CPR 1986

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The fields of cardiopulmonary resuscitation (CPR) and emergency cardiac care (ECC), like other fields of medicine, are constantly changing. This is a result of continuing research and experience through which new ideas and better techniques aimed at improving survival and neurologic outcome following cardiopulmonary arrest are developed. The first national conference on CPR was held in 1966 and was sponsored by the National Academy of Sciences – National Research Council (NAS–NRC). At that time it was recommended that all medical and allied health personnel be trained in the techniques of mouth-to-mouth resuscitation and external chest compression.[1]

At a second conference, held in 1973 and sponsored by the NAS–NRC and the American Heart Association (AHA), the recommendation for training in CPR was extended to include the general public. In addition, at that conference an attempt was made to standardize the techniques of both Basic Life Support (mouth-to-mouth breathing, external chest compression) and Advanced Life Support (drugs, defibrillation, definitive care), and these standards were published in 1974.[2] Because it was recognized that new information might necessitate changes in some of the standardized methods it was decided that conferences should be held every six years to update the standards.

At the National Conference in 1979 it was recognized that overly rigid standards, particularly in the area of Advanced Cardiac Life Support (ACLS) could impinge upon the physician's prerogative for discretionary action. Accordingly, the publication resulting from that conference was entitled "Standards and Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiac Care (ECC)."[3] The standards and guidelines were intended, among other things, "To indicate that the body of knowledge and the skills recommended or defined do not represent the only medically or legally acceptable approach to a designated problem but an approach ... regarded as having the best likelihood of success in view of present knowledge."[3]

In July, 1985, the fourth National Conference was convened to make recommendations for changes in the standards and guidelines based on clinical and scientific data accumulated since 1979. In some subject areas sound scientific data had been accumulated, and changes in recommendations could be made on that basis. In other areas, while experimental data were not conclusive, recommendations were altered on the basis of clinical evidence or in order to simplify the material and thereby, hopefully, to improve retention of the information. Changes to be discussed are in the areas of Basic Life Support (BLS), Advanced Cardiac Life Support for adults, and Advanced Pediatric Life Support.

Basic life support

Two-rescuer CPR is seldom, if ever, used by lay rescuers since when help is summoned it usually arrives in the form of emergency medical service (EMS) personnel who then relieve the lay rescuer. Teaching one- and two-rescuer CPR to the lay public thus introduces information and techniques which are not useful and may detract from the primary message: i.e., prevention of heart disease, early warning signs of a heart attack, how to get the victim into the EMS system, and finally, how to properly perform one-rescuer CPR if needed until EMS personnel arrive. For these reasons it is recommended that only one-rescuer CPR be taught to the lay public.

Proper assessment of the victim's status prior to the actual performance of CPR. The recommended sequence for BLS for adults is:

1 Determine unresponsiveness.
2 Call for help.
3 Position the victim.
4 Open the airway using the head tilt/chin lift manoeuvre.
5 Determine presence or absence of breathing.

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6 If spontaneous breathing is absent, begin rescue breathing by giving *two* slow breaths (allow 1–1.5 sec per breath).
7 Determine presence or absence of pulse in carotid artery.
8 Activate the EMS system.
9 If pulse is absent, begin external chest compression at a *rate of 80 to 100/min*, using a compression: relaxation ratio of 50:50. Perform four cycles of 15 compressions and two ventilations. At the end of four cycles reevaluate the patient for possible return of pulse and breathing.

During two-rescuer CPR, external chest compressions are performed at a *rate of 80–100/min* and the compression: ventilation ratio is 5:1, with the rescuer performing compressions *pausing at the end of each fifth compression to allow for ventilation*. The rescuer performing ventilations may elect to use the technique of mouth-to-mask ventilation in place of mouth-to-mouth. For this purpose clear plastic masks are available which contain one-way valves that divert the victim's exhaled air away from the rescuer.

None of the newer methods of CPR, such as interposed abdominal compression (IAC-CPR),[4] continuous abdominal binding,[5] "MAST" – augmented CPR,[6] and simultaneous compression – ventilation CPR (SCV-CPR),[7] which were introduced in the hope of improving blood flow during CPR, have been shown to improve survival. For this reason, at this time they are not being recommended.

Early defibrillation has been demonstrated to be the key factor in determining the success rate of attempted defibrillation, and defibrillation by emergency medical technicians who have been trained in BLS and in the recognition and management of ventricular fibrillation has been shown to improve survival in out-of-hospital arrests that occur in rural areas which do not have paramedics with ACLS training.[8] The recommendation from the 1985 conference was that the concept of prehospital defibrillation by emergency medical technicians (EMT-D) should be implemented and that strict medical control must be maintained over these programs.

