8

Resuscitation and Stabilization of Babies Born Preterm

What you will learn

- Why babies born preterm are at higher risk of medical complications
- The additional resources needed to prepare for a preterm birth
- Additional strategies to maintain the preterm baby's body temperature
- How to assist ventilation when a preterm baby has difficulty breathing
- Additional considerations for oxygen management in a preterm baby
- Ways to decrease the chances of lung and brain injury in preterm babies
- Special precautions to take after the initial stabilization period
- How to present information to parents before the birth of an extremely premature baby

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Key Points

- Preterm newborns are at increased risk for requiring resuscitation and assistance with transition after birth.
- Preterm newborns are at increased risk of complications because of rapid heat loss, immature organ systems, small blood volume, and vulnerability to hypoglycemia.
- Additional resources (including skilled personnel, a polyethylene plastic bag or wrap, a hat, thermal mattress, temperature sensor and cover for a servo-controlled radiant warmer, preterm-sized masks and endotracheal tubes, a positive-pressure device that can provide positive-end expiratory pressure [PEEP] and continuous positive airway pressure [CPAP], and surfactant) should be available.
- The temperature in the room where resuscitation takes place should be 23°C to 25°C (74°F-77°F).
- If the baby is less than approximately 32 weeks' gestation, a polyethylene plastic bag or wrap and a thermal mattress should be prepared.
- If positive-pressure ventilation (PPV) is required, use the lowest inflation pressure necessary to achieve and maintain an adequate heart rate response. It is preferable to use a device that can provide PEEP.
- Consider using CPAP immediately after birth if the baby is breathing spontaneously with a heart rate of at least 100 beats per minute (bpm) but has labored respirations or low oxygen saturation.
- To decrease the risk of neurologic injury, handle the baby gently, avoid positioning the baby's legs higher than the head, avoid high PPV or CPAP pressures, use a pulse oximeter and blood gases to adjust ventilation and oxygen concentration, and avoid rapid intravenous fluid infusions.

The following 2 cases describe the birth and resuscitation of preterm babies. As you read the cases, imagine yourself as part of the team from the anticipation of the delivery through the resuscitation, stabilization, and transfer to an intensive care nursery.

Case 1: Stabilization of a baby born very preterm

A woman is in premature labor at 29 weeks' gestation with ruptured membranes and clear amniotic fluid. A vaginal birth is anticipated. The resuscitation team leader meets with the obstetrician and parents to discuss the care plan. Anticipating the possibility of a complex resuscitation, your resuscitation team is assembled and reviews each team member's role. Using a written checklist, your team ensures that ali supplies and equipment needed to resuscitate and stabilize a preterm baby are ready for use. One team member attaches a preterm-sized mask to the T-piece resuscitator. The peak inflation pressure (PIP) is adjusted to 20 cm H_20 and positive end-expiratory pressure (PEEP) is set to 5 cm H_20 . Next, a laryngoscope with a size Oblade and both a 3.0-mm and 2.5-mm endotracheal tube are prepared. The oxygen blender is adjusted to deliver 21% oxygen. Additional team members increase the delivery room temperature, turn on the radiant warmer, obtain polyethylene plastic wrap, activate a thermal mattress, and cover the mattress with a cotton blanket. The obstetrician prepares a warm blanket.

At the time of birth, the baby has flexed extremities but <loes not cry. The obstetrician holds the baby on the warm blanket, provides gentle tactile stimulation, and gently suctions secretions from the mouth and nose. After 15 seconds, the baby begins to take spontaneous breaths. By 30 seconds, the baby has sustained respirations and is actively moving. An assistant clamps and cuts the umbilical cord 60 seconds after birth and the baby is handed to your resuscitation team. The baby is carried to the radiant warmer, placed on the blanket-covered thermal mattress, and wrapped in the plastic sheet. A servo-controlled temperature sensor is applied to the baby's skin to monitor and control the baby's body temperature, and a hat is placed on the baby's head. The baby is breathing and has a heart rate greater than 100 beats per minute (bpm), but breathing is labored and breath sounds are decreased. A team member attaches a pulse oximeter sensor to the baby's right hand and cardiac monitor leads to the chest. Continuous positive airway pressure (CPAP) with 21% oxygen is administered using the face mask and T-piece resuscitator. The baby's breath sounds and work of breathing improve, but the oxygen saturation (SPo_2) is below the target range. The oxygen concentration ($F10_2$) is gradually increased to 30% and the SPo_2 begins to rise. Nasal CPAP prongs are placed. Your team continues to adjust the oxygen blender based on pulse oximetry and, by 15 minutes of age, the $F10_2$ has been decreased to 21%.

