The importance of basic life support in the pediatric age group

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ABSTRACT

Cardiorespiratory Arrest (CRP) is defined by the sudden interruption of ventricular mechanical activity and breathing. In adults, CRP often has a cardiac etiology. However, in children, CRP is usually secondary to respiratory failure and shock. Despite advances, CRP in the pediatric age group is still associated with high lethality and neurological disorders. In order to reduce mortality and poor prognosis in children, it is essential to recognize an early stop and already start the Basic Life Support (BLS) that has particularities in relation to the age group, such as infant, child and adolescent.

Keywords: Pediatric cardiac arrest, Pediatric survival, Bronchoaspiration, Cardiopulmonary massage.

1 INTRODUCTION

Cardiorespiratory Arrest (CRP) is characterized by being a sudden interruption of useful ventricular mechanical activity and breathing, being considered one of the cardiovascular emergencies of great prevalence in the adult population. The most relevant determining factor for the survival of a patient in CRP is the presence of an individual, who can be a layman, as long as he is well educated and able to recognize CRP quickly, to perform cardiopulmonary resuscitation maneuvers (CPR).[1, 2]

In adults, CRP often has cardiac etiology, however, it is important to emphasize that in the pediatric age group, CRP is commonly secondary to respiratory failure and shock, whose causes are multiple and of different etiopathogenesis, such as: infections, trauma, asthma, intoxications, sudden

infant death syndrome and submersion accidents. Thus, primary CRP of cardiac cause is a rare event in children, and corresponds to between 5 and 15% of prehospital pediatric CRP.3, 4

Importantly, more than 20,000 babies and children have CRP every year in the United States. Out-of-hospital CRP rates remain deficient, particularly in infants, even with increased survival and good neurological outcomes in pediatrics in in-hospital CRP. Despite advances in CPR, only 17% of adults and 27% of children survive hospital discharge after CRP.[5]

The most prevalent etiology of arrest and subsequent death in infants is closely related to neonatal problems, such as prematurity and its complications, malformations and airway obstruction. In older children, the most prevalent etiology is related to traumas, especially automobile injuries and unprotected physical practices.[5]

Pediatric care includes several particularities depending on the age group of the child, so it is essential to have knowledge about them for better care and management in the emergency. Therefore, infants under 1 year of age are considered infants, excluding newborns (NB). Children are those who are older than 1 year and do not show signs of puberty, such as the appearance of breast bud in girls and the appearance of pubic and axillary hair in boys. Adolescents, on the other hand, show signs of puberty and certain recommendations are similar to those of adults.[2, 3]

Regarding the epidemiology of CRP in the pediatric age group, several literatures agree that pre-hospital arrest has a survival rate three times lower than in-hospital arrest, in addition to presenting a worse neurological prognosis, due to the delayed recognition and treatment. Higher survival seems to be related to age progression, shockable rhythm, use of the automatic external defibrillator (AED) and early and high-quality basic life support (BLS). In addition, it is essential to report that most CRP in children occurs in children under 1 year of age (44-64%).[5]

Regarding survival in pediatric patients of traumatic etiology, a low value can be observed, in addition to a worse neurological prognosis. Unlike drowning, survival is higher at 22.7%. Non-shockable rhythms are the most prevalent in pediatrics, asystole and pulseless electrical activity (SPA) have been identified and are related to worse survival when compared to shockable rhythms.[5]

In this perspective, after the data exposed above, it can be concluded that CRP in the pediatric age group constitutes an important emergency situation, of high lethality and poor prognosis, therefore, it becomes a very relevant subject for discussion and dissemination, which will be carried out in the Portfolio in question.

