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CPR UPDATE

Cardiopulmonary Resuscitation Update

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Abbreviations
AED = automatic external defibrillator
ACS = acute coronary syndrome
ALS = advance life support
CPR = cardiopulmonary resuscitation
EMS = emergency medical services
PCI = percutaneous coronary intervention
ROSC = return of spontaneous circulation
VF = ventricular fibrillation
VT = ventricular Tachycardia

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ABSTRACT

BACKGROUND AND OBJECTIVES: Every 5 years experts, after reviewing literature and scientific evidence, update the guidelines on Cardiopulmonary resuscitation (CPR). The objective of this report is to review the main changes in resuscitation that occurred over the last 5-year period.

CONTENTS: High-quality chest compressions with adequate rate and depth allowing full recoil of the chest with minimal interruptions is the mainstay of the recommended changes. The 30:2 compression ventilation ratio is maintained, but the former order is modified, chest compressions first, followed by airway and breathing (C-A-B instead of A-B-C). Avoidance of excessive ventilation is also recommended. Chest compressions-only CPR in primary cardiac arrest victims is an option for rescuers who are unable or unwilling to perform mouth-to-mouth ventilation. Advanced life support algorithm is simplified regarding drugs, routes of administration, endotracheal intubation. Treatment of acute coronary syndromes (ACS) has also been updated. Better practices for teaching and learning resuscitation skills are addressed.

CONCLUSIONS: Updating CPR guidelines is important and continuous education is recommended. This will improve the quality of resuscitation and survival of patients in cardiac arrest.

INTRODUCTION

Bystanders and healthcare providers play an essential role in providing CPR for victims of cardiac arrest. In addition, advance life support (ALS) certified personnel can provide excellent peri-arrest and post arrest care. The aim of the developed and updated guidelines is to achieve prompt and focused care during the 'golden half hour' after cardiac arrest. This report summarizes the key issues in the Guidelines by relevant topics.

LAY RESCUER ADULT CPR

Guidelines for cardiopulmonary resuscitation (CPR) are provided specifically for laypersons, field responders, hospital providers, and – to a much more limited ex-

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tent – emergency medical dispatchers. Dispatcher's assistance is recently being recognized as playing an integral and critical role in the chain of post arrest survival.[1] To help bystanders immediately recognize cardiac arrest, the dispatcher should specifically check for absence of response and victim's breathing. [2] Dispatchers should be specifically educated in helping bystanders detect agonal gasps to improve cardiac arrest recognition. [3] They must also be aware that brief generalized seizures may be the first manifestation of cardiac arrest.

Given that Hands-Only (compression-only) bystander CPR substantially improves survival compared with no CPR at all, dispatchers should provide instructions for lay rescuers to provide Hands-Only CPR for unresponsive with no breathing or no normal breathing adults especially if the lay rescuer is untrained or unwilling to provide mouth to mouth ventilation. For victims likely to have had an asphyxial arrest (e.g., drowning), dispatchers should provide instructions for conventional CPR.[4,5]

For the victim of sudden cardiac arrest the role of early chest compressions is highly emphasized.[6] Animal data demonstrated that delays or interruptions in chest compressions reduced survival rate, therefore any delay or interruption should be minimized throughout the entire resuscitation effort. In order to avoid time consuming actions, the recommended resuscitation algorithm starts with chest compressions which should be initiated immediately, while avoiding positioning the head and achieving a seal for mouth-to-mouth or bag-mask rescue breathing that could be time consuming. "Look, listen, and feel for breathing" has been abandoned. Wasting time to find the appropriate site for chest compressions has also been removed from the recommendations. For healthcare providers the absence of pulse within 10 seconds should prompt the initiation of CPR and use of automatic external defibrillation (AED) when it is available. Components of high-quality CPR include allowance of complete chest recoil after each compression and avoidance of excessive ventilation. [7] Oxygen and energy delivery to the heart and brain mainly depends upon blood flow. To this extent, high quality compressions that generate adequate flow are essential. In order to establish the appropriate blood flow and keep the above organs viable, the adult sternum should be compressed by at least 2 inches (5 cm). Return of spontaneous circulation (ROSC) and survival with good neurologic function is also depended upon the rate of chest compressions, the actual number of compressions, the compression-to- ventilation ratio. Chest compressions at a rate of "**at least** 100/min", than "100/min "is now recommended. [8]

