In August 2000, the Emergency Cardiovascular Care Committee of the American Heart Association (AHA) published new guidelines (Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care) for advanced cardiac life support. The developmental approach used to draft the new guidelines incorporated two significant changes. First, as has been a recent trend in all areas of medicine, the AHA moved to make the new guidelines evidence-based. As such, the recommendations were formulated only after a critical review of resuscitation literature available at the time of publication. The second major change was that the AHA did not make these recommendations alone, but in conjunction with the International Liaison Committee on Resuscitation.

Included in these recommendations were some changes in pediatric advanced life support (PALS). Although most of the guidelines regarding PALS were not changed, the few that were are important. In this article, we will discuss the significant changes regarding PALS included in these guidelines.

**Medications**

**Vasopressin**

Two new medications were introduced for consideration in the 2000 Guidelines. The first is vasopressin, an endogenous hormone. Supraphysiologic doses of vasopressin result in potent systemic vasoconstriction, as occurs with epinephrine. Further, use of vasopressin results in increased blood flow to the brain and heart during cardiopulmonary resuscitation. In contrast to epinephrine, however, vasopressin does not produce such concomitant adverse effects on the heart as ischemia, increased irritability, and the paradoxical increased propensity for ventricular fibrillation.

Despite reasonable evidence for vasopressin’s use in adults, the medication’s efficacy in children is in question. This is due in part to a study that revealed vasopressin to be less effective than epinephrine in a pediatric porcine model. As children are often catecholamine-depleted at the time of cardiac arrest and vasopressin’s mechanism of action causes a release of catecholamines, vasopressin is considered less effective than epinephrine. Moreover, epinephrine provides the additional benefits of exerting positive chronotropic effects and restoring electrical activity in an asystolic heart.

In summary, changes in PALS included in the 2000 Guidelines do not include vasopressin for the resuscitation of pediatric patients.

**Amiodarone**

Another new drug that was introduced for consideration in the 2000 Guidelines is amiodarone. This complex medication functions as an antiarrhythmic agent via multiple interactions in sodium, potassium, and calcium channels. Additionally, it has both α- and β-adrenergic antagonist effects. The 2002 Guidelines recommend that amiodarone be regarded as the primary drug in ventricular fibrillation and ventricular tachycardia, as the medication is extremely useful for both atrial and ventricular dysrhythmias. In addition, amiodarone is relatively distinct in utility in the abnormal heart (eg, congestive heart failure, Wolff-Parkinson-White syndrome).

Dosing for amiodarone is 5 mg/kg over 20 minutes to 1 hour and can be repeated as necessary. The maximum dose is 15 mg/kg per 24 hours. Infusions of amiodarone, though used in adults, should not be used as a continuous infusion in pediatric patients, as the drug leeches chemicals from intravenous tubing that can be harmful to children.

**Epinephrine**

Although epinephrine remains the primary drug for treating patients for cardiopulmonary arrest, escalating doses are deemphasized in the new guidelines. Although high-dose epinephrine may be effective in restoring spontaneous circulation, high doses of the medication have not been shown to improve outcomes in cardiopulmonary arrest. Additionally, results of a randomized, blinded trial of high-dose epinephrine versus standard-dose epinephrine in a swine model of pediatric asphyxial cardiac arrest suggest that neurologic outcomes were worse for those who received high-dose epinephrine. Consequently, routine use of high doses is discouraged. Regardless, high-dose epinephrine can still be considered for patients with refractory arrest.
**Vascular Access Guideline Changes**

Indications for the placement of intraosseous needles in pediatric patients have been expanded in the new guidelines. Previous guidelines recommended intraosseous access in children who are 6 years and younger after either 90 seconds or 3 attempts at peripheral intravenous access. In contrast, according to the 2000 Guidelines, it is now acceptable to attempt intraosseous needle placement in any child for whom vascular access is critically necessary. However, this recommendation should be tempered by the consideration that as children age and their bones become progressively more calcified, intraosseous needle placement may become significantly more difficult.

**Airway Management Guideline Changes**

In the United States, failure to maintain the airway is the leading cause of preventable death in children. Reason dictates, therefore, that airway issues should continue to be an area of focus for PALS recommendations included in all guidelines. In this regard, the 2000 Guidelines are no exception.

As a recent study identified a lack of proficiency in advanced airway techniques even by relatively experienced personnel, the focus of the new guidelines related to PALS is on basic airway techniques. For example, the guidelines emphasize bag-valve-mask ventilation because it has been shown to be highly effective and safer than multiple endotracheal intubation attempts.

Another recommendation included in the 2000 Guidelines, consistent with the emphasis on basic airway techniques, is implementation of the laryngeal mask airway (LMA) device. Although this device has been used for decades by anesthesiologists for the ventilation of patients undergoing surgical procedures, its use has only recently been supported in resuscitation recommendations.

Benefits associated with implementation of the LMA device include ease of placement and large range of sizes available for infants up to large adults. Disadvantages most often cited are the device’s inability to prevent aspiration and inability to serve as a route for administering medication. Regardless, placement of the LMA device has been shown to be a simple and safe alternative when endotracheal intubation is unsuccessful.

Another addition to the 2000 Guidelines regarding PALS specific to airway management is the suggestion for secondary confirmation of tracheal tube placement. Use of end-tidal carbon dioxide monitors or colorimetric devices for secondary confirmation of tube placement is a new priority.

**Automated External Defibrillator Guidelines**

More than 85% of cardiac arrests in pediatric patients involve asystole, or pulseless electric activity. Recent studies, however, show that when ventricular fibrillation is present, patients respond promptly to effective defibrillation; therefore, the AHA is recommending that automated external defibrillators be used in children with sudden collapse or presumed cardiac arrest who are older than 8 years, or who weigh more than 25 kg or are 50 inches long. As the electric energy delivered by a defibrillator is a fixed amount (range, 150 to 200) and has been shown to be safe only for children with the above characteristics, no recommendation has been made for its use in younger, presumably smaller children. However, with the increased incidence of ventricular fibrillation in children who are 8 years of age and older, the new recommendation for the use of automated external defibrillators appears to be well-reasoned.

**PALS Textbook**

Perhaps the most impressive change in the 2000 Guidelines related to PALS comes in the form of a new textbook. Improvements that include teaching chapters on toxicology, sedation, rapid sequence intubation, and coping with death and dying make this edition cohesive and dense with useful information. Additionally, each chapter has been expanded to include case studies and review questions, which allow for self-assessment. Finally, important concepts are highlighted in color and recent changes are encased in boxes, facilitating a quick scan for updated materials.

**Summary**

Most of the 2000 Guidelines related to PALS remain unchanged. The changes that were made are based on a review of the literature and were made to simplify the overall management of the critically ill child. Despite these changes, the primary goals of PALS—early recognition of respiratory failure and shock and prevention of cardiopulmonary arrest—remain unchanged.

**References**