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New cardiopulmonary resuscitation guidelines 2010: Managing the newly born in delivery room

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ABSTRACT

Most newborns are born vigorous and do not require neonatal resuscitation. However, about 10% of newborns require some type of resuscitative assistance at birth. Although the vast majority will require just assisted lung aeration, about 1% requires major interventions such as intubation, chest compressions, or medications.
Recently, new evidence has prompted modifications in the international cardiopulmonary resuscitation (CPR) guidelines for both neonatal, paediatric and adult patients. Perinatal and neonatal health care providers must be aware of these changes in order to provide the most appropriate and evidence-based emergency interventions for newborns in the delivery room.
The aim of this article is to provide an overview of the main recommended changes in neonatal resuscitation at birth, according to the publication of the international Liaison Committee on Resuscitation (ILCOR) in the CoSTR document (based on evidence of sciences) and the new 2010 guidelines released by the European Resuscitation Council (ERC), the American Heart Association (AHA), and the American Academy of Pediatrics (AAP).

1. Introduction

Neonatal resuscitation in the delivery room requires prompt intervention to avoid circulatory insufficiency and cerebral hypoperfusion. To restore cardiorespiratory function in the depressed neonate, standard treatment of care implies step-wise interventions, including initial stabilization and evaluation, bag-and-mask and/or endotracheal positive-pressure ventilation, administration of oxygen and, more rarely, chest compressions and use of drugs such as adrenaline. However, many recommendations that are related to neonatal resuscitation, and in particular, regarding the premature infant, are not generated from carefully controlled studies, but are often based on case series or even expert opinion.

In 1992, the International Liaison Committee on Resuscitation (ILCOR) was established, aiming to provide a forum for the main resuscitation organizations in the world, including the American Heart Association (AHA), American Academy of Pediatrics (AAP), and the European Resuscitation Council (ERC), among others. The creation of ILCOR established a unique opportunity for international collaboration in the development of guidelines and training programs on resuscitation over the past twenty years. One of the main objectives of ILCOR is to produce appropriate statements that reflect international consensus on resuscitation-specific issues, for subjects of any age. The new guidelines released in 2010 are based on the most recent International Consensus on CPR Science with Treatment Recommendations (CoSTR), which incorporated the results of systematic reviews of a wide range of topics relating to CPR, including the resuscitation of the newly born in the delivery room [1].

The aim of this article is to provide an overview of the main changes on neonatal resuscitation at birth, for term and preterm newly born infants, according to the new ILCOR 2010 recommendations on cardiopulmonary resuscitation.

2. Initial assessment and treatment

Term newly born infants, who are actively breathing and crying, have good muscle tone, and have clear amniotic fluid with no signs of meconium, require routine care. This includes drying and providing warmth. Of note, clearing the airways is rarely needed.

In newborns not requiring resuscitation, cord clamping should be delayed for at least 1 min from the complete delivery of the baby. Conversely, lack of evidence does preclude any recommendation about a time for clamping in infants who need resuscitation.

In compromised newly born infants, following the initial evaluation, progression to the next step is now defined by the simultaneous

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assessment of two vital characteristics, i.e. heart rate and respirations. Pulse oximetry should be used for evaluation of oxygenation because assessment of colour is often unreliable.

2.1. Temperature control

Thermoregulation is important in resuscitation because neonatal hypothermia is associated with increased mortality in premature neonates. When very low-birth weight infants less than 28 weeks gestation were wrapped in polyethylene occlusive skin wrapping at birth, they had significantly higher NICU admission temperatures when compared to a control group that received usual care [2]. The use of exothermic mattresses was also found to be effective in reducing heat losses in newborns weighing less than 1500 g [3]. Thus, preterm babies less than 28 weeks gestation should be wrapped immediately after birth, up to their neck and without drying, and kept wrapped under radiant heat until their temperature has been verified in the NICU. For these infants delivery room temperature should be maintained at least at 26 °C.

2.2. Use of oxygen in resuscitation

While early guidelines recommended initial resuscitation be done with 100% oxygen for both term and preterm neonates, developing research suggests that resuscitation with room air may be as effective and less harmful than resuscitation with 100% oxygen [4]. Concerns exist regarding the potentially harmful effects of oxygen free radicals and changes in cerebral perfusion and respiratory physiology with 100% oxygen administration, but also about the dangers of oxygen deprivation during and after asphyxia. After examining the conflicting research, the International Liaison Committee on Resuscitation (ILCOR) recommends to begin with air rather than 100% oxygen in term infants receiving resuscitation at birth with positive pressure ventilation [1]. If despite effective ventilation there is no increase in heart rate or if oxygenation, best guided by pulse oximetry, remains unacceptable, a higher concentration of oxygen should be considered. Oxygen saturation during labour and just after birth is more or less 60% and will increase to $\pm$90% after 10 min.

In preterm babies of <32 weeks' gestation, in whom target saturations may not be easily reached in air, blended oxygen and air may be given judiciously, again ideally guided by pulse oximetry. Both hyperoxemia and hypoxemia should be avoided.

2.3. Devices for assisting ventilation

Positive pressure ventilation (PPV) is an extremely important and effective intervention that should be initiated if the infant is apneic or gasping or if the heart rate is less than 100 bpm after 30 s of administering the initial steps of resuscitation. Prompt improvement in heart rate is the best indicator of adequate ventilation. There are several devices available for delivering PPV, including self-inflating bag, flow inflating bag and T-piece resuscitator [5]. Like the other two types of devices for assisted ventilation, the T-piece can be connected to either a face mask or an endotracheal tube. The T-piece resuscitator is specifically used for neonatal resuscitation. Its pressure controls for peak inspiratory pressure (PIP), positive end expiratory pressure (PEEP), and maximum circuit pressure are set prior to its use. The provider occludes the PEEP valve to deliver the PIP to the baby. Instead of squeezing a bag, the provider intermittently occludes the PEEP cap to control the rate of respirations.