The parents are updated by the team leader, they have an opportunity to see and touch their baby, and the baby is moved to the intensive care nursery in a pre-warmed transport incubator. Shortly afterward, team members co11duct a debriefing to review their preparation, teamwork, and communication.

Case 2: Resuscitation and stabilization of a baby born extremely preterm

A woman is in preterm labor at 24 weeks' gestation with ruptured membranes and clear amniotic fluid. Your resuscitation team leader meets with the obstetrician and parents to discuss current outcome data and the procedures that may be required to resuscitate and stabilize an extremely premature newborn. After the discussion, they develop a care plan based on the parents' assessment of their baby's best interest. The parents and health care providers agree to provide intensive medica} care, including endotracheal intubation, chest compressions, and emergency medication, if necessary. Despite tocolysis, labor progresses anda vaginal birth is anticipated. Your resuscitation team is assembled for a pre-resuscitation team briefing to review each member's roles and responsibilities. Using a written checklist, the team prepares the necessary supplies and equipment.

At the time of birth, the baby is flaccid and does not cry. The obstetrician holds the baby on the warm blanket, provides gentle tactile stimulation, and gently suctions secretions from the mouth and nose, but the baby's tone remains poor and the baby is not breathing. The umbilical cord is clamped and cut and the baby is handed to your resuscitation team. The baby is carried to the radiant warmer, placed on the blanket-covered thermal mattress, and wrapped in the plastic sheet. A servo-controlled temperature sensor is applied to the baby's skin to monitor and control the baby's body temperature, and a hat is placed on the baby's head. The baby remains limp without respiratory effort. You administer positive-pressure ventilation (PPV) using the T-piece resuscitator and 30% oxygen. A team member attaches a pulse oximeter sensor to the right wrist and cardiac monitor leads to the chest. The baby's heart rate is 60 bpm and the chest is not moving with PPV. The ventilation corrective steps are performed, including incrementally increasing the inflation pressure from 20 cm H_20 to 30 cm H_20, but the heart rate still <loes not improve. A 2.5-mm endotracheal tube is inserted and placement is confirmed with a carbon dioxide ($C0_2$) detector. Positive-pressure ventilation is continued with the T-piece resuscitator, breath sounds are equal

bilaterally, and the heart rate promptly increases. The nasal-tragus length (NTL) is 4.5 cm and the endotracheal tube is secured with the 5.5-cm mark adjacent to the baby's lip. The FIO_2 is gradually adjusted to meet the oxygen saturation target, and the T-piece PIP is adjusted to maintain gentle chest movement with each breath. A short time later, surfactant is administered through the endotracheal tube. By 20 minutes, the FIO_2 has been decreased to 25%.

The parents are updated by the team leader, they have an opportunity to see and touch their baby, and the baby is moved to the intensive care nursery in a pre-warmed transport incubator with blended oxygen and continuous monitoring. Shortly afterward, your team members conduct a debriefing to review their preparation, teamwork, and communication.

Preterm Birth

In the previous lessons, you learned a systematic approach to neonatal resuscitation. When birth occurs before term gestation (less than 37 weeks' gestation), additional challenges make the transition to extrauterine life more difficult. The likelihood that a preterm newborn will need help making this transition is related to gestational age. Babies born at lower gestational ages are more likely to require additional interventions. Because preterm newborns are also more vulnerable to injury from resuscitation procedures, it is important to find the correct balance between initiating resuscitation without delay and avoiding unnecessarily invasive procedures. Your management during these first minutes may decrease the risk of both short- and long-term complications. This lesson focuses on the additional problems associated with preterm birth and the actions you can take to prevent or manage them.

Why do preterm babies have a higher risk of complications?

Sorne complications result from the underlying problem that caused the preterm birth while others reflect the baby's anatomic and physiologic immaturity.

- Thin skin, decreased subcutaneous fat, large surface area relative to body mass, and limited metabolic response to cold lead to rapid heat loss.
- Weak chest muscles, poorly compliant (stiff) lungs, and flexible ribs decrease the efficiency of spontaneous breathing efforts.

