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Update on Neonatal Resuscitation: The 2010 Guidelines

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Abstract

There have been major changes in the way that newborn infants are managed in the delivery room. The International Liaison Committee on Resuscitation guidelines incorporated much of the newly available evidence on the management of newborn infants and was last updated in 2010. The most important updates being; resuscitating term newborns with room air, use of blended oxygen for preterm infants, use of pulse-oximeter in the delivery room, to provide positive pressure ventilation with one of the three devices (self-inflating bag, flow inflating bag or T piece) when necessary. The updated guidelines also provide indications for use of intravenous epinephrine, which is the preferred route of administration, and recommend not to use sodium bicarbonate or naloxone during resuscitation. Other recommendations includethermal support to resuscitate preterm infants and use of therapeutic hypothermia for infants born at or more than 36 weeks' gestation with moderate to severe hypoxic-ischemic encephalopathy.

Keywords: Neonatal advanced life support; NALS 2010; Newborn resuscitation guidelines.

Introduction

With the growing evidence and the introduction of newer technologies in the field of neonatology, the science of neonatal resuscitation is constantly changing. The international liaison committee on resuscitation (ILCOR) reviewed the latest evidence on neonatal resuscitation with inputs from seven councils and committees including the European Resuscitation Council (ERC) and American Heart Association (AHA).The ILCOR committee brought up some major changes, which were recently published in the year2010.[1]The current review is an update of 2010 resuscitation guidelines [2]and summarizes the salient changes (Box 1). This would help in evidence based resuscitation of newborns in delivery room.

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Box 1: Salient features of resuscitation guidelines 2010 (AHA)

1. Adequate ventilation is the key to affective neonatal resuscitation.
2. Heart rate remains the most sensitive indicator for assessing the response to resuscitation. The most accurate way of assessing the heart rate is by auscultation of the precordium.
3. Colour is not recommended as a useful indicator of oxygenation or effectiveness of resuscitation
4. Pulse Oximetry provides objective assessment of oxygenation and effectiveness of resuscitation
5. The requirement of oxygen needs to be titrated according to the pulse oximeter reading.
6. Providing positive end-expiratory pressure (PEEP) during delivery room ventilation helps establishing functional residual capacity.
7. Term newborn resuscitation to be initiated with room air.
8. Cord clamping to be delayed for atleast 60 seconds for infants not requiring resuscitation.
9. Newborns (term and near term) with perinatal asphyxia of moderate to severe degree should be considered for therapeutic hypothermia.

Major changes in 2010 newborn resuscitation guidelines (American Heart Association)with evidence

Initial assessment and intervention

• Instead of four questions in 2005 recommendations, three questions need to be answered. Amniotic fluid clear or not removed from the initial assessment.

• Heart rate is the vital sign by which the need for and efficacy for resuscitation can be judged. Auscultation of the precordium is the standard for assessing the heart rate. Palpation of the

umbilical pulse can also be used to provide a rapid estimate of the pulse.

• Heart rate should be reassessed every 30 seconds in a neonate who requires resuscitation.

Evidence

Precordial auscultation is better than umbilical cord palpation for detection of heart rate (LOE2, LOE4). Even though amniotic fluid clear is not a part of assessment at birth, tracheal suction of non vigorous babies with meconium stained amniotic fluid (MSAF) still to be continued (part of clearing airway in initial steps).

Temperature management for preterm neonates

• It is recommended that the temperature in the delivery room be maintained at minimally 26°C.

• Immediately after birth, preterm neonates < 28 weeks old should be completely covered in a food- grade plastic wrap or bag up to their necks, without drying [3,4](Class-I, LOE-A).

