Sudden cardiac death is the most prevalent yet preventable clinical problem. It is estimated that about 300,000 to 400,000 deaths occur annually due to cardiovascular causes with 63% occurring due to sudden cardiac deaths. The most important determinant of survival among these patients is the prompt and effective delivery of basic life support at the site or by the first bystander. Although there has been a decline in overall cardiovascular morbidity and mortality but the incidence of sudden deaths from cardiovascular causes has remained constant. Currently the basic life support not only includes cardiopulmonary resuscitation but also defibrillation using automated external defibrillators. The latest guidelines for cardiopulmonary resuscitation published in 2010 by the American Heart Association (AHA) have made substantial changes to the basic life support strategy. The conventional stepwise approach A-B-C has been changed to C-A-B. This mandates the decrease in time to deliver first compression. Look, listen and feel has been omitted to avoid unnecessary delay of the chest compressions. The pulse check parameter has also been diminished for healthcare providers. This review covers the management of cardiopulmonary resuscitation, and scrutinizes current practices and data supporting the use of CPR.

Key words: Adult basic life support, recent guidelines 2010, a review.

Introduction

Sudden cardiac death causes almost 63% deaths. Survival in such patients is dependent on prompt and effective delivery of basic life support at the site. Sudden cardiac arrest is often the first manifestation of coronary artery disease (CAD), accounting for up to 50% mortality in United States and other developed countries. The incidence of sudden cardiac death is 55 per 100,000 persons or 5.6% mortality per year. Although a decline in overall mortality due to cardiovascular causes has been noted but the incidence of sudden death from cardiovascular disease has remained constant.

Cardiac arrest leads to unexpected and sudden interruption of effective cardiac pumping function. This results from either ventricular asystole, pulseless ventricular tachycardia (VT) or ventricular fibrillation (VF) currently.
be successful, the actions of bystanders and other care providers must occur with a system that coordinates and integrates each facet of care into a comprehensive program that focuses on survival to discharge from the hospital. The recent 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular care marks the 50th anniversary of modern CPR. In these 2010 guidelines, scientists and healthcare providers have identified factors which have the greatest potential impact on survival. On the basis of strength of the available evidence, they developed recommendations to support the interventions that showed most promising outcomes. There was a unanimous support for continued emphasis on high-quality CPR, with compressions of adequate rate and depth. Thus allowing complete chest recoil, minimizing interruption in chest compressions and avoiding excessive ventilations. High-quality CPR is the cornerstone of a system of care that can optimize outcomes which lie beyond the return of just spontaneous circulation. Return to previous quality of life and functional state of health is the ultimate goal of a resuscitation system of care. Recent guidelines are based on the latest and comprehensive reviews of literature on resuscitation.

**Task force**

The 2010 guidelines were formulated by 356 resuscitation experts from 29 countries, who reviewed, analyzed, evaluated, debated and discussed the researches and hypotheses through interactive meetings for 36-months before the 2010 consensus conference. The experts produced 411 scientific evidence reviews on 277 topics in resuscitation and emergency cardiovascular care. The process included structured evidence evaluation, analysis and cataloging of the literature.

Current guidelines also confirm the safety and effectiveness of many approaches. It introduces new treatments based on intensive evidences, evaluations and consensus of experts. Yet these guidelines do not apply to all rescuers and all victims in all situations. The leader of a resuscitation task may need to adapt applications of these recommendations according to the prevailing circumstances.

The guidelines published in 2005 by the American Heart Association are based on the International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with treatment recommendations. These include a substantial change to the practice of Basic Life Support.

This review summarizes the key modifications in the updated guidelines and highlights the most important practical changes to CPR from the year 2000 to 2010.

**Approaches**

**Shock-first versus CPR first approach**

It was considered important in 2005 guidelines to distinguish between witnessed (known duration of cardiac arrest) and unwitnessed arrest. If a cardiac arrest is witnessed and CPR is begun immediately, shock can be given as soon as the defibrillator is available. In an unwitnessed cardiac arrest, it is recommended to give two minutes of CPR first and then give shock. Cobb and colleagues showed that in patients in whom response intervals exceeded 4 minutes, delivery of 90 seconds of CPR before defibrillation resulted in a 27% survival rate to discharge compared with a 17% survival rate in the group receiving defibrillation first by emergency medical technicians (p-value= 0.01). They also showed an overall improvement in neurologic status in the CPR first group independent of response time. However, one randomized trial by Wik and colleagues also showed similar results. In prolonged ventricular fibrillation, CPR provides benefit by depleting high-energy phosphate molecules to cardiac myocytes. CPR improves the metabolic status of the heart by providing a critical amount of perfusion to the heart.