- Immature lungs that lack surfactant are more difficult to ventilate and are at greater risk of injury from PPV.
- Immature tissues are more easily damaged by oxygen.
- Infection of the amniotic fluid and placenta (chorioamnionitis) may initiate preterm labor, and the baby's immature immune system increases the risk of developing severe infections such as pneumonia, sepsis, and meningitis.
- A smaller blood volume increases the risk of h_{yp} ovolemia from blood loss.
- Immature blood vessels in the brain cannot adjust to rapid changes in blood flow, which may cause bleeding or damage from insufficient blood supply.
- Limited metabolic reserves and immature compensatory mechanisms increase the risk of h_{yp} oglycemia after birth.

What additional resources do you need for resuscitating a preterm newborn?

The chance that a preterm baby will require resuscitation is significantly higher than for a baby born at full term. This is true even for late-preterm babies born at 34 through 36 weeks' gestation.

- If the baby is anticipated to be less than 32 weeks' gestation, prepare a polyethylene bag or wrap and a thermal mattress as described in the next section.
- A servo-controlled radiant warmer with a temperature sensor helps to maintain the baby's temperature within the normal range.
- An oxygen blender and a pulse oximeter with an appropriate-sized sensor should be available for all preterm births.
- A cardiac monitor with 3 chest leads or limb leads provides a rapid and reliable method of continuously displaying the baby's heart rate if the pulse oximeter has difficulty acquiring a signal.
- A resuscitation device capable of providing PEEP and CPAP, such as a T-piece resuscitator or flow-inflating bag, is preferred.
- A preterm-sized resuscitation mask, size Olaryngoscope blade (size 00 optional), and appropriate-sized endotracheal tubes (3.0 mm and 2.5 mm) should be prepared.
- Consider having surfactant available if the baby is expected to be less than 30 weeks' gestation.
- A pre-warmed transport incubator with blended oxygen anda pulse oximeter is important for maintaining the baby's temperature and oxygenation within the target range if the baby will be moved after the initial stabilization.

How do you keep the preterm newborn warm?

Preterm newborns have a high risk of developing hypothermia (body temperature below 36.S°C) and complications from cold stress. While drying with warm towels, skin-to-skin contact, and early breastfeeding may be sufficient to maintain normal temperature for term newborns and sorne vigorous late-preterm newborns, additional measures are required for more premature newborns and those requiring assistance after birth. When a preterm birth is expected, anticípate that temperature regulation will be challenging and prepare for it.

- Set the temperature in the room where the baby will be resuscitated and receive initial careto approximately 23°C to 25°C (74°F to 77°F).
- Preheat the radiant warmer well before the time of birth.
- After delivery, quickly place a hat on the baby's head.
- Use a pre-warmed transport incubator if the baby will be moved after initial care is completed.
- Maintain the baby's axillary temperature between 36.S°C and 37.S°C.

Additional steps for thermoregulation of babies less than 32 weeks' gestation*

- Use a thermal mattress as an additional heat source.

  Portable thermal mattresses release heat when a chemical gel inside the mattress is activated to form crystals.

  - The thermal mattress should be stored and activated at room temperature (19°C to 28°C or 66°F to 82°F). If the mattress is stored or activated at a warmer temperature, it may exceed the target surface temperature.
  - Following the manufacturer's recommendations, squeeze the pad to actívate the gel approximately 5 minutes before the baby is born. Once activated, it will reach the target surface temperature within 5 minutes and maintain that temperature for 1 hour after activation.
  - Once the thermal mattress is activated, place it on the radiant warmer and cover it with a blanket (Figure 8.1) so the mattress is not directly exposed to radiant heat and the heated surface is not in direct contact with the baby's skin.

*Note: Depending on the baby's birth weight and environmental conditions, sorne babies up to 35 weeks' gestation may benefit from the use of a tl1ermal mattress and plastic bag/wrap.

Figure 8. 1. Thermal mattress placed under a blanket on the resuscitation table

- Wrap the baby in a polyethylene plastic bag or wrap.
  - Drying the body is not necessary. Instead of drying the body with towels, very premature newborns should be wrapped up to their neck in polyethylene plastic immediately after birth.
  - You may use a food-grade reclosable 1-gallon plastic bag, a large plastic surgical bag, food wrap, a commercially available plastic poncho, or sheets of commercially available polyethylene plastic (Figure 8.2).
  - If using a reclosable bag, you may cut the bottom open, slide the baby into the bag through the cut side, and close the bag below the baby's feet.
  - If using a plastic sheet or food wrap, you may either wrap the baby in a single sheet or use 2 sheets and place the baby between the sheets.
  - It is important to keep the newborn fully covered during resuscitation and stabilization. If the newborn requires insertion of an umbilical catheter, cut a small hole in the plastic and pull the umbilical cord through the hole rather than uncovering the newborn.
- Monitor the baby's temperature frequently because overheating has been described while using a combination of warming methods.
  - Consider placing a temperature sensor and sensor cover on the newborn and using the warmer's servo-control mode to adjust the radiant heat.