2 ETIOLOGY OF CRP

In pediatrics, as noted earlier, CRP is rarely sudden, and is typically the end result of deteriorating respiratory function or shock. The most frequent terminal rhythm is bradycardia with progression to electromechanical dissociation or asystole. In this sense, shockable rhythms, such as

pulseless ventricular tachycardia and ventricular fibrillation, have been described in 15% or less of pediatric patients who are victims of CRP, so only the most frequent causes of CRP in children will be detailed in this Portfolio.[2]

2.1 ACUTE RESPIRATORY FAILURE IN THE CHILD

Respiratory problems are considered recurrent causes of emergency care worldwide, and are one of the main causes of CRP in children, both at the hospital and pre-hospital levels. Most acute respiratory failure (ARI) emergencies, about 2/3 of cases, happen in the first year of life.[6]

AKI is defined as the inability of the respiratory system to obtain oxygen and eliminate carbon dioxide from cellular metabolism. As a result of AKI, hypoxemia, hypo/hypercapnia, or acid-base balance disorders may occur. Hypoxemia is characterized as a partial pressure of oxygen in arterial blood < 50 mmHg in newborns and < 60 mmHg in older children and hypercapnia as partial pressure of carbon dioxide > 45 mmHg at any age.[6]

It is worth noting that children have anatomical and physiological characteristics that predispose them to the development of ARF when affected by pathologies of the respiratory system. The first characteristic that can be observed is that infants have a larger tongue in relation to the oropharynx and a smaller mandible, when compared to adults, thus, the tongue fills a large part of the oral cavity of the infant, consequently, in situations that lead to loss of muscle tone and posterior displacement of the tongue, can cause obstruction of the upper airways in children.[6]

In addition, the airways in children are shorter and have a smaller diameter, in addition to having less developed respiratory muscles and higher respiratory rate, which corroborates to the greater susceptibility in children to develop respiratory effort.[6]

Regarding the clinical manifestations, the respiratory rate is often increased (tachypnea) and there may be associated increased respiratory effort that is manifested by flapping of the wing of the nose, intercostal drafting, use of accessory muscles, retraction of furcula and groaning.[6]

The decrease in respiratory rate (bradypnea) and the appearance of irregular breathing rhythm are warning signs for the deterioration of the clinical conditions of the child. Skin pallor and central cyanosis signal hypoxemia.[6]

Thus, the early recognition of AKI is essential, since the outcome after respiratory arrest has a better prognosis when compared to the outcome after cardiac arrest. Therefore, the earlier the signs of respiratory distress or respiratory failure are detected and the earlier the initiation of appropriate therapy, avoiding progression to cardiac arrest, the greater the chances of survival.[6]

2.2 SHOCK

Shock is defined as a complex medical emergency, with high mortality rates, often due to late diagnosis combined with inadequate therapy and insufficient knowledge. It is a clinical syndrome with varied etiology that presents metabolic and circulatory alterations of an evolutionary nature. Often, in children, this syndrome accompanies a picture of sepsis, promoting the systemic inflammatory response syndrome (SIRS), consequent to bacterial infection in the blood circulation and the immunological mechanisms of the child.[7, 8]

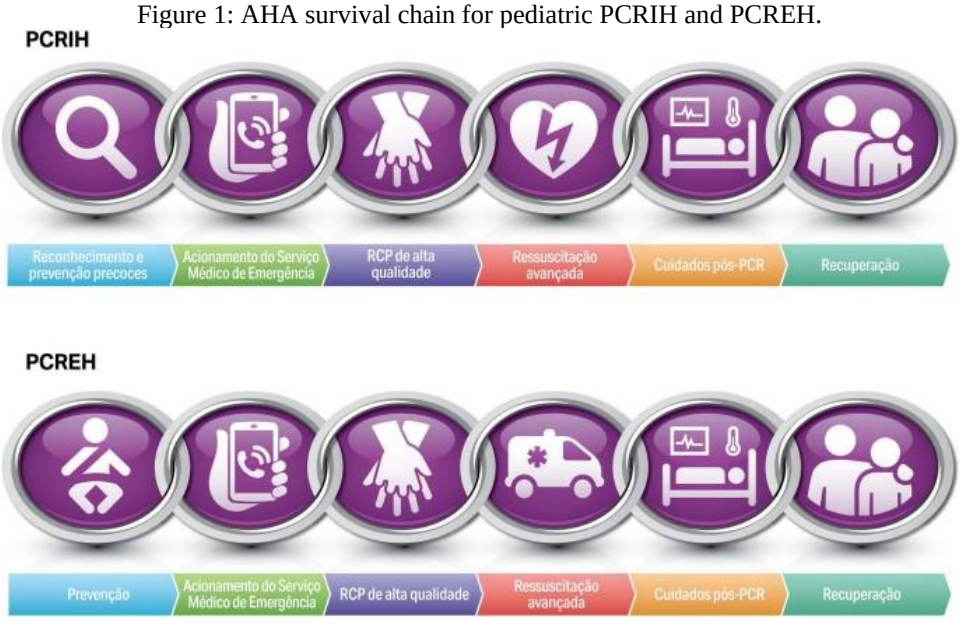
The clinical presentation of shock varies according to the type of shock, its initial cause, and the organic response. Severe findings are common to all types, however some findings may be suggestive of a particular type of shock, such as hypovolemic, cardiogenic, obstructive and distributive.[8]

