

Updated Neonatal Resuscitation Guidelines 2015 – Major Changes

SATVIK C BANSAL AND #SOMASHEKHAR M NIMBALKAR

From Department of Pediatrics, Pramukhswami Medical College, and#Central Research Services, Charutar Arogya Mandal; Karamsad, Gujarat, India.

Correspondence to: Dr. Somashekar Nimbalkar, Professor, Department of Pediatrics, Pramukhswami Medical College, Karamsad, Anand, Gujarat 388 325, India. somu_somu@yahoo.com

The latest guidelines on neonatal resuscitation from American Heart Association (AHA) [1] and European Resuscitation Council (ERC) [2] were released in October 2015. There have been slight variations between these guidelines; although they use nearly identical literature for evidence evaluation. We present here the major changes in the recent guidelines [3,4], and comparison between the ERC and AHA guidelines of 2015. The major changes are detailed in **Table I**. Some of the major recommendations of previous AHA guidelines are continued without reviews and are elaborated in **Table II**. The major recommendations are summarized in **Box 1**.

IMPLICATIONS FOR RESOURCE-LIMITED SETTINGS

With the emergence of scientific evidence from developing countries, these studies from resource-limited countries are forming the basis of major changes in clinical practice guidelines. Also, specific and separate recommendations are being made for resource-limited settings, as many of the standard recommendations may not be feasible in these settings.

We discuss some of the points below to put things into perspective:

- Therapeutic hypothermia has been recommended in resource-limited setups. The cost is still forbidding for those in need as well as the availability of centers that can provide it. Newer phase-change material based devices are available and evidence is increasing of its safety for use in Indian conditions [7].
- Skin-to-skin contact has been stressed as a method for maintaining newborn temperature in the peri-partum period based on evidence drawn from India and other resource-limited countries [8].
- The evidence for delayed cord clamping has grown stronger as well as the evidence for cord milking. The guidelines caution against cord milking below 29 weeks. This has great relevance to neonatal

management and is a significant change.

- Removal of routine tracheal suction in non-vigorous neonates is a welcome change, leading to uniformity of the guidelines in all the scenarios. This significant change is contributed by evidence drawn from India [9].
- The routine use of ECG and pulse oximeters, might find little practical use in resource— limited settings. There is still no data available of widespread use of pulse oximeters in India and given the resource constraints this change may not be practiced uniformly.
- Similarly, use of exhaled CO₂ monitors, oxygen blenders, and laryngeal mask airways will remain out of reach in most resuscitation situations in resource limited settings
- Decreased usage of oxygen in preterm newborns, and preference CPAP over mechanical ventilation might contribute to the decentralization of newborn care and better care at level 1 or level 2 setups.
- While earlier there was a mandate for training all health personnel involved in neonatal care every two years in neonatal resuscitation, the committees have recommended more frequent trainings without stipulating, a duration between trainings. The evidence is rising for ‘Low Dose High Frequency’ trainings for neonatal resuscitation.

CONCLUSION

There are critical changes in updated resuscitation guidelines of 2015 with subtle differences between the AHA and ERC. The authors believe that the Indian Academy of Pediatrics and the National Neonatology Forum of India will bring out India-specific recommendations to guide the resuscitation methods to be followed in India. This will ensure that the clinicians practicing resuscitation on a daily basis have some basis for their variance from International Guidelines.