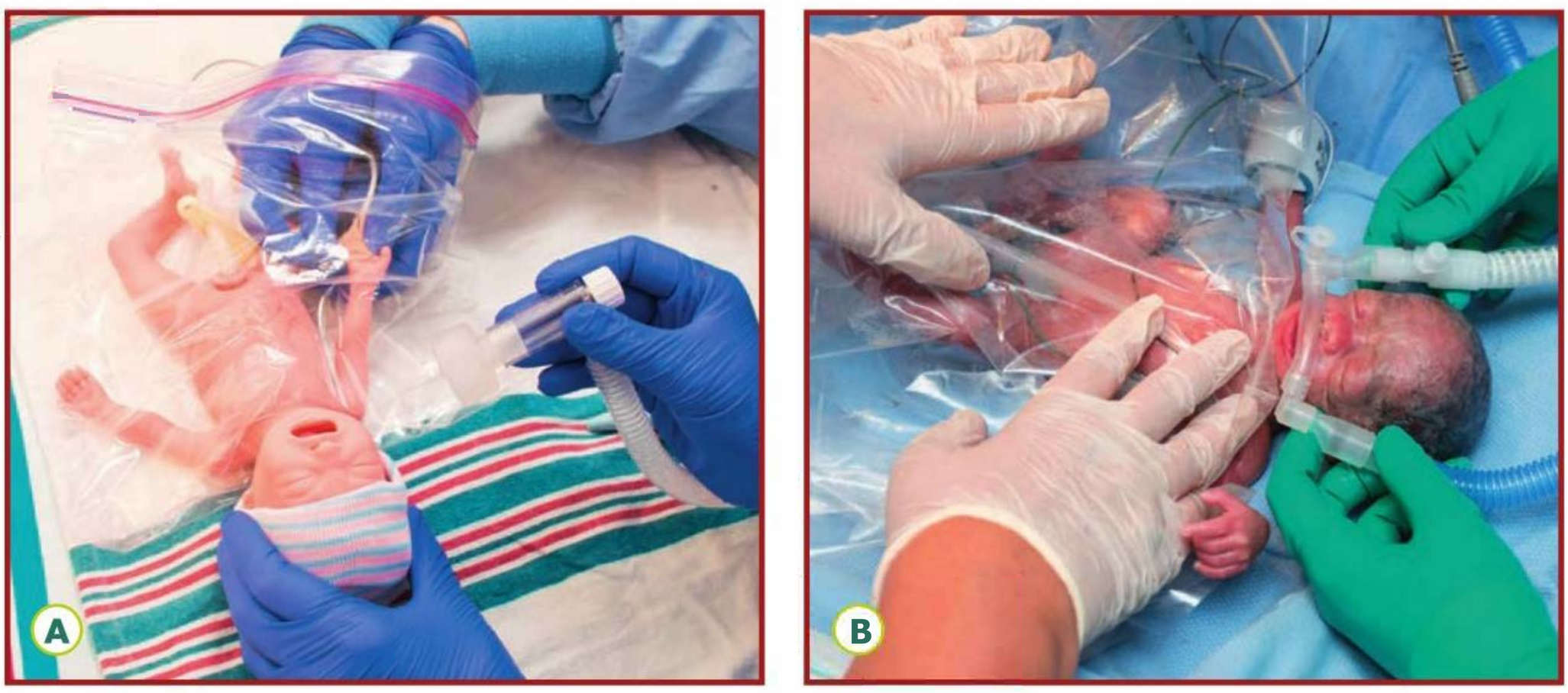

Figure 8.2. Polyethylene plastic bag {A) and wrap (B) for reducing heat loss. (Figure 8.2B used with permission of Mayo Foundation for Medica! Education and Research.)

How do you assist ventilation?

Preterm babies have immature lungs that may be difficult to ventilate and are more susceptible to injury from PPV. Use the same criteria for initiating PPV with a preterm baby that you have learned for a term baby (apnea, or gasping, or heart rate less than 100 bpm within 60 seconds of birth despite the initial steps).

