA [8, 9]. In brief, worldwide recognized committees for resuscitation recommend continuation of TTM for at least 24 h after achievement of targeted temperature (33–36°C).

2.2 Mechanized devices

The quality of CPR is probably one of the hottest topics for the medical community. This context, comprising chest compression rate, depth, and fraction of hands-on time, is integral to cardiac arrest survival. Some recent data postulated that introducing mechanized devices to target these measures of quality in the challenging prehospital environment may offer better outcomes [10]. Manual chest compressions remain the standard of care; however, in circumstances where high-quality manual chest compressions are difficult or unsafe, paramedics should consider using a mechanical device [11]. By combining high-quality manual chest compressions and judicious application of mechanical chest compressions, EMS agencies can optimize personnel safety and outcomes in OHCA.

Although animal models deliver favorable results on markers of perfusion and manikin studies demonstrate improved consistency of high-quality CPR performance with device use, real-world application of these devices via prospective randomized human researches failed to demonstrate beneficial effects in outcomes and, therefore, cannot be supported by current evidence [10].

2.3. Extracorporeal membrane oxygenation (ECMO)

Recent data derived from well-designed controlled studies suggest that early initiation of ECMO in these patients is critical. In the last decade, outstanding international committees on resuscitation recommended consideration of ECMO in patients presenting with cardiac arrest from presumed reversible etiology, including myocardial infarction, pulmonary embolism, and refractory VF [12].

3. Conclusion

While cardiac disease, specifically acute cardiac catastrophes like VF remains a major death cause for the reproductive age of human being, a multifaceted approach would fit best to improve survival in those with cardiac arrest and other emergencies. This book was intended to focus on the new opportunities for diagnosing cardiac events and for optimal resuscitation of these, in order to save more lives as possible.

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