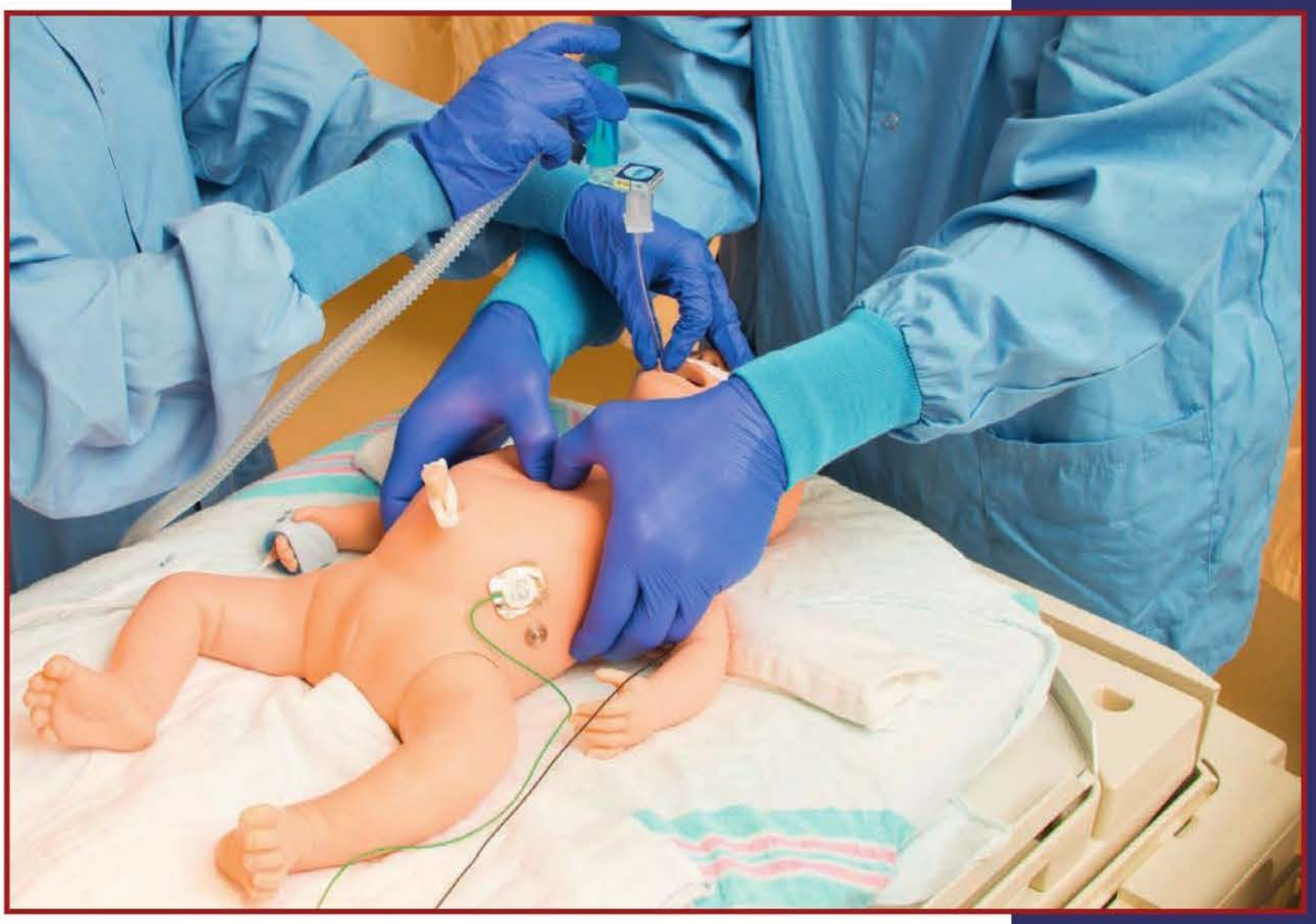
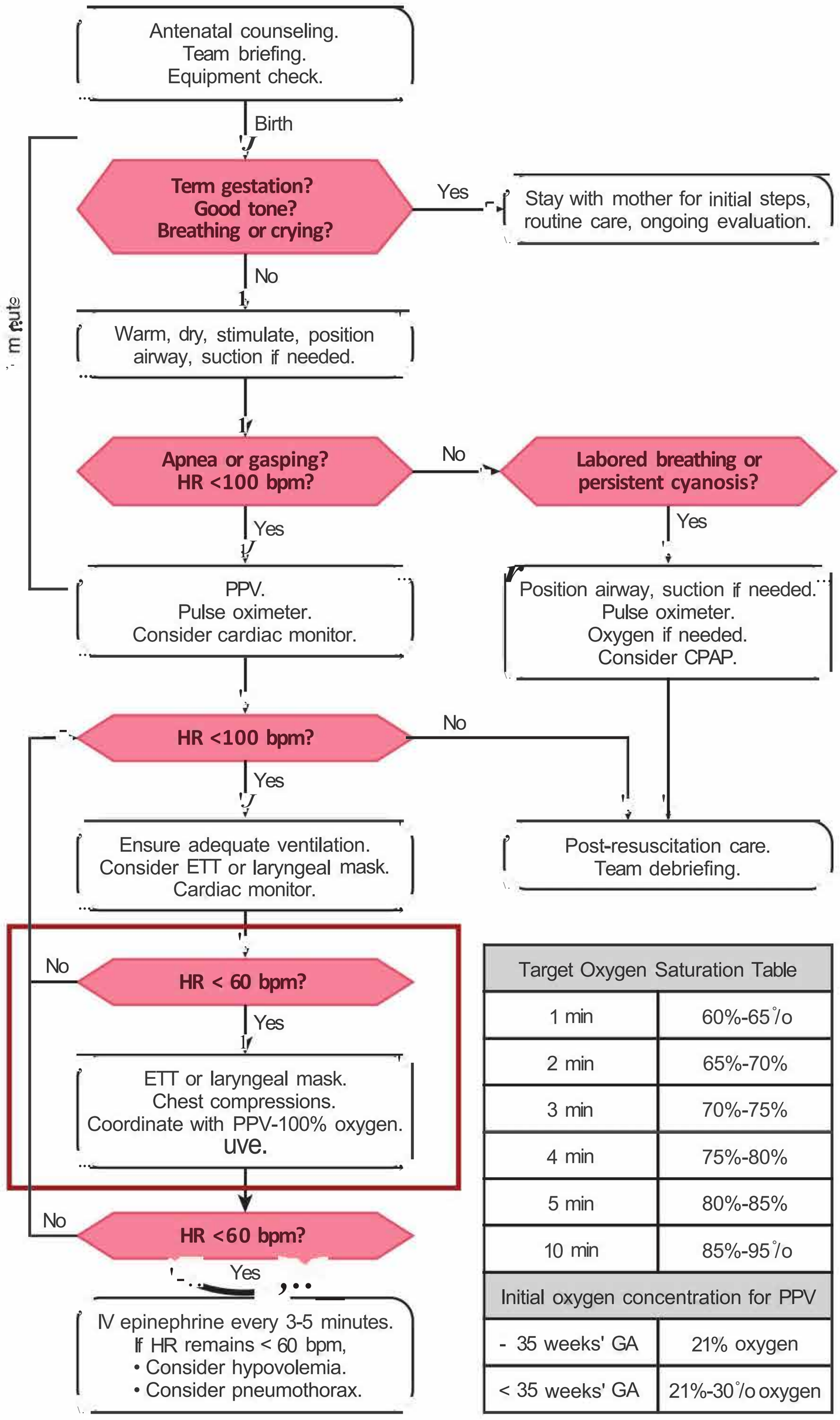
Chest Compressions

