

Initial Steps of Newborn Care

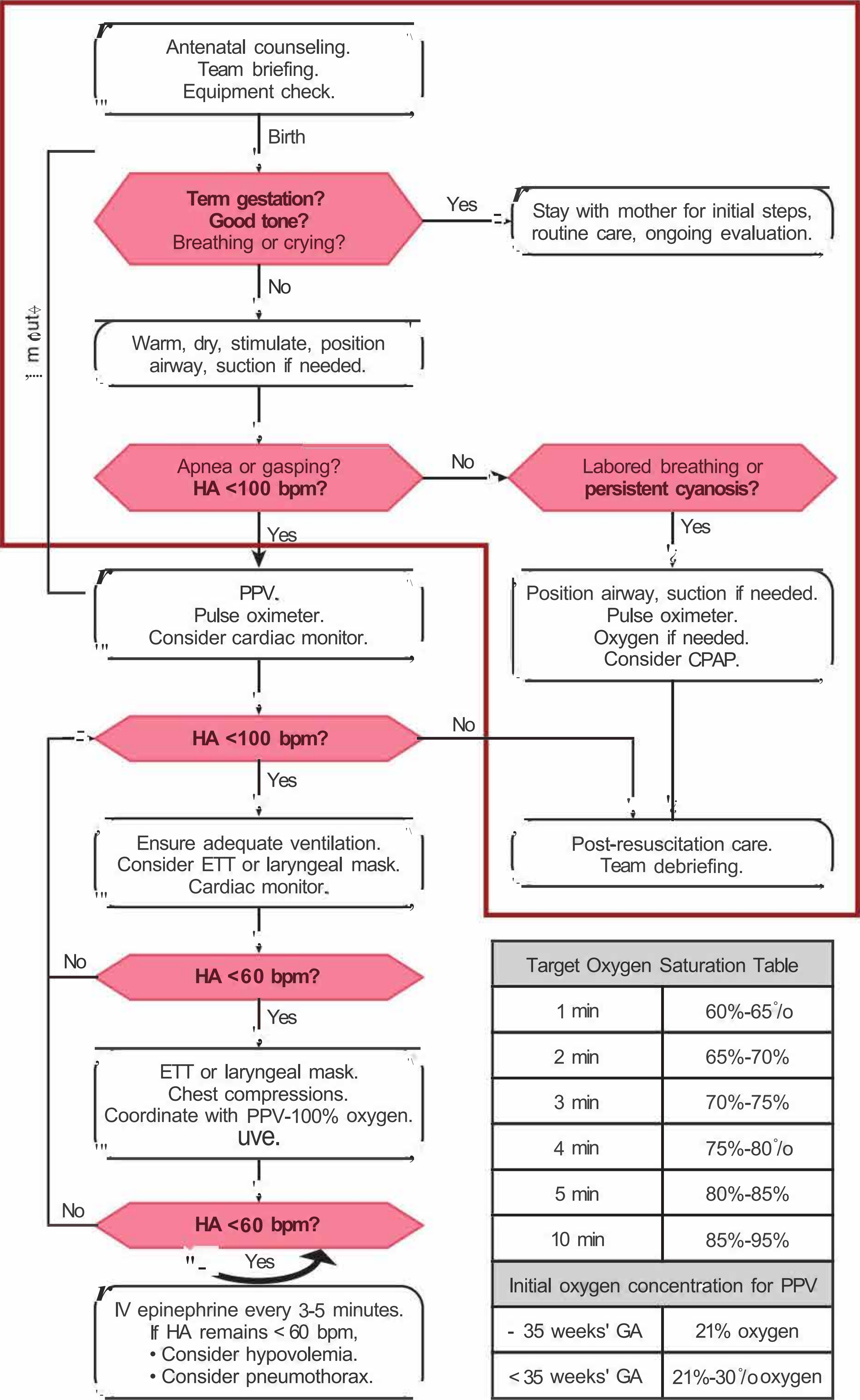
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What you will learn

- How to perform a rapid evaluation
- The initial steps of newborn care
- How to determine if additional steps are required
- What to do if a baby has persistent cyanosis or labored breathing
- How to use a pulse oximeter and interpret the results
- How to give supplemental oxygen
- When to consider using continuous positive airway pressure
- What to do when meconium-stained amniotic fluid is present



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Key Points

- O For most vigorous term and preterm newborns, clamping the umbilical cord should be delayed for at least 30 to 60 seconds.
- f) All newborns require a rapid evaluation. Ask if the baby is term, has good muscle tone, and is breathing or crying. If the answer is "NO" to any of these, the newborn should be brought to the radiant warmer for the initial steps of newborn care.
- E) The 5 initial steps include the following: provide warmth, dry, stimulate, position the head and neck to open the airway, clear secretions from the airway if needed.
- 8 Use pulse oximetry and the Target Oxygen Saturation Table to guide oxygen therapy (a) when resuscitation is anticipated, (b) to confirm your perception of persistent central cyanosis, (c) if you give supplemental oxygen, or (d) if positive-pressure ventilation is required. Visual assessment of cyanosis is not a reliable indicator of oxygen saturation.
- 0 If meconium-stained fluid is present and the baby is not vigorous, bring the baby to the radiant warmer to perform the initial steps. Routine laryngoscopy with or without intubation for tracheal suction is not suggested.

Case 1: An uncomplicated birth

A healthy woman arrives in active labor at 39 weeks' gestation. You are the nurse assigned to care for the newborn at birth, and you must know the answers to the 4 pre-birth questions to assess the perinatal risk and confirm that only 1 qualified person is needed to manage this newborn. You know that the baby is term. The mother's membranes ruptured shortly after arrival and the amniotic fluid is clear. You learn that her pregnancy has been uncomplicated. You complete a standardized equipment check to ensure that neonatal resuscitation supplies and equipment are ready for use if needed. You review the umbilical cord management plan with the obstetric provider and introduce yourself to the mother.

At the time of birth, the baby appears to be full term, has good muscle tone, and cries vigorously. The baby is placed skin-to-skin on the

mother's chest and is covered with a warm blanket. You gently dry and stimulate the baby and position the baby's head to ensure the airway is open. One minute after birth, the cord is clamped and cut. The baby's color becomes increasingly pink during the transition to newborn circulation. You continue to evaluate breathing, tone, color, and temperature to determine if additional interventions are required. Shortly after birth, the mother positions the newborn to initiate breastfeeding.

Case 2: Delayed transition

A woman arrives in labor at 39 weeks' gestation. Labor progresses rapidly and the obstetric provider calls your resuscitation team to attend the vaginal birth. You ask the obstetric provider the 4 pre-birth questions to assess perinatal risk factors and determine who should attend the birth. This is a term baby. Membranes are ruptured and the fluid is clear. Additional risk factors include fetal tachycardia and maternal fever. The mother has received intrapartum antibiotics for suspected chorioamnionitis. Fetal heart rate monitoring shows a Category II (indeterminate) pattern. You discuss the umbilical cord management plan with the obstetric providers.

When you enter the room, you introduce the team to the laboring mother. Your team completes a pre-resuscitation briefing and equipment check.

Immediately after birth, the baby has poor tone and does not cry. The obstetric provider holds the baby in a warm blanket, and dries and stimulates the baby to breathe by gently rubbing the baby's back. The baby still has poor tone and irregular respiratory effort. The cord is clamped and cut and the baby is brought to the radiant warmer. You position the head and neck to open the airway and use a bulb syringe to clear secretions from the mouth and nose in anticipation of positive-pressure ventilation (PPV) while an assistant continues to provide gentle stimulation. A scribe documents the events as they occur.