The management of patients in shock requires admission to the intensive care unit (ICU). However, much emphasis has been placed lately so that the resuscitation of the patient is performed as early as possible, even before entering the ICU. Thus, the systematization of initial care in the emergency room with BLS is fundamental.[7]

3 PAEDIATRIC SURVIVAL CHAIN

The survival chain represents the set of sequenced procedures associated with a chain of five inseparable links that aim to increase the survival of the CRA victim. Broadly speaking, the five links in the pediatric survival chain represent the following steps, respectively: Prevention of CRP, high-quality early CPR by people present on site, rapid activation of the emergency service, advanced life support with rapid stabilization and transportation, and integrated care after CRP.[3]

Figure 1: AHA survival chain for pediatric PCRIH and PCREH.



Source: Brazilian Society of Pediatrics (SBP).

The goal of the BLS Guidelines in Pediatrics is to achieve a higher survival rate after CRP, with better quality of life for survivors. A weak link in the survival chain is sufficient to greatly decrease the chances of survival in cases of CRP, especially when they occur in the extra-hospital environment.[3]

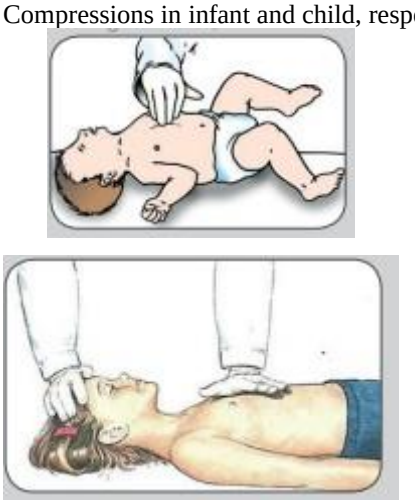
4 BASIC LIFE SUPPORT (BLS) IN PEDIATRICS

The diagnosis should be early and agile, and the evaluation of three parameters is considered fundamental for the recognition of a stopped victim: responsiveness, breathing and pulse. In the first analysis, it is essential that the rescuer evaluates the safety of the site to test the previous parameters. If the victim does not respond, does not breathe and has no pulse, it is indicative of PCR, and the emergency service should be triggered and the CPR maneuver should be initiated immediately.[2]

In 2010, the American Heart Association modified the resuscitation sequence in children on CRP to the mnemonic C-A-B-D. The letter "C" corresponds to compressions (30 compressions), "A" is the opening of the airways, "B" relates to good ventilation (two ventilations) and "D" to defibrillation, immediately as soon as available. This mnemonic should be used for care after PCR detection.[3]

The 2015 CPR guidelines recommend that chest compressions be performed with adequate frequency (100-120/min), with a depth of 4 to 6 cm in the anteroposterior region, more precisely in the sternum. It is important to allow the return of the chest between compressions, as well as to minimize interruptions, not exceeding more than 10 seconds and to avoid excessive ventilation. In infants the depth of chest compressions should be 4 cm, in children approximately 5 cm and in adolescents should not exceed 6 cm .[2, 3]

Figure 2: Compressions in infant and child, respectively.