6

What you will learn

- When to begin chest compressions
- How to administer chest compressions
- How to coordinate chest compressions with positive-pressure ventilation
- When to stop chest compressions





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%
Initial oxygen concentration for PPV	
- 35 weeks' GA	21% oxygen
< 35 weeks' GA	21%-30% oxygen

Key Points

0 Chest compressions are indicated when the heart rate remains less than 60 beats per minute (bpm) despite at least 30 seconds of positive-pressure ventilation (PPV) that inflates the lungs (chest movement). In most cases, you should have given ventilation through a properly inserted endotracheal tube or laryngeal mask.

8 Inaccurate assessment of heart rate can result in un11ecessary cardiac compressions. If perinatal risk factors suggest the likelihood of complex resuscitation, consider placing cardiac monitor leads once PPV starts.

E) If the chest is not moving with PPV, the lungs have not been inflated and chest compressions are not yet indicated. Continue to focus on achieving effective ventilation.

8 Once the endotracheal tube or laryngeal mask is secure, move to the head of the bed to give chest compressions. This provides space for safe insertion of an umbilical venous catheter and has mechanical advantages that result in less compressor fatigue.

0 If the heart rate is less than 60 bpm, the pulse oximeter may not have a reliable signal. When chest compressions begin, ventilate using 100% oxygen until the heart rate is at least 60 bpm and the pulse oximeter has a reliable signal.

9 To administer chest compressions, place your thumbs on the sternum, in the center, just below an imaginary line connecting the baby's nipples. Encircle the torso with both hands. Support the back with your fingers. Your fingers do not need to touch each other.

0 Use enough downward pressure to depress the sternum approximately one-third of the anterior-posterior (AP) diameter of the chest.

0 The compression rate is 90 compressions per minute and the breathing rate is 30 breaths per minute.

a. This is a slower ventilation rate than used during assisted ventilation without compressions.

b. To achieve the correct rate, use the rhythm: "One-and-Two-and-*Three-and-Breathe-and*...."

f) After 60 seconds of chest compressions and ventilation, briefly stop compressions and check the heart rate. A cardiac monitor is the preferred method for assessing heart rate during chest

compressions. You may also assess the baby's heart rate by listening with a stethoscope. If necessary, you may briefly stop ventilation to auscultate the heart rate.

If the heart rate is 60 bpm or greater, discontinue compressions and resume PPV at 40 to 60 breaths per minute. When a reliable pulse oximeter signal is achieved, adjust the oxygen concentration to meet the target oxygen saturation guidelines.

4D If the baby's heart rate remains less than 60 bpm despite 60 seconds of effective ventilation and high-quality, coordinated chest compressions, epinephrine administration is indicated and emergency vascular access is needed.

Case: Late preterm newborn that does not respond to effective ventilation

Your team is called to attend an emergency cesarean birth for a woman at 36 weeks' gestation because of fetal distress. The amniotic fluid is clear. You complete a pre-resuscitation briefing, assign roles and responsibilities, and prepare your supplies and equipment. After birth, the obstetrician dries and stimulates the baby to breathe, but the baby remains limp and apneic. The umbilical cord is clamped and cut, and the baby is moved to a radiant warmer. You position the baby's head and neck, suction the mouth and nose, and provide brief additional stimulation, but the baby remains apneic. You begin positive-pressure ventilation (PPV) with 21% oxygen, while other team members assess the baby's heart rate with a stethoscope, place a pulse oximeter sensor on the right hand, and document the events as they occur. The pulse oximeter <loes not have a reliable signal and cardiac monitor leads are placed on the baby's chest. The heart rate is 40 beats per minute (bpm), not increasing, and the baby's chest is not moving with PPV. You proceed through the ventilation corrective steps, including increasing the ventilation pressure, but the chest still <loes not move with ventilation and the baby's heart rate <loes not increase.

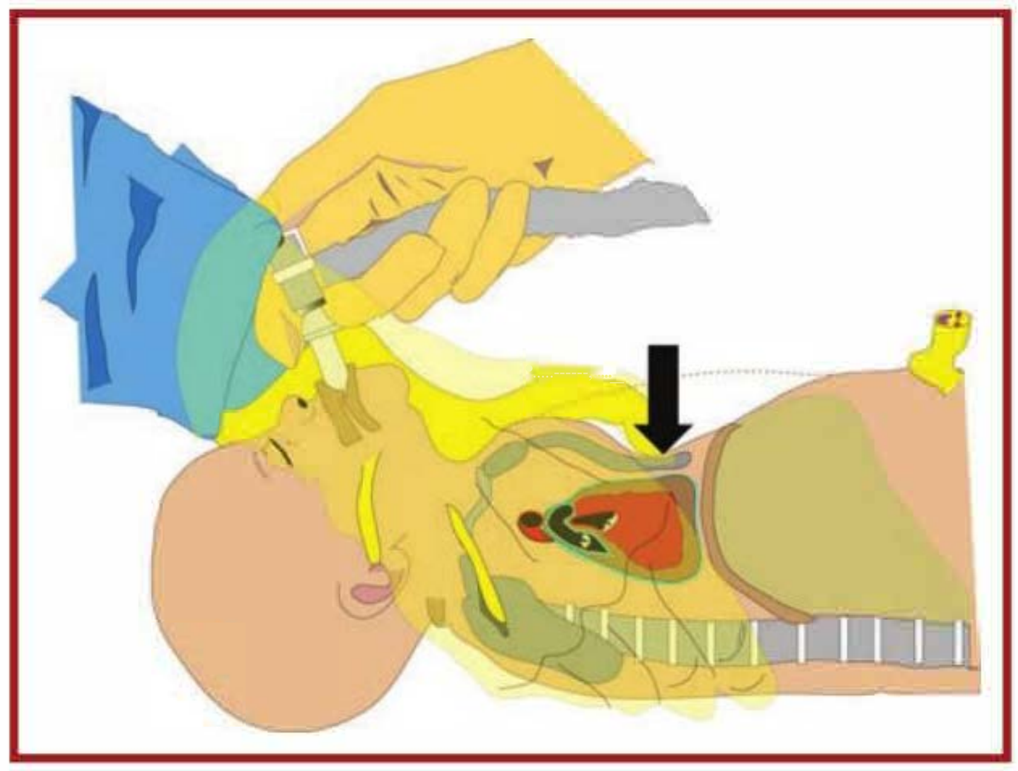
A team member inserts and secures an endotracheal tube, and ventilation resumes. The carbon dioxide ($C0_2$) detector <loes not change color; however, there is good chest movement with PPV through the tube, and breath sounds are equal in the axillae. Anticipating a prolonged resuscitation, a team member applies a servo-controlled temperature sensor to the baby's skin to monitor and control the baby's body temperature. Ventilation through the endotracheal tube is continued for 30 seconds, but the heart rate remains 40 bpm. Your team increases the oxygen concentration ($F10_2$) to 100%, begins chest compressions coordinated with PPV, and calls