Some resuscitations start with a single rescuer. In the vast majority of witnessed cardiac arrests which occurs in public places, resuscitation efforts implicate several willing rescuers. For this reason, it is imperative that rescuer training should focus in effective team work. Several actions can be performed simultaneously on the scene, including activation of the emergency medical system, compressions, ventilation and retrieving a defibrillator if available.

ELECTRICAL THERAPIES

Defibrillation, the third element in the chain of survival, is highlighted and programs for easy access of defibrillation especially in places with high incidence of cardiac arrest are emphasized.[9] Automatic external defibrillator (AED) use may be considered for in-hospital use, especially for areas with no trained personnel in rhythm recognition.[10] The use of an AED without a dose attenuator in infancy (<1 year of age) is a reasonable alternative to manual defibrillation or an AED with pediatric dose attenuation given that no adverse effects have been reported.

The «Shock First» vs. «CPR First» strategy is clearly recommended for out-of-hospital arrest when an AED is available. The CPR First approach was supported by the assumption that when ventricular fibrillation (VF) is present for more than a few minutes, the myocardium is depleted of oxygen and energy so a brief period of chest compressions may increase the likelihood of successful defibrillation. The existing trials do not support the above assumption. Therefore the Shock First strategy is recommended. The optimal dose for pediatric defibrillation is 4 J/kg for first and subsequent shocks. There are different alternative positions from the conventional sternal-apical placement of the AED electrode pads that appear to be equally effective to treat atrial or ventricular arrhythmias. In the presence of a victim with a pacemaker or implantable cardioverter-defibrillator, pads or paddles should not be placed directly over the device in order to avoid malfunction after a successful defibrillation. On

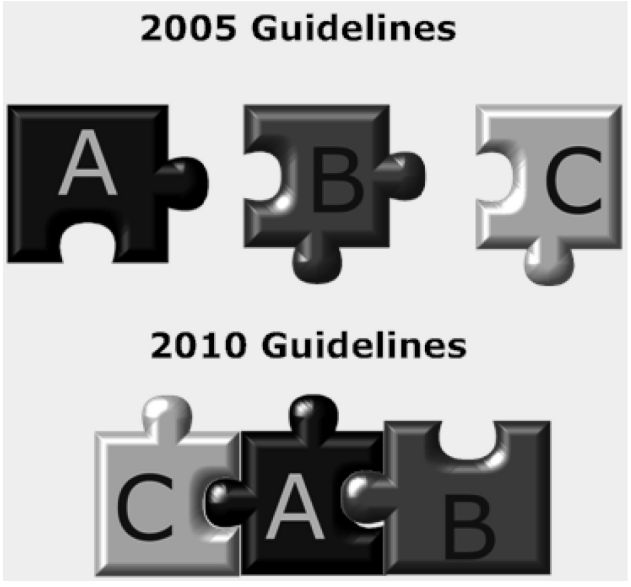

FIGURE 1. Airway - Breathing - Compression sequence in former and current guidelines.

the other hand, correct pad or paddle placement should not delay attempted defibrillation. New energy dose for of atrial fibrillation (biphasic 120 to 200 J, monophasic 200 J) and less energy for other supraventricular arrhythmia cardioversion is recommended. Biphasic dose is clearly recommended for cardioversion of monomorphic ventricular tachycardia (VT) but not for treatment of polymorphic VT.

CPR TECHNIQUES AND DEVICES

The precordial thump is thought to produce an electrical depolarization of 2 to 5 joules and has been reported to convert ventricular tachyarrhythmias. However, it is effective only if used near the onset of VF or pulseless VT. It should be used only when the arrest is witnessed or monitored and a defibrillator is not immediately ready for use.[11] Several mechanical CPR devices have been the focus of recent clinical trials. These devices have been reported to delay or interrupt CPR, so rescuers should be cautious to minimize interruptions in chest compressions or defibrillation.