**Compression-ventilation ratio**

The compression ventilation ratio was also addressed in 2005 and changed from 15:2 to 30:2. In 2010, compression-ventilation ratio of 30:2 was retained. In the new strategy the compressions were to be given before ventilations unlike previously when ventilations were given before chest compressions. Compressions before ventilations increase the chances of survival by providing early blood flow to vital organs and therefore, increasing the chances of giving unnecessary CPR to unconscious victims who are infect not suffering from cardiac arrest.

**One shock versus three shocks**

No evidence has proven that one shock is better than three stacked shock. However, checking the pulse and analyzing the rhythm, in the three stacked shock protocol, causes unnecessary delay in delivering CPR as each time when a patient receives a shock, there is a delay of 40 seconds to resume CPR. Two other studies have also shown delay of 17 to 38 second in the postshock CPR. Delays of 15-20 second in CPR in the three stacked shocks is a predictor of poor neurologic outcomes. Interruption of CPR results in low cardiac perfusion pressures. In more than 60% of patients after cardiac arrest the initial rhythm after the delivery of shock was either asystole or a non-reperfusing rhythm. Therefore, immediate CPR is strongly recommended after the first shock. A total of five cycles of CPR should be given before the rhythm is checked. The pulses...
are checked if the rhythm is other than asystole or a pulseless electrical activity. The time of second shock is standardized after five cycles of CPR, and should not be more than 2 minutes.

Sequence of defibrillation shocks was modified in 2005 from 3 stacked shocks to one shock only followed by immediate CPR and defibrillation after 5 cycles of CPR. This sequence has remained unchanged in 2010 guidelines.

Monophasic versus biphasic defibrillators
Biphasic waveforms have been shown to be more effective than monophasic waveforms. None provides survival benefit over the other. The American heart association recommends 360J for the monophasic waveform and 200J for the biphasic waveform just for the sake of ease and to prevent unnecessary delays in selection of the joules. Superiority of either escalating or fixed subsequent doses of energy has not been tested yet with different waveforms. However, if higher energy levels are available in the device at hand, they may be considered if the initial shocks are unsuccessful in terminating the arrhythmia. In the last 5 to 10 years many randomized trials have compared biphasic with monophasic cardioversion in atrial fibrillation. Cardioversion of adult atrial flutter and other supraventricular tachycardias generally requires less energy; an initial energy of 50 J to 100 J is often sufficient. If the initial shock fails, increase the dose in a stepwise fashion. Adult cardioversion of atrial fibrillation with monophasic waveforms should begin at 200J and increase in a stepwise fashion where necessary.

CPR duration before defibrillation
To give the victim the best chance of survival, 3 actions must occur within the first few moments of a cardiac arrest.

1. Activation of the EMS system
2. Provision of CPR
3. Operation of a defibrillator

One controversial area is whether delivering a longer period of CPR before defibrillation improves outcomes in cardiac arrest or not. In early studies, survival was shown to be improved but in 2 recent randomized controlled trials CPR performed before defibrillation did not affect the outcome. As a rule if two rescuers are present, one should start CPR and second should call EMS and obtain the defibrillator for use.

Role of automated external defibrillator (AED)
AED’s are safe, simple and effective devices designed to be used by the general public and by first responders. The layperson and first responders can perform defibrillation even at home. Studies have shown that laypersons and first responders can be trained for defibrillation techniques. Use of AED for in-hospital cardiac arrest has led to a 2.6-fold increase in survival from cardiac arrest. A study reported 34% survival at discharge for in-hospital patients with cardiac arrest caused by ventricular tachycardia or ventricular fibrillation.

CPR by lay rescuers
During the past 5 years large observational studies have provided important information about the positive impact of bystander CPR on survival in an out-of-hospital cardiac arrest. For most of the adults with out-of-hospital cardiac arrest, bystander CPR with chest compressions only (Hands-Only CPR) appears to achieve similar outcomes as those from conventional CPR (compressions with rescue breathing).

