

## AHA/AAP Neonatal Resuscitation Guidelines 2010: Summary of Major Changes and Comment on its Utility in Resource-Limited Settings

Resuscitation step	Recommendations (2005)	Recommendations (2010)	Comments/LOE
1) <b>Assessment for need of resuscitation</b>	<b>Four questions</b> <ul style="list-style-type: none"> <li>Gestation-term or not?</li> <li>Amniotic fluid- clear or not?</li> <li>Tone- Good?</li> <li>Breathing /Crying?</li> </ul>	<b>Three questions</b> <ul style="list-style-type: none"> <li>Gestation-term or not?</li> <li>Tone- Good?</li> <li>Breathing /Crying?</li> </ul>	<ul style="list-style-type: none"> <li>Instead of 4 questions now 3 questions are asked at initiation of resuscitation.</li> <li>“Amniotic fluid- clear or not” not part of assessment at birth. However, tracheal suction of non-vigorous babies with meconium stained amniotic fluid (MSAF) still to be continued (part of clearing airway in initial steps)</li> </ul>
2) <b>Routine care(Given if answer to all three question is YES)</b>	<ul style="list-style-type: none"> <li>Provide warmth</li> <li>Clear airway</li> <li>Dry</li> <li>Assess color</li> </ul>	<ul style="list-style-type: none"> <li>Provide warmth</li> <li>Assure open airway</li> <li>Dry</li> <li>Ongoing evaluation(color, activity and breathing)</li> </ul>	<ul style="list-style-type: none"> <li>Emphasis on placing baby on mothers chest in skin to skin contact</li> </ul>
3) <b>Initial steps</b>	<ul style="list-style-type: none"> <li>Provide warmth</li> <li>Position; Clear airway(if required)</li> <li>Dry, stimulate, reposition</li> </ul>	<ul style="list-style-type: none"> <li>Provide warmth</li> <li>Open airway( no routine suction)</li> <li>Dry , stimulate</li> </ul>	<ul style="list-style-type: none"> <li>No change except for terminology</li> </ul>
<b>4) Assessment (after initial steps and ongoing)</b> 4.1) Assessment for need for progressive steps after initial steps  4.2) Assessment of heart rate	<b>Look for 3 signs</b> <ul style="list-style-type: none"> <li>Hear rate</li> <li>Color</li> <li>Respiration</li> </ul> Palpation of umbilical cord pulsation for 6 sec and multiply by 10	<b>Look for 2 signs</b> <ul style="list-style-type: none"> <li>Heart rate</li> <li>Respiration( Labored, unlabored, apnea, gasping)</li> </ul> Auscultation of heart at the precordium is the most accurate	<ul style="list-style-type: none"> <li>Color has been removed from the signs of assessment</li> <li>Pre-cordial auscultation better than umbilical cord palpation for detection of heart rate (LOE2, LOE4)</li> </ul>
<b>5) Positive pressure ventilation (PPV)</b> 5.1) Indication for PPV  5.2) Assessment of effectiveness of resuscitation steps once PPV is started	Indications are(any 1 out of 3) <ul style="list-style-type: none"> <li>Hear rate &lt; 100/min</li> <li>Apnea or gasping</li> <li>Persistent central cyanosis despite free flow oxygen</li> </ul> Heart rate Color Respiration	Indications (1 out of 2) <ul style="list-style-type: none"> <li>Hear rate &lt; 100/min</li> <li>Apnea or gasping</li> </ul> Heart rate Pulse oximetry Respiration	<ul style="list-style-type: none"> <li>Persistent central cyanosis is not mentioned in the indication for PPV; use pulse oximetry to assess oxygenation</li> <li>Increase in HR most sensitive indicator of resuscitation efficacy (LOE5)</li> </ul>

Resuscitation step	Recommendations (2005)	Recommendations (2010)	Comments/LOE