for additional help. During compressions and coordinated ventilation, the $C0_2$ detector changes color to yellow, and, within 60 seconds, the heart rate increases to greater than 60 bpm. You stop compressions and continue PPV as the heart rate continues to increase. Your team members frequently reevaluate the baby's condition and share their assessments with each other. The pulse oximeter shows a reliable signal and the $F10_2$ is adjusted to meet the oxygen saturation target. As the baby's tone improves, you observe intermittent spontaneous respiratory effort and the baby's heart rate increases to 160 bpm. The parents are updated and the baby is moved to the special care nursery for post-resuscitation care. Shortly afterward, your team members conduct a debriefing to review their preparation, teamwork, and communication.

What are chest compressions?

Babies who do not respond to ventilation that inflates their lungs are likely to have very low blood oxygen levels, significant acidosis, and insufficient blood flow in their coronary arteries. As a result, cardiac muscle function is severely depressed. Improving coronary artery blood flow is crucial for restoring the heart's function.

The heart lies in the chest between the lower third of the sternum and the spine. Rhythmically depressing the sternum compresses the heart against the spine, pushes blood forward, and increases the blood pressure in the aorta. When pressure on the sternum is released, the heart refills with blood and blood flows into the coronary arteries (Figure 6.1). By compressing the chest and ventilating the lungs, you help to restore the flow of oxygenated blood to the heart muscle and the lungs.



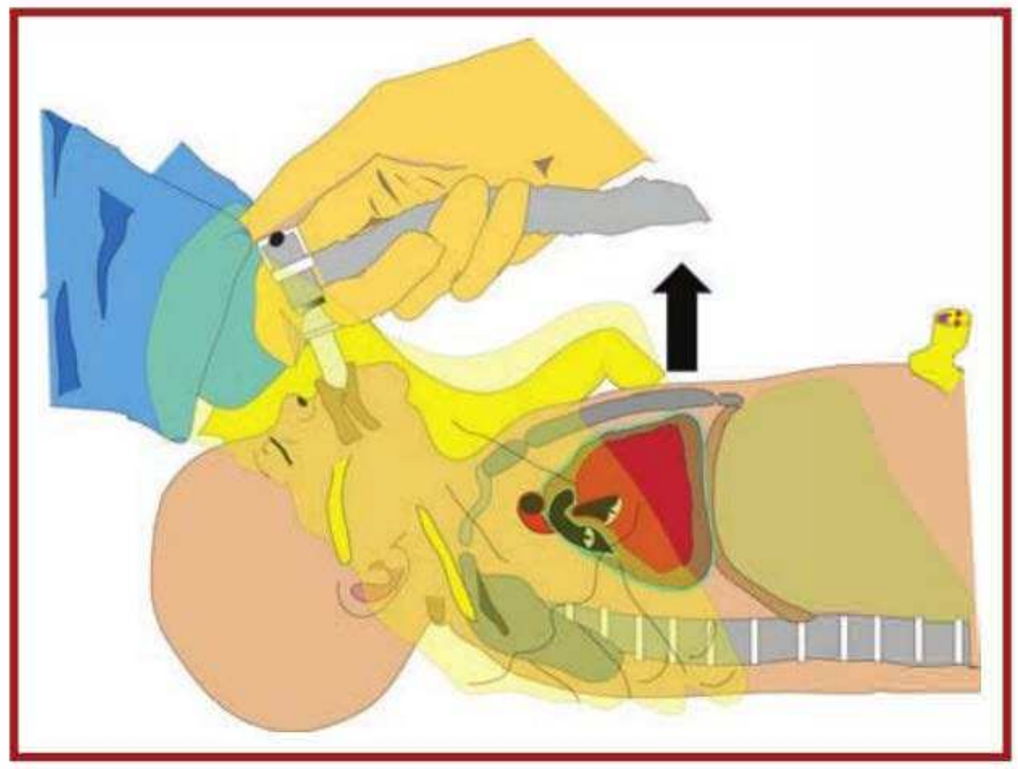
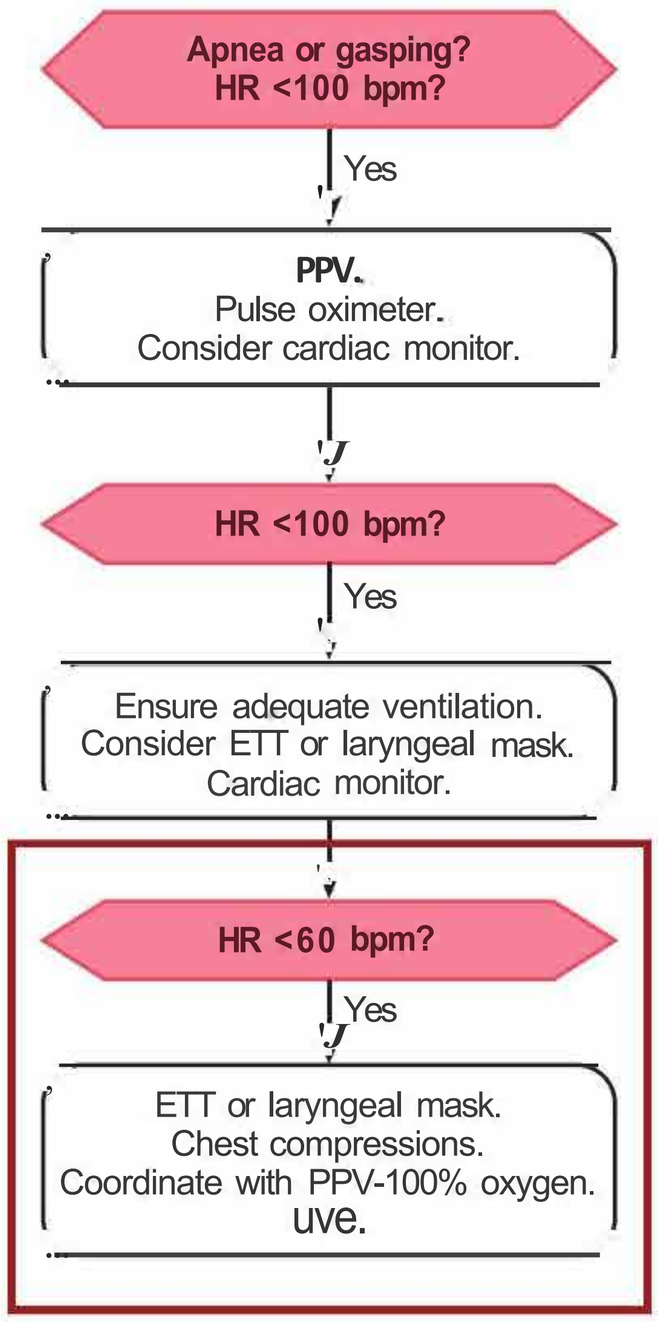


Figure 6.1. Compression (top) and release (bottom) phases of chest compressions

When do you begin chest compressions?