TABLE I COMPARISONS OF THE 2015 NEONATAL RESUSCITATION GUIDELINES CHANGES WITH THE 2010 GUIDELINES

<i>Resuscitation Step</i>	<i>AHA 2010 Recommendations</i>	<i>AHA 2015 Recommendations</i>	<i>ERC 2015 Recommendations</i>	<i>Remarks</i>
Umbilical cord management	No recommendation given	<ul style="list-style-type: none"> • Delayed Cord Clamping (DCC) for >30 • No recommendation for infants resuscitated at birth. • Cord milking - Routine use is not recommended. 	<ul style="list-style-type: none"> • DCC for ≥1 min is recommended. • No recommendation for infants resuscitated at birth. • Cord milking - Routine use is not recommended. 	Delayed cord clamping is recommended, however the minimum wait for clamping is different in both the newer guidelines.
Normal temperature of newborn in the delivery room.	No temperature range specified.	The temperature of non-asphyxiated infants should be maintained between 36.5-37.5°C	The temperature of non-asphyxiated infants should be maintained between 36.5-37.5°C	The newer guidelines specifically mention the range of temperature, which was missing till now.
Interventions to maintain normal temperature	In VLBW (<1500) pre-term babies- <ul style="list-style-type: none"> • Delivery room temp to 26°C • Plastic wrap • Exothermic mattress • Radiant heat. 	In infants <32 wk various combinations of following strategies should be used- <ul style="list-style-type: none"> • Radiant warmers and plastic wrap with a cap. • Increased room temperature. • Thermal mattress. • Warmed humidified resuscitation gases. 	In infants <32 wk various combinations of following strategies should be used- <ul style="list-style-type: none"> • Radiant warmers and plastic wrap with a cap. • Increased room temperature. • Thermal mattress. • Warmed humidified resuscitation gases. 	Additional strategies to maintain temperature are recommended for <32 weeks rather than the weight criteria of <1500 g. Use of warm humidified resuscitation gases is introduced.
Warming of unintentionally hypothermic new-borns (i.e. hypothermic after resuscitation)	No recommendation given	Either rapid (0.5°C/h or greater) or slow rewarming (less than 0.5°C/h).	No recommendations given	There has always been debate on how to rewarm newborns. The AHA 2015 recommends both methods.
Maintaining normo-thermia in resource-limited settings	No specific recommendation	<ul style="list-style-type: none"> • Covering the newborn in a clean food-grade plastic bag up to the level of the neck and swaddle them after drying. • Skin-to-skin contact or kangaroo mother care. 	<ul style="list-style-type: none"> For babies born outside hospital setup <ul style="list-style-type: none"> • Placement in food grade plastic bag after drying and then swaddling. • Skin to skin contact care (in >30 wk). 	AHA has separately introduced recommendations for maintaining normal newborn temperature in resource-limited countries. The ERC gives similar recommendations for babies born outside ideal delivery environment and thus can be applied to resource-limited countries

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<i>Resuscitation Step</i>	<i>AHA 2010 Recommendations</i>	<i>AHA 2015 Recommendations</i>	<i>ERC 2015 Recommendations</i>	<i>Remarks</i>
Clearing the airway when meconium is present	Endotracheal suctioning in non-vigorous babies.	<ul style="list-style-type: none"> Routine intubation for tracheal suction in non-vigorous babies is not suggested. Initial steps followed by positive pressure ventilation (PPV) should be done as per routine indications. 	<ul style="list-style-type: none"> Routine intubation for tracheal suction in non-vigorous babies is not suggested. Initial steps followed by PPV should be done as per routine indications. For suctioning use of 12–14 FG catheter, connected to a suction source \leq 50 mmHg. Routine surfactant is not recommended. 	<p>This major change has wide implications for developing countries and it puts emphasis on earlier initiation of PPV in non-vigorous babies with meconium stained liquor.</p> <ul style="list-style-type: none"> ERC 2015 also recommends against the routine use of surfactant in babies delivered through meconium stained liquor (MSL).
Assessment of heart rate	No specific recommendation for heart rate measurement	Use of 3-lead electrocardiogram (ECG) for measurement of the newborn's heart rate.	Use of 3-lead ECG for measurement of the newborn's heart rate.	It is doubtful if this will be utilized in resource-limited settings.
Administration of oxygen in preterm infants	No earlier recommendation	<ul style="list-style-type: none"> In newborns $<$35 wk of gestation begin resuscitation with low oxygen (21% to 30%). Titrate according to the pre-ductal oxygen saturation. 	<ul style="list-style-type: none"> In newborns $<$ 35 wk of gestation begin resuscitation with low oxygen (21% to 30%). Titrate according to the pre-ductal oxygen saturation. 	A major change for preterms and reduces the complexity for the resuscitation team.
Positive pressure ventilation (PPV)	Positive and expiratory pressure (PEEP) with PPV can be used at birth if suitable equipment is available.	<ul style="list-style-type: none"> Routine application of sustained inflation $>$5 secs is not recommended. Effectiveness of respiratory mechanics monitors and exhaled CO₂ monitors not established. In preterm newborns, along with PPV use approximately 5 cm H₂O PEEP. For PPV- Ventilate at a rate of about 40-60 breaths per minute. 	<ul style="list-style-type: none"> Routine application of sustained inflation $>$5 secs is not recommended. For first 5 positive pressure breaths, maintain the initial inflation pressure for 2–3s. Effectiveness of respiratory mechanics monitors and exhaled CO₂ monitors not established. In preterm newborns, along with PPV use approximately 5 cm H₂O PEEP. For PPV- Ventilate at a rate of about 30 breaths per minute allowing 1 second for each inflation. 	Both ERC and AHA latest guidelines also talk about application of sustained inflation in initial few breaths. However, the recommended rate of PPV is different in both the guidelines.
Spontaneously breathing preterm infants with respiratory distress.	Either Continuous positive airway pressure (CPAP) or intubation with mechanical ventilation	CPAP is preferred than routine intubation	CPAP is preferred than routine intubation	Most resuscitation teams would be comfortable with CPAP in a controlled setting. Initiating it in the delivery room will require a paradigm change.

