This article provides information test sitters needed for the USMLE Step 2 on the topic of neonatal resuscitation. It provides an overview to the epidemiology of neonatal resuscitation in the delivery room. The article discusses some differential causes of resuscitation need and outlines a procedural overview of resuscitation including initial stabilization, airway breathing and circulation, chest compressions and drug therapy.

Epidemiology of Neonatal Resuscitation

Most infants make the transition between intra- and extra-uterine conditions well; however, some 10% of infants require intervention at birth. 1% require extensive resuscitation at birth.

Transient Tachypnea of the newborn

Consider this in any infant with tachypnea. This is a common problem, especially in those who underwent a Cesarean section (the majority in the United States). It is caused by a failure of fetal alveolar fluid to clear the airway and results in respiratory distress in the infant. It usually resolves in the first 24 hours of life and is insignificant. On a chest X-
ray, there is retained amniotic fluid which causes perihilar streaking in the interlobular fissures. **Therapy can be given** and is usually CPAP or oxygen dependent on the attending physician’s preference. This usually resolves the condition.

**Therapy of Neonatal Resuscitation**

**An overview of resuscitation**

This guideline is recommended by the [AHA/AAP/ILCOR 2015 guidelines](https://www.ahrq.gov). Moving from one step to the next is determined by the response of the infant. **60 seconds should be given to evaluate the effect of any interventions one performs.** Remember—do not just career on with the list. Assess the infant and ask – have they improved? When you assess, look at the respiratory status (is there apnea, are they gasping, is there effort of breathing etc.) and their heart rate8 (is the heart rate above 100 beats per minute?):

1. Initial stabilization
2. Airway, breathing, circulation
3. Chest compressions
4. Administration of epinephrine or volume expansion

**Initial stabilization**

Maintain the temperature in the child. **Hypothermia in the delivery room is associated with an increased probability in mortality and this must be prevented at all costs.** Children who have been born pre-term, or who are underweight, are particularly susceptible to hypothermia and one must take this into consideration. Below are the appropriate steps in maintaining the temperature of the child in the initial stabilization phase:

- Dry the baby
- Warm the baby. You can raise the room temperature to achieve this
- Keep the baby under a warmer or swaddled. Skin to skin contact with the mother whilst the infant is covered in

**Airway, Breathing, Circulation**

Keep **neck in neutral or slightly extended position.** This should allow the airway to be opened. You can place a towel under the shoulder of the infant to aid extension of the neck and opening of the airway.

**Suction out the nose and mouth with a bulb.** This only occurs if there is an obvious blockade and you should consider wiping the nose and mouth as an alternative in infants who are more than 35 weeks to term. Suction used to be recommended for infants with meconium-stained amniotic fluid, but this is no longer recommended.

**Check the heart rate** (umbilical cord will pulsate and is the easiest place to check the child’s heart rate). You can use pulse oximetry to measure the heart rate. ECG is actually more reliable for a rapid assessment.

**Chest Compressions**

If there is apnea or the heart rate is below 100 beats per minute, give positive pressure ventilation with a bag and mask. To initiate bag mask ventilation (which takes some
practice), follow the following steps:

- Stand at the head of the infant, with their airway open
- Suction the nose and mouth of any blockade or mucus
- Seal the mask and the mouth
- Initial breaths require pressure of 30—40 cm H2O to inflate the lungs

If the heart rate is below 60 despite 30 seconds of positive pressure ventilation, provide chest compressions and give oxygen.

CPAP can be effective in helping the baby breath. This is best used in very pre-term infants who have a significant risk of respiratory distress syndrome.

Intubate if the bag mask is ineffective or if chest compressions are required. The intubation will allow access to the trachea and can be used to successfully deliver positive pressure ventilation.

