MANAGING THE CARDIAC ARREST PATIENT

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ABSTRACT

Cardiac arrest or Sudden Cardiac Arrest (SCA) occurs before Sudden Cardiac Death (SCD). SCD is a common cause of death around the world with an estimated figure of 7 million deaths annually and over 300,000 occurring in the United States. Appropriate management of cardiac arrest patients (CAP) could increase their chances of survival. Cardiopulmonary resuscitation (CPR) with improvement in emergency medical services (EMS) are effective in saving lives. Bystanders and health care providers ought to be adequately skilled and equipped to deliver effective cardiopulmonary resuscitation. This article reviews effective methods of managing cardiac arrest victims.
Keywords: Cardiac Arrest, Cardiopulmonary resuscitation (CPR).

INTRODUCTION

CARDIAC arrest (CA) which is also called Sudden Cardiac Arrest (SCA) has been defined severally as the sudden cessation of effective cardiac activity presenting with pulselessness, apnea and unconsciousness, in a patient who is not expected to die at that point in time [1] or the sudden cessation of cardiac activity such that the victim becomes unresponsive, with either persisting gasping respirations or absence of any respiratory movements, and no signs of circulation as manifested by the absence of a perceptible pulse. An arrest is presumed to be of cardiac etiology unless it is known or likely to have been caused by trauma, drowning, respiratory failure or asphyxia, electrocution, drug overdose, or any other non-cardiac cause [2]. Sudden Cardiac Death (SCD) is defined as sudden and unexpected death occurring within an hour of the onset of symptoms, or occurring in patients found dead within 24 hours of being asymptomatic and presumably due to a cardiac arrhythmia or hemodynamic catastrophe [2]. If corrective measures are not taken rapidly, sudden cardiac arrest progresses to sudden cardiac death (SCD) which signifies a natural death from cardiac causes, heralded by an abrupt loss of consciousness within one hour of the onset of acute symptoms [3]. Therefore, SCD should not be used to describe events that are not fatal. Cardiac arrest is a clinical event that can be reversed, usually by cardiopulmonary resuscitation (CPR) in form of Basic Life Support (BLS) and Advanced Life Support (ALS). It could be of two types. Out-of-hospital cardiac arrest which is associated with higher morbidity and mortality compared with In-hospital cardiac arrest.

James Elam was the first to prove that oxygen content of expired air was sufficient to maintain oxygenation. Peter Safar and James Elam invented mouth-mouth resuscitations. American Heart Association (AHA) started a closed-chest cardiac resuscitation training for physicians in 1960. Advanced Cardiovascular Life Support (ACLS) was developed at the third National Conference on CPR in 1979. AHA released a statement on Hands-Only CPR in 2005 [4].

CAUSES OF CARDIAC ARREST

All forms of heart diseases and insults could lead to cardiac arrest if not properly managed. The most common cause of SCD in USA and Western countries is coronary artery disease, otherwise called Ischaemic Heart Disease [2]. While about 82% of patients who suffered sudden cardiac death was a result of hypertensive heart disease in Nigeria [5]. Another review conducted in Obafemi Awolowo University Teaching Hospital (OAUTHC) on 2,592 medico-legal autopsies, of which 79 were as a result of SCD, 83.5% SCD was as a result of Hypertensive Heart Disease. This further underscores Hypertensive Heart Disease as the leading cause of SCD [6]. However, there are certain causes that are reversible. These are; hypoxia, hypovolaemia, hyper/hypokalaemia, hypothermia, tension pneumothorax, toxins, cardiac tamponade, and pulmonary embolism. "4H, 4T".

MANAGEMENT OF CARDIAC ARREST

The approach to management of cardiac arrest depends on many factors including; age of victim, location of occurrence (in-hospital or out-of-hospital) and quality of

emergency medical response available in the environment amongst others.

Cardiopulmonary resuscitation (CPR) is a collection of emergency interventions performed to provide oxygenation and circulation to the body during cardiac arrest. The modern-day approach to CPR stemmed from certain work of few physicians in the 1950s. The most widely accepted guidelines in North America are those produced by the American Heart Association (AHA). These are published every 5 years, after the International Liaison Committee on Resuscitation (ILCOR) meeting [7, 8].

