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Review Article

Advanced Life Support in Children. Best Practices 2021. Respect but Critical Reflection

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Abstract

Cardiopulmonary resuscitation (hereafter = CPR) is the flagship of intensive care medicine. Since 1990, every five years, major institutions of the American Heart Association or International Liaison Committee on Resuscitation (AHA or ILCOR) publish a current summaries and analyzes of various CPR data [1,2]. We follow the development of opinions and attitudes and procedures in CPR in children in the past, but especially in the period 2010 - 2020. There are certain opinions here, such as those: new approach in the care of newborns immediately after birth - Apgar score is obsolete, consideration of the benefit of adrenaline during CPR that differ from established resuscitation procedures. We are trying to express a clear position on them, which should help especially those who provide CPR in children outside of hospital.

Keywords: *CPR; Children; Care for the Newly Born - Transporting; Adrenaline*

History

Since biblical times, people have been trying to find a way to bring life back to a person whose heart suddenly stopped or suffocated and suffered from critical hypoxia. Only in the early 1960s in Pittsburgh (USA) P. Safar and co-workers publish lung to lung breathing to restore and maintain acceptable tissue oxygenation [3]. At the same time, in Baltimore (USA), W. Kouwenhoven comes up with an external cardiac massage - compression of the sternum of the chest, which is supposed to replace the currently insufficiently functioning heart. a shock applied to the chest can eliminate fatal arrhythmias. By combining these procedures, in case of insufficient heart activity, perfusion of vital organs or restoration of spontaneous heart activity is maintained.

This method is still used without major modifications and especially in children we can not to which they were added, D (drugs), E (EKG), F (fibrillation), G (grouping - sorting-what will be the next care?). There are opinions that this type of CPR is too complicated, especially for lay people providing CPR outside the hospital. These considerations were supported by the fact that of those who deserved CPR, barely 30% were resuscitated. Resuscitated outside the hospital are accepted to the ICU after the return of spontaneous circulation. However, only 6% of survivors are released home, some of whom have brain damage. addition, many rescuers abroad do not have a complete medical education, but only specialized courses. These are police officers, soldiers, firefighters, sports coaches, etc. They also gave rise to „complaints“ about the resuscitation of children. They tend to be uncertain how to proceed with regard to different age categories, especially with regard to the various devices and instruments and the procedures performed by them.

Hands only resuscitation [4]

At the end of the first decade of this century, several studies appeared with thousands of resuscitators, who were applied for the first few minutes of CPR combination of perfect external cardiac massage with defibrillation.

The airways were not cleaned. Adrenaline 0.01 mg/kg i.v.(intravenously) or bm-blood marrow is given as soon as possible. After 2 minutes of compressing the chest wall, external cardiac +++++++massage (hereinafter ECM), is the heart rhythm checked if it is suitable for electric defibrillation shock. The best is ventricular fibrillation. After defibrillation shock applied and the ECM continues. Only a few minutes after the onset of CPR (even more than 10 minutes) the airways are cleaned, artificial respiration is started, 2 artificial breaths are applied to 30 sternal compressions, without interrupting the massage.

So, from A, B, C C… A. B. Enthusiasm prevailed - in the eyes of the rescuers, the simplified procedure had, at first glance, better results than A, B, C. It was easier to teach and the number of people in the community who started CPR outside the hospital increased.

But at the end of 2015, however, the first reports appeared that the numbers of successfully with good results are not significantly better than A, B, C. And we categorically can declare: Do not use hands only resuscitation in children. The exception is a situation in children older 12 years, where is not possible to start lung to lung ventilation due to serious face injury. They say that: bad resuscitation best the non-resuscitation used in children.

Children versus adults in cardiac arrest and CPR

Another note on Hands only CPR. In the latest recommendations, this method of CPR gets into the position: better bad CPR than no CPR.

New guidelines from November 2020 [1] from the above, it is clear that a completely different procedure is needed at the onset of CPR. In adult arrest, defibrillation must be performed first. For children at the start of CPR, we first provide artificial respiration and ECM for the first 1 - 2 minutes, only during CPR, we call for help ourselves.