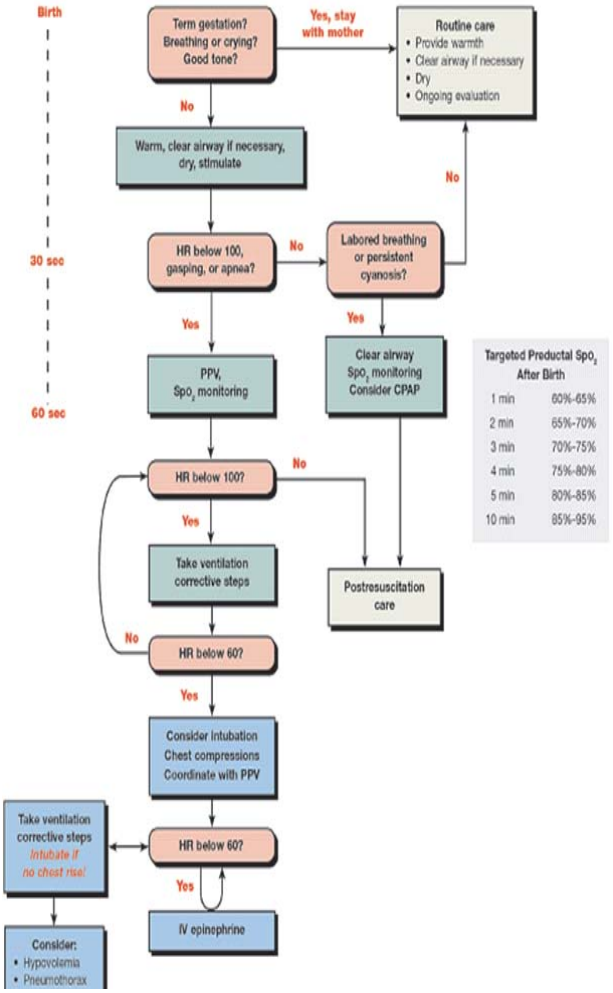
• All resuscitation procedures, including endotracheal intubation, chest compression, and insertion of intravenous lines, can be performed with newborn in plastic wrap in place.

• Newborn with no resuscitation needs should be placed in skin to skin contact with mother

Evidence

Preterm neonates have poor temperature control and are at risk of hypothermia. Randomised controlled trials have shown that placing the preterm neonate <28 weeks gestation in food-grade plastic wrap at birth without drying, significantly improves temperature on admission to the neonatal intensive care. The updated Cochrane review[5] on the temperature management in delivery room reported that plastic bags and wraps reduce heat loss in preterm infants but not mortality. "Plastic wraps or bags were effective

Figure1: Neonatal resuscitation algorithm[1]



Source: 2010: American Heart Association

in reducing heat losses in infants < 28 weeks' gestation (4 studies, n = 223; WMD 0.68 °C; 95% CI 0.45, 0.91), but not in infants between 28 to 31 week's gestation".Further resuscitation procedures are carried out with the neonate in wrap. Maintaining a delivery room temperature of at least 26°C in combination with the polyethylene wraps is most effective.

NALS 2010

"Additional warming techniques are recommended (eg, prewarming the delivery room to 26°C, covering the baby in plastic wrapping (food or medical grade, heat-resistant plastic) (Class I, LOE A), placing the baby on an exothermic mattress (Class IIb, LOE B), and placing the baby under radiant heat (Class IIb, LOE C)"[1]

Ventilation

• There is no difference between longer or shorter inflation breaths.

• Positive end expiratory pressure (PEEP) should be considered in preterm neonates who have respiratory distress at birth.

• As for ventilation devices, there is yet no clinical evidence that compares T-piece with flow-inflating bags or self-inflating bags

• A laryngeal mask should be considered during resuscitation if facemask ventilation is unsuccessful and tracheal intubation is unsuccessful or not feasible

Evidence

Establishing FRC in the non-breathing baby is a key requisite to effective ventilation.

Effective ventilation can be achievedwith either a flow-inflating or self-inflating bag or with a T-piece mechanical device designed to regulate pressure. Target inflation pressures and long inspiratory times are more consistently achieved in mechanical models when T-piece devices are used rather than bags, although the clinical implications of these findings are not clear (ClassIIb, LOEC)[6,7].

Laryngeal mask airways that fit over the laryngeal inlet have been shown to be effective for ventilating newborns weighing more than 2000 g or delivered >34 weeks gestation [8,9](Class IIb, LOEB).There are limited data on the use of these devices in small pre-term infants, <34 weeks.