The baby's tone and respiratory effort quickly improve. Listening with a stethoscope, your assistant reports that the baby's heart rate is 120 beats per minute (bpm). Five minutes after birth, central cyanosis persists and a pulse oximeter sensor is secured on the baby's right hand. The pre-ductal oxygen saturation (SPO₂) is below the target described in the Target Oxygen Saturation Table, so supplemental free-flow oxygen is administered. Documentation continues while the oxygen concentration (FIO₂) is adjusted so that the SPO₂ remains within the target range. By 10 minutes after birth, the baby is breathing

regularly and supplemental oxygen has been gradually discontinued. The SpO_2 remains normal and the baby is placed skin-to-skin on the mother's chest to continue transition while vital signs and activity are closely monitored for possible deterioration. Shortly afterward, the team members conduct a short debriefing to evaluate their preparation, teamwork, and communication.

When should the umbilical cord be clamped?

At the time of birth, a large volume of the baby's blood remains in the placenta. If maternal blood is still flowing to the placenta and the umbilical cord has not been clamped, placental gas exchange will continue and additional oxygenated blood will be returned to the baby through the umbilical vein. This blood may play an important role in the newborn baby's transition from fetal to neonatal circulation.

Mark the *time of birth* by starting a timer when the last fetal part emerges from the mother's body. The ideal time for clamping the umbilical cord is the subject of ongoing research.

- In preterm newborns, potential benefits of delayed cord clamping compared with immediate cord clamping include decreasing the chance of needing medications to support blood pressure after birth, requiring fewer blood transfusions during hospitalization, and possibly improved survival.
- In term and late preterm newborns, delayed cord clamping may improve early hematologic measurements and, although uncertain, there may be benefits for neurodevelopmental outcomes. However, there may also be an increased chance of needing phototherapy for h_{yp} erbilirubinemia.

Before birth, establish with the obstetric provider what the plan will be for the timing of umbilical cord clamping. For most vigorous preterm newborns, the current evidence suggests that clamping should be delayed for at least 30 to 60 seconds. Among vigorous term newborns, the evidence suggests that a similar delay may be reasonable. During this time, the baby may be placed skin-to-skin on the mother's chest or abdomen, or held securely in a warm, dry towel or blanket. Very preterm newborns, less than 32 weeks' gestation, may be wrapped in a warm blanket or polyethylene plastic to help maintain their temperature. Remember, until the cord is clamped, the baby will also be receiving warm blood from the placenta. During the interval between birth and umbilical cord clamping, the obstetric provider and neonatal team should evaluate the baby's tone and breathing effort and continue the initial steps of newborn care described in the remainder of this lesson.

Early (immediate) cord clamping is indicated, or may be considered, in certain cases.

- If the placental circulation is not intact, such as after a placental abruption, bleeding placenta previa, bleeding vasa previa, or cord avulsion, the cord should be clamped immediately after birth.
- Most delayed cord clamping studies have excluded multiple gestations, so there is currently not enough evidence to evaluate the safety of delayed cord clamping in the setting of a multiple gestation birth.
- Other scenarios, where safety data on delayed cord clamping are limited, may benefit from a discussion between the neonatal and obstetric providers to plan whether cord clamping should be delayed. These scenarios may include fetal intrauterine growth restriction (IUGR), abnormal umbilical artery Doppler measurements, abnormal placentation, and other situations where utero-placental perfusion or umbilical cord blood flow are affected.
- There is not enough evidence to make a definitive recommendation whether umbilical cord clamping should be delayed in newborns who are not vigorous.
 - If the placental circulation is intact, it may be reasonable to briefly delay cord clamping while the obstetric provider gently stimulates the baby to breathe and suctions the mouth and nose with a bulb syringe. If the baby does not begin to breathe, additional treatment may be required. Clamp the umbilical cord and bring the baby to the radiant warmer.
 - Initiating resuscitation close to the mother with the cord intact is the subject of ongoing research that may provide additional evidence to inform future recommendations.

How do you evaluate the newborn immediately after birth?

After birth, all newborns should have a rapid evaluation to determine if they can remain with their mother to continue transition or if they should be moved to a radiant warmer for further assessment. This initial evaluation may occur during the interval between birth and umbilical cord clamping. You will rapidly ask 3 questions: (1) Does the baby appear to be term, (2) Does the baby have good muscle tone, and (3) Is the baby breathing or crying?

Does the baby appear to be term?

Determine if the baby's appearance is consistent with the expected gestational age. In some situations, the baby's gestational age is unknown before birth. If the baby appears to be term, proceed to the

next assessment question. If the baby appears to be preterm (less than 37 weeks' gestation), bring the baby to the radiant warmer for the initial steps.

Preterm babies are more likely to require interventions during the transition to extrauterine life. For example, they have more difficulty aerating their lungs, establishing good respiratory effort, and maintaining their body temperature.

- Because of these risks, once the cord has been clamped, preterm babies should have the remaining initial steps of newborn care performed under a radiant warmer.
- If the baby is born at a late-preterm gestation (34 to 36 weeks) and appears vigorous with good respiratory effort, the baby can be brought to the mother within several minutes to continue transition.

A Rapid Evaluation for Every Newborn

- Term?
- Tone?
- Breathing or crying?

Does the baby have good muscle tone?

Quickly observe the baby's muscle tone. Healthy term babies should be active with flexed extremities (Figure 3.1). Newborns requiring intervention may have flaccid extremities (Figure 3.2).

Is the baby breathing or crying?

A vigorous cry is a clear indicator of strong respiratory effort (Figure 3.1). If the baby is not crying, observe the baby's chest for breathing effort. Be careful not to be misled by a baby who is gasping. Gasping is a series of deep, single or stacked inspirations that occurs in the setting of severely impaired gas exchange. A gasping baby requires intervention and must be brought to the radiant warmer.



Figure 3.1. Low-risk newborn: full-term, good tone, crying. (Used with permission of Mayo Foundation for Medical Education and Research.)



Figure 3.2. High-risk newborn: preterm, poor tone, not crying

Once you have completed your rapid evaluation, what are the initial steps of newborn care?

The initial steps include providing warmth, drying, providing gentle tactile stimulation, positioning the head and neck so that the airway is open, and clearing the airway of secretions if needed. These steps may be initiated during the interval between birth and umbilical cord clamping and should be completed within approximately 30 seconds of birth. In many cases, the initial steps are provided by more than 1 person and some steps may be performed simultaneously.

How do you provide the initial steps for vigorous, term newborns?

Initial Steps of Newborn Care

- Provide warmth.
- Dry.
- Stimulate.
- Position the head and neck.
- Clear secretions if needed.

If the answers to all 3 rapid evaluation questions are "Yes," the baby can remain with the mother and have the initial steps performed on the mother's chest or abdomen.

- Warmth is maintained by direct skin-to-skin contact and covering the baby with a warm towel or blanket (Figure 3.3).
- Dry the baby with the towel or blanket and gently stimulate the baby.
- Position the baby on the mother's chest or abdomen to ensure the airway is open.



Figure 3.3. Vigorous, term newborn. Initial steps are performed skin-to-skin with mother. (Used with permission of Mayo Foundation for Medical Education and Research.)

- If necessary, secretions in the upper airway can be cleared by wiping the baby's mouth and nose with a cloth. Gentle suction with a bulb syringe should be reserved for babies who are having difficulty clearing their secretions.
- After the initial steps are completed, continue monitoring the newborn's breathing, tone, activity, color, and temperature to determine if additional interventions are required.

How do you provide the initial steps for non-vigorous and preterm newborns?

If the answer to any of the initial evaluation questions is "No," bring the baby to a radiant warmer because additional interventions may be required.

Provide warmth.

Place the baby under a radiant warmer so that the resuscitation team has easy access to the baby without causing excessive heat loss (Figure 3.4). Leave the baby uncovered to allow full visualization and to permit the radiant heat to reach the baby.

- If you anticipate that the baby will remain under the warmer for more than a few minutes, apply a servo-controlled temperature sensor to the baby's skin to monitor and control the baby's body temperature. Avoid both h_{yp} othermia* and overheating.
- During resuscitation and stabilization, the baby's body temperature should be maintained between 36.5°C and 37.5°C .