- Chest compressions are indicated if the baby's heart rate remains **less than 60 bpm** after at least 30 seconds of PPV that inflates the lungs, as evidenced by chest movement with ventilation.
- In most cases, you should have given at least 30 seconds of ventilation through a properly inserted endotracheal tube or laryngeal mask.



- If compressions are started, **call for help** if needed as additional personnel may be required to prepare for vascular access and epinephrine administration.

If the lungs have been adequately ventilated, it is rare for a newborn to require chest compressions. Only approximately 1 to 2 per 1,000 newborns are expected to require chest compressions. Do not begin chest compressions unless you have achieved chest movement with your ventilation attempts. If the chest is not moving, you are most likely not providing effective ventilation. Focus your attention on the ventilation corrective steps, ensuring that you have an unobstructed airway, before starting compressions. This program recommends ventilating through an endotracheal tube or laryngeal mask for 30 seconds before starting chest compressions.

Sometimes a newborn receives unnecessary chest compressions because the heart rate is inaccurately assessed. If perinatal risk factors suggest the likelihood of a complex resuscitation, consider placing cardiac monitor leads once PPV starts. The cardiac monitor can then be used to assess the heart rate and support critical decision-making, such as beginning chest compressions and administering medication.

Where do you stand to administer chest compressions?

When chest compressions are started, you may be standing at the side of the warmer. One of your team members, standing at the head of the bed, will be providing coordinated ventilations through an endotracheal tube.

Figure 6.2. Compressor standing at the head of the bed

If chest compressions are required, there is a high probability that you will also need to insert an emergency umbilical venous catheter for intravascular access. It is difficult to insert an umbilical venous catheter if the person administering compressions is standing at the side of the warmer with their arms encircling the baby's chest. Once intubation is completed and the tube is secure, the compressor should move to the head of the bed while the person operating the PPV device moves to the side (Figure 6.2). In addition to providing space for umbilical venous catheter insertion, this position has mecl1anical advantages that result in less fatigue for the compressor.

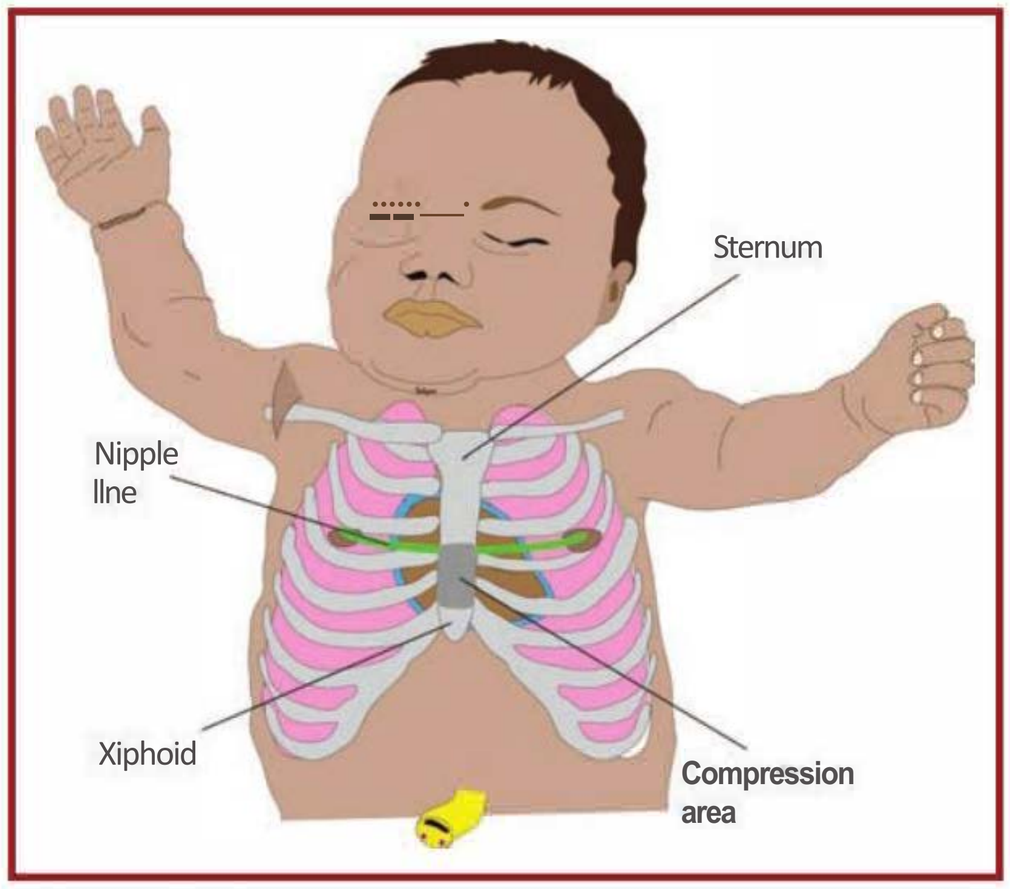


Figure 6.3. Landmarks for chest compressions

Figure 6.4. Chest compressions using 2 thumbs from the head of the bed. Thumbs are placed over the lower third of the sternum, hands encircling the chest.

Where do you position your hands during chest compressions?

During chest compressions, apply pressure to the lower third of the sternum. Place your thumbs on the center of the sternum, either side-by-side or one on top of the other, just below an imaginary line connecting the baby's nipples (Figure 6.3). Do not place your thumbs on the ribs or on the xiphoid. The xiphoid is the small, pointed projection at the bottom of the sternum where the lower ribs meet at the midline.

Encircle the baby's chest with your hands. Place your fingers under the baby's back to provide support (Figure 6.4). Your fingers do not need to touch.

How deeply do you compress the chest?

Using your thumbs, press the sternum downward to compress the heart between the sternum and the spine. Do not squeeze the chest with your encircling hands. With your thumbs correctly positioned, use enough pressure to depress the sternum ***approximately one-third of the anterior-posterior (AP) diameter of the chest*** (Figure 6.5), and then release the pressure to allow the heart to refill. One compression consists of the downward stroke plus the release. The actual distance compressed will depend on the size of the baby.