Gaps in knowledge: The major gap in use of ventilation devices in neonatal resuscitation is that the inflation pressures willc hange as compliance improves following birth. But the relationship of pressures to delivered volume and the optimal volume to deliver with each breath as FRC is being established have not been studied. So the lung compliance needs to be addressedwhile resuscitation of newborn is being attempted.

Cord clamping

• The cord clamping should be delayed for one minute for neonates who do not require resuscitation(LOE 1)

• There is insufficient evidence to recommend an appropriate time for clamping of the cord in neonates who were severely compromised at birth.

Evidence

There has been an interest and controversy in the timing of cord clamping. This placental transfusion of 80 ml of blood at one minute after birth provides the newborn with 40–50 mg/kg of extra iron, and this helps to improve the iron status of the child in the first six months of life.

Cochrane update[10] on delayed cord clamping for uncomplicated preterm births has shown that neonates with delayed cord clamping 30 seconds to three minutes after delivery have been shown to have higher blood pressures during stabilisation, lower incidence of intraventricular haemorrhage and received fewer blood transfusions. A nonsignificant increase in hyperbilirubinemia needing phototherapy was also noted. Thus, in uncomplicated term and preterm births, there is a benefit in delaying the cord clamping for at least one minute. As for neonates who require resuscitation, there is currently insufficient evidence to support or refute a recommendation. For maternal risks, cochrane review of delayed cord clamping (>1 minute after birth or when cord pulsations have ceased) in uncomplicated term births did not demonstrate any increase in the risk of maternal haemorrhage.

Oxygenation

Air/oxygen for resuscitation

• For term neonates requiring resuscitation at birth with positive pressure ventilation, it is recommended to begin resuscitation with air as opposed to 100% oxygen.

• If despite effective ventilation, there is no increase inheart rate or oxygenation (preferably

guided by oximetry), the use of higher oxygen concentration should be considered until the recovery of a normal heart rate.

• For neonates < 32 weeks old, it is recommended that blended oxygen be given judiciously, guided by pulse oximetry. If blended oxygen is not available, resuscitation may be initiated using what is available

Evidence

Term neonates: Trials have revealed a short term as well as long term benefits of room air resuscitation. In short term neonates resuscitated with 100 % oxygen resulted in increased time to first breath and first cry, or both. In long term, results from cochrane update[11] revealed decrease in mortality in neonates resuscitated with room air. Another meta-analysis showed in addition to decrease in mortality,trend towards reduction in severe grades of HIE.[12]

Gaps

There are no studies in term infants comparing outcomes when resuscitations are initiated with different concentrations of oxygen other than 100% or room air.

Preterm Neonates

In preterm neonates < 32 weeks gestation, initial use of air or 100% oxygen is more likely to result in hypoxemia or hyperoxia, respectively, than when blended oxygen and titration to oxygen saturation are used. The newborn antioxidant capacity is overwhelmed, leading to oxidative stress and increasing damage to cell structures, enzymes, RNA, DNA and eventually, organ damage.

Till date few randomised trials[13–15]have looked into short term outcomes, in preterm neonates resuscitated with room air versus 100 % oxygen. These trials have compared the effect of resuscitation with low oxygen concentrations as compared with 90-100% oxygen concentration. The outcomes evaluated were short-term effects of different oxygen concentrations on SpO2 changes.One study also evaluated the effects on measures of oxidative stress. One studyreporteda decrease in the incidence of bronchopulmonary dysplasia in their low-inspired-oxygengroup this benefit was not reproducedintheotherprospectivetrials.

Gaps: None of these trials evaluated or was powered to look into important longer-term outcomes (neurodevelopment).

Assessment of oxygenation: Pulse oximetery

It is recommended that oximetry be used when resuscitation can be anticipated, when positive pressure is administered for more than a few breaths, when cyanosis is persistent, or when supplementary oxygen is administered (Class I,LOE B). There is some evidence that attaching the probe to the baby before connecting the probe to the instrument facilitates the most rapid acquisition of signal (Class IIb, LOE C).