Dry.

Wet skin increases evaporative heat loss (Figure 3.5). Place the baby on a warm towel or blanket and gently dry any fluid. If the first towel or blanket becomes wet, discard it and use fresh, warm towels or blankets for continued drying (Figure 3.6).

- Drying is not necessary for very preterm babies less than 32 weeks' gestation because they should be covered immediately in polyethylene plastic, which reduces evaporative heat loss.
- The interventions used to reduce heat loss in very preterm babies are described in Lesson 8.

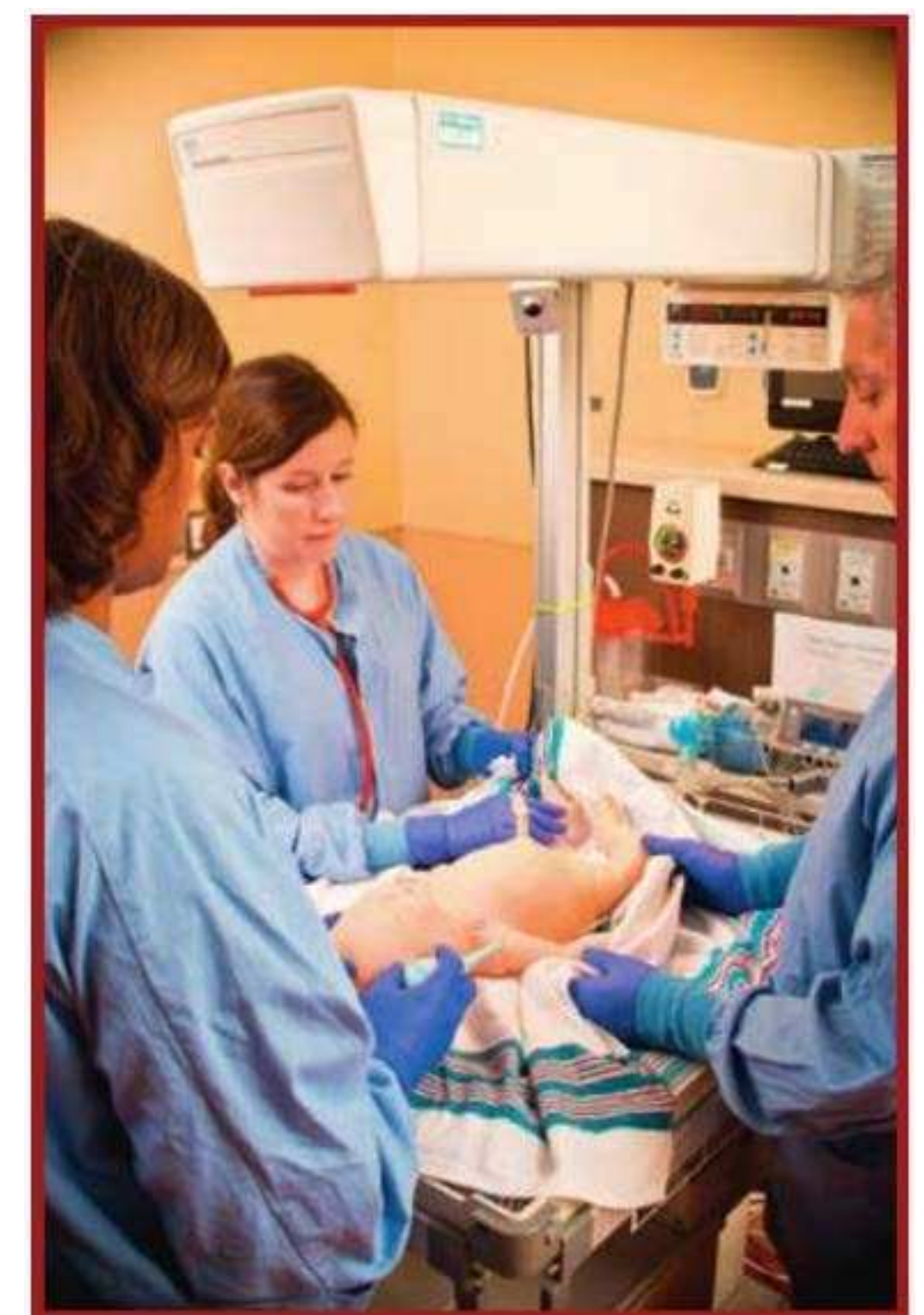


Figure 3.4. Radiant warmer used for the initial steps with high-risk newborns

*After resuscitation, therapeutic hypothermia is indicated for certain high-risk newborns and is further described in Lesson 8.



Figure 3.5. Wet skin promotes rapid body cooling.



Figure 3.6. Dry the baby and remove wet linen to prevent heat loss and stimulate breathing. Gentle tactile stimulation may also initiate breathing. (Used with permission of Mayo Foundation for Medical Education and Research.)

Stimulate.

Drying the baby will frequently provide enough stimulation to initiate breathing. If the newborn does not have adequate respirations, brief additional tactile stimulation may stimulate breathing.

- Gently rub the newborn's back, trunk, or extremities (Figure 3.6).
- Overly vigorous stimulation is not helpful and can cause injury.
- **Never shake a baby.**

Position the head and neck to open the airway.

Position the baby on the back (supine) with the head and neck neutral or slightly extended and the eyes directed straight upward toward the ceiling in the «sniffing the morning air" position (Figure 3.7). This position opens the airway and allows unrestricted air entry.

- Avoid hyperextension or flexion of the neck because these positions may interfere with air entry.
- To help maintain the correct position, you may place a small, rolled towel under the baby's shoulders (Figure 3.8). A shoulder roll is particularly useful if the baby has a large occiput (back of head) from molding, edema, or prematurity.

If needed, clear secretions from the airway.

Routine suction for a crying, vigorous baby is not indicated. Clear secretions from the airway if the baby is not breathing, if the baby is gasping, if the baby has poor tone, if secretions are obstructing the airway, if the baby is having difficulty clearing their secretions, or if you anticipate starting PPV. Secretions may be removed from the upper airway by suctioning gently with a bulb syringe (Figure 3.9).



Figure 3.7. Correct sniffing position



Figure 3.8. Optional shoulder roll for maintaining the sniffing position

If the newborn has copious secretions coming from the mouth, turn the head to the side. This will allow secretions to collect in the cheek where they can be removed.

- Brief, gentle suction usually is adequate to remove secretions.
- Suction the mouth before the nose to ensure there is nothing for the baby to aspirate if the baby gasps when the nose is suctioned. You can remember «mouth before nose" by thinking «M" comes before «N" in the alphabet.
- *Be careful not to suction vigorously or deeply.* Vigorous suction may injure tissues. Stimulation of the posterior pharynx during the



Figure 3.9. Gently suction the mouth then nose with a bulb syringe. Use your thumb to depress the bulb syringe before placing it in the baby's mouth or nose.

first minutes after birth can produce a vagal response leading to bradycardia or apnea.

- If using a suction catheter, the suction control should be set so that the negative pressure reads approximately 80 to 100 mm Hg when the tubing is occluded.

How do you evaluate the newborn's response to the initial steps?

Assess the newborn's respirations to determine if the baby is responding to the initial steps. This should take no more than an additional 30 seconds.

Is the baby apneic or gasping?

After the initial steps, determine if the baby is crying or breathing. If the baby is apneic, or has gasping respirations after initial steps, proceed directly to PPV. Remember, gasping respirations are ineffective and are treated the same as apnea. The details of providing PPV with a face mask are described in Lesson 4.

If you are the only provider at the warmer, call for immediate additional help.

If the baby has not responded to the initial steps within the first minute of life, it is not appropriate to continue to provide only tactile stimulation. For babies who remain apneic or bradycardic, delaying the start of PPV beyond the first minute of life worsens outcomes.

