Neonatal Advanced Life Support (NALS)

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Introduction

- NRP (Neonatal Resuscitation Program) is an educational program in neonatal resuscitation that was developed by AAP & AHA.

- This program focuses on basic as well as advanced resuscitation skills for newborn infants

- The latest rollout was 8th Edition.

Contents

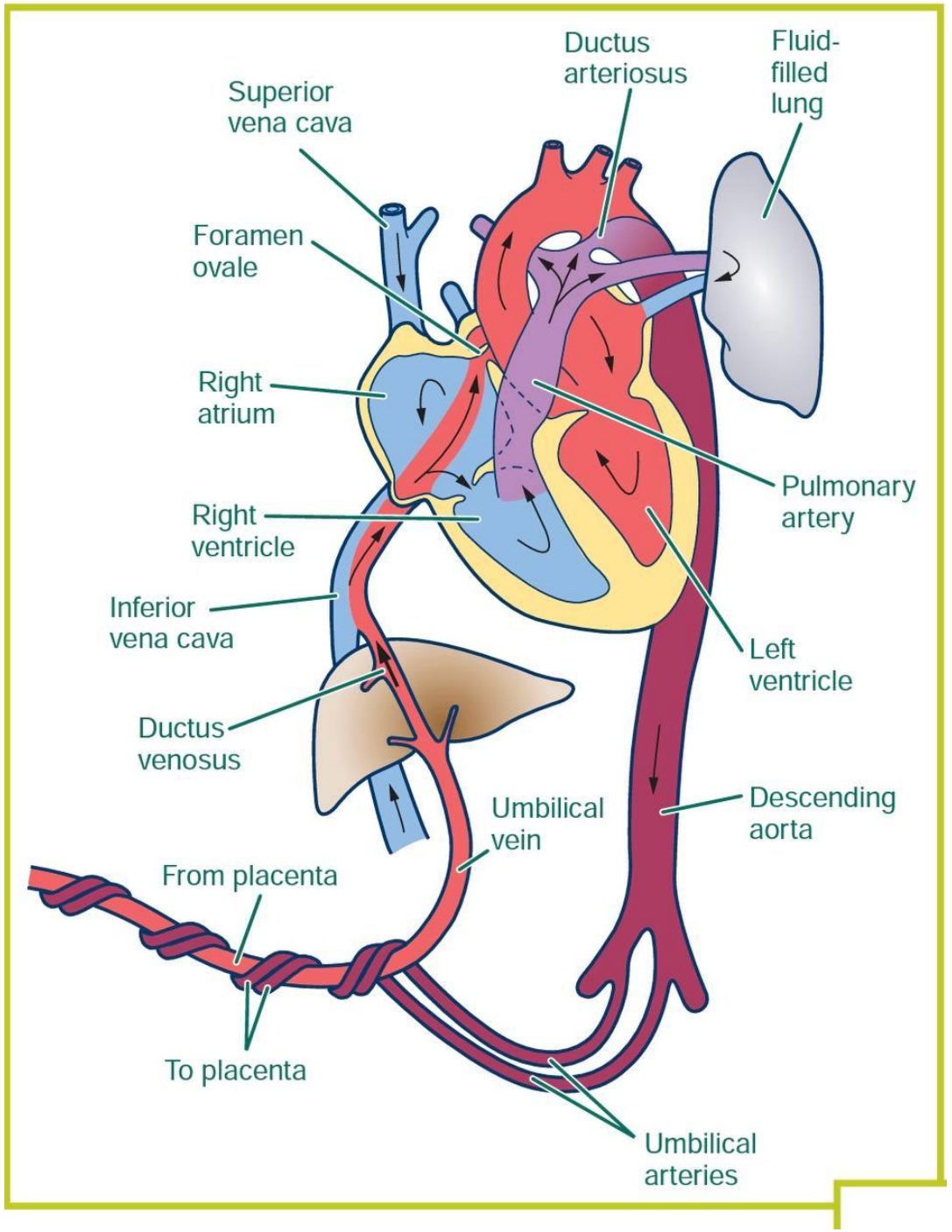
- Overview & principles of resuscitation
- Initial Steps
- Use of resuscitation devices
- Tracheal intubation & laryngeal masks
- Chest Compression
- Medication
- Post resuscitation care
- Resuscitation of preterm babies
- Special considerations

What happens during transition from fetal to neonatal circulation?