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<i>Resuscitation Step</i>	<i>AHA 2010 Recommendations</i>	<i>AHA 2015 Recommendations</i>	<i>ERC 2015 Recommendations</i>	<i>Remarks</i>
Chest compressions	No specific recommendations were provided for oxygen use during chest compressions. However, it mentioned providing 100% oxygen, in newborns with bradycardia even after 90 seconds of resuscitation with lower concentration of oxygen.	<ul style="list-style-type: none"> • Give 100% oxygen with chest compression. • Routine use of End tidal carbon dioxide (ETCO₂) monitors or pulse oximeters for detection of return of spontaneous circulation is not recommended. 	Recommends giving 100% oxygen with chest compressions, although mentions lack of evidence for the same.	The 2010 AHA guidelines based, AAP-AHA Neonatal Resuscitation Textbook, mentioned 100% oxygen with chest compressions [5], regardless of time of resuscitation, despite not being in the guidelines released in 2010.
Induced therapeutic hypothermia	Only under clearly defined protocols and in places with multi-disciplinary care.	Recommends use also in resource-limited settings (<i>i.e.</i> , lack of qualified staff, inadequate equipment)	<ul style="list-style-type: none"> • Only under clearly defined protocols and in places with multi-disciplinary care. • Whole body cooling and selective head cooling are appropriate. 	Again taking into consideration the emerging evidence from developing countries, AHA recommends therapeutic hypothermia in resource-limited settings also.
Sodium Bicarbonate infusion	No recommendation	No recommendation	<ul style="list-style-type: none"> • During prolonged arrests unresponsive to other therapies. • Dosage 1–2 mmol/kg; slow intravenous injection. 	Usage of sodium bicarbonate in prolonged arrests doesn't find any mention in AHA guidelines
Prognostic tools	No recommendation given	No recommendation given	<p>Combined Apgar appears to be a better predictor of outcome than routinely used Apgar score. In Combined Apgar, the interventions needed to achieve the particular score are scored as well and a combined score is generated [6].</p> <p><i>Not indicated-</i> Conditions with almost certain early death and or with high morbidity.</p> <p><i>Nearly always indicated –</i> Conditions with a high rate of survival and acceptable morbidity.</p> <p><i>Borderline-</i> In conditions with uncertain prognosis in which survival is borderline, and morbidity is high.</p> <ul style="list-style-type: none"> • Comfort and dignity of the baby and family should not be ignored. 	More studies are required to form a universal recommendation
Guidelines for withholding resuscitation	<i>Not indicated-</i> Conditions with almost certain early death and or with high morbidity.	Prognosis for < 25 weeks consider - <ul style="list-style-type: none"> • accuracy of gestational age assessment. • Chorioamnionitis. • Available facilities. • Region-specific guidelines to be followed. 	<p><i>Not indicated-</i> Conditions with almost certain early death and or with high morbidity.</p> <p><i>Nearly always indicated –</i> Conditions with a high rate of survival and acceptable morbidity.</p> <p><i>Borderline-</i> In conditions with uncertain prognosis in which survival is borderline, and morbidity is high.</p> <ul style="list-style-type: none"> • Comfort and dignity of the baby and family should not be ignored. 	AHA 2015 introduces regard for region specific guidelines. ERC 2015 mentions fixed criteria similar to AHA 2010.