The new guidelines fully respect these facts

Recommendations for CPR in children - 2021

1) Heart rate determination is best on the screen (AED- defibrillator + monitor).
2) If “shock is able” is a defibrillation shock and EC M 100 - 130 per minute and 1 breath in 2 - 3 sec, i.e. 20 - 30 breaths without interruption of ECM. O_2 in the inhaled gas mixture according to the SpO_2 sensor and heart rate.
3) Entry into a vein or bone marrow (hereafter BM).
4) Apply adrenaline 0.01 mg/kg body weight (maximum 1 mg), as soon as possible after stopping and then repeatedly after 3 - 5 min (see part Adrenalin) iv or BM. When there is not iv or BM entry is possible to apply intratracheally - dose 0.1 mg/kg.
5) If the shock defibrillation fails, repeat in minutes - the first 2 J/kg, if repeated, double the amount of J.
6) Amiodarone (5 mg/kg can be administered twice more; the alternative drug is lidocaine 1 mg/kg.
7) Isoosmolar solutions 10 - 20 ml as a bolus iv together with catecholamines. After long CPR, when a shock state can be expected.

The family has the right to be present in CPR, but so as not to disturb health professionals. One member of the team should be with the family and provide information and prevent expressions of despair. After 30 minutes when comprehensive ALS has been provided

(intubation, vein, adrenaline, monitoring, defibrillation and crossbreeding do not show signs of life, 2 team members, definitely the team leader or the head physician of the workplace.

New recommendations for CPR in newborns - October 2015 [5]

We informed in detail about the new attitudes after birth in newborns - newly born.js in 2016 [2]. According to various sources, the planet has given birth to about 135 million children a year in recent years. 10% of them need help in adapting to the new environment, there is talk of transport. In neonates weighing > 2.49 kg, whose postpartum condition requires CPR to the extent that corresponds to advanced life support (heart massage, artificial respiration, adrenaline) is only 0.1 - 1.0% of newborns A decision on the level of care - transport assistance versus CPR - needs to be taken as soon as possible. Instead of the classic evaluation of asphyxia according to Apgar, which is old and the condition of the newborn is expressed by new classification [5] into one of 3 groups and it is still treated accordingly - from gentle skin tactile stimulation to tracheal intubation. Cardiac action is monitored and the frequency and rhythm of the heart, together with the first breaths, play a major role in further care. But for monitors, let's not forget that a beating umbilical cord means a frequency > 100/min. Regarding the application of oxygen, we will certainly not forget that a healthy newborn has a preductal SaO_2 of 80% at the end of 3 minutes after birth. A critical condition of a child through hard breathing and a heart rate > 100/min can be caused by a congenital defect (diaphragmatic hernia, transposition of large arteries, choanal atresia). Guidelines care for newly born 2015 in many places emphasize the literally vital importance of maintaining optimal body temperature, ie 36.5 - 37.5°C and state the means by which to maintain the child's temperature. An uncontrolled decrease in body temperature is thought to be associated with increased morbidity and mortality.

Who is really resuscitated?

In newborns from group 2 has been reported in 3 out of 10 children with delayed onset of respiration who are likely to be resuscitated, may induce spontaneous pulmonary ventilation within 60 seconds.

CPR is given to children from group 3. The airways are relaxed and their patency is maintained mainly by the correct, so-called neutral, position of the head. As for tracheal intubation, it is considered a special procedure requiring experience and training. Perfect breathing through a mask and bag is considered an acceptable equivalent.

Ventilation should begin with 5 breaths within 2 - 3 sec. Inflationary pressures are 20 - 30 cm H_2O (~ 2 - 2.9 kPa). This is followed by intermittent overpressure with a frequency of 30/min, so that the ratio of artificial breaths and sternal compression is 1: 3. Mature neonates are ventilated by air and if the O_2 fraction is added to the inhaled gas mixture, then a pulse oximeter and a capnograph are considered necessary for tracheal intubation. It is recommended to use a positive overpressure at the end of expiration up to 54 cm H_2O.