The following are special considerations for assisting ventilation of preterm babies:

- **If the baby is *breathing spontaneously,* consider using CPAP rather than intubating.**

  If the baby is breathing spontaneously and has a heart rate of at least 100 bpm, but has labored respirations or oxygen saturation below the target range, administration of CPAP may be helpful. Using early CPAP, you may be able to avoid the need for intubation and mechanical ventilation. CPAP alone is **NOT** appropriate therapy for a baby who is not breathing **or** whose heart rate is less than 100 bpm.

- **If PPV is required, use the lowest inflation pressure necessary to achieve and maintain a heart rate greater than 100 bpm.**

  The baby's heart rate response is the best indicator of effective ventilation. An initial inflation pressure of 20 to 25 cm H_20 is adequate for most preterm newborns. The volume of air required to ventilate a preterm baby's lungs is very small and may not result in perceptible chest movement.

  Use the lowest inflation pressure necessary to maintain a heart rate of at least 100 bpm and gradually improve oxygen saturation. The maximum inflation pressure used for a baby born at term may be too high for preterm newborn. Use your judgment when increasing ventilation pressure; however, it is reasonable to limit face-mask ventilation to a maximum inflation pressure of 30 cm H_20. If face-mask ventilation at this pressure does not result in clinical improvement, providing ventilation through an endotracheal tube may improve the efficacy of PPV and allow you to decrease the ventilating pressure.

  Airway obstruction and face-mask leak are common problems during face-mask ventilation with preterm newborns, and very small changes in the head and neck position may lead to significant changes in ventilation. A $C0_2$ detector placed between the mask and PPV device may provide a visual cue to help identify when you have achieved the correct mask and neck position. The $C0_2$ detector will

change color when ventilation successfully exchanges gas within the baby's lungs and CO_2 is exhaled through the mask.

- **If PPV is required, it is preferable to use a device that can provide PEEP.**

  Using PEEP (5 cm H_2O) helps the baby's lungs to remain inflated between positive-pressure breaths. This is particularly important if you are using an endotracheal tube for ventilation. Both the T-piece resuscitator and flow-inflating bag can provide PEEP during ventilation through either a face mask or an endotracheal tube. If a PEEP valve is attached, a self-inflating bag may provide PEEP during endotracheal tube ventilation. It is difficult to maintain PEEP during face-mask ventilation with most self-inflating bags.

- **Consider administering surfactant if the baby requires intubation for respiratory distress or is extremely preterm.**

  After initial stabilization, preterm babies who need intubation and mechanical ventilation because of respiratory distress syndrome should be given surfactant.

  Studies completed prior to the common use of antenatal steroids and early CPAP concluded that babies born at less than approximately 30 weeks' gestation would benefit from intubation and prophylactic surfactant treatment before they developed respiratory distress. Subsequent studies indicate that CPAP used immediately after birth should be considered as an alternative to routine intubation and prophylactic surfactant administration. Many preterm babies can be treated with early CPAP and avoid the risks of intubation and mechanical ventilation.

  Surfactant can be selectively administered to babies who fail a trial of CPAP. In sorne cases, you may be able to administer surfactant through a thin tube while the baby remains on CPAP (Less Invasive Surfactant Administration [LISA] or Minimally Invasive Surfactant Treatment [MIST]) or remove the endotracheal tube immediately after surfactant administration and return to CPAP for ongoing respiratory support (INtubate-SURfactant-Extubate [INSURE]). Sorne experts still recommend prophylactic surfactant for extremely premature newborns (less than 26 weeks' gestation) because the likelihood of CPAP failure in this subgroup is relatively high. Criteria for CPAP failure and the administration of surfactant should be developed in coordination with local experts.

  If the resuscitation team does not have expertise in surfactant administration, it may be preferable to wait for the arrival of more experienced providers.

How much oxygen should you use?

You have learned in previous lessons that injury during transition may result from inadequate blood flow and oxygen delivery and that restoring these factors are important goals during resuscitation. However, research indicates that administering excessive oxygen after perfusion has been restored can result in additional injury. Preterm babies may be at higher risk for this reperfusion injury because fetal tissues normally develop in a low-oxygen environment and the mechanisms that protect the body from oxygen-associated injury have not yet fully developed. Nevertheless, many preterm newborns will require supplemental oxygen to achieve the gradual increase in oxygen saturation that occurs after a healthy term birth.