Remember: Ventilation of the baby's lungs is the most important and effective step during neonatal resuscitation.

If the baby is breathing after the initial steps, assess the heart rate.

If the baby is breathing effectively, the heart rate should be at least 100 bpm. If the heart rate is less than 100 bpm, **start PPV even if the baby is breathing.**

Your initial assessment of the heart rate will be made using a stethoscope. Auscultation along the left side of the chest is the most accurate physical examination method of determining a newborn's heart rate (Figure 3.10). Although pulsations may be felt at the umbilical cord base, palpation is less accurate and may underestimate the true heart rate. While listening, you may tap out the heartbeat on the bed so that your team will also know the heart rate.

- Estimate the heart rate by counting the number of beats in 6 seconds and multiplying by 10. For example, if you listen for 6 seconds and hear 12 beats, the heart rate is 120 bpm.

- Clearly report the heart rate to your team members ("The heart rate is 120 beats per minute").

If you cannot determine the heart rate by physical examination and the baby is not vigorous, ask another team member to quickly connect a pulse oximeter or cardiac monitor. Other options include the use of a handheld Doppler ultrasound or digital stethoscope.

Cautions

- Pulse oximetry may not function if the baby's heart rate is low or if the baby has poor perfusion. In this case, determining the heart rate with a cardiac monitor is the preferred method.
- In unusual circumstances, a cardiac monitor may show an electrical signal, but the heart is not actually pumping blood. This is called pulseless electrical activity (PEA). In the newborn, PEA should be treated the same as an absent heart rate (asystole).



Figure 3. 10. Assess the heart rate by listening with a stethoscope. (Used with permission of Mayo Foundation for Medical Education and Research.)

What do you do if the baby is breathing and the heart rate is at least 100 bpm, but the baby appears persistently cyanotic?

The term cyanosis describes skin or mucous membranes with a blue hue caused by poorly oxygenated blood. Cyanosis limited to the hands and feet (acrocyanosis) is a common finding in the newborn and does not indicate poor oxygenation (Figure 3.11). Low oxygen saturation causing the baby's lips, tongue, and torso to appear blue is called central cyanosis. Healthy babies may have central cyanosis for several minutes after birth. Studies have shown that visual assessment of cyanosis is not a reliable indicator of the baby's oxygen saturation and should not be used to guide oxygen therapy. If persistent central cyanosis is suspected, a pulse oximeter placed on the right hand or wrist should be used to assess the baby's oxygenation.



Figure 3. 11. This baby has cyanosis of the hands and feet (acrocyanosis), but the trunk and mucous membranes are pink. Acrocyanosis is normal. Supplemental oxygen is only needed if oxygen saturation is below the target range.

What is a pulse oximeter?

Oxygen is carried by the hemoglobin inside red blood cells. Hemoglobin that is carrying oxygen absorbs red light differently than hemoglobin that is not carrying oxygen. A pulse oximeter uses a light

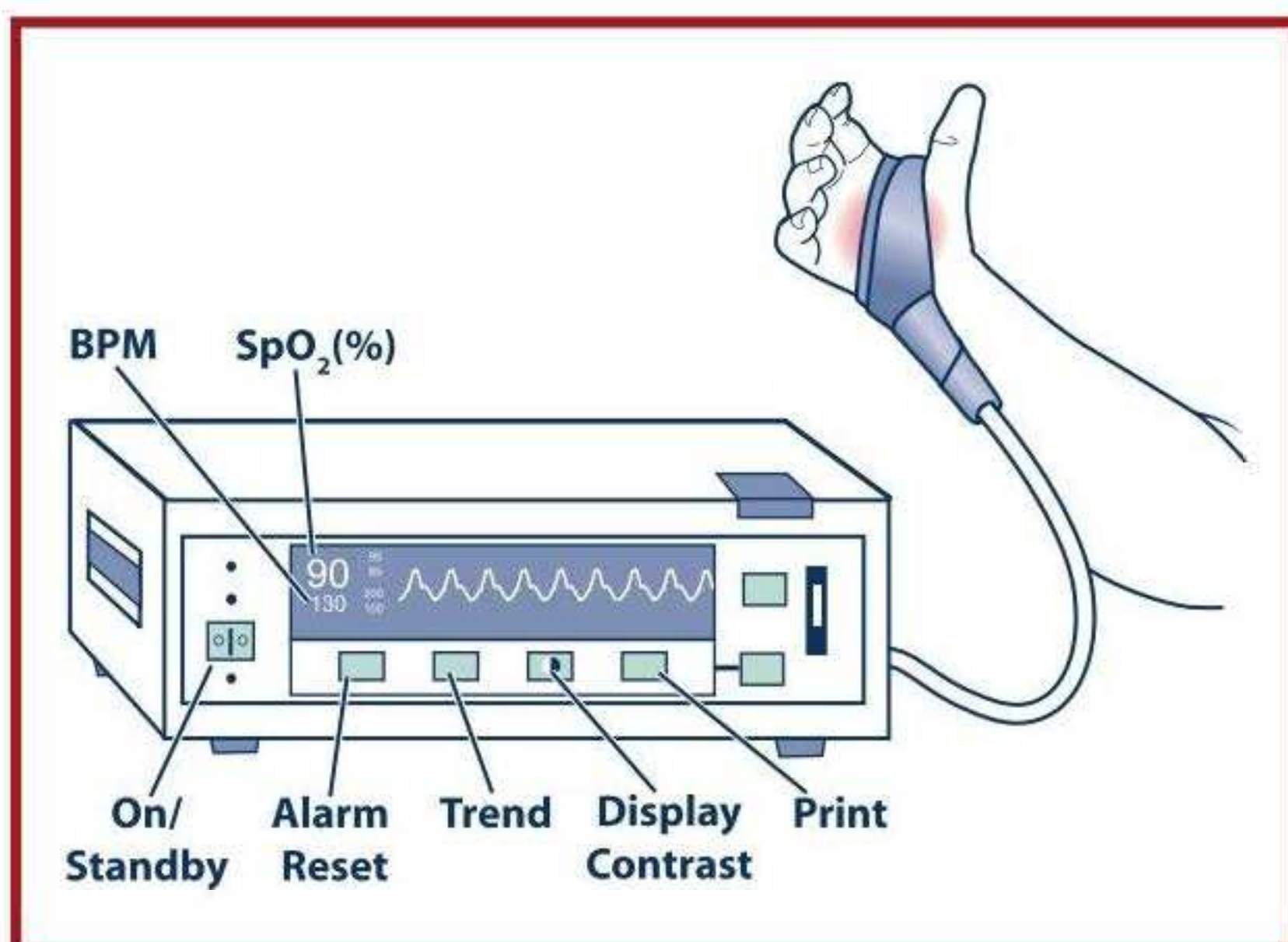


Figure 3.12. Pulse oximeter with sensor attached to a baby's right hand on the hypothenar eminence

Indications for Pulse Oximetry

- When resuscitation is anticipated
- To confirm your perception of persistent central cyanosis
- When supplemental oxygen is administered
- When PPV is required

source and sensor to measure the absorption of red light passing through capillaries in the skin and estimates the percentage of hemoglobin that is carrying oxygen (Figure 3.12). The monitor displays the oxygen saturation, which ranges from 0% to 100%. This number is not the same as the partial pressure of oxygen (PO_2) measured by a blood gas machine. The pulse oximeter also displays the baby's heart rate by sensing pulsatile blood flow in the capillaries.

When is pulse oximetry used in the delivery room?

Use pulse oximetry to guide your treatment when resuscitation is anticipated, to confirm your perception of persistent central cyanosis, if you give supplemental oxygen, or if PPV is required.

Where and how should the pulse oximeter sensor be placed?

In most babies, the artery supplying the baby's right arm branches from the aorta before the patent ductus arteriosus enters the aorta. Blood in the right arm is often called "pre-ductal" and has a similar oxygen saturation as the blood perfusing the heart and brain. The origin of blood flow to the left arm is less predictable. The arteries supplying both legs branch from the aorta after the patent ductus arteriosus and are called "post-ductal."