<b>5) Oxygenation</b> 5.1) Assessment of oxygenation  5.2) Target saturation (pre-ductal)	<ul style="list-style-type: none"> <li>Based on color</li> <li>Pulse oximetry recommended for only preterm &lt; 32weeks with need for PPV</li> </ul> Not defined	<ul style="list-style-type: none"> <li>Based on pulse oximetry for both term and preterm in case of following situations               <ol style="list-style-type: none"> <li>Anticipated need for resuscitation</li> <li>Need for PPV for more than few breaths</li> <li>Persistent cyanosis</li> <li>Supplementary oxygen</li> </ol> </li> </ul> Target SpO <sub>2</sub> ranges provided as a part of algorithm	<ul style="list-style-type: none"> <li>Attach probe to right hand or wrist (measure pre-ductal saturations)</li> <li>Attach neonatal probe before connecting it to machine</li> <li>Recording of tracing may take 1-2 min</li> <li>Pulse oximetry should not replace clinical assessment</li> </ul> 1min- 60-65% 2 min- 65-70% 3min- 70-75% 4min- 75-80% 5min- 80-85% 10min- 85-95% (same for both term and preterm)
<b>6) Initial oxygen concentration for resuscitation in case of PPV</b>	<p><b>Term babies(≥ 37 weeks)</b></p> <ul style="list-style-type: none"> <li>Start with 100% O<sub>2</sub> during PPV</li> <li>However if room air resuscitation is started supplemental O<sub>2</sub> up to 100% should be given if no improvement within 90 seconds following birth</li> <li>In case non availability of O<sub>2</sub>- start room air resuscitation</li> </ul> <p><b>Preterm babies(&lt;32weeks)</b></p> <ul style="list-style-type: none"> <li>Start with oxygen concentration <b>somewhere</b> between 21-100%</li> <li>No specific concentration recommended</li> <li>Advocates use of blender for graded increment or decrement of O<sub>2</sub></li> <li>Pulse oximetry for targeting SPO<sub>2</sub>-85-95%</li> </ul>	<p><b>Term babies (≥ 37 weeks)</b></p> <ul style="list-style-type: none"> <li>Start with room air (21%)</li> <li>No improvement in heart rate or oxygenation as assessed by pulse oximetry- use higher concentration by graded increase up to 100% to attain target saturations</li> <li>Use blender for graded increased in delivered oxygen concentrations</li> </ul> <p><b>Preterm(&lt;32weeks)</b></p> <ul style="list-style-type: none"> <li>Initiate resuscitation using O<sub>2</sub> concentration between 30-90%</li> <li>Titrate O<sub>2</sub> concentration to attain SPO<sub>2</sub> values recommended at different time points</li> <li>Uses blended air oxygen mixture judiciously guided by pulse oximetry</li> </ul>	<p>LOE-2</p> <ul style="list-style-type: none"> <li>Paradigm shift from 100% to 21% O<sub>2</sub> for resuscitation of term babies needing PPV</li> <li>Supplemental oxygen started at 90 sec from birth in case of no improvement</li> <li>Use of blender and pulse oximetry is recommended for term babies also</li> <li>Preterm start with O<sub>2</sub> concentration 30-90% and then increase or decrease</li> <li>No evidence to give appropriate initial oxygen strategy for infants 32-37 weeks</li> </ul>

Resuscitation step	Recommendations (2005)	Recommendations (2010)	Comments/LOE
<b>7) Peripartum suctioning for neonates born through meconium-stained amniotic fluid</b>	<ul style="list-style-type: none"> <li>• No routine oropharyngeal and nasopharyngeal suction</li> <li>• Tracheal suction only in non-vigorous babies born through meconium stained amniotic fluid (MSAF)</li> <li>• Intrapartum suctioning for MSAF not advised</li> </ul>	<ul style="list-style-type: none"> <li>• No routine oropharyngeal and nasopharyngeal suction required</li> <li>• Tracheal suction of non-vigorous babies with MSAF still to be continued though evidence for the same is conflicting</li> <li>• Intrapartum suctioning for infants with MSAF , after delivery of head before delivery of shoulder not advised</li> </ul>	<ul style="list-style-type: none"> <li>• No evidence for or refuting tracheal suction even in non vigorous babies born through MSAF (LOE 4)</li> <li>• However no change suggested to existing practice</li> <li>• If tracheal intubation is unsuccessful or there is severe bradycardia-then proceed to PPV</li> </ul>