Cardiopulmonary resuscitation entails the series of actions taken to restore spontaneous cardiac activity in a patient who had suffered cardiac arrest. It is basically divided into two phases: basic life support and advanced life support. Basic life support involves quick diagnosis of cardiac arrest, chest compressions, and rescue breaths. Early defibrillation is advocated to convert abnormal heart rhythms to normal ones. Advanced life support combines the features of BLS with drugs administration and use of advanced airway equipment.

CHAIN OF SURVIVAL

- Chain of survival: The actions that link the victim of cardiac arrest with survival.

Source: American Heart Association
(IHCA -In hospital cardiac arrest, OHCA - Out-of-hospital Cardiac Arrest)

The chain of Survival refers to the events that must occur in rapid succession to maximize the chances of survival from sudden cardiac arrest.

- Early recognition and activation of emergency response system.
- Immediate high-quality Cardiopulmonary Resuscitation.
- Rapid Defibrillation - Basic and advanced emergency medical services.
- Advanced Life Support and Post-Resuscitation Care.

HIGHLIGHTS OF THE ALGORITHM FOR MANAGING AN ADULT CARDIAC ARREST PATIENT

Advanced Cardiovascular Life Support (ACLS) Algorithm 2015 for the management of cardiac arrest follows the resuscitation chain C-A-B [7].

1. Early recognition and activation of emergency response system: Check victim's responsiveness by shaking his/her shoulders and calling out loud "are you okay?" If non-responsive, and breathing is absent or agonal, call for help (bystanders or an emergency call number) and Automated external defibrillator (AED). Checking carotid pulse is limited to health professionals and all the checks should be accomplished within 10 seconds. Laymen are not encouraged to check for carotid pulse to avoid time wasting. Early commencement of chest compressions has been found to result in increased survival rate.

2. Immediate high-quality Cardiopulmonary Resuscitation: Cardiopulmonary resuscitation is an emergency procedure combining chest compressions and ventilatory breaths to maintain oxygenation and circulation in a person who has suffered a cardiac arrest. Lay patient supine on a firm surface and administer high quality chest compressions and rescue breaths at the rate of 30:2 until defibrillator or/and emergency service providers arrive the scene. High quality chest compression involves putting the heels of the two hands over each other at the center of the chest over the lower half of the sternum, with elbows locked, rescuer leaning over patient and compressing up to about 2 inches (5-6cm) at the rate of at least 100-120 cycles per minute. Complete chest recoil should be ensured between compressions. Rescue breath should be enough to make the chest rise and last at least 1 second. Airway could be opened up with head tilth, chin lift and jaw thrust provided there is no injury to the cervical spine. Interruptions to chest compressions should be minimized and limited to when procedures are needed. It should not last more than 10 seconds on any occasion. For every 30 chest compressions, 2 rescue breaths have been recommended.

3. Rapid Defibrillation: defibrillator (manual or AED) is attached to the patient according to instructions on the pads as soon as it is available. The rhythm is read and shock delivered if indicated. Shockable rhythms include; ventricular fibrillation and pulseless ventricular tachycardia. Asystole and pulseless electrical activity are non-shockable rhythms. Rescuers are to stay clear during shock delivery and recommence chest compressions as soon as shock was delivered. All that is needed to use an AED is to switch it on. It will continue to give directives

through voice prompts and deliver shock if necessary, after analyzing the heart rhythms.

4. Advanced Life Support and Post-Resuscitation Care: this usually involves the participation of emergency health workers. It includes the use of drugs, advanced airway equipment and defibrillator. It is the second phase of cardiopulmonary resuscitation and a continuation of BLS. ALS helps to sustain the gains of BLS and improves long term survival. Post-resuscitation care is meant for survivors of cardiopulmonary arrest with return of spontaneous circulation (ROSC). It is usually done in an intensive therapy unit using vasopressors, antiarrhythmics and treating identifiable reversible causes of cardiac arrest while providing enabling environment for recovery. ALS involves; high quality CPR, heart rhythm analysis and shock delivery, drug therapy, use of advanced airway equipment and treatment of identifiable reversible causes. CPR would have been started according to standard, Automated External Defibrillator (AED) or manual defibrillator is applied as soon as it is available.