- To measure the oxygen saturation of the pre-ductal blood that is perfusing the heart and brain, *place the pulse oximeter sensor on the baby's right hand or wrist.*
- The left arm and both legs may have lower oxygen saturation. They may receive blood from the aorta that has been mixed with poorly oxygenated venous blood that bypassed the lungs through the patent ductus arteriosus (post-ductal).

Proper placement of the sensor is important. Once the sensor is attached to the baby, watch the monitor to ensure that it is detecting a pulse with each heartbeat. Most instruments will not display a

saturation reading until a consistent pulse is detected. If you are monitoring the heart rate with a cardiac monitor, the heart rate displayed on the pulse oximeter should be the same as the heart rate on the cardiac monitor.

- The sensor must be oriented correctly so that it can detect the transmitted red light. After placement, it may be helpful to cover the sensor to shield it from light in the room. If the pulse oximeter is not detecting a consistent pulse, you may need to adjust the sensor to be sure that it is positioned opposite the light source.
- With good technique, a pulse oximeter will accurately display the heart rate and oxygen saturation within approximately 1 to 2 minutes of birth.
- If the baby has a very low heart rate or poor perfusion, the pulse oximeter may not be able to detect the pulse or oxygen saturation.

What is the target oxygen saturation?

Healthy newborns undergoing normal transition usually take several minutes to increase their blood oxygen saturation from approximately 60%, which is the normal intrauterine state, to more than 90%, which is the eventual state of air-breathing healthy newborns. Figure 3.13 shows the time course of oxygen saturation changes after birth in healthy, full-term newborns breathing room air (21 % oxygen). Oxygen saturation values following cesarean birth are slightly lower than those following vaginal birth.

When the pulse oximeter has a reliable signal, compare the baby's pre-ductal oxygen saturation with the range of target values in Table 3-1. These values are based on oxygen saturations obtained from healthy, term babies breathing room air during the first 10 minutes of life. The ideal oxygen saturation after birth has not been established and there is ongoing controversy about which targets should be used. These targets have been selected to represent a consensus of acceptable values that can be easily remembered.

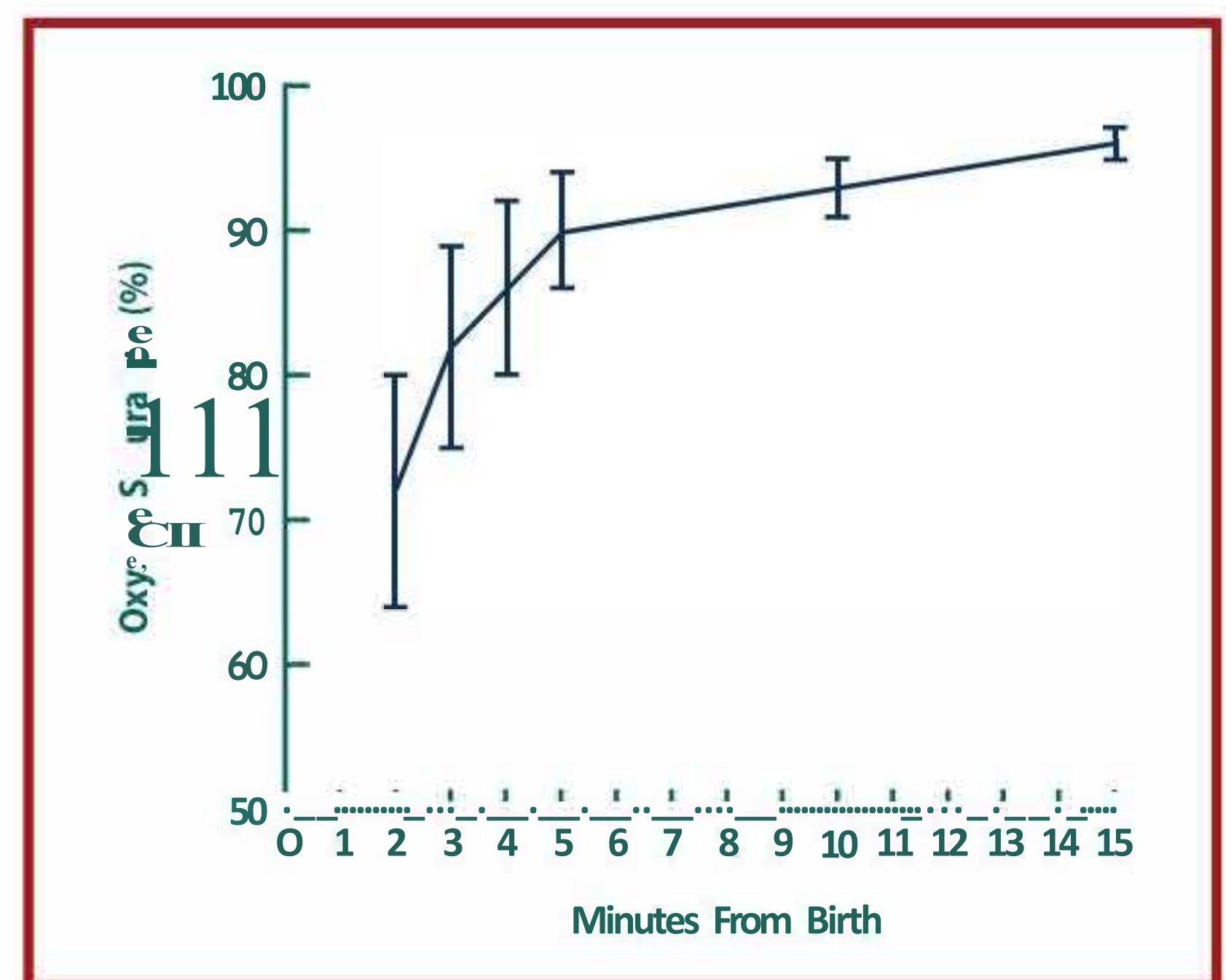


Figure 3.13. Pre-ductal oxygen saturation changes following birth (median and interquartile range). (From Mariani G, Dik PB, Ezquer A, et al. Pre-ductal and post-ductal O_2 saturation in healthy term neonates after birth. *J Pediatr*. 2007; 150[4]:418-421.)

Table 3-1 • Target Pre-Ductal Oxygen Saturation

Target Oxygen Saturation Table	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

Figure 3.14. Free-flow oxygen given to a spontaneously breathing baby by holding oxygen tubing close to the baby's mouth and nose



When and how do you administer supplemental oxygen?

Use supplemental free-flow oxygen when the pulse oximeter reading remains below the target range for the baby's age. Free-flow oxygen can be given to a spontaneously breathing baby by holding oxygen tubing close to the baby's mouth and nose (Figure 3.14). Free-flow oxygen is not effective if the baby is not breathing.

You may also use one of the positive-pressure delivery devices described in Lesson 4 (Figure 3.15).

- If you are using a flow-inflating bag or T-piece resuscitator, hold the mask close to the face but not so tight that you make a seal and pressure builds up within the mask.



Figure 3.15. Free-flow oxygen given by (A) a flow-inflating bag, (B) a T-piece resuscitator, and (C) the tail of a self-inflating bag with an open reservoir.

Note: For free-flow oxygen, the mask of a flow-inflating bag and T-piece resuscitator is NOT held tightly against the face.

- If a flow-inflating bag is used, the bag *should not inflate* when used to provide free-flow oxygen.
 - An inflated bag indicates that the mask is tight against the face and unintended positive pressure is being delivered.
- If a T-piece resuscitator is being used, do not occlude the opening on the T-piece cap.
 - During free-flow oxygen administration, the T-piece pressure manometer should read “zero.”
- **Do not** attempt to administer free-flow oxygen through the mask of a self-inflating bag (Figure 3.16) because gas does not reliably flow through the mask unless the bag is being squeezed.
 - Free-flow oxygen may be administered through the open reservoir (tail) on some self-inflating bags. If your hospital has self-inflating bags with closed reservoirs, you will need separate oxygen tubing to administer free-flow oxygen (Figure 3.14).



