

# Neonatal Resuscitation — Procedure and Guidelines

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**This article provides information test sitters needed for the USMLE Step 2 on the topic of neonatal resuscitation. It provides an overview of the epidemiology of neonatal resuscitation in the delivery room. The article discusses some differential causes of the need for resuscitation 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, approximately 10% of infants require intervention at birth, with 1% requiring extensive resuscitation at birth.

## Transient Tachypnea of the newborn

Transient tachypnea should be considered in any infant with tachypnea. This is a common situation, especially in infants born via Cesarean section (the majority of cases are in the United States). The condition is **caused by a failure of fetal alveolar fluid to clear the airway**, resulting in respiratory distress in the infant. The condition usually resolves within the first 24 hours of life and is insignificant in nature. The chest x-ray

shows retained amniotic fluid, which can cause perihilar streaking in the interlobular fissures. Therapy can be administered and is usually continuous airway pressure (CPAP) or oxygen, depending on the attending physician's preference. This treatment usually resolves the condition.

## Therapy of Neonatal Resuscitation

### An overview of resuscitation

Guidelines are recommended by the American Heart Association ([AHA/AAP/ILCOR 2015 guidelines](#)). Progression from one step to the next in the guidelines is determined by the response of the infant. **Wait 60 seconds to evaluate the effect of any intervention that is performed.** Remember—do not just proceed with the list. Assess the infant, ask, and determine whether he or she has improved. During the assessment, review the respiratory status. Check for apnea, gasping, effort breathing, etc. Check the heart rate: Is it above 100/min? The four steps of neonatal resuscitation include the following:

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

### Initial stabilization

It is important to maintain the temperature in the infant. **Hypothermia in the delivery room is associated with an increased probability in mortality, and this must be prevented at all costs.** Infants born preterm or who are underweight are particularly susceptible to hypothermia, and this must be taken into consideration. Listed below are the appropriate steps for maintaining the infant's temperature in the initial stabilization phase:

- Dry the baby
- Warm the baby (increase the room temperature to achieve this)
- Keep the baby swaddled or under a warmer. Maintain skin-to-skin contact with the mother while the infant is covered

### Airway, Breathing, Circulation

Keep the infant's **neck in neutral or a slightly extended position.** This will allow the airway to open. Place a towel under the infant's shoulder to help with the extension of the neck and the opening of the airway.

**Suction out the nose and mouth with a bulb.** Perform this only if there is an obvious blockage. For infants who are more than 35 weeks' gestation, consider wiping the nose and mouth as an alternative. Suction used to be recommended for infants with meconium-stained amniotic fluid, but this is no longer recommended.

**Check the heart rate.** The umbilical cord will pulsate and is the easiest place to check the infant's heart rate. Use pulse oximetry to measure the heart rate. The ECG is actually more reliable for a rapid assessment.

## Chest Compressions

With apnea or a heart rate below 100/min, administer positive pressure ventilation using a bag and mask. To initiate bag-mask ventilation (requires practice), follow these steps:

- Stand at the head of the infant, with his or her airway open
- Suction the nose and mouth to remove any blockage or mucus
- Seal the mask and the mouth
- Apply the required 30 to 40 cm water to inflate the lungs for initial breaths

If the heart rate is below 60/min despite 30 seconds of positive pressure ventilation, apply chest compressions and give oxygen. CPAP can be effective in helping the infant breathe. This is best used in very premature preterm infants who have a significant risk of respiratory distress syndrome.

Intubate the infant 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 previously) if the infant's heart rate remains below 60/min despite adequate ventilation for 30 seconds. Two techniques are used for infant chest compressions: the thumb technique and the two-finger technique. Both are outlined below:

### Thumb technique

- Place both hands around the infant's chest
- Place your thumbs on the sternum
- Apply downward pressure

### Two-finger technique

- Place tips of the first two fingers over the sternum
- Do not to place too much pressure directly over the xiphoid process, as that can fracture and cause liver injury
- Re-assess 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 below 60/min after consistent attempts at resuscitation, medication may be needed. Treat with epinephrine if the heart rate continues to be below 60/min. The easiest access route in an emergency situation is via the umbilical vein. Insert the cannula 2 to 4 cm deep. Even though there is little data on the effectiveness of epinephrine, it is widely used.

Administer normal saline or a blood transfusion if blood loss is suspected. Intubation for meconium is no longer recommended.

## When should resuscitation be stopped?

It is rarely mentioned in medical textbooks 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 that after this point, high levels of mortality and morbidity occur in infants, and

thus, the benefits do not outweigh the harm done. Remember, with hypoxia, irreversible damage can occur in a matter of minutes in major organs such as the brain, and can lead to lifelong complications.

## Apgar scores

Measure the Apgar score (developed by Virginia Apgar) at 1, 5, and 10 minutes. The scores 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 infant death.

The following general rules apply to Apgar scores: A score of 8 to 10 indicates a healthy infant with good cardiopulmonary adaptation. An infant with Apgar scores of 4 to 7 usually exhibits a need for resuscitation (as discussed before, this is not the initiator for resuscitation). An infant with Apgar scores of 0 to 3 almost definitely needs resuscitation, but again, Apgar scores are not the initiating factor for resuscitation.

	<b>0 points</b>	<b>1 point</b>	<b>2 points</b>
<b>A</b> - Appearance	Entirely blue	Blue extremities	Pink
<b>P</b> - Pulse	None	< 100	≥ 100
<b>G</b> - Grimace (response to stim)	None	Grimace	Cough, sneeze, or cry
<b>A</b> - Activity	Silence	Whimpering	Crying
<b>R</b> - Respiration	None	Irregular	Regular

## Differential Diagnosis of Neonatal Resuscitation

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

With no response to positive pressure ventilation, **consider a mechanical block**. The infant may have meconium or excess mucus in the airway that needs clearing. He or she may also have a malformation of the pharyngeal airway that does not allow gas transport down the trachea. Infants who do not respond to positive pressure ventilation may have a lung function problem (e.g., a pneumothorax or significant pleural effusion, etc.).

If the infant appears to have central cyanosis, **consider congenital heart disease**. If there is consistent bradycardia or slow heart rate, consider a heart block. If the child is totally apneic, consider hypoxia of the central nervous system (CNS). The infant may also have some congenital neuromuscular condition. Also, 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 levels, 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. The **longer the duration of the resuscitation process, the more likely an infant will have significant complications**. Intensive care may be needed for close monitoring of some infants.

# References

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