Your thumbs should remain in contact with the chest during both compression and release. Allow the chest to fully expand by lifting your thumbs sufficiently during the release phase to permit the chest

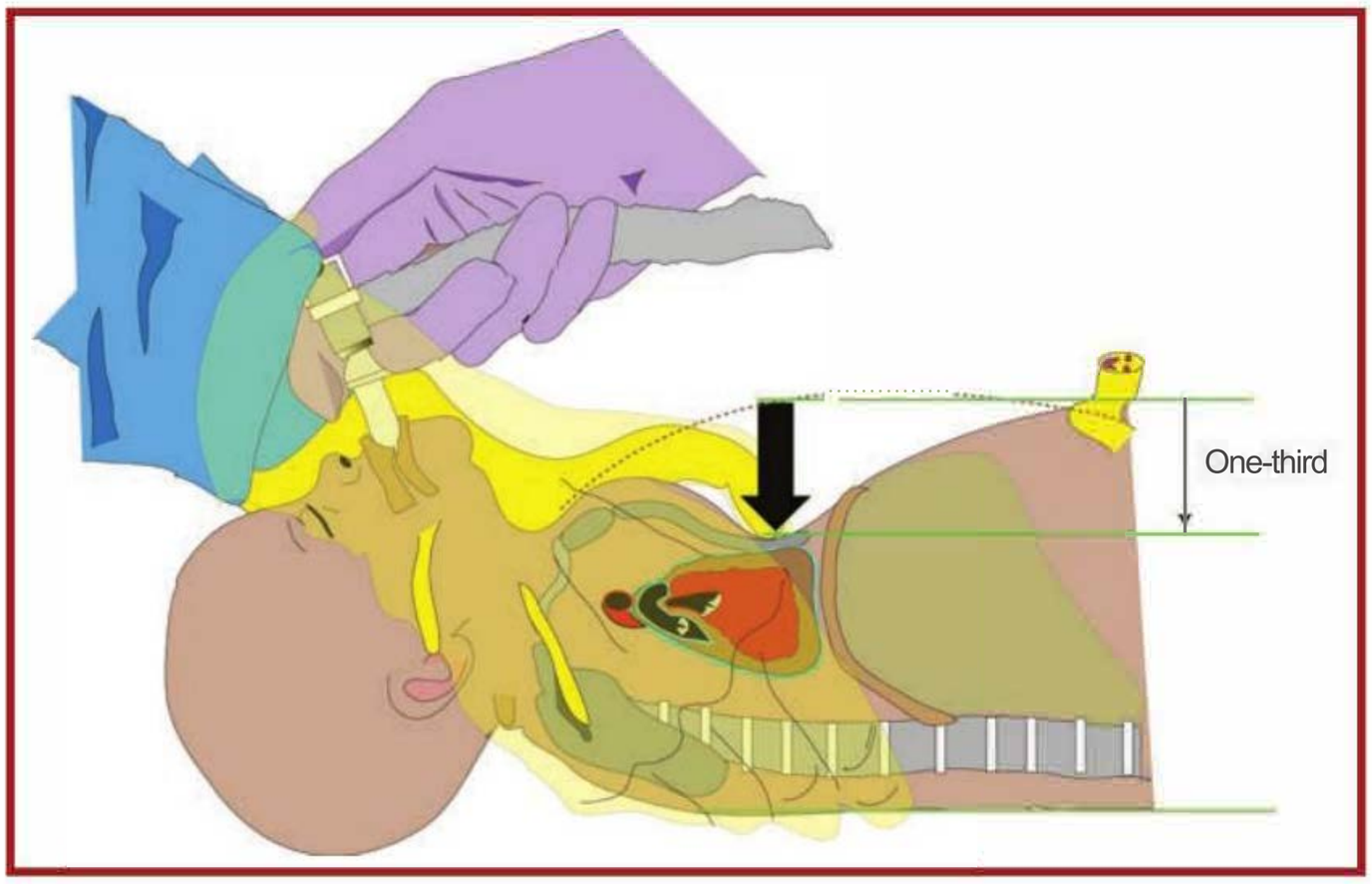


Figure 6.5. Compression depth is approximately one-third of the anterior-posterior diameter of the chest.

to expand; however, do not lift your thumbs completely off the chest between compressions.

What is the compression rate?

The compression rate is 90 compressions per minute. To achieve this rate, you will give 3 rapid compressions and 1 ventilation during each 2-second cycle.

How are compressions coordinated with positive-pressure ventilation?

During neonatal cardiopulmonary resuscitation, chest compressions are always accompanied by coordinated PPV. Give 3 rapid compressions followed by 1 ventilation.

Coordinated Compressions and Ventilations

3 compressions + 1 ventilation every 2 seconds

To assist coordination, the person doing compressions should count the rhythm out loud. Speak loudly enough for the person ventilating to hear the rhythm, but not so loud that the rest of the team members cannot hear each other as they share information. The goal is to give 90 compressions per minute and 30 ventilations per minute (90 + 30 = 120 events per minute). This is a rapid rhythm. Achieving good coordination requires practice.

Learn the rhythm by counting out loud: *"One-and-Two-and-Three-**and-Breathe-and;** One-and-Two-and-Three-and-Breathe-and; One-and-Two-and-Three-and-Breathe-and."*

- Compress the chest with each counted number *("One, Two, Three").*
- Release the chest between each number *("-and-").*
- Pause compressions and give a positive-pressure breath when the compressor calls out *"breathe-and."*

Inhalation occurs during the "breathe-and" portion of the rhythm, and exhalation occurs during the downward stroke of the next compression. Note that during chest compressions, the ventilation rate is slower than you used when giving only assisted ventilation. This slower rate is used to provide an adequate number of compressions and avoid simultaneous compressions and ventilation.

3:1 Compression:Ventilation Rhythm

One-and-Two-and-Three-and-Breathe-and;

One-and-Two-and-Three-and-Breathe-and;

One-and-Two-and-Three-and-Breathe-and

What oxygen concentration should be used with positive-pressure ventilation during chest compressions?

- When chest compressions are started, **increase the Fio $_2$ to 100%.**
- Once the heart rate is greater than 60 bpm and a reliable pulse oximeter signal is achieved, adjust the **F1O$_2$** to meet the target oxygen saturation guidelines.

The ideal **F1O$_2$** to use during chest compressions is an area of active research, and this recommendation is based on expert opinion. Oxygen is essential for organ function. During chest compressions, blood flow to vital organs may be decreased, and using a higher oxygen **F1O$_2$** concentration may improve oxygen uptake and delivery. In addition, circulation may be so poor that the pulse oximeter will not give a reliable signal, and targeting an oxygen saturation may not be possible. However, once heart function has recovered, continuing to use 100% oxygen may increase the risk of tissue damage from excessive oxygen exposure.

When should you check the baby's heart rate after starting compressions?

Wait ***60 seconds*** **after starting coordinated chest compressions and ventilation** before briefly pausing compressions to reassess the heart rate.

Studies have shown that it may take a minute or more for the heart rate to increase after chest compressions are started. When compressions are stopped, coronary artery perfusion is decreased and requires time to recover once compressions are resumed. It is, therefore, important to avoid unnecessary interruptions in chest compressions because each time you stop compressions, you may delay the heart's recovery.