- Before birth, the fetal lungs are filled with fluid, not air, and they do not participate in gas exchange

- Oxygenated blood returning to the fetus from the placenta via the umbilical vein flows through the foramen ovale or ductus arteriosus and bypasses the lungs. Because blood flows directly from the right side of the heart to the left side without entering the lungs, it is called a *right-to-left shunt.*

Before birth



Baby cries & takes deep breath to move fluid from the airways

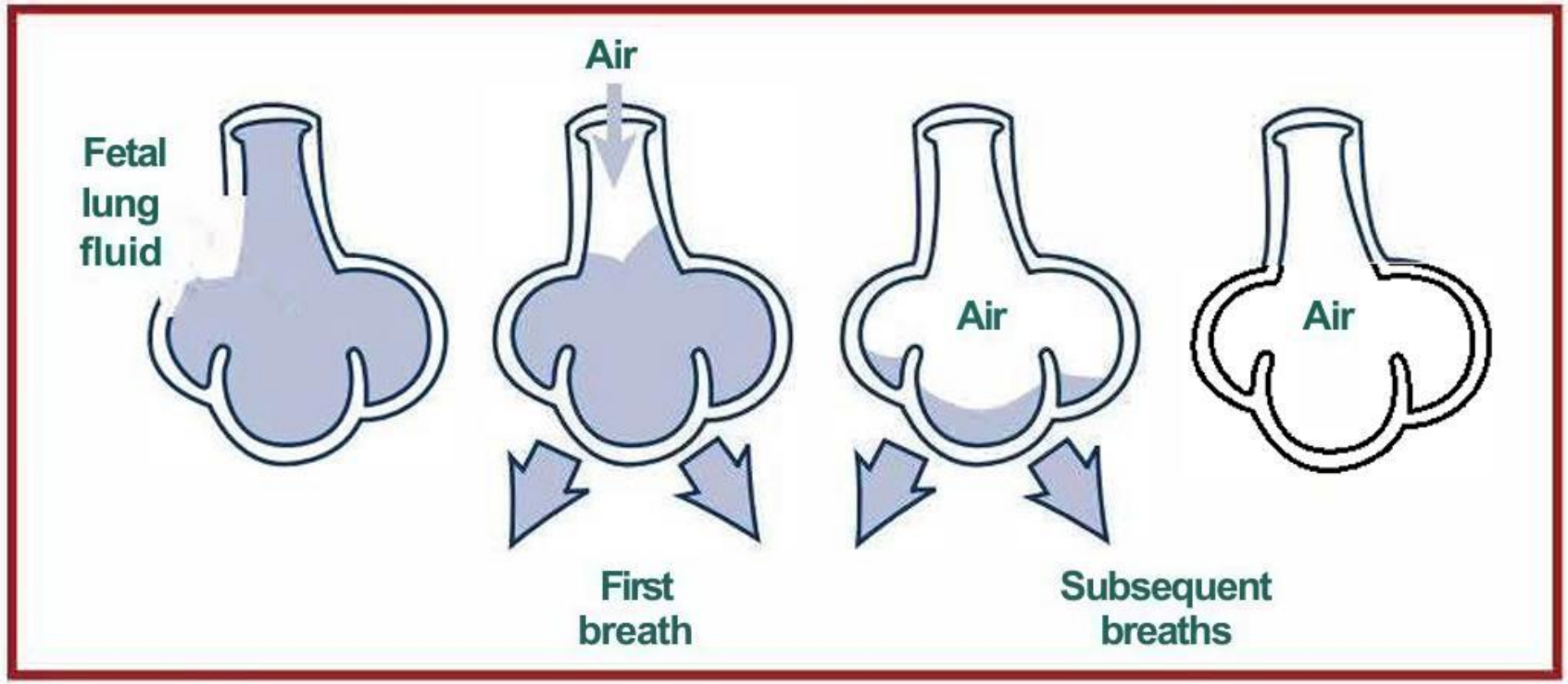
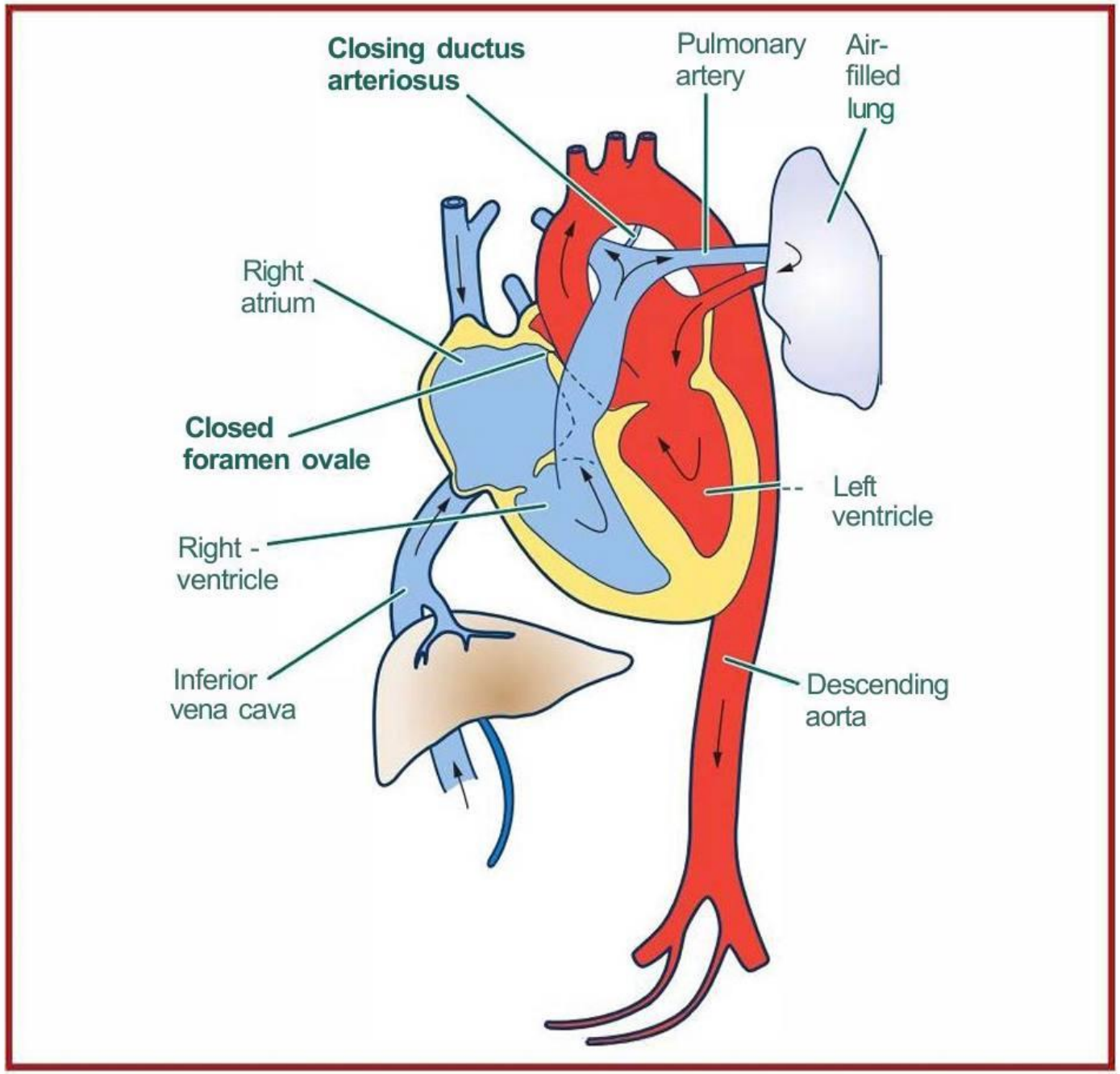
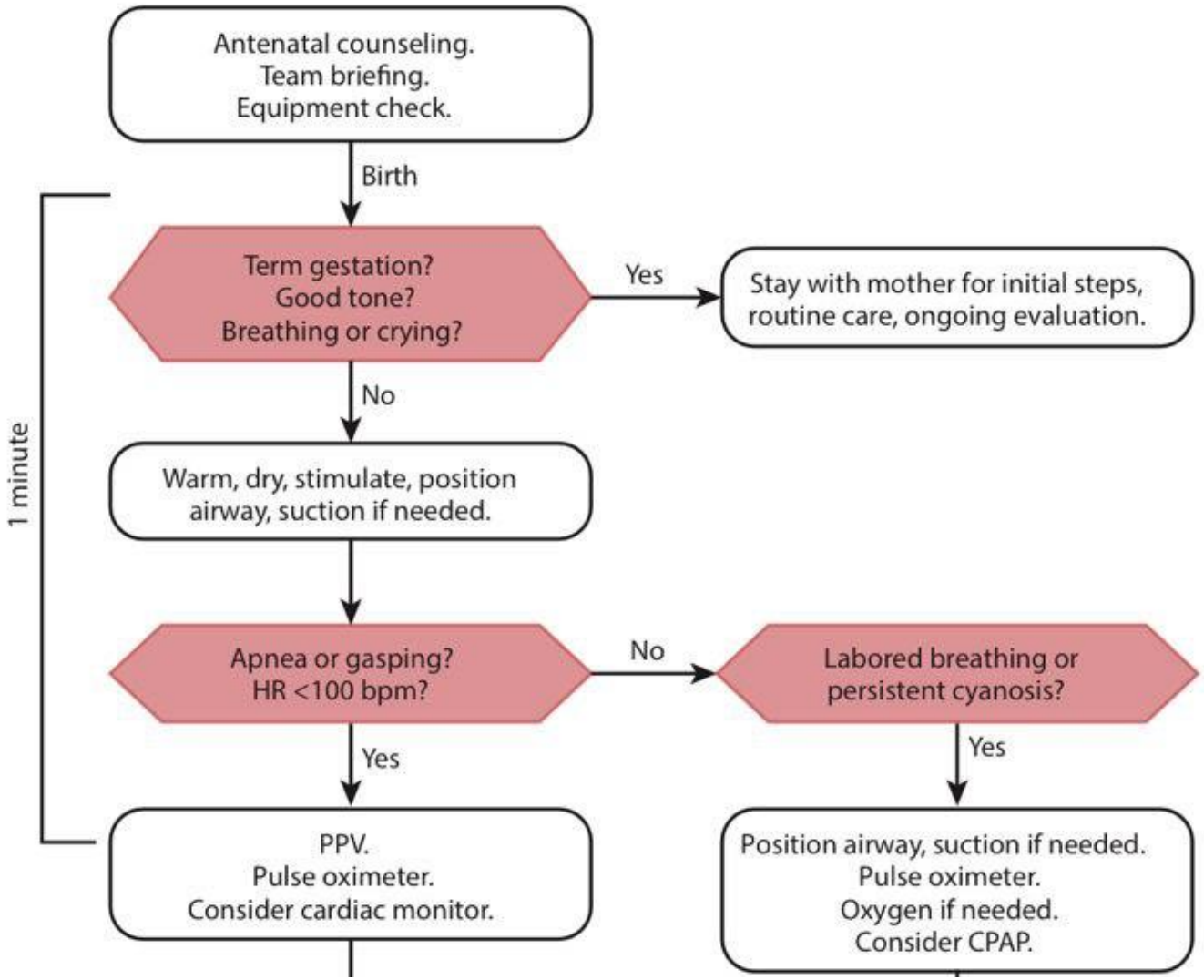