Figure 3.16. Do not attempt to give free-flow oxygen using the mask of a self-inflating bag.

How is the concentration of supplemental oxygen adjusted?

If supplemental oxygen is necessary, it is reasonable to start with 30%. Then, guided by pulse oximetry, adjust the F_{IO_2} to maintain the baby's oxygen saturation within the target range described in Table 3-1. The goal is to prevent low oxygen saturations without exposing the newborn to the potential risk of additional, unnecessary oxygen. Adjust the concentration and flow of supplemental oxygen using compressed air and oxygen, a blender, and a flowmeter (Figure 3.17).

Compressed air and oxygen

Compressed gases may be built into the wall or obtained from portable tanks. Medical air (21% oxygen) is supplied from high-pressure hoses that are color coded yellow, and 100% oxygen is supplied from high-pressure hoses that are color coded green.



Figure 3.17. Adjust the concentration and flow of oxygen with compressed air (inflow from yellow hose), compressed oxygen (inflow from green hose), an oxygen blender, and a flowmeter. The image shows 2 flowmeters attached to the oxygen blender. Your system may only have 1 flowmeter.

O_{xy}gen blender and flowmeter

The compressed gases are connected to a blender, which has a dial that adjusts the gas mixture (21 %-100%). The blended gas travels to an adjustable flowmeter. The flowmeter commonly has a floating ball within a glass tube that indicates the rate of gas flow leaving the device. Depending on the size of the flowmeter, you can adjust the dial to achieve gas flows between 0 L/min and 20 L/min. The blended gas, adjusted to the desired concentration and flow rate, is directed through tubing to the oxygen delivery device.

- For free-flow supplemental oxygen, **adjust the flowmeter to 10 L/min.**
- Begin free-flow oxygen supplementation with the blender set to 30% oxygen. Using the blender, adjust the FIO₂ as needed to achieve the oxygen saturation target.

If an oxygen blender is not available

If supplemental free-flow oxygen is necessary and an oxygen blender is not available, such as when resuscitation occurs outside the delivery room, free-flow oxygen may be delivered by using 100% oxygen from your wall or portable oxygen source. As described previously, direct the flow of oxygen toward the baby's mouth and nose using oxygen tubing, a mask, or appropriate PPV device. As oxygen flows out of the tubing or mask, it mixes with air. The concentration of oxygen that reaches the baby's nose is determined by the amount of 100% oxygen coming from the tubing or mask and the amount of air it must pass through to reach the baby. The closer the tubing or mask is to the face, the higher the concentration of oxygen breathed by the baby. Guided by pulse oximetry, adjust the FIO₂ by moving the tubing or mask closer to or farther from the baby's face.

If the baby continues to require supplemental oxygen after the first few minutes, how should it be given?

Attempt to gradually decrease the FIO₂ until the newborn can maintain saturation within the target range without supplemental oxygen. If respirations and heart rate are stable but the newborn continues to require supplemental oxygen, use pulse oximetry to guide the appropriate FIO₂.

- Oxygen administered directly from a compressed source is cold and dry.
- To prevent heat loss, oxygen given to newborns for a prolonged period of time should be heated and humidified.

What do you do if the baby has labored breathing or persistently low oxygen saturation?

If the baby has labored breathing, or the oxygen saturation cannot be maintained within the target range despite 100% oxygen, you may consider a trial of continuous positive airway pressure (CPAP) or PPV.

CPAP is a method of respiratory support that uses a continuous low gas pressure to keep a spontaneously breathing baby's lungs open. CPAP may be helpful if the airway is open, but the baby has signs of labored breathing or persistently low oxygen saturations. CPAP should only be considered in the delivery room if the baby is breathing and the baby's heart rate is at least 100 bpm.

- Administering CPAP may increase the chance of developing a pneumothorax (air leak).
- Providers should be aware of this potential complication and prepared to address it.

If desired, a trial of CPAP in the delivery room can be given by using a flow-inflating bag or a T-piece resuscitator attached to a mask that is held tightly to the baby's face (Figure 3.18). CPAP **cannot** be given using a self-inflating bag. The equipment and method for administering CPAP are described in more detail in Lesson 4.



Figure 3.18. Administering CPAP using (A) a flow-inflating bag or (B) a T-piece resuscitator. The baby must have spontaneous breathing and a heart rate greater than 100 bpm.

Note: For CPAP, the mask is held tightly against the face to create a seal.

Does the presence of meconium-stained amniotic fluid change who should attend the birth or how the initial steps are performed?

The presence of meconium-stained amniotic fluid may indicate fetal distress and increases the risk that the baby will require resuscitation after birth. At least 2 qualified people who can initiate resuscitation should be present at the time of birth solely to manage the baby. An individual with intubation skills should be identified and immediately available.

If additional risk factors indicate that an extensive resuscitation is likely, a qualified team with full resuscitation skills should be present at the time of birth.

Meconium-stained fluid and a vigorous newborn

If the baby is vigorous with good respiratory effort and muscle tone, the baby may stay with the mother to receive the initial steps of newborn care.

Meconium-stained fluid and a non-vigorous newborn

If a baby is born through meconium-stained amniotic fluid and has depressed respirations or poor muscle tone, bring the baby to the radiant warmer and perform the initial steps of newborn care as described in this lesson. You will use a bulb syringe to clear secretions from the mouth and nose. If the baby is not breathing or if the baby is breathing and the heart rate is less than 100 bpm after the initial steps are completed, proceed with PPV.

Routine laryngoscopy with or without intubation for tracheal suction is not suggested. Historically, routine intubation and suction immediately after birth was recommended in an effort to reduce the chance of developing meconium aspiration syndrome; however, a recent systematic review found no evidence to support this practice. Intubation and tracheal suction may be necessary if PPV does not inflate the lungs and airway obstruction is suspected.

Focus on Teamwork

The initial steps of resuscitation highlight several opportunities for effective teams to use the Neonatal Resuscitation Program® (NRP®) Key Behavioral Skills.

Behavior	Example
Anticipate and plan.	Ensure that you have enough personnel present at the time of delivery based on the identified risk factors.
Communicate effectively. Use available information.	Immediately after birth, the obstetric and neonatal care teams need to share their assessment of the newborn. Subsequent interventions will be based on this assessment. The care teams need to communicate their findings clearly and efficiently.
Know your environment.	Know how the pulse oximeter, compressed air and oxygen source, oxygen blender, and flowmeters work in your practice setting. Know what device is available to administer CPAP in your hospital. Know how to obtain a cardiac monitor if needed.
Use available resources.	If you cannot auscultate a heart rate and the baby is not vigorous, quickly place a pulse oximeter sensor or cardiac monitor leads and attach them to the appropriate monitor.
Call for additional help when needed.	After the initial steps, if you identify apnea, gasping, or a heart rate less than 100 bpm and you are alone, call for additional help. Positive-pressure ventilation is required and you will need additional personnel.

Quality Improvement Opportunities

Ask yourself the following questions and begin a discussion with your team if you find a difference between the NRP recommendations and what is currently done in your own hospital setting. Consider using the suggested process and outcome measures to guide your data collection, identify areas for improvement, and monitor if your improvement efforts are working.

Quality improvement questions

- Are vigorous newborns placed skin-to-skin with their mother?
- 8 How are the findings of the baby's initial assessment communicated between the obstetric and pediatric providers?
- 8 Do vigorous newborns routinely have their mouth and nose suctioned?