Therapeutic hypothermia

• Term or near term neonates with moderate to severe HIE should be offered therapeutic hypothermia [33.5°C–34.5°C].

• This does not affect immediate resuscitation but is important for post-resuscitation care

Evidence

Multicenter randomised controlled trials[16–18] have shown that induced therapeutic hypothermia [33.5°C–34.5°C] within sixhours of birth in neonates born at > 36 weeks gestation with moderate to severe hypoxic-ischemic encephalopathy significantly reduces death and neuro-disability at 18-24 months. Therapeutic hypothermia can be provided as whole body or selective head cooling.

Meconium aspiration

• Intrapartumoropharyngeal suctioning of the neonate born through meconium-stained amniotic fluid is no longer recommended.

• For the non-vigorous neonate born through meconium, there is no change in the current

practice of direct oropharyngeal and tracheal suctioning

Evidence

Routine intrapartumoropharyngealsuction of neonates born through meconium-stained amniotic fluid (MSAF) before delivery of the shoulders does not prevent meconium aspiration syndrome[19]. In healthy neonates, suctioning of the nose and mouth is associated with cardiorespiratory complications. Thus, routine intrapartumoropharyngeal and nasopharyngeal suctioning of neonates born with clear or MSAF is no longer recommended. For the non vigorous neonate born through MSAF, there is currently no randomised trial comparing intubation and tracheal suctioning versus no tracheal suctioning. Hence, the current recommendation of endotracheal suctioning of depressed neonates born through MSAF should be followed.

Gaps

In the term non-vigorous infant delivered through MSAF does endotracheal suctioning as compared to no suctioning affect the outcome (short term or long term).

Volume expansion

• Early volume replacement with crystalloid for neonates who are not responding to resuscitation. Give a bolus of 10mls/kg initially. This may be repeated if response is achieved.

• Red blood cell transfusion is indicated for neonates with blood loss.

Evidence

• There is insufficient evidence to support the routine use of volume administration in the neonate with no blood loss who is refractory to ventilation, chest compression and epinephrine.

Drugs

• Adrenaline via the intravenous (IV) route is preferred. The dose of IV adrenaline used remains as 0.01–0.03 mg/kg.

• If the IV route is not available, ETT adrenaline may be considered at a dose of 0.05–0.1 mg/kg.

• In neonates/newborns, the concentration of adrenaline for both IV and endotracheal routes should be 1:10,000.

• Administration of naloxone is not recommended as part of initial resuscitative efforts in the delivery room for newborns with respiratory depression. Heart rate and oxygenation should be restored by supporting ventilation.

• No role of soda bicarbonate in newborn resuscitation.

Evidence

For the IV route, there is no evidence to suggest that a higher dose is better. A few case reports suggest that a higher dose of adrenaline should be used if administered through the ETT. None of the studies[20,21]on use of soda bicarbonate in neonatal resuscitation has proved to be useful.

Discontinuation of resuscitation

If there is no return of heart rate after ten minutes of adequate resuscitation, it is acceptable to discontinue resuscitation.

Evidence

If there is no return of heart rate after ten minutes, evidence suggests that the newly born is likely to suffer from severe neurological impairment or death.

Withholding/non-initiation of resuscitation

• There is no change in guidelines for with holding resuscitation

• This includes the following: extreme prematurity (gestational age < 23 weeks and/ or birth weight < 400 g) and anomalies such as anencephaly or confirmed trisomy 13.

Conclusion

Resuscitation in the newborn continues to evolve as new studies and observations throw light on how the science of resuscitation can be applied better for intact survival of newborn. Resuscitation guidelines are not uniformly followed in tertiary care NICUs. Major factor for this non uniformity is lack of scientific evidence. Hence, more research needs to be done to order to obtain a clearer understanding of how to enhance resuscitation in this vulnerable neonatal population. More direct clinical research needs to be done to fine-tune resuscitation to meet the acute resuscitative needs of the newborn.

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