When stabilizing a preterm baby, it is important to balance the desire to rapidly correct low oxygen saturation against avoiding exposure to excessive levels of oxygen. The current recommendation is to initiate resuscitation of preterm newborns (less than 35 weeks' gestational age) with 21% to 30% oxygen and use a pulse oximeter and oxygen blender to maintain oxygen saturation within the same target range described for full-term newborns (Table 8-1).

Table 8-1. Target Pre-Ductal O_{xy} gen 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%
Initial Oxygen Concentration for PPV	
≥ 35 weeks' GA	21% oxygen
<35 weeks' GA	21%-30% oxygen

What can you do to decrease the chances of neurologic iniury in preterm newborns?

Before approximately 32 weeks' gestation, a preterm newborn has a fragile network of capillaries in their brain that are prone to rupture and bleeding. Obstruction of venous drainage from the head or rapid changes in blood $C0_2$ levels, blood pressure, or blood volume may increase the risk of rupturing these capillaries. Bleeding in the brain may cause tissue damage and lead to lifelong disability. Inadequate blood flow and oxygen delivery may cause damage to other areas of the brain even in the absence of hemorrhage, while excessive oxygen administration may cause damage to the developing retina, leading to vision loss.

An organized care plan that is practiced during simulation can help you to cluster interventions and complete them efficiently while minimizing disturbances to the preterm newborn.

Consider the following precautions when resuscitating a preterm newborn:

- **Handle the baby gently.**

  While this may seem obvious, this aspect of care may be forgotten when members of the resuscitation team are trying to perform many

steps quickly. If possible, avoid multiple intubation attempts, frequent tracheal suctioning, and other painful, noisy, or irritating stimuli.

- **Do not position the baby's legs higher than the head (Trendelenburg position).**

  Placing the legs higher than the head may increase cerebral venous pressure and the risk of bleeding. lt may be helpful to place the baby in a midline, supine (on the back) position with the head slightly elevated to avoid obstruction of venous drainage.

- **Avoid using high pressure during PPV or CPAP.**

  Excessive pressure can create a pneumothorax or interfere with venous return from the head. Both of these complications have been associated with an increased risk of brain hemorrhage.

- **Use a pulse oximeter and blood gases to monitor and adjust ventilation and oxygen concentration.**

  Continuously monitor SPo_2 until you are confident that the baby can maintain normal oxygenation while breathing room air. If the baby requires continued assistance with ventilation, a blood gas should be obtained to guide therapy. Rapid changes in $C0_2$ levels can increase the risk of bleeding. If your hospital <loes not have the resources to manage preterm babies who require ongoing assisted ventilation, arrange transfer to an appropriate facility.

- **Do not rapidly infuse intravenous fluids.**

  If volume expansion is needed, infuse the fluid slowly over at least 5 to 1Ominutes. H_{yp} ertonic intravenot1s solutions, such as sodium bicarbonate, should be avoided or given very slowly.

What special precautions should be taken after the initial stabilization period?

During the last trimester of pregnancy, the fetus undergoes physiologic changes in preparation for extrauterine survival. If a baby is born prematurely, many of these adaptations have not occurred. Consider the following:

- **Monitor the baby's temperature.**

  Continue to carefully monitor the baby's temperature after the initial resuscitation and stabilization period. A servo-controlled warmer or incubator that uses a skin sensor to adjust the heat output based on the baby's skin temperature may be helpful. Very premature babies should remain wrapped in polyethylene plastic until they have been moved to a warmed and humidified incubator. Even moderate and late preterm newborns remain at risk for h_{yp} othermia and should be carefully monitored.

- **Monitor blood glucose.**

  Babies born very prematurely have lower amounts of stored glucose than babies born at term. If resuscitation is required, it is more likely that these stores will be depleted quickly and the baby may become hyp oglycemic. Promptly secure intravenous access, initiate a dextrose infusion, and monitor the baby's blood glucose.

- **Monitor the baby for apnea and bradycardia.**

  Respiratory control is often unstable in preterm babies. Significant apnea and bradycardia during the stabilization period may be the first clinical sign of an abnormality in body temperature, oxygenation, CO_2, electrolytes, blood glucose, or blood acid levels.

Focus on Teamwork

The resuscitation and stabilization of babies born preterm highlights severa! opportunities for effective teams to use the Neonatal Resuscitation Program® (NRP®) Key Behavioral Skills.