“A-B-C” changed to “C-A-B”

The latest development in the Guidelines for CPR is a change in the basic life support (BLS) sequence of steps from “A-B-C” (Airway, Breathing, Chest compressions) to “C-A-B” (Chest compressions, Airway, Breathing) for adults and pediatric patients (children and infants, excluding the newborns).

The experts have also agreed to the importance to reduce time to first chest compressions. The 2010 Guidelines for CPR recommend this change for the following reasons:

1. The vast majority of cardiac arrests occur in adults, and in these patients the critical initial elements of CPR are EARLY chest compressions and EARLY defibrillation.
2. By changing the sequence to C-A-B, chest compressions will be initiated earlier and ventilation will be minimally delayed until completion of the first cycle of chest compressions (30 compressions should be accomplished in approximately 18 seconds).
3. Most rescuers find rescue breaths delivery more difficult than chest compressions.
4. It is reasonable for healthcare providers to tailor the sequence of rescue actions to the most likely cause of arrest. For example, if a lone healthcare provider sees a victim collapsing suddenly, the provider should assume that the victim has suffered a sudden VF cardiac arrest and must provide CPR. But for a presumed victim of drowning or other likely asphyxial arrest, the priority would be to provide about 5 cycles (about 2 minutes) of conventional CPR (including rescue breathing) before activating the emergency response system.

New key changes in the guidelines for CPR

1. In order to avoid time delay “Look, Listen and Feel” has been removed from the stepwise approach to BLS. The recent guidelines stress on the immediate activation of the emergency response system and starting chest compressions for any unresponsive
adult victim who has either no breathing or abnormal breathing (i.e., only gasps).

2. Hands-Only (compression only) CPR has been encouraged for the untrained lay rescuer who hesitates giving rescue breaths due to the fear of contacting contagious diseases. Hands-Only CPR is easier to perform even by those who have no training. Results are similar to conventional CPR.

3. New recommendations stress on chest compressions before giving rescue breaths (C-A-B rather than A-B-C) \(^{18}\).

4. There is an increased focus on methods to ensure that high-quality CPR is performed, i.e. push hard and fast on a hard surface at a rate of 100 per minute with minimum interruptions and allow equal time for recoil of chest. The recommended depth of compression for adult victims has increased from a depth of 1 and 1/2 to a depth of at least 2 inches.

5. Many tasks performed by healthcare providers during resuscitation attempts can be performed concurrently by an integrated team of highly trained rescuers. A lone rescuer can start alone and call for help, resulting in the arrival of additional team members by that time.\(^{18}\)

6. The importance of pulse check has been decreased for the healthcare providers. Detection of a pulse can be difficult, and even highly trained healthcare providers often incorrectly assess the presence or absence of a pulse when the blood pressure is very low or absent. The lay rescuer should not attempt to check for a pulse and should assume that cardiac arrest is present if an adult suddenly collapses, is unresponsive, and is not breathing or not breathing normally (i.e., only gasping).

**Key points of continued emphasis for the 2010 guidelines for CPR**

1. Responsiveness should be checked first for early recognition of cardiac arrest.

2. Training should focus on alerting potential rescuers to the unusual presentations of sudden cardiac arrest such as gasping respiration and seizure.

3. Minimize interruptions during effective chest compressions until termination of resuscitative efforts.

4. Minimize the importance of pulse check by healthcare providers. Healthcare providers should take no more than 10 seconds to determine if a pulse is present or not.\(^{18}\)

**Stabilization of the Patient with ACS**

A packaged system of care for patients with ST elevation myocardial infarction (STEMI) has been suggested in 2010 guidelines. This system stresses on taking 12-lead electrocardiograms (ECGs) before reaching the hospital, triage to percutaneous coronary intervention (PCI) capable center, and comprehensive care for patients following cardiac arrest with confirmed STEMI. A well-organized approach to STEMI care also requires integration of community, EMS, physician, and hospital resources.\(^{52-58}\) A 12-lead ECGs before reaching the hospital decreases time to primary percutaneous coronary intervention (PCI) and guides patient transfer to specific hospitals when PCI is the most likely option. Early ECG diagnosis by EMS team causes timely activation of the cardiac catheterization laboratory by the EMS team or ED physician leading to significant reductions in time to reperfusion. The ACS guidelines have also made new recommendations for triage of patients to PCI centers after cardiac arrest. Performing routine cardiac catheterization as part of standardized post-cardiac arrest protocols has also been considered reasonable in the new guidelines. Early PCI will cause less or no neurological damage and improve functional recovery. It is also recommended to carry out emergent angiography and prompt revascularization in patients with out-of-hospital cardiac arrest. The ECG may be insensitive or misleading following cardiac arrest, and coronary angiography in subjects with arrest of presumed ischemic cardiac etiology may be reasonable, even in the absence of a clearly defined STEMI.