Medicine of choice in CPR newly of choice is adrenaline (hereinafter AD). It is given, preferably with a short cannula, into the umbilical vein. The first application occurs after about 3 minutes of previous external heart massage and artificial ventilation (mask-bag), when the heart rate does not rise even with increasing FiO_2. The dose is 0.01 mg/kg body weight for dosi. Usually, 1 mg = 1 ml to 10 ml of 0.9% NaCl is diluted for neonatal resuscitation, so 0.1 ml = 0.01 mg. The dose of 0.01 mg/kg can be repeated after 3 - 5 minutes of CPR and increased up to threefold to 0.03 mg/kg get that a beating umbilical cord means a frequency > 100/min. Regarding the application of oxygen, we will certainly not forget that a healthy newborn has at the end of 3 minutes after birth a preductal SaO_2 of 80%. A critical condition of a child through hard breathing and a heart rate > 100/min can be caused by a congenital defect (diaphragmatic hernia, transposition of large arteries, choanal atresia).

The end with the opinion of the authors [7] on the obsolescence of postpartum evaluation according to Apgar the proposal of a new method of evaluation, no reputable workplace agreed. Prof. Pařízek states that at his clinic in VFN and I.LF UK, Prague they use a wise newborn evaluation system: Immediately according to Apgar's score and in case of ambiguity and worse adaptation, determination of pH and pO_2 from the umbilical artery. So- nice lady, but V. Apgar is firmly above our newly born.

Adrenaline a little different [6]

In the last 2 years, studies have emerged that question the usefulness of adrenalin (hereafter A) during cardiopulmonary resuscitation (CPR). The main argument is that CPR has been slightly more successful with A than with placebo. The criterion for success is survival > 30 days from the date CPR was performed. Possible brain involvement of group „A" versus group „placebo" is also evaluated. In most studies, it was found that unwanted brain damage is statistically insignificantly more common in survivors who were given CPR A. Adrenalin there was a tendency to exclude A from CPR procedures, i when the differences in results were mostly statistically insignificant.

Studies in interpreting the results and defining the outcomes do not respect the fundamental pathophysiological axioms. Neither is autoregulation of the cerebral circulation mentioned once, and the results are not taken into account with regard to the key question: How many minutes after detecting circulatory arrest was A administered? At the same time, the study with the strongest warning of possible CNS damage after administration of A states that the mean time of application of A from the receipt of information on circulatory arrest was 21 minutes! Attention: The collection of as many resuscitated people as possible is an „out-of-hospital", where the time availability of advanced life support is, of course, an order of magnitude delayed against the situation of CPR in a medical facility.

Based on many years of experience with severe craniocerebral injuries in children and resuscitation car provided to them and a critical evaluation of published studies, we present: The brain has extraordinary protection from harmful blood pressure coke. In the range MAP 60-160 torr, the so-called brain self-regulation of circulation holds blood flow through the brain at the necessary level prevents both hypoperfusion and spilling". Adrenaline has an important role in maintaining this pressure range.

After circulatory arrest for 3 - 5 minutes, adrenaline can be used to maintain increased blood flow through the coronary artery and brain with generalized systemic vasoconstriction, while autoregulation is still partially preserved (systolic blood pressure at 60 torr). Beneficial effect, on the contrary - if a transient increase in systolic blood pressure is achieved, it leads to undesirable flooding of the CNS (undesirable flooding) and subsequent collapse of the microcirculation [8,9].

Conclusion for Clinical Practice

- Adrenaline should be applied during CPR as soon as possible after contact with the rescued person and remains an essential part of the ledge artis procedure in advanced life support.
- It should be considered whether to repeat the adrenaline again with refractory circulatory arrest and advanced life support lasting 10 minutes or more. An alternative could be to use vasopressin (terlipressin 1 mg/i.v. can be repeated).

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