Process and outcome measures

- O What percentage of vigorous newborns have umbilical cord clamping delayed at least 30 to 60 seconds?
- f) What percentage of newborns are crying or breathing after drying and stimulation?
- E) What percentage of newborns with meconium-stained fluid still undergo laryngoscopy and tracheal suction?

Frequently Asked Questions

After birth, do all babies need to have their mouth and nose suctioned with a bulb syringe?

No. Vigorous newborns that are breathing or crying and have good tone do not need to have their mouth and nose suctioned. If necessary, the upper airway can be cleared by wiping the baby's mouth and nose with a cloth. Gentle suction should be reserved for babies with difficulty clearing their secretions, babies with secretions obstructing their airway, and those who are not breathing or crying, have poor tone, or require PPV.

Does it matter if the pulse oximeter sensor is attached to the baby's hand or wrist?

For a small baby, some health care providers find it easier to secure the sensor to the baby's wrist; however, some manufacturers recommend placing the pulse oximeter sensor only on the baby's hand. There is evidence that an accurate reading can be obtained using a sensor placed on the baby's wrist. In the studies that established the normal progression of oxygen saturation in healthy newborns, the pulse oximeter sensor was placed on the baby's wrist. Placement on either the hand or wrist is acceptable as long as the transmitted light is detected by the sensor and a reliable signal is obtained.

Previously, the Neonatal Resuscitation Program recommended routine endotracheal intubation and suction for non-vigorous babies born through meconium-stained amniotic fluid. Why is this no longer recommended? Does this change who should attend the birth of the baby with meconium-stained amniotic fluid?

Prior to each edition of the *Textbook of Neonatal Resuscitation*, questions are identified by the International Liaison Committee on Resuscitation (ILCOR) Neonatal Task Force. The scientific evidence is

reviewed using a systematic approach and treatment recommendations are developed using a method that evaluates the strength of the supporting evidence (GRADE). Before the *Textbook of Neonatal Resuscitation*, 7th edition (2016), the NRP recommendation for tracheal suction was based on small observational studies that did not use currently accepted research methods for comparing treatments. As a result, the conclusions from those studies are subject to bias and the strength of evidence is considered very weak.

Recently, several small randomized trials enrolling non-vigorous newborns have been published that do not show benefit to tracheal suction. Both the 2015 and 2019 ILCOR reviews determined that the existing evidence did not support routine tracheal suction. A large, properly randomized trial is still needed.

The NRP Steering Committee's values include avoiding invasive procedures without good evidence of benefit for important outcomes. As a result, the NRP Steering Committee does not currently suggest routine laryngoscopy with or without tracheal suction for non-vigorous babies delivered through meconium-stained fluid. If additional evidence becomes available, the ILCOR Neonatal Task Force and NRP Steering Committee will reevaluate this recommendation.

The presence of meconium-stained fluid is still considered a perinatal risk factor that increases the likelihood that the newborn will require resuscitation. At least 2 qualified people who can initiate resuscitation should be present at the time of birth solely to manage the baby. An individual with intubation skills should be identified and immediately available. If additional risk factors indicate that an extensive resuscitation is likely, a qualified team with full resuscitation skills should be present at the time of birth.

LESSON 3 REVIEW

1. List the 3 rapid evaluation questions that determine which newborns should be brought to the radiant warmer for the initial steps.
2. List the 5 initial steps of newborn care.
3. You count a newborn's heartbeat for 6 seconds and count 6 beats. You report the heart rate as (36 beats per minute)/ (60 beats per minute).
4. Oxygen saturation should be 85% to 95% by (2 minutes of age)/ (10 minutes of age).

5. Which image shows the correct way to position a baby's head to open the airway (A, B, or C)?



6. You have provided warmth, dried, stimulated, positioned the head and neck, and cleared the airway of secretions. It is now 60 seconds after birth, and the baby is still apneic and limp. What is your next action?
7. If a baby is breathing, the heart rate is greater than 100 beats per minute, the airway is clear and correctly positioned, but the respirations are labored, you may consider (deep pharyngeal suction)/continuous positive airway pressure [CPAP]).

Answers

1. Is the baby term? Does the baby have good tone? Is the baby breathing or crying?
2. Provide warmth, dry, stimulate, position the head and neck, clear secretions from the airway if necessary.
3. You report the heart rate as 60 beats per minute.
4. Oxygen saturation should be 85% to 95% by 10 minutes of age.
5. Image B shows the correct way to position a newborn's head to open the airway.
6. Your next action is to start positive-pressure ventilation. Call for help if you are alone.
7. You may consider continuous positive airway pressure (CPAP).

LESSON 3: PRACTICE SCENARIOS

Initial Steps of Newborn Care

Learning Objectives

- O Identify the newborn who requires initial steps of resuscitation at the radiant warmer.
- f) Demonstrate correct technique for performing initial steps when the newborn stays with the mother and when the newborn is received at the radiant warmer.
- E) Demonstrate accuracy when assessing a newborn heart rate with a stethoscope.
- C, Demonstrate correct placement of the pulse oximeter sensor, interpretation of pulse oximetry, and administration of supplemental free-flow oxygen.

These Practice Scenarios are for review/practice and evaluation.

This is the suggested Practice Scenario sequence.

- O **Review the Knowledge Check Questions** with your Neonatal Resuscitation Program (NRP) instructor.
 - a. What are the 3 rapid evaluation questions? How do the answers to those questions determine whether a newborn may stay with the mother or come to the radiant warmer?
 - b. Which newborns receive the initial steps? What are the 5 initial steps of newborn care?
 - c. When do you start the Apgar timer?
 - d. How do you assess a newborn's heart rate? What will you do if the baby is not vigorous and you cannot hear the heart rate with the stethoscope?
 - e. Why do you use pulse oximetry and when is it indicated?
 - f. What concentration of oxygen is used to initiate free-flow oxygen?
 - g. What is CPAP and when is it a consideration in the delivery room?

- 8 **Practice/review these skills** with your NRP instructor.
 - a. Perform initial steps of care for a baby who stays with the mother.
 - b. Perform initial steps of care for a baby on the radiant warmer, including proper use of the bulb syringe.
 - c. Assess heart rate using a stethoscope.
 - d. Apply a pulse oximeter sensor and practice using the Target Oxygen Saturation Table to administer and wean free-flow oxygen.
- E) **Practice the scenarios** applicable to your role with your NRP instructor until you need little or no assistance or coaching.
- 9 **Pass the Lesson 3 Practice Scenario evaluation** by leading practice scenario(s) and performing the skills relevant to your role and responsibilities. If a technical skill included in this scenario is not within your scope of responsibility, delegate the skill to a qualified team member and perform the role of assistant if appropriate. When you can lead the scenario(s) and perform the skills with little or no instructor coaching, proceed to the next lesson's practice scenario.

Practice Scenarios

Four scenario options are offered. Use the same scenario introduction for each scenario; the answers to the 4 pre-birth questions are different for each scenario. The number of people attending the birth and their qualifications are determined by the instructor and based on hospital policy.

- 0 Vigorous term newborn who may stay with the mother for initial steps
- 8 Vigorous term newborn with meconium-stained fluid and persistent cyanosis (this scenario is designed for a 2-person team)
- E) Term newborn requires initial steps at radiant warmer, returned to mother for skin-to-skin care
- 9 Late preterm newborn with clear fluid, requires initial steps at radiant warmer, remains apneic

"You are called to attend a vaginal birth. The mother is in active labor with ruptured membranes. How would you prepare for the birth of this baby and perform the initial steps of newborn care? As you work, say your thoughts and actions aloud so I will know what you are thinking and doing."