**Adult Stroke**

Approximately 795,000 people suffer a new or repeat stroke each year, and stroke remains the third leading cause of death worldwide. A collection of effort in stroke patients should include public education, 911(or any other) dispatch, pre-hospital diagnosis and triage and a stroke care system in hospitals. As with STEMI patients, pre-arrival hospital notification by the transporting EMS unit significantly increase the percentage of patients with acute stroke who receive fibrinolytic therapy. The 2010 AHA Guidelines for CPR recommend that every hospital with an Emergency Department have a written plan that is communicated to EMS systems describing how patients with acute stroke are to be managed in that institution. Triage of patients with acute stroke directly to designated stroke centers is a new Class I recommendation. Another new Class I recommendation is admission of the stroke patient to a dedicated stroke unit managed by a multidisciplinary team experienced in stroke care. Since the publication of the 2005 AHA Guidelines for CPR, additional data have emerged extending the time window for administration of IV recombinant tissue plasminogen activator (tPA) to select patients with acute ischemic stroke. These guidelines now recommend IV rtPA for patients who meet the eligibility criteria for the National Institute of Neurological Disorders and Stroke (NINDS) or the Third European Cooperative Acute Stroke Study (ECASS-3) if rtPA is administered by physicians in the setting of a clearly defined protocol with a knowledgeable team and...
institutional commitment. However, it is important to emphasize the continued time-dependent reperfusion window and that earlier treatment is better and is associated with improved outcome. Patients ineligible for standard IV fibrinolytic therapy may be considered for intra-arterial fibrinolytic therapy or mechanical revascularization only at selected centers with specialized capabilities. Finally these guidelines recommend admission to a stroke unit within 3 hours of presentation to the ED. Recent studies establish that stroke unit care is superior to care in general medical wards, and positive effects of stroke unit care can persist for years. The benefits from treatment in a stroke unit are comparable to the beneficial effects achieved with IV rtPA. Overall stroke care has progressed dramatically. Improvements in education, prehospital management, hospital system development, and acute treatments have lead to significant improvements in patient outcomes.

Special Situations

Cardiac arrest in special situations may require special treatments or procedures beyond those provided during standard BLS. Because of difficulty in conducting randomized clinical trials in these areas or their infrequent occurrence, these unique situations call for an experienced provider to go “beyond basics” using clinical consensus and extrapolation from typical circumstances. Topics with these potentially unique features include asthma, anaphylaxis, pregnancy, morbid obesity, pulmonary embolism, electrolyte imbalance, ingestion of toxic substances, trauma, accidental hypothermia, drowning, electric shock or lightning strikes, and special procedural situations affecting the heart, including PCI, cardiac tamponade, and cardiac surgery.

On the 50th anniversary of modern-era CPR, it is acknowledged that, despite measurable progress aimed at its prevention, cardiac arrest, both in and out of the hospital, continues to be a major public health challenge. Over these 50 years, scientific knowledge about arrest pathophysiology and resuscitation mechanisms has increased substantially. In the ongoing commitment to ensure optimal community-based care for all victims of cardiac arrest, it must be continued to effectively translate the science of resuscitation into clinical care and improved resuscitation outcomes.

BLS training facilities are lacking in developing countries including Pakistan. Even the most concerned personnel lack the specialty as a professional and attendance in the BLS courses is also less frequent. There are Emergency Medical Services available in our country but in a primitive state. There is a need to educate skills of BLS to train health care providers and relatives of those patients who suffer or are at high risk for coronary artery disease. There is also a need to refresh/update on a large scale the current BLS system to the personnel who are an integral part in the healthcare system professions.

References