How should you assess the baby's heart rate response during compressions?

Briefly pause compressions to assess the baby's heart rate. If necessary, briefly pause PPV. A cardiac monitor is the preferred method for assessing heart rate during chest compressions. You may assess the baby's heart rate by listening with a stethoscope or using a pulse oximeter. There are limitations to each of these methods.

- During resuscitation, auscultation can be difficult, prolonging the interruption in compressions, and potentially giving inaccurate results.
- If the baby's perfusion is very poor, a pulse oximeter may not reliably detect the baby's pulse.
- A cardiac monitor displays the heart's electrical activity and may shorten the interruption in compressions, but electrical activity may be present without the heart pumping blood. This unusual finding is called *pulseless electrical activity (PEA),* and is suspected when the cardiac monitor shows electrical activity but the baby continues to deteriorate without palpable pulsations in the umbilical cord, audible heart sounds on auscultation, or a signal on the pulse oximeter. In the newborn, PEA is treated the same as absent electrical activity (heart rate = Oor asystole).

When do you stop chest compressions?

Stop chest compressions when the heart rate is **60 bpm or greater.**

Once compressions are stopped, return to giving PPV at the faster rate of 40 to 60 breaths per minute. When a reliable pulse oximeter signal is achieved, adjust the FIO_2 to meet the target oxygen saturation guidelines.

What do you do if the heart rate is *not* improving after 60 seconds of compressions?

While continuing to administer chest compressions and coordinated ventilation, your team needs to quickly assess the quality of your

ventilation and compressions. In most circumstances, endotracheal intubation or laryngeal mask insertion should have been performed. If not, one of these procedures should be performed now.

Quickly ask each of the 5 questions in Table 6-1 out loud and confirm your assessment as a team. You can use the mnemonic "CARDIO" to remember the 5 questions.

Table 6-1. Questions to Ask When Heart Rate Is Not Improving With Compressions and Ventilation (Mnemonic CARDIO)

1. Chest movement: Is the chest moving with each breath?
2. **Airway:** Is the airway secured with an endotracheal tube or laryngeal mask?
3. **Rate:** Are 3 compressions coordinated with 1 ventilation being delivered every 2 seconds?
4. Depth: Is the depth of compressions one-third of the AP diameter of the chest?
5. Inspired Oxygen: Is 100% oxygen being administered through the PPV device?

If the baby's heart rate remains less than 60 bpm despite 60 seconds of effective ventilation and high-quality, coordinated chest compressions, epinephrine administration is indicated and emergency vascular access is needed.

Focus on Teamwork

Providing chest compressions highlights several opportunities for effective teams to use the Neonatal Resuscitation Program® (NRP®) Key Behavioral Skills.

Behavior	Example
Anticípate and plan.	Ensure that you hove enough personnel present at the time of delivery based on the risk factors you identified. If there is evidence of severe fetal distress, be prepared for the possibility of a complex resuscitation, including chest compressions. If chest compressions are required, there is a high likelihood of also needing vascular access and epinephrine. Plan for this possibility during your team briefing. If compressions are started, a team member should immediately prepare the equipment necessary for emergency vascular access (umbilical venous catheter or intraosseous needle) and epinephrine. If a complex resuscitation is anticipated, prepare to apply a servo-controlled temperature sensor to the baby's skin to monitor and control the baby's body temperature.
Call for additional help when needed. Delegate workload optimally.	If chest compressions are required, you may need 4 or more health care providers. Performing ali of the tasks quickly, including PPV, auscultation, placing a pulse oximeter, intubating the airway, administering compressions, monitoring the quality of compressions and ventilations, monitoring the baby's response, preparing emergency vascular access, documenting events as they occur, and supporting the baby's family, requires multiple team members.

Behavior	Example
Clearly identify a team leader. Allocate attention wisely.	The team leader needs to maintain situation awareness, paying attention to the entire situation, and not becoming distracted by any single activity or procedure. This means that leadership may need to shift to another person if the team leader is performing a procedure that occupies their attention. It is important for someone to monitor the quality of ventilation and compressions while also monitoring the baby's heart rote.
Use available resources.	If the compressor becomes fatigued, hove another team member take over compressions. A respiratory therapist can administer PPV, enabling a nurse or physician to prepare for emergency vascular access and medication administration.
Communicate effectively. Maintain professional behavior.	During compressions, the compressor and ventilator need to coordinate their activity and maintain correct technique. They cannot perform other roles or hove conversations while compress1ons are 1n progress. If a correction is required, make a clear, calm, and directed statement. Speak clearly, directly, and loudly enough for team members to hear you, but avoid extraneous conversation or unnecessarily loud communication that may be distracting. Share information with the individual documenting events so they can be accurately noted.

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

- Who are the providers that have chest compression skills in your delivery room setting?
- Is someone with chest compression skills immediately accessible if needed?
- How often do providers practice their chest compression and coordinated ventilation skills?
- Is a cardiac monitor accessible in your delivery room setting for use when a baby requires intubation and chest compressions?

Process and outcome measures

- How often do newborns receive chest compressions in your delivery room setting?
- When compressions are required, how often is a skilled provider present at the time of birth?

E) How often <loes a baby have an endotracheal tube or laryngeal mask inserted before chest compressions are started?

O How often is the Fro_2 increased to 100% when compressions begin?

Frequently Asked Questions

What are the potential complications of chest compressions?

Chest compressions can cause trauma to the baby. Two vital organs lie within the rib cage-the heart and lungs. As you perform chest compressions, you must apply enough pressure to compress the heart between the sternum and spine without damaging underlying organs. The liver lies in the abdominal cavity partially under the ribs. Pressure applied directly over the xiphoid could cause laceration of the liver.

Chest compressions should be administered with the force directed straight down on the middle of the sternum. Do not become distracted and allow your thumbs to push on the ribs connected to the sternum. By following the procedure outlined in this lesson, the risk of injuries can be minimized.

Why does the Neonatal Resuscitation Program Algorithm follow A-8-C (Airway-Breathing-Compressions) when other programs follow C-A-8 (Compressions-Airway-Breathing)?

The NRP focuses on establishing effective ventilation, rather than starting chest compressions because the vast majority of newborns who require resuscitation have a healthy heart. The underlying problem is respiratory failure with impaired gas exchange; therefore, ventilation of the baby's lungs is the single most important and effective step during neonatal resuscitation. Very few babies will require chest compressions once effective ventilation has been established. Other programs focus on chest compressions because adults are more likely to have a primary cardiac problem causing cardiorespiratory collapse. Teaching a single approach for children and adults simplifies the educational process.

Why does the Neonatal Resuscitation Program use a 3: 1 compression-to-ventilation ratio instead of the 15:2 ratio used in other programs?

Neonatal animal studies have shown that the 3:1 ratio shortens the time to return of spontaneous circulation. Alternative ratios, as well as asynchronous (uncoordinated) ventilations after intubation, are routinely used outside the newborn period but have not been shown to improve recovery in newborns. Additional chest compression techniques and ratios are currently being studied, but there is insufficient evidence to recommend them at this time.