ADVANCED CARDIOVASCULAR LIFE SUPPORT

Capnography is the most reliable method of confirming correct placement of an endotracheal tube. It could also help in monitoring the effectiveness of chest compressions as well the detection of ROSC. Capnography is recommended for intubated patients throughout the periarrest period. [12] Early intubation or drug therapy does not improve the victim's chances for neurologically intact survival or hospital discharge. Consequently the algorithm has been simplified in order to emphasize the importance of high-quality CPR.[13]

Vascular access, drug delivery, and advanced airway management, are still recommended, but their role is deemphasized on behalf of compression and defibrillation, which by clinical data seem to have greater impact on the final outcome. Atropine has been removed from the Cardiac Arrest Algorithm, given that routine use of atropine during pulseless electrical activity (PEA) or asystole is unlikely to favour a successful outcome. Adenosine can be used as a diagnostic or treatment tool in specific rhythm disturbances (supraventricular tachycardia), while infusion of chronotropic agents can be an effective alternative to external transcutaneous pacing. Therapeutic hypothermia and percutaneous coronary interventions (PCIs) should be provided when indicated.[14]

A multidisciplinary approach of care, with hemodynamic, respiratory, and neurologic support has been shown to improve survival to hospital discharge. Oxygen saturation of 100% may correspond to a PaO2 between 80 and 500 mm Hg. Since there is evidence that hyperoxia could potentially have adverse effects after ROSC, it is reasonable to titrate inspired oxygen to maintain a saturation of ≥94% but <100%.[15]

ACUTE CORONARY SYNDROMES (ACS)

The primary goals of therapy for patients with acute coronary syndromes (ACS) target on strategies that reduce the amount of myocardial necrosis, prevent major adverse cardiac events and emphasize the need for urgent revascularization. Key element in successful outcome of ACS patients are educational programs for recognition of ACS symptoms, development of emergency medical services (EMS) protocols for out-of-hospital interventions, and programs for intra-facility and inter-facility transport once ACS interventional care is needed. The use of out of- hospital 12-lead ECG can reduce the time to primary PCI when interventional therapy is the appropriate strategy, by early activation of the cardiac care team, including the cardiac catheterization laboratory.[16]

ETHICAL ISSUES

Termination of resuscitation efforts may be considered when there is not witnessed arrest, no bystander CPR provided, no ROSC after ALS care in the field and no shocks delivered. Implementation of these recommendations could reduce the rate of unnecessary hospital transports, decrease high cost EMS personnel involvement in futile resuscitation efforts. [17] Absence of pupillary response to light, motor response to pain and bilateral absence of cortical response to median nerve somatosensory evoked potentials, 72 hours post arrest, is associated with poor outcome. The reliability of serum biomarkers as prognostic indicators is limited.[18]

EDUCATION, IMPLEMENTATION, AND TEAMS

Periodic assessment of rescuer knowledge and skills is needed. Lay rescuers should be educated to overcome barriers to perform CPR. Compression-only CPR should be taught to those unwilling or unable to provide mouth to mouth ventilation.[4,5]

Emergency medical services dispatchers should instruct bystanders how to recognize victims of cardiac arrest and encourage them to provide conventional or compression-only CPR, if they are untrained.[2] Video presentations are equally effective educational tools.[19] Courses should include training in teamwork and leadership skills. ALS courses should include debriefing to review performance in the clinical setting in order to improve subsequent actions.

CONCLUSION

CPR is vital in the management of the cardiac arrest patient. Guidelines have helped to standardize teaching and improve implementation of resuscitation. [20] CPR quality must be number one priority. Cardiac arrest victims benefit from an holistic care by an organized team and require excellent post–cardiac arrest care by a multi-disciplinary approach. Education and frequent retraining improves performance. Ongoing research is still needed since favorable outcome post cardiac arrest still remains at disappointing low levels.

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