<b>8) Initial breath strategy Positive pressure ventilation (PPV)</b>	<ul style="list-style-type: none"> <li>• No specific recommendation for short or long inflation time</li> <li>• No specific PIP recommendation</li> <li>• No specific recommendation for PEEP</li> <li>• Guiding of PPV looking at chest rise and improvement in heart rate</li> </ul>	<ul style="list-style-type: none"> <li>• No specific recommendation for short or long inflation time as evidence is conflicting</li> <li>• PIP- for initial breaths 20-25 cm H<sub>2</sub>O for preterm and 30-40 cm H<sub>2</sub>O for some term babies</li> <li>• PEEP likely to be beneficial for initial stabilization of preterm infants, if provided with suitable equipment (T-piece or flow inflating bags)</li> <li>• Guide the PPV looking at heart rate and oxygenation especially in preterm, chest rise less reliable</li> <li>• Pressure monitoring device facilitates consistent delivery of pressures without any proven clinical benefit</li> <li>• Routine monitoring of tidal volume not recommended</li> </ul>	<ul style="list-style-type: none"> <li>• No specific recommendation for inflation time (LOE 1)</li> <li>• Addition of PEEP in preterm suggested (LOE 5)</li> </ul>
<b>9) CPAP in delivery room</b>	<p>Suggested for preterm babies (&lt; 32 weeks) with respiratory distress</p>	<p>Spontaneously breathing preterm infants with respiratory distress may be supported with CPAP or ventilation as per local practice(Class IIB; LOE B)</p>	<ul style="list-style-type: none"> <li>• CPAP is now mentioned in the algorithm for persistent cyanosis or labored breathing after initial steps,</li> <li>• CPAP in term babies- no evidence to support or refute its use.</li> <li>• May be considered for preterm infants with respiratory distress</li> </ul>

Resuscitation step	Recommendations (2005)	Recommendations (2010)	Comments/LOE
<b>10) Airway management</b> 10.1) Confirmation of endotracheal tube placement  10.2) Laryngeal mask airway	Exhaled CO <sub>2</sub> detection is recommended except in cardiac asystole where direct laryngoscopy may have to be done  For near term and term infants > 2500g may be used with no definite mention of indications	Exhaled CO <sub>2</sub> detection is recommended except in cardiac asystole where direct laryngoscopy may have to be done  LMA may be used for infants >2000g and ≥ 34 weeks in case bag and mask is ineffective and tracheal intubation is unsuccessful or not feasible(LOE 2)	Indications for endotracheal intubation are same as are recommendations for confirming its placement in trachea.  LMA not recommended - in cases of me conium stained AF, during CCR and for drug administration
<b>11) Upper airway interface</b>	<ul style="list-style-type: none"> <li>Mask- rounded cushioned of appropriate size</li> <li>Other alternative is anatomical shaped mask</li> </ul>	<ul style="list-style-type: none"> <li>Evidence for anatomical shaped or rounded mask to maintain seal is conflicting (LOE 5)</li> <li>PPV by nasal prongs superior to facial masks for providing PPV(LOE2)</li> </ul>	Nasal prongs are an alternative way of giving PPV
<b>12) Method of providing PPV</b>	Bag mask ventilation	Bag mask superior to mouth to mask or mouth to tube ventilation	In resource limited setting mouth mask (LOE 2)or mouth tube ventilation may be used(LOE 5)
<b>13) Chest compression</b>	<ul style="list-style-type: none"> <li>Ratio of compression 3:1</li> <li>Two thumb technique better than two finger technique</li> <li>The compression is applied at the lower one third of sternum</li> <li>The depth of compression should be one-third of the antero-posterior diameter of the chest</li> </ul>	<ul style="list-style-type: none"> <li>Ratio of compression 3:1 unless cardiac arrest is due to a clear cardiac etiology where ratio of 15:2 may be considered</li> <li>Two thumb technique better than two finger technique</li> <li>The compression is applied at the lower one third of sternum</li> <li>The depth of compression should be one-third of the antero-posterior diameter of the chest</li> </ul>	No major changes in the guidelines and most recommendations are based on low level of evidence(LOE5)