In the case at the beginning of the lesson, the CO_2 detector did not change color even though the endotracheal tube was correc y inserted. Why?

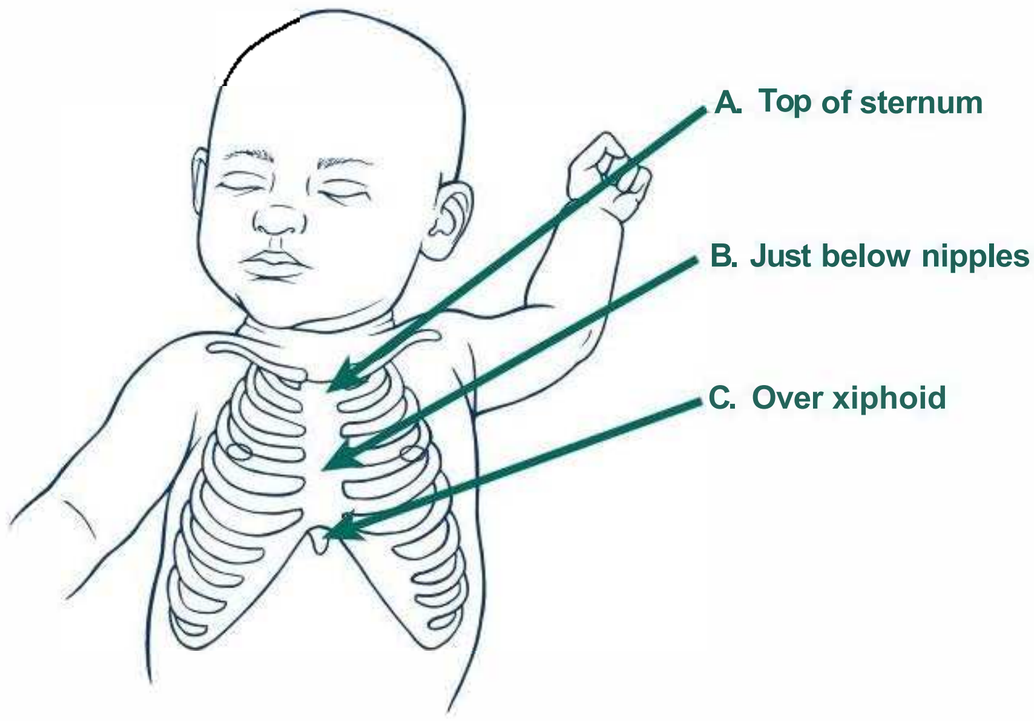
If a baby has a very low heart rate or very poor cardiac function, there may not be enough $C0_2$ carried to the lungs to change the detector's color. In this case, you will need to use other indicators (chest movement and breath sounds) to determine if the endotracheal tube is correctly inserted. If the $C0_2$ detector begins to change color during compressions, this may be an indication of improving cardiac function.

LESSON 6 REVIEW

1. A newborn is apneic at birth. The baby <loes not improve with the initial steps, and positive-pressure ventilation is started. After 30 seconds, the heart rate has increased from 40 beats per minute (bpm) to 80 bpm. Chest compressions (should)/(should not) be started. Positive-pressure ventilation (should)/(should not) continue.

2. A newborn is apneic at birth. The baby <loes not improve with the initial steps or positive-pressure ventilation. An endotracheal tube is inserted properly, the chest moves with ventilation, bilateral breath sounds are present, and ventilation has continued for another 30 seconds. The heart rate remains 40 beats per minute. Chest compressions (should)/(should not) be started. Positive-pressure ventilation (should)/(should not) continue.

3. Mark the area on this baby where you would apply chest compress1ons.



4. The correct depth of chest compressions is approximately
   a. One-fourth of the anterior-posterior diameter of the chest
   b. One-third of the anterior-posterior diameter of the chest
   c. One-half of the anterior-posterior diameter of the chest
   d. Two inches

5. The ratio of chest compressions to ventilation is (3 compressions to 1 ventilation)/(1 compression to 3 ventilations).

6. What phrase is used to achieve the correct rhythm for coordinating chest compressions and ventilation? _____.

7. You should briefly stop compressions to check the baby's heart rate response after (30 seconds)/(60 seconds) of chest compressions with coordinated ventilations.

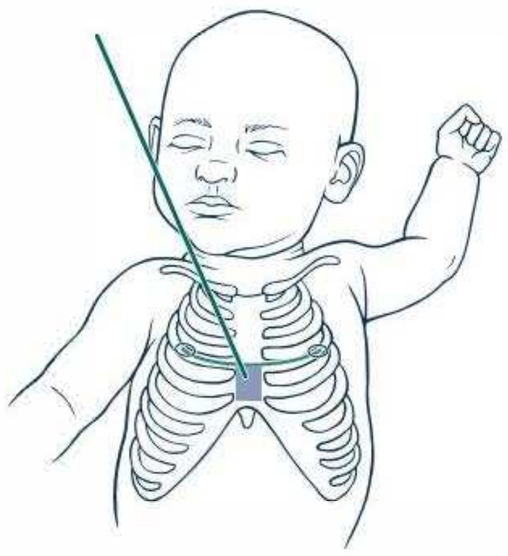
8. Chest compressions can be discontinued when the heart rate is greater than (100 beats per minute)/(60 beats per minute).

Answers

1. Chest compressions should not be started. Positive-pressure ventilation should continue.

2. Chest compressions should be started. Positive-pressure ventilation should continue.

3. Compression area (B) just below the nipples.



4. The correct depth of chest compressions is approximately one-third of the anterior-posterior diameter of the chest.

5. The ratio of chest compressions to ventilation is 3 compressions to 1 ventilation.

6. ((One-and-Two-and-Three-and-Breathe-and...."

7. You should briefly stop compressions to check the baby's heart rate response after 60 seconds of chest compressions with coordinated ventilations.

8. Discontinue chest compressions when the heart rate is greater than 60 beats per minute.

LESSON 6: PRACTICE SCENARIO

Chest Compressions

Learning Obiectives

- Identify the newborn that requires chest compressions.
- Interpret the meaning of a carbon dioxide ($C0_2$) detector that <loes not change color even though there are other clinical signs that indicate lung inflation with positive-pressure ventilation (PPV).
- Demonstrate the correct technique for performing chest compress1ons.
- Identify the sign that indicates chest compressions should be discontinued.
- Demonstrate behavioral skills to ensure clear communication and teamwork during this critica! component of newborn resuscitation.

This Practice Scenario is for review/practice and evaluation.

This is the suggested Practice Scenario sequence.

- **Review the Knowledge Check Questions** with your Neonatal Resuscitation Program (NRP) instructor.
  a. What are the indications for beginning chest compressions?
  b. What oxygen concentration is used when chest compressions are required?
  c. How long are chest compressions administered before checking a heart rate?
  d. When can chest compressions be discontinued?
- **Practice/review these skills** with your NRP instructor.
  a. Move to the head of the baby to perform compressions when intubation is complete and the tube is secure. The person providing PPV moves to the side.
  b. Position your hands in correct positio.n on the baby's chest.
  c. Provide compressions at the correct rate and depth.
  d. Count the chest compression rhythm out loud and coordinate chest compressions with ventilation.
  e. Apply a servo-controlled temperature sensor and adjust the radiant warmer.