Drug therapy is usually engaged during the chest compression cycle following the second shock administration in an in-hospital cardiac arrest. First line drugs include adrenaline, vasopressin and amiodarone. First dose of adrenaline at 1mg in an adult is administered after the second shock. The second dose comes about 3-5 minutes later after a third shock. This is then followed by a dose of amiodarone at 300mg stat. The route of administration is either intravenous or intraosseous. Other drugs include; magnesium sulphate which is indicated in Torsades de pontes of hypomagnesemia, Lignocaine for treatment of ventricular tachycardia or fibrillation. Other drugs are Dopamine, Sodium bicarbonate, calcium carbonate or gluconate, phenylephrine and Dobutamine. Advanced airway devices such as oropharyngeal airway, laryngeal mask airway (LMA), endotracheal tubes, laryngeal tubes etc. are placed within 10 seconds by the fastest and best team member, minimizing interruption of chest compressions. This improves quality of ventilation which could be administered at 10 cycles per minute or maintained at 2 breaths for every 30 chest compressions. In an in-hospital cardiac arrest, reversible causes (4Hs & 4Ts) are identified and treated to improve outcome. Rhythm is reassessed every two minutes, and if there is return of spontaneous circulation, post-resuscitation care is commenced.

FACTORS AFFECTING OUTCOME

The successful performance of CPR depends on continuous professional training, by acquiring sufficient knowledge, skills and abilities to initiate CPR maneuvers effectively [9]. Essential materials and equipment must be available within 15 minutes of request to improve outcome, including automated external defibrillators and mechanical ventilators when indicated. Pre-arrest diagnosis and initial heart rhythm were highlighted to influence the outcome of a cardiopulmonary resuscitation. More cardiac arrest victims with lower lactate level and or shorter period of resuscitation had better chances of survival [10]. For cardiac arrest cases recorded outside the hospital, outcome is poorer and largely influenced by bystander willingness and community practices.

WHEN TO STOP CPR

The rescuer could stop CPR in the following instances:

1. When the first responders transfer care to the emergency service providers
2. When the rescuer(s) are tired and help has not arrived
3. When there are obvious signs of death
4. If the rescuer detects there was a "do not resuscitate order".

OUTCOMES

The outcome of patient management following cardiac arrest is poor. There has been significant improvement in outcome over the past two decades [11,12]. The Utstein-style definition and reporting template has been used in effectively increasing the clinical outcomes following CPR as well as improving international consensus as regarding CPR and its guidelines [13,14].

Factors such as: effectiveness and timeliness of emergency medical services (EMS); the effectiveness of chest compression; timeliness of defibrillation; and artificial ventilation have significantly influenced the outcome of CPR [14].

Age, gender, and pre-existing medical conditions amongst others also contribute to the clinical outcome of in-hospital cardiac arrest patients [12]. Also, the outcome of resuscitation varies between traumatized cardiac arrest patients and non-traumatized cardiac arrest patients [15], with a poorer outcome in patients with traumatic cardiac arrest compared to patients with non-traumatic cardiac arrest [16].

POST-RESUSCITATION MANAGEMENT OF THE CARDIAC ARREST PATIENT

Improved outcomes have been proven with pre-arrest interventions (access to automated defibrillators) [17], intra-arrest interventions (vasopressin for asystole) [18], and post-arrest interventions (therapeutic hypothermia) [19, 20]. To date, studies indicate that less than 20% of patients experiencing cardiac arrest are discharged from hospital [21].

Hyperglycemia is common following resuscitation from cardiac arrest and several studies have addressed the as-

sociation of blood glucose concentration and neurologic outcome in humans following cardiac arrest [22-27].

Induction of hypothermia by application of ice packs, surface cooling with cooled forced-air, or circulating water blankets, infusion of IV fluids at 4 degrees Celsius, immersion in cold water, specialized endovascular cooling devices and cardiopulmonary devices with no published results of comparing these trials. Neuromuscular blockade is given to prevent shivering during hypothermia by administering IV meperidine alone or in combination with buspirone. In post-arrest patients each degree Celsius over 37 is associated with increased risk of severe disability, coma, or persistent vegetative state [26].

Infusion of glucose containing solutions or the provision of enteral or parenteral feeding was felt to be critical to prevent hypoglycemia in post-arrest patients, particularly when insulin infusions are used [26].
Also, guidelines on nutrition support favour enteral nutrition over parenteral nutrition and suggest initiation within 24 to 48 hours after ICU admission [28].

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