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<i>Resuscitation Step</i>	<i>AHA 2010 Recommendations</i>	<i>AHA 2015 Recommendations</i>	<i>ERC 2015 Recommendations</i>
*Structure of educational programs and Instructors	No recommendation	Instructors to be trained using timely, objective, structured, and individually targeted verbal and/or written feedback	No recommendation
*Structure of educational programs – Providers	Simulation, briefing, and debriefing techniques should be used.	Training should occur more frequently than the current 2-year interval.	No recommendation

*AHA guidelines mention recommendations for training of instructors; [§]AHA 2015 recommends increase in frequency of provider courses, for better retention of skills.

TABLE II RECOMMENDATIONS THAT REMAIN UNCHANGED

Temperature control	Resuscitation should be performed with temperature-controlling interventions.
Clearing the airway when amniotic fluid is clear	Routine suctioning is not recommended.
Assessment of need of oxygen therapy and monitoring of oxygen therapy	Oximetry should be used to monitor if any neonate needs PPV, with persistent central cyanosis persists and with the use of supplementary oxygen.
Administration of oxygen in term infants	Initiate resuscitation with room air. Supplementary oxygen may be administered to achieve appropriate pre-ductal oxygen saturation.
Initial breaths and assisted ventilation	An initial inflation pressure of 20 cm water is adequate; some term babies may require up to ≥ 30 to 40 cm water. Rate of giving PPV- 40 to 60 per minute.
Endotracheal tube placement	Exhaled CO ₂ detection is most reliable.
Chest compressions	Coordinated chest compressions and PPV should be done if heart rate < 60 per minute after establishing effective ventilation.
Epinephrine	IV dose - 0.01 to 0.03 mg/kg of 1:10 000 epinephrine. For an endotracheal route - 0.05 to 0.1 mg/kg.
Volume expansion	Volume expansion when blood loss is known/suspected. Dose - 10 mL/kg of isotonic crystalloid solution or blood, may be repeated.

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Box 1. MAJOR CHANGES IN UPDATED GUIDELINES

- Delayed cord clamping for both term and preterm infants who do not require resuscitation at birth. Routine use of cord milking (outside of a research setting) for infants born at less than 29 weeks of gestation is not recommended
- Temperature should be recorded as a predictor of outcomes and as a quality indicator. It is recommended that the temperature of newly born non-asphyxiated infants be maintained between 36.5°C and 37.5°C after birth
- Strategies (radiant warmers, plastic wrap with a cap, thermal mattress, warmed humidified gases, and increased room temperature plus cap plus thermal mattress) are advocated to prevent hypothermia in preterm infants. In resource-limited settings, simple measures to prevent hypothermia in the first hours of life (use of plastic wraps, skin to-skin contact, and even placing the infant after drying in a clean food-grade plastic bag up to the neck) may reduce mortality.
- Neonates born through meconium-stained amniotic fluid and who are non-vigorous at birth, should be placed under a radiant warmer and PPV should be initiated if needed. Routine intubation for tracheal suction is no longer recommended. Intubation and suction of the airway may be used as needed for ensuring oxygenation and ventilation.
- Use of a 3-lead ECG for assessment of heart rate in first minute may be used. However, the use of the ECG should not replace the need for pulse oximetry to evaluate the newborn's oxygenation.
- Resuscitation of preterm newborns of less than 35 weeks of gestation should be initiated with low oxygen (21% to 30%) and the oxygen titrated to achieve pre-ductal oxygen saturation approximating the range achieved in healthy term infants.
- CPAP may be offered to spontaneously breathing preterm infants with respiratory distress in place of routine intubation for administering PPV.
- Recommendation to use of 100% oxygen whenever chest compressions are provided.
- In resource-limited settings, use of therapeutic hypothermia may be considered under clearly defined protocols and in facilities with the capabilities for multidisciplinary care and follow-up.
- Neonatal resuscitation task training should be done more frequently than the current 2-year interval.

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