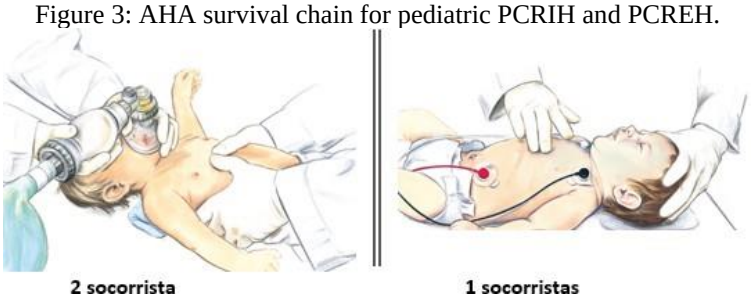
Source: BLS Protocol - Ministry of Health.

For the proper performance of the BLS, firstly, the safety of the site should be checked. If it is not safe, the rescuer must remove the victim to a safe location and start the Service. Responsiveness should be checked, in infants it is possible to hit the plantar region of one of the baby's feet for about three times. In children, one should call and touch the shoulders. If the victim does not respond, the emergency service should be activated.[1, 2, 3]

Check breathing and central pulse simultaneously (brachial in infants and carotid in children) for at least 5 and maximum of 10 seconds. The compression/ventilation ratio is as follows: 30 compressions and two ventilations with one rescuer or 15 compressions and two ventilations with two first responders.[3]

On the site and the technique of compression, in infants, draw an imaginary line between the nipples and place two fingers just below the nipple line. With two rescuers, wrap the chest and support the back with the fingers of both hands, using the thumbs side by side, to perform chest compressions in the lower third of the sternum, avoiding the xiphoid appendix. The thumbs can overlap in very small babies. In children, use one or two hands, in the lower third of the sternum, avoiding the xiphoid appendix.[9, 10]

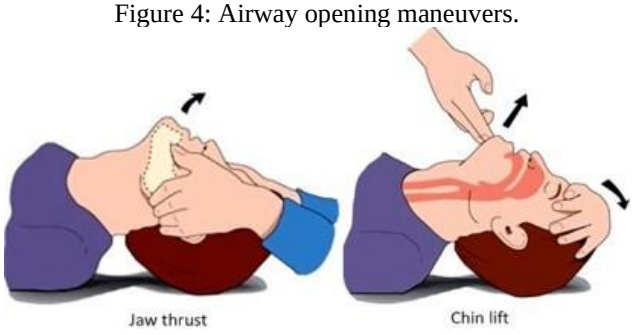
Figure 3: AHA survival chain for pediatric PCRIH and PCREH.



Source: SanarMed.

Regardless of the technique used to apply ventilations, the opening of the airway is necessary, which can be performed with the maneuver of head tilt and chin lift (Chin Lift) and, if trauma is suspected, the maneuver of elevation of the jaw angle (Jaw Thrust).[3]

Figure 4: Airway opening maneuvers.



Source: SanarMed.

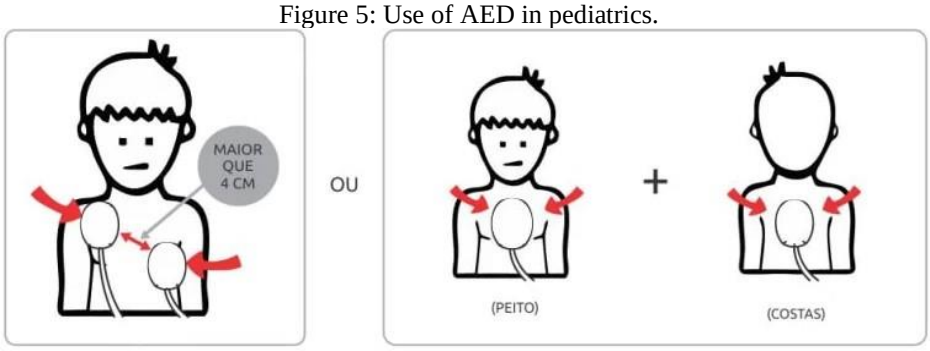
The AED is an equipment that works by means of self-adhesive electrodes that are fixed in the chest, in order to reverse the arrhythmia, so that there is no loss of cardiac and brain functions. The AED is available in both adult and child models.[9]

The children's model can be used in children from 4 to 25 kg. The fixed load is 250J, and its use with load attenuator is preferable in children under 8 years, including infants or under 25 kg. The attenuator reduces about 50-75 J. The DEA analyzes the rhythm and tells you if the shock is indicated or not.[10th]

Ventricular fibrillation and pulseless ventricular tachycardia are the shockable rhythms. If shock is indicated, it should be performed by following the safety steps. After shock, restart chest compressions immediately. If shock is not indicated, maintain high-quality CPR. It is critical that the AED is not withdrawn until it is replaced with other victim monitoring equipment.[9, 10]

In children, children's electrodes will be used in the same way and position as in adults. However, for younger children, in which the electrodes are less than 4cm away from each other, they should be positioned differently, with one electrode in the center of the chest, and the other on the back, also in the center.[3]

Figure 5: Use of AED in pediatrics.