Option 1: Vigorous term newborn may stay with the mother for initial steps

Critical Performance Steps	
Assess perinatal risk.	
	Assesses perinatal risk (learner asks the 4 pre-birth questions and instructor ["OB provider"] responds)
Gestational age?	"39 weeks' gestation."
Clear fluid?	"Amniotic fluid is clear."
Additional risk factors?	"There are no additional risk factors."
Umbilical cord management plan?	"I will delay cord clamping. If the baby is not crying, I'll take a moment to stimulate the baby. If there's no response, I'll clamp and cut the cord."
Assemble team.	
	Assembles team based on perinatal risk factors.
	When the likelihood of resuscitation is low, 1 qualified individual should attend the birth.
	If the birth will be attended by 1 person, Knows the answers to the 4 pre-birth questions, determines supplies and equipment needed, knows how to call for help
Perform equipment check.	
	"The baby has been born."
Rapid evaluation.	
	Asks 3 rapid evaluation questions:
• Term?	"Yes."
• Muscle tone?	"Yes."
• Breathing or crying?	"Yes, the baby is crying."
	Newborn stays with mother for initial steps.
Initial steps.	
	Places baby skin-to-skin with mother, dries baby and stimulates if needed, positions head and neck. Covers with warm blanket.
End scenario.	
	Continues ongoing evaluation of breathing, heart rate, tone, activity, color, and temperature

Option 2: Vigorous term newborn with meconium-stained fluid and persistent cyanosis

Critical Performance Steps	
Assess perinatal risk.	
Assesses perinatal risk (learner asks the 4 pre-birth questions and instructor ["OB provider"] responds)	
Gestational age?	"41 weeks' gestation."
Clear fluid?	"The fluid is meconium-stained."
Additional risk factors?	"None besides meconium-stained amniotic fluid."
Umbilical cord management plan?	"I will delay cord clamping. If the baby is not crying, I'll take a moment to stimulate the baby. If there's no response, I'll clamp and cut the cord."
Assemble team.	
Assembles team based on perinatal risk factors.	
<ul style="list-style-type: none">When meconium-stained fluid is the only risk factor, at least 2 qualified people who can initiate resuscitation should be present at the birth solely to manage the baby. An individual with intubation skills should be identified and immediately available.A fully qualified resuscitation team should be present at the time of birth if additional risk factors suggest that advanced resuscitation measures may be required.	
Perform a pre-resuscitation team briefing.	
Identifies team leader.	
Assesses risk factors, delegates tasks, identifies who will document events as they occur (if necessary), determines supplies and equipment needed, knows how to call for additional help.	
Perform equipment check.	
	"The baby has been born."
Rapid evaluation.	
Asks 3 rapid evaluation questions:	
<ul style="list-style-type: none">Term?	"Yes."
<ul style="list-style-type: none">Muscle tone?	"Yes."
<ul style="list-style-type: none">Breathing or crying?	"Yes."
Newborn may stay with mother for initial steps.	
Initial steps.	
Places baby skin-to-skin with mother, dries baby, stimulates as needed, positions head and neck, clears secretions if needed. Monitors breathing, tone, activity, color, and temperature to determine if additional interventions are required.	
	"The newborn is 4 minutes old and remarkably cyanotic."
Checks breathing.	"The baby is breathing, with no distress."
Auscultates heart rate accurately.	Heart rate per auscultation = 140 bpm
Applies pulse oximeter sensor to right hand/wrist.	SP02=68%
Administer free-flow oxygen.	
Adjusts blender to 30% and administers free-flow oxygen using correct technique.	
Monitors oxygen saturation and adjusts blender appropriately per pulse oximetry to maintain oxygen saturation within target range. May attempt to wean supplemental oxygen. Monitors oxygen saturation with pulse oximetry until vital signs are stable and oxygen saturation is stable within target range.	
Monitors breathing, heart rate, tone, activity, color, and temperature.	
Communicates with neonatal team per hospital protocol to discuss next steps.	
Updates perinatal team.	
Updates parents and communicates next steps, including the plan for post-resuscitation care.	
End scenario.	

Option 3: Term newborn requires initial steps at radiant warmer, returned to mother for skin-to-skin care

Critical Performance Steps	
Preparation for resuscitation.	
	Assesses perinatal risk (learner asks the 4 pre-birth questions and instructor ["OB provider"] responds) <ul style="list-style-type: none"> • Gestational age? "Term." • Clear fluid? "Amniotic fluid is clear." • Additional risk factors? "Repeated fetal heart rate decelerations have been noted in the last 15 minutes."¹¹ Umbilical cord management plan? "I will delay cord clamping. If the baby is not crying, I will take a moment to stimulate the baby. If there's no response, I will clamp and cut the cord."¹¹
Assemble team.	
	Assembles team based on perinatal risk factors. At least 2 qualified people should be present solely to manage the baby because risk factors are present. The number of team members and qualifications vary depending on risk.
Perform a pre-resuscitation briefing.	
	Identifies team leader. Assesses risk factors, delegates tasks, identifies who will document events, determines supplies and equipment needed, knows how to call for additional help.
Perform equipment check.	
	"The baby has been born."¹¹
Rapid evaluation.	
	Asks 3 rapid evaluation questions: <ul style="list-style-type: none"> • Term? "Yes."¹¹ • Muscle tone? "No."¹¹ • Breathing or crying? "No."¹¹
Initial steps.	
	Receives baby at radiant warmer. Dries with towel or blanket, removes wet linen. Stimulates by rubbing back and/or extremities. Positions airway. Suctions mouth and nose if still apneic.
Check breathing. If breathing, check heart rate.	
	Assesses breathing "The baby is crying." Auscultates heart rate accurately Heart rate = 120 bpm
End scenario.	
	Wraps baby in blanket, returns baby to the mother, and places baby skin-to-skin with the mother. Monitors breathing, tone, activity, color, and temperature to determine if additional interventions are required.

Option 4: Late preterm newborn with clear fluid, requires initial steps at warmer, remains apneic

Critical Performance Steps	
Assess perinatal risk.	
	Assesses perinatal risk (learner asks the 4 pre-birth questions and instructor ["OB provider"] responds) <ul style="list-style-type: none">• Gestational age? "36 weeks' gestation."• Clear fluid? "Amniotic fluid is clear."• Additional risk factors? "The mother has a fever." Umbilical cord management plan? "I will delay cord clamping. If the baby is not crying, I'll take a moment to stimulate the baby. If there's no response, I'll clamp and cut the cord."
Assemble team.	
	Assembles team based on perinatal risk factors. At least 2 qualified people should be present solely to manage the baby because risk factors are present. The number of team members and qualifications vary depending on risk.
Perform a pre-resuscitation briefing.	
	Identifies team leader. Assesses risk factors, delegate tasks, identifies who will document events as they occur (if necessary), determines supplies and equipment needed, knows how to call for additional help.
Perform equipment check.	
	"The baby has been born."
Rapid evaluation.	
	Asks 3 rapid evaluation questions: <ul style="list-style-type: none">• Term? "No, appears 36 weeks' gestation as expected."• Muscle tone? "No."• Breathing or crying? "No."
Initial steps.	
	Receives baby at radiant warmer. Dries with towel or blanket, removes wet linen. Stimulates by rubbing back and/or extremities. Positions airway. Suctions mouth and nose.
Check breathing. Also check heart rate if breathing.	
	<ul style="list-style-type: none">• Breathing? "No, baby is apneic." (Heart rate= 70 bpm, if assessed)• Indicates need for PPV• Indicates the standardized method to call for additional help
End scenario.	

Sample Debriefing Questions

- O What factors determined the decisions for who would attend the births described in these scenarios?
- f) How did you know if the newborn required
 - a. Initial steps at the radiant warmer?
 - b. Pulse oximetry?
 - c. Supplemental oxygen?
- E) What would you do differently when preparing for resuscitation or performing initial steps in our next scenario?
- O State an example of how you used at least one of the NRP Key Behavioral Skills.

NRP Key Behavioral Skills

- Know your environment.
- Use available information.
- Anticipate and plan.
- Clearly identify a team leader.
- Communicate effectively.
- Delegate the workload optimally.
- Allocate attention wisely.
- Use available resources.
- Call for additional help when needed.
- Maintain professional behavior.