

Resuscitation and Stabilization of Babies Born Preterm

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Why do preterm babies have a higher risk of complications?

- 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.



- A smaller blood volume increases the risk of hypovolemia 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 hypoglycemia after birth

Additional resources for resuscitating a preterm newborn?

- If the baby is anticipated to be less than 32 weeks' gestation, prepare a polyethylene bag or wrap and a thermal mattress.
- A servo-controlled radiant warmer with a temperature sensor
- An oxygen blender and a pulse oximeter
- 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 0 laryngoscope 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 and a 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 36.5°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 some vigorous late-preterm newborns.
- Set the temperature in the room at 23°C . to 25°C .
- 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 36.5°C and 37.5°C .



Thermal mattress

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).
- 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 activate 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



Thermal mattress

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

- 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.
- It is important to keep the newborn fully covered during resuscitation and stabilization.
- 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



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)**
- 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.
- 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 H₂O is adequate for most preterm newborns.
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- The volume of air required to ventilate a preterm baby's lungs is very small and **may not result in perceptible chest movement.**

How do you assist ventilation?

- Use the lowest inflation pressure necessary to maintain a heart rate of at least 100 bpm and gradually improve oxygen saturation.
- Use your judgment when increasing ventilation pressure; however, it is reasonable to limit face-mask ventilation to a maximum inflation pressure of 30 cm H₂O.
- 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 CO₂ 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.
- Using PEEP (5 cm H₂O) helps the baby's lungs to remain inflated between PPV.
- **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, but it is difficult to maintain PEEP during face-mask ventilation with most self-inflating bags.**

Consider administering surfactant if the baby requires intubation

- After initial stabilization, preterm babies who need intubation and mechanical ventilation because of respiratory distress syndrome should be given surfactant.
- Many preterm babies (born at less than approximately 30 weeks' gestation) 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
 - 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]).
- Some 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.

How much oxygen should you use?

- 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.
- 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

How much oxygen should you use?

Target Preductal Oxygen Saturation	
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%
< 35 weeks` GA	21%-30%

What can you do to decrease the chances of neurologic injury 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 CO₂ 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.

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

- **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.
- **It 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.**

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

- 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 SPO₂ 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 CO₂ levels can increase the risk of bleeding.*
- Do not rapidly infuse intravenous fluids.
 - If volume expansion is needed, infuse the fluid slowly over at least 5 to 10 minutes.
- Hypertonic intravenous solutions, such as sodium bicarbonate, should be avoided or given very slowly

special precautions should be taken after the initial stabilization

- 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 hypothermia and should be carefully monitored
- 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 hypoglycemic.
 - 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, CO₂, electrolytes, blood glucose, or blood acid levels.

Lecture 8: Resuscitation and Stabilization Babies Born Preterm

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