In mechanical models, target inflation pressures and long inspiratory times are achieved more consistently when using T-piece devices than when using bags, although the clinical implications are not clear. More training is required to provide an appropriate pressure using flow-inflating bags compared with self-inflating bags. Usually all self-inflating bags, flow-inflating bags and oral T-piece mechanical devices are designed to regulate pressure or limit pressure applied to the airway, and can be used to ventilate a newborn.

2.4. Clearing the airway of meconium

In births with meconium-stained amniotic fluid, suctioning of the oropharynx and nasopharynx before delivery of the shoulders is no longer recommended. In babies born through meconium-stained fluid, available evidence does not support or refute the routine endotracheal intubation and suctioning, even if they are depressed at birth and the current practice should not been changed.

2.5. Confirming endotracheal tube placement

Detection of exhaled carbon dioxide, in association with clinical assessment, e.g. increasing heart rate, is the most reliable method for confirming endotracheal tube placement in infants with spontaneous circulation [6,7].

Colorimetric exhaled CO_2 detectors are more effective than clinical assessments at revealing esophageal intubations and may also be useful in identifying airway obstruction during face-mask ventilation in preterm infants [8].

2.6. Chest compression during cardiopulmonary resuscitation

Chest compressions are indicated when the heart rate is less than 60 beats per minute despite adequate ventilation for 30 s. In the newly born infant who need chest compressions, available evidence does not support a change in the standard compression:ventilation ratio of 3:1. In fact, such ratio provides relatively more ventilations per minute, which could be appropriate in predominantly asphyxial cardiac arrest. However, if the arrest is clearly due to a cardiac etiology, a higher compression:ventilation rate (e.g. 15:2) may be considered [1]. Compressions should be delivered on the lower third of the sternum at a depth of one third of the anterior posterior diameter of the chest. There are two possible methods which can be employed: the two thumb-encircling hands and two finger method. The two thumb-circling hands method is recommended because it is less tiring and allows for better depth control.

2.7. Drugs administration and vascular access

In neonatal resuscitation efforts, the use of drugs is rarely indicated because the most important and effective step is establishing adequate ventilation. If emergency drugs are required, they can be given by three possible routes: venous (e.g. umbilical vein), endotracheal tube and intraosseous.

If the heart rate remains less than 60 beats per minute despite adequate assisted ventilation for 30 s and chest compression for an additional 30 s, then the administration of adrenaline may be considered, despite the lack of human neonatal data. Adrenaline must be administered at the dose of 0.01–0.03 mg/Kg, intravenously. A temporary intraosseous access, using the same adrenaline dose, may be useful if the venous access is not promptly available [9]. In the tracheal route is used, slightly higher doses are needed (0.05–0.1 mg/Kg) in order to achieve the same effect of the intravenous dose. Higher intravenous doses could be harmful and are not recommended.

2.8. Therapeutic hypothermia

The use of therapeutic hypothermia in term and near-term asphyxiated newborns has been recently supported by several studies, showing that both whole-body hypothermia and selective head-cooling may reduce the risk of death and disability in infants with moderate to-severe hypoxic-ischemic encephalopathy [10,11]. Therefore, ILCOR 2010 guidelines have determined that there is

sufficient evidence to recommend hypothermia as treatment for neonates with suspected asphyxia. Hypothermia should be induced following the protocols of the randomized clinical trial, i.e. lowering temperature to 33.5 °C to 34.5 °C within six hours of birth, continuing it for 72 h and then rewarming over at least four hours. Treated infants should be followed up on a long term basis.

2.9. Withholding or withdrawing resuscitation

As in earlier guidelines, healthcare providers may consider not initiating neonatal resuscitation when there are factors associated with almost certain infant death or unacceptable morbidity, or both. These include gestational age less than 23 weeks, birthweight less than 400 g, anencephaly, or confirmed trisomy 13 or trisomy 18 syndromes. When chances of survival are uncertain, the neonatal and obstetric care providers should meet with the family prior to delivery whenever possible. The parents must be included in the decision-making process regarding initiating or withholding resuscitation of their infant, particularly in situations when the prognosis is uncertain and morbidity rate is very high.

Studies have shown that infants without signs of life after 10 min of resuscitation have an increased mortality rate and risk of severe neurodevelopmental disability. Therefore, discontinuing continuous and adequate resuscitation after 10 min, if there are no signs of life, is justifiable. Differently, when heart rate is less than 60 beats per minute at birth, and does not respond to 10–15 min of adequate resuscitative efforts, the choice to suspend or continue the cardio-pulmonary support may be quite difficult, no clear evidence being available as yet.

3. Conclusions

About 10% of neonates require some resuscitation manoeuvres at birth. Prompt availability of well trained personnel skilled in neonatal resuscitation can result in a significant decline in neonatal morbidity and mortality. However, the science of resuscitation is rapidly evolving, as indicated in the recent 2010 ILCOR treatment recommendations. ILCOR initiatives include ongoing reviews of available evidence and publishing of interim advisory statements, which allow treatment guidelines to be updated in a timely manner. Healthcare professionals caring for newborns at birth should be kept informed about the advances in this field, implementing new treatments and adjusting local protocols according to the most recent evidence based information.

Conflict of interest statement

For this manuscript, the authors have no conflicts of interest.

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