Behavior	Example
Anticipate and plan. Delegate workload optimally.	Multiple procedures may be performed in a brief period of time. Work with a multidisciplinary team to develop and practice a systematic approach to the first hours of care by predefining roles and responsibilities.
Use available information. Clearly identify a team leader.	Complete a pre-resuscitation team briefing to review the prenatal and intrapartum history, identify a team leader, review roles and responsibilities of each team member, and plan the approach to respiratory support.
Know your environment.	Know where polyethylene plastic bags/wraps and thermal mattresses are stored. Know how to use the temperature sensor on your radiant warmer. Know how to set up a device to administer CPAP.
Allocate attention wisely.	If the team leader becomes involved in endotracheal intubation, their attention is focused primarily on that task and they may not be able to pay full attention to the baby's condition or the passage of time. A different team leader who can maintain situation awareness may need to be identified.
Communicate effectively. Maintain professional behavior.	Share your assessments aloud so that all members of the team are aware of the baby's condition and response to treatment. The importance of effective communication continues after the resuscitation is completed. A post-resuscitation team debriefing is an important opportunity to review the team's performance, identify oreas for improvement, practice effective communication skills, and improve teamwork. If the baby will be transferred to another hospital after birth, develop a plan for efficiently communicating the maternal and newborn history. Designate a team member to communicate progress updates and plans with parents.

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

- Where are polyethylene plastic bags/wraps stored in your delivery setting?
- Can you increase the room temperature in your delivery setting?
- Do you have a protocol or checklist to organize the first hour of post-resuscitation care for a baby born very preterm?
- Has your team simulated the resuscitation and stabilization of a very preterm newborn to assess your preparedness?

Process and outcome measures

- How often are preterm newborns hypothermic (temperature < 36.S°C) at 1 hour of age?
- How often are preterm newborns h_{yp}oglycemic at 1 hour of age?
- How often do parents receive an update on their baby's condition and have the opportunity to see and touch their baby within the first 30 to 60 minutes?
- How often <loes your team complete a debriefing after the resuscitation and stabilization of a preterm newborn?
- How soon after giving birth are mothers instructed how to express or pump breast milk?

Frequently Asked Questions

Should delayed umbilical cord clamping be considered for preterm newborns?

Early cord clamping (< 30 seconds after birth) may interfere with healthy transition from fetal to neonatal circulation, as it leaves fetal blood in the placenta rather than filling the newborn's circulating blood volume. Preterm newborns who have delayed umbilical cord clamping are less likely to receive medications for h_{yp}otension or receive a blood transfusion. Delayed umbilical cord clamping for

preterm newborns may increase the probability of survival, but this evidence is less certain.

Before birth, establish the plan for the timing of umbilical cord clamping with the obstetric providers. For most vigorous preterm newborns, the current evidence suggests that it is reasonable to delay clamping the umbilical cord for at least 30 to 60 seconds after birth. By carefully coordinating with the obstetric providers, the initial steps of newborn care, including clearing the airway if necessary and providing gentle stimulation, can be performed with the umbilical cord intact.

If the mother is hemodynamically unstable or the placenta! circulation is not intact, such as after a placenta! abruption, bleeding placenta previa, bleeding vasa previa, or cord avulsion, the cord should be clamped immediately after birth.

There is not enough evidence to make a definitive recommendation whether umbilical cord clamping should be delayed in preterm newborns who are not vigorous after birth. If the placenta! circulation is intact, it may be reasonable to briefly delay umbilical cord clamping while the obstetric provider clears the airway and gently stimulates the baby to breathe. If the baby <loes not begin to breathe during this time, additional treatment is required. The umbilical cord should be clamped and the baby should be brought to the radiant warmer. Research studies are investigating whether it is feasible and beneficia! to initiate resuscitation adjacent to the mother with the umbilical cord intact.

For newborns less than 28 weeks' gestation, umbilical cord milking is not recommended because it has been associated with an increased risk of intraventricular hemorrhage.

How do you counsel parents before the birth of an extremely preterm baby?

Meeting with parents before the birth of an extremely preterm baby is important for both the parents and the neonatal care providers. Prenatal discussions are an opportunity to provide parents with important information, discuss goals of care, and establish a trusting relationship that will support shared decision-making for their baby.

These discussions can be difficult because of the challenges inherent in communicating a large amount of complex information during a stressful time. You should be prepared with accurate information about available treatment options and the anticipated short- and long-term outcomes for the specific situation. You should be familiar with both national and local outcome data and understand the limitations of each. If necessary, consult with specialists at your regional referral

center to obtain up-to-date information. Ideally, both the obstetric provider and the neonatal provider should be present to talk with the parents. The obstetric and neonatal perspectives may be different. These differences should be discussed before meeting with the parents so that the information presented is consistent.