Source: SanarMed.

5 FOREIGN BODY AIRWAY OBSTRUCTION

Foreign body aspiration (FBA) of the airway is defined as the obstruction of the airways as a result of accidental ingestion, inhalation, aspiration or reflux of objects or substances into the respiratory tract. It is considered the leading cause of accidental death at home in children under 6 years of age.[11th]

It is known that children have a high risk of choking and airway obstruction due to anatomical and physiological issues, since babies present immaturity of the sphincters, increasing the risk of reflux, in addition to having less developed respiratory muscles. Considering that hypoxia is one of the main causes of CRP in pediatrics, it is not possible to comment on BLS, therefore, without mentioning the maneuvers of airway clearance.[11th]

To clear the airways of babies (patient < 1 year of age), the guardian should sit down and with the index and middle finger (fingers in furcula), should hold the child's mouth open and position the baby in ventral decubitus on the forearm of the responsible, keeping the head lower than the body. It is important for parents to support the forearm on the thigh to have more firmness.[12th]

Subsequent to the above steps, repeated cycles of five strokes should be applied to the back (between the scapulas and with the heel of the hand), followed by five chest compressions just below the nipple line, until the object is expelled or the baby becomes unresponsive. Compressions should be approximately 4 cm deep.[11th]

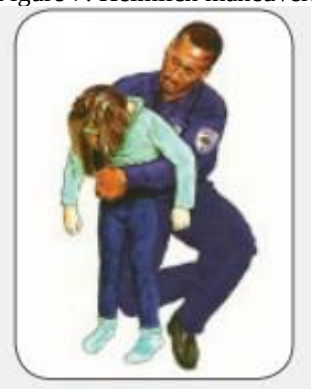
Figure 6: Clearance maneuvers in infants.

Source: BLS Protocol - Ministry of Health.

After all the above steps, it is important to pay attention to the baby. If you cry, vomit or cough is a sign that you have choked. Your color will return to normal. If the baby remains choking and conscious trying to breathe, it is recommended to repeat the steps again. However, if the baby becomes unconscious or unresponsive, parents should initiate CPR maneuvers.[12th]

In children over 1 year of age, the Heimlich maneuver is indicated. Thus, the person in charge should position himself behind the patient, and may be standing or kneeling, close one of the hands in a fist and position it on the patient's abdomen in the midline, above the navel, with the thumb facing the abdomen. With the other hand spread over the first, compress the abdomen in rapid movements, directed inward and upward (in J). Repeat the maneuver until the obstruction is cleared or the patient becomes unresponsive. After expulsion of the foreign body, perform the primary evaluation and offer oxygen by mask if necessary.[11, 12]

Figure 7: Heimlich maneuver.



Source: BLS Protocol - Ministry of Health.

6 SELF-REFLECTION

"The doctor who only knows medicine, nor medicine knows." It is essential to begin self-reflection with this phrase of the doctor and professor Portuguese Abel Salazar, because it faithfully illustrates all the teaching passed by Professor Alexandre Galvão during his classes that make up Medical Practice IV.

During medical school, students are often preoccupied with evaluative activities and close themselves behind books, often forgetting the affective and practical part of the profession. The material of the BLS workshop lit a light in the consciousness of the authors of this Portfolio about the importance of extra-hospital practical experience, and how both lay people and health professionals can make a big difference in the prognosis of the victim, when attended in a correct, humane and early way.

It is essential, therefore, to take all practical, theoretical and most important knowledge of all, the human and gentle side, of how to start a service and behave in front of a victim of PCR or other emergency situations passed by Professor Alexandre.

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