E) **Practice this scenario** with your NRP instructor and your team until you need little or no assistance or coaching.

O **Pass the Lesson 6 Practice Scenario evaluation** by leading a practice scenario and performing chest compressions and other skills relevant to your role and responsibilities. If a technical skill included in a scenario is not within your scope of responsibility, delegate the skill to a qualified team member and perform the role of assistant if appropriate.

0 When you can lead the scenario(s) and perform the skills with little or no instructor coaching, proceed to the next lesson's practice scenar10.

Practice Scenario

"You are called to attend an emergency cesarean birth due to fetal bradycardia. How would you prepare for the resuscitation of the baby? As you work, say your thoughts and actions aloud so I will know what you are thinking and doing."

Critical Performance Steps	
Assess perinatal risk.	
	Assesses perinatal risk (learner asks 4 pre-birth questions and instructor ["OB provider"] responds) Gestation? **"Term."** Fluid clear? **"Fluid is clear."** Additional risk factors? **"Fetal bradycardia for the last 3 minutes."** Umbilical cord management plan? **"We'll assess the baby at birth. If the baby's not vigorous, 1'11give brief stimulation, and if there's no improvement, 1'11clamp the cord and bring the baby to the radiant warmer."**
Assemble team.	
	Assembles team based on perinatal risk factors. If risk factors are present, at least 2 qualified people should be present solely to manage the baby. 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 as they occur, determines supplies and equipment needed, identifies how to cal! for additional help.
Perform equipment check. (Learners may prep for intubation, umbilical venous catheter insertion, and medication.)	
	"The baby has been born."
Rapid evaluation.	
	• Term? **"Appears term."** • Tone? **"No tone."** • Breathing or crying? **"No breathing."**
Initial steps.	
	Receives baby at radiant warmer, dries, stimulates, positions airway, suctions mouth and nose

	Critical Performance Steps (cont)
Assess breathing. If breathing, assesses heart rate.	
	Checks breathing **"Baby is apneic." (Heart rote = 40 bpm, if assessed)**
Begin PPV within 60 seconds of birth.	
	Begins PPV in 21 % oxygen (room air). Within 15 seconds of beginning PPV, learner asks assistant to check heart rote and assess if heart rote is rising. **Heart rote = 40 bpm, not increasing "Pulse oximeter has no signal."** Applies cardiac monitor (optional at this time).
Assess chest movement.	
	• If chest movement observed, continues PPV x 15 seconds (for total of 30 seconds PPV). • If no chest movement observed, proceeds through corrective steps (MR. SOPA) until chest movement is achieved (instructor may determine how many steps are required); then administers PPV x 30 seconds. Heart rote will remain less than 60 bpm. • *If* no *chest movement is achieved after M and R, S and* O, *and P steps, learner indicates need for alternative airway and proceeds directly to intubation or laryngeal mask insertion.*
Check heart rote after 30 seconds of PPV that moves the chest.	
	Checks heart rote. **Heart rate = 40 bpm and not increasing** Indicates need for alternative airway.
	Places cardiac monitor leads and connects to monitor in anticipation of alternative airway (if not already done)
Insert alternative airway (endotracheal tube or laryngeal mask).	
	• Intubates (size 1 blade and size 3.5 endotracheal tube) or inserts laryngeal mask (size 1) • Checks for rising heart rote, CO_2 detector color change, bilateral breath sounds, and chest movement with PPV • For endotracheal intubation: Checks tip-to-lip insertion depth using nasal-tragus length or insertion depth chart • Asks assistant to secure endotracheal tube or laryngeal mask
	If PPV device not successfully inserted: **"Color is not changing on the CO_2 detector, chest is not moving, and heart rote is not increasing."** • Removes device • Resumes PPV by face mask • Repeats insertion attempt
	If device successfully inserted: **Note: Color might not change on the CO_2 detector due to low heart rate.** **Heart rote = 40 bpm and not increasing** **"Chest is moving with PPV, pulse oximeter has no signal."** • Continues PPV x 30 seconds
Check heart rote after 30 seconds of PPV with alternative airway.	
	Checks heart rote after 30 seconds of PPV that moves the chest **Heart rote = 40 bpm and not increasing "Pulse oximeter has no signal."**
Begin chest compressions.	
	Calls for additional help if necessary. Asks assistant to increase oxygen to 100%. Asks assistant to place servo-controlled temperature sensor on baby and adjust the radiant warmer to maintain baby's temperature 36.5°C to 37.5°C. May ask team member to prepare for umbilical venous catheter insertion and epinephrine administration.

	Critical Performance Steps (cont)
	Compressor moves to head-of-bed position, ventilator to side of bed
	Places thumbs on sternum (lower third, below imaginary line connecting nipples); fingers under back, supporting spine (fingers do not need to touch)
	Compresses sternum one-third of the anterior-posterior diameter of chest, straight up and down • Compressor counts cadence "One-and-two-and-three-and-breathe-and" • Positive-pressure ventilation administered during compression pause ("breathe-and") • One cycle of 3 compressions and 1 breath every 2 seconds
Check heart rote after l minute.	
	Pauses compressions, continues PPV, and checks heart rote after 60 seconds of compressions and ventilations **Heart rote = 70 bpm and rising** **"Pulse oximeter has o signal. No spontaneous respirations."**
Discontinue compressions-Continue PPV.	
	• Discontinues chest compressions • Continues PPV with higher ventilation rote (40-60 breaths/min) • Adjusts oxygen concentration per target oxygen saturation **Heart rote is > l00 bpm and increasing SP02=78% "No spontaneous respirations."**
Check vital signs.	
	Continues PPV and adjusts oxygen concentration per oximetry **Heart rote is > l00 bpm SP02=90%** **"Muscle tone improving. Sorne spontaneous respirations."**
End scenario.	
	Supports baby with PPV and supplemental oxygen per Target Oxygen Saturation Table. Monitors heart rote, respiratory effort, oxygen saturation, activity, temperature. Prepares to move baby to post-resuscitation care setting. Communicates with perinatal team. Updates parents and informs them of next steps. Debriefs the resuscitation.

Sample Debriefing Questions

- What went well during this resuscitation?
- What is the most important issue to discuss during this debriefing?
- What will you do differently when faced with chest compressions in a future scenario?
- Do you have additional comments or suggestions for your team? For the leader?
- Give me an example of how you used at least one of the NRP Key Behavioral Skills.

If significant errors were made, consider asking the learners

- What happened? What should have happened? What could you have done to make the right things happen?
- What NRP Key Behavioral Skills might have been helpful in this situation?

NRP Key Behavioral Skills

- Know your environment.
- Use available information.
- Anticípate 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.