If possible, meet with both parents (or the mother and her chosen support person) at the same time and allow enough time for them to consider the content of your discussion and ask questions. Try to meet with the parents before the mother has received medications that might make it difficult for her to understand or remember your conversation and before the final stages of labor. If you are called when the woman is in active labor, there may not be time for an extended discussion, but it is still helpful to introduce yourself and briefly describe potential issues and your preliminary treatment plan. Use clear language without medical abbreviations or jargon. Be cautious about describing outcomes in terms of risk ratios, proportions, or percentages because parents may have limited understanding of mathematical concepts. In addition, quoting these data may give the impression that your estimates are more precise than they actually are. It is important to present a balanced and objective picture of the range of possible outcomes while avoiding excessively negative or unrealistically positive descriptions. Use an appropriately trained medical interpreter, not a friend or family member, if the family is not proficient in the language spoken by the health care team or includes someone with a hearing disability. Visual aids and written materials, including pictures and graphs, can supplement your discussion and help the parents remember the topics that you discussed. Offer to give the parents time alone to discuss what you have told them. Some parents may want to consult with other family members or clergy. If time allows, offer to make a return visit to confirm both their understanding of what may occur and your understanding of their wishes.

After you meet with the parents, document a summary of your conversation in the mother's chart. Review what you discussed with the obstetric care providers and the other members of your delivery room resuscitation team. If it was decided that resuscitation would not be initiated, ensure that all members of your team, including on-call personnel and the obstetric care providers, are informed and in agreement with this decision. If disagreements occur, discuss them in advance and consult additional professionals, including legal and ethics consultants, if necessary.

LESSON 8 REVIEW

1. You have turned on the radiant warn1er in anticipation of the birth of a baby at 27 weeks' gestation. List 4 additional steps that will help maintain this baby's temperature.

   a. _____

   b. _____

   c. _____

   d. _____

2. A baby is born at 26 weeks' gestation. The initial steps of care, including gentle stimulation, have been completed and the baby is nearly 1 minute old. The baby is not breathing and the heart rate is 80 beats per minute. You should (start continuous positive airway pressure [CPAP] with a face mask)/(start positive-pressure ventilation).

3. A baby is delivered at 30 weeks' gestation. At 5 minutes of age, the baby is breathing, has a heart rate of 140 beats per minute, and is receiving CPAP with 30% oxygen. A pulse oximeter on the right hand is reading 95% and is increasing. You should (decrease the oxygen concentration)/(begin positive-pressure ventilation).

4. A (self-inflating bag)/(T-piece resuscitator) can provide CPAP for a spontaneously breathing baby.

5. You are preparing for the birth of a baby of 34 weeks' gestation. You set the positive-pressure ventilation device so that the peak inflation pressure is (20 to 25 cm H_20)/(25 to 30 cm H_20) and positive end-expiratory pressure (PEEP) is (5 cm H_20)/(10 cm H_20).

6. Initiate resuscitation of the preterm baby (< 35 weeks' gestational age) with (21% to 30% oxygen)/(60% to 100% oxygen).

7. You may *decrease* the risk of neurologic injury in a premature newborn during and after resuscitation by (tilting the bed so the baby's legs are higher than the head)/(adjusting the bed *so* that the baby's legs are even with or lower than the head).

8. Compared with term newborns, preterm newborns have a (higher)/(lower) risk of developing h_{yp} oglycemia shortly after resuscitation.

Answers

1. You can increase the room temperature to 23° C to 25° C (74° F to 77° F), prepare a thermal mattress, prepare a polyethylene plastic bag or wrap, and pre-warm a transport incubator if the baby will be moved after birth.

2. You should start positive-pressure ventilation.

3. You should decrease the oxygen concentration.

4. A T-piece resuscitator can provide CPAP for a spontaneously breathing baby. A self-inflating bag **cannot** be used to provide CPAP.

5. Set the peak inflation pressure to 20 to 25 cm H_20 and positive end-expiratory pressure (PEEP) to 5 cm H_20.

6. Initiate resuscitation of the preterm baby with 21% to 30% oxygen.

7. You may *decrease* the risk of neurologic injury in a premature newborn during and after resuscitation by adjusting the bed so that the baby's legs are even with or lower than the head.

8. Preterm newborns have a higher risk of developing hypoglycemia shortly after resuscitation.