Chest compressions are required (as mentioned before) if the infant’s heart rate remains below 60 beats per minute despite adequate ventilation for 30 seconds. There are two techniques for infantile chest compressions. The thumb and the two finger technique. Both are outlined below:

**Thumb technique**

- Place both hands around the chest of the infant
- Place your thumbs on the sternum
- Pressure down here

**Two finger technique**

- The tips of the first two fingers are placed over the sternum
- When giving chest compression, try not to place too much pressure directly over the xiphoid process as it can fracture and cause liver injury
- Re-assessment should take place after 30 seconds of chest compression

Administration of epinephrine or volume expansion

**Drugs should not be routinely used and are considered a last resort.** If, however, the heart rate remains (HR) below 60 after consistent attempts at resuscitation, they may be needed.

Give epinephrine if HR is persistently below 60. The easiest access route in an emergency is via the umbilical vein. Insert the cannulae 2-4 cm deep. There is little data on the effectiveness of epinephrine (although it is widely used)

Normal saline or blood transfusion if blood loss is suspected. Intubation for meconium is no longer recommended

**When should resuscitation be stopped?**

Rarely mentioned in medical textbooks is when resuscitation attempts should be discontinued; however, it is an important topic. Usually, if there are **no signs of life after 10 minutes of resuscitation attempts, then it should be stopped.** Research suggests after this point, those individuals who are resuscitated have high levels of mortality and morbidity; thus, beyond this point, the benefits do not outweigh the harm done. Remember hypoxia to important organs, such as the brain, can lead to lifelong
complications, and irreversible damage can be done in a matter of minutes.

Apgar scores

Make sure to measure the Apgar score at 1, 5, and 10 minutes. The score was developed by Virginia Apgar (hence the name). They are NOT used to guide resuscitation. They are, however, a good general marker of the success of a team’s resuscitation attempts. The score is determined using 5 categories: heart rate, respiratory effort, muscle tone, reflex irritability, and color. The Apgar score predicts neonatal and infantile death.

As general rules, you can think of Apgar scores as follows. 8—10 is usually an infant with good cardiopulmonary adaptation and is well. An individual that scores between 4—7 indicates the need for resuscitation (usually, although, as discussed before, this is not the initiator for resuscitation). Scores between 0—3 almost definitely need resuscitation, but again Apgar scores are not the initiating factor for resuscitation.

<table>
<thead>
<tr>
<th></th>
<th>0 points</th>
<th>1 point</th>
<th>2 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Appearance</td>
<td>Entirely blue</td>
<td>Blue extremities</td>
<td>Pink</td>
</tr>
<tr>
<td>P - Pulse</td>
<td>None</td>
<td>&lt; 100</td>
<td>≥ 100</td>
</tr>
<tr>
<td>G - Grimace (response to stim)</td>
<td>None</td>
<td>Grimace</td>
<td>Cough, sneeze, or cry</td>
</tr>
<tr>
<td>A - Activity</td>
<td>Silence</td>
<td>Whimpering</td>
<td>Crying</td>
</tr>
<tr>
<td>R - Respiration</td>
<td>None</td>
<td>Irregular</td>
<td>Regular</td>
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</tbody>
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Differential Diagnosis of Neonatal Resuscitation

If the infant does not respond to resuscitation attempts, the following approach can be taken to ascertain the cause.

If they do not respond to positive pressure ventilation, consider a mechanical block. They may have meconium or excess mucus in the airway that needs clearing. They could also have a malformation of the pharyngeal airway that does not allow gas transport down the trachea. Those that do not respond to positive pressure ventilation could also have a lung function problem, i.e., a pneumothorax or significant pleural effusion etc.

If the infant appears to have a central cyanosis, consider congenital heart disease. If there is a consistent bradycardia or slow heart rate, consider heart block. If the child is totally apneic, consider hypoxia of the CNS. They may also have some congenital neuromuscular condition etc. If the mother was given opioids for pain relief at any period, then consider opioid-induced respiratory depression.

Complications of Neonatal Resuscitation

Infants in need of extensive resuscitation are likely to have complications if they do survive. Consider sodium status, glucose, CNS complications (e.g., hypoxic brain injury can lead to a whole host of problems in the newborn), hypotension (think shock), hypocalcemia, and issues with feeding in these individuals. The longer the resuscitation process took, the more likely an infant is to have significant complications. Intensive care may be needed for close monitoring of some infants.
References


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