In the name of God

Lesson 8

Resuscitation and Stabilization of Babies Born Preterm

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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

Preterm Birth

When birth occurs before term gestation (less than 37 weeks' gestation), additional challenges make the transition to extra-uterine life more difficult.

The likelihood that a preterm newborn will need help making this transition is related to gestational age.

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.

Why do preterm babies have a higher risk of complications?

Some 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 in creases 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.

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.

- 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 O 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, additional measures are required for more premature newborns and those requiring assistance after birth.

When a preterm birth is expected, anticipate 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 care to 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 36.5°C and 37.5 °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.

- 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.

- - 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.

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:

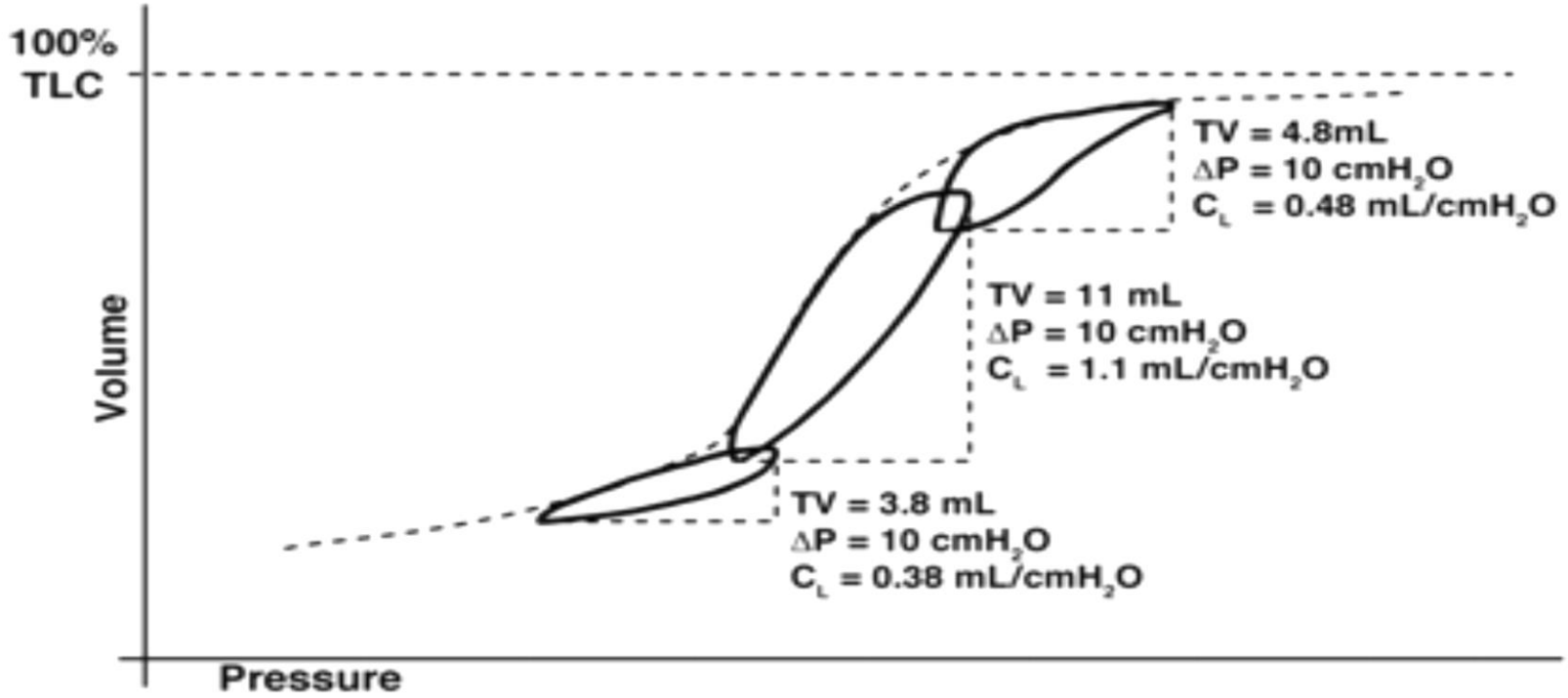
- **If the baby is breathing spontaneously, consider using CPAP rather than intubating**

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.

Deflation Pressure-Volume Relationship and Pulmonary Mechanics



• 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 H20 is adequate for most preterm newborns.

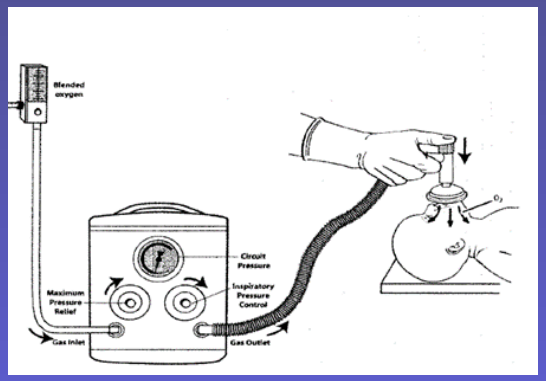
The volume of air required to ventilate a preterm baby's lungs is very small and may not result in perceptible chest movement. Use the lowest inflation pressure necessary to maintain a heart rate of at least 100 bpm and gradually improve oxygen saturation.

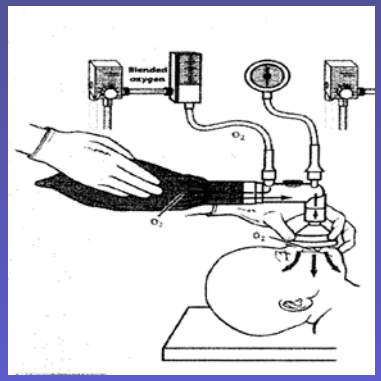
The maximum inflation pressure used for a baby born at term may be too high for preterm newborn. Use your judgment when increasing ventilation pressure; however, it is reasonable to limit face-mask ventilation to a maximum inflation pressure of 30 cm H20 . If face-mask ventilation at this pressure change color when ventilation successfully exchanges gas within the baby's lungs and C02 is exhaled through the mask.

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

Using PEEP (5 cm H20) 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.

- 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.

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.

How much oxygen should you use?

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. 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 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 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. 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.

- 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. If your hospital

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 hypothermia 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 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.

The JOURNEY of a premature baby is often

ONE step forward and TWO steps back....

Photo: Lisa Nicole Imagery

Watch them breathe, watch them sleep and nourish them with 'LIQUID GOLD'. When strong enough, they will take three LEAPS forward and NEVER look back.....