<b>14) Drugs</b> 14.1) Naloxone	Naloxone considered in case of infants born to mothers with history of opiod exposure within 4 hours of delivery and there is persistent respiratory depression even after restoration of heart rate and color by effective PPV	<ul style="list-style-type: none"> <li>Naloxone is not recommended as part of initial resuscitation in babies with respiratory depression.</li> <li>Focus needs to be on effective ventilation</li> </ul>	<ul style="list-style-type: none"> <li>Safety and long term effects on naloxone not established(LOE 5)</li> <li>Naloxone is not indicated in delivery room.</li> </ul>

Resuscitation step	Recommendations (2005)	Recommendations (2010)	Comments/LOE
<b>15) Supportive care</b> 15.1)Therapeutic Hypothermia  15.2)Delayed cord clamping	No sufficient evidence to recommend routine use of modest systemic or selective cerebral hypothermia after resuscitation in infants with suspected asphyxia Avoid hyperthermia in such cases  Not recommended	Therapeutic hypothermia (whole body or selective head cooling) recommended for infants $\geq$ 36weeks with moderate to severe hypoxic ischemic encephalopathy as per the protocol used in major cooling trials with provision for monitoring for side effects and long term follow up  For uncomplicated births both term and preterm not requiring resuscitation – delay cord clamping by at least 1 minute	Lack of supporting evidence from resource-limited settings, need of intensive and multidisciplinary care during therapeutic hypothermia and established follow-up services after discharge limit the applicability in middle- and low-income countries  Delaying cord clamping for at least 1 min in all infants not requiring resuscitation at birth(LOE1)
<b>16) Changes in ongoing care</b>	After birth 3 types of care mentioned <ul style="list-style-type: none"> <li>• routine care,</li> <li>• observational care and</li> <li>• post resuscitation care</li> </ul>	Post resuscitation two types of ongoing care mentioned <ul style="list-style-type: none"> <li>• routine care and</li> <li>• post resuscitation care</li> </ul>	
<b>17) Withholding Resuscitation</b>	<ul style="list-style-type: none"> <li>• The guidelines needs to interpreted according to local policy</li> </ul> In general withhold care for <ul style="list-style-type: none"> <li>• Gestational age &lt; 23 weeks</li> <li>• Birth weight &lt;400 grams</li> <li>• Major chromosomal anomalies (e.g. Trisomy 13)</li> <li>• Anencephaly</li> <li>• The decision to this regard should be taken only after examining the baby after birth and with parental agreement</li> </ul>	<ul style="list-style-type: none"> <li>• The guidelines needs to interpreted according to local policy</li> </ul> In general withhold care for <ul style="list-style-type: none"> <li>• Gestational age &lt; 23 weeks</li> <li>• Birth weight &lt;400 grams</li> <li>• Major chromosomal anomalies (eg. Trisomy 13)</li> <li>• Anencephaly</li> <li>• The decision to this regard should be taken only after examining the baby after birth and with parental agreement</li> </ul>	No change in the guidelines
<b>18) Discontinuing care</b>	If there is no detectable heart rate for >10 min despite adequate measures, it is appropriate to discontinue resuscitation measures.	If there is no detectable heart rate for >10 min despite adequate measures, it is appropriate to discontinue resuscitation measures	In situations of prolonged bradycardia with heart rate < 60 /min for > 10-15 min, there is insufficient evidence to make recommendation regarding continuation or discontinuation of resuscitation
<b>19) Educational program to teach resuscitation</b>	No mention of such a section	AHA/AAP NRP should adopt simulation, briefing-debriefing techniques in designing an educational program for acquisition and maintenance of skills necessary for effective neonatal resuscitation.	This recommendation is newly added to design NRP programme in a more effective manner.