It is recommended that the Heimlich manoeuvre (subdiaphragmatic abdominal thrust)[9] be taught as the single technique for relieving upper airway obstruction caused by a foreign body. The manoeuvre is as effective and safe as any other single method, and it is hoped that student retention will be increased if only one manoeuvre is taught. Because of concern for potential injury to intraabdominal organs resulting from the use of the Heimlich manoeuvre in infants less than one year of age, the combination of back blows and chest thrusts continues to be recommended for the treatment of foreign body airway obstruction in this age group.[3]

The sequence for performing BLS in the infant (less than one year) or child (one to eight years) is the same as that for the adult (greater than eight years). It is important to remember that cardiac arrest in the paediatric age group is rarely of cardiac origin, being more commonly the result of hypoxia due to respiratory insufficiency or arrest. Thus it is not surprising that the outcome from CPR in children who have suffered a cardiac arrest is poor, while that asociated with resuscitation from pure respiratory arrest is much better.[10]

Because recent evidence[11] indicates that the heart of the infant is lower in relation to the external chest landmarks than previously thought, the recommendation for hand placement for external chest compression is now lower than it has been in previous standards. External chest compressions should be performed using two fingers, with the most cephalad of the rescuer's fingers being placed one finger-breadth below the intermammary line.

Advanced cardiac life support for adults

Airway and circulatory adjuncts

Because of the difficulties encountered by most health professionals and paraprofessionals in providing adequate oxygenation and ventilation using a bag-valve-mask (BVM) device, it was the recommendation of the 1985 Conference that the use of this system by other than anaesthesia personnel be de-emphasized. The technique of mouth-to-mask ventilation with supplemental oxygen until such time as an individual skilled in the technique of endotracheal intubation is available was felt to be preferable. The esophageal obturator airway (EOA) and esophageal gastric tube airway (EGTA) present the rescuer with one of the major problems encountered with the BVM, that of poor mask fit. A number of studies[12,13] have demonstrated that

ventilation and oxygenation obtainable with an esophageal airway are inferior to these when an endotracheal tube is in place. The esophageal airways should be considered alternates to endotracheal intubation, to be used only when endotracheal intubation is not possible. Medical and paramedical personnel who are to be responsible for airway management should not be limited to the use of esophageal airways but should be trained to perform endotracheal intubation as well.

A significant delay in the arrival of drugs at the heart when peripheral intravenous sites are used for injection during CPR has been demonstrated.[14] For this reason current recommendations are that peripheral cannulation should be attempted first since it is an easier technique to learn, results in fewer complications, and does not necessitate interruptions of CPR. However, if adequate spontaneous circulation is not rapidly restored following initial drug administration via a peripheral line, a central venous line should be placed by an individual skilled in the technique.

Drug therapy

Lidocaine, and not bretylium, should be the first-line antiarrhythmic agent for ventricular ectopy. Bretylium has been found to be no better than lidocaine for treating ventricular fibrillation and tachycardia,[15] but it produces more frequent and serious side-effects.

The use of $NaHCO_3$ and calcium preparations is being relatively de-emphasized in the most recent standards and guidelines. There is little data to show that the use of these agents improves outcome following cardiac arrest,[16,17] and both may produce undesirable side-effects.[18,19]

Defibrillation

The most important factor in survival from ventricular fibrillation is the rapid delivery of defibrillation. Thus defibrillation should be attempted as soon as the diagnosis of ventricular fibrillation is made and a defibrillator is available. The energy level for the first attempt in an adult is approximately 200 joules and for the second attempt 200 to 300 joules. Should the first two attempts fail to defibrillate a third shock of not more than 360 joules should be immediately delivered. This constitutes a change from previous guidelines in which a pause between the second and third attempts for drug administration was recommended, and reflects the increasing evidence indicating the importance of rapid delivery of defibrillation to survival.

Cerebral resuscitation

Measures for cerebral resuscitation should be aimed at optimizing cerebral perfusion and minimizing cellular damage. Autoregulation of cerebral blood flow (CBF) is compromised by hypoxemia and hypercarbia, and flow becomes passively dependent on cerebral perfusion pressure (CPP). Following cardiac arrest, after a brief period of hyperemia, CBF is reduced,[20] even when CPP is normal. Any reduction in systemic mean arterial pressure (MAP) or elevation in intracranial pressure (ICP) may decrease CPP and compromise CBF even further. Thus therapy must be directed at maintaining MAP at a normal or slightly elevated level and preventing increases in ICP. In addition, conditions which increase the oxygen requirements of the brain, such as seizure activity and elevated body temperature, must be avoided.

A great deal of exciting research is underway in the area of cerebral preservation. However, at this time no method of treatment has been proven sufficiently to warrant its routine use in patients who have undergone cardiac arrest and cardiopulmonary resuscitation.

Paediatric and neonatal advanced life support

Because of differences between adult and paediatric resuscitation including the causes of cardiac arrest, resuscitation techniques, and dosages for drugs and defibrillation, as well as the recognition that expertise in paediatric and/or neonatal resuscitation is necessary for some but not all medical personnel, advanced Paediatric Life Support and Neonatal Advanced Life Support are being developed as free-standing courses separate from Advanced Cardiac Life Support.

A vascular access route that has been added to those currently recommended for paediatric patients is the intraosseous route. The absorption of catecholamines is rapid when these agents are administered via this route,[21] but its efficacy during CPR has not been examined.

The most common arrhythmias causing cardiac arrest in the paediatric patient are bradyarrhythmias

and asystole.[22] Thus defibrillation is required much less commonly than is true for the adult victim of cardiac arrest; the initial energy dose is 2 joules·kg^{-1}.[23] If this is unsuccessful, the dose is doubled and repeated twice if needed. If ventricular fibrillation does not convert following three attempts, drug therapy should be instituted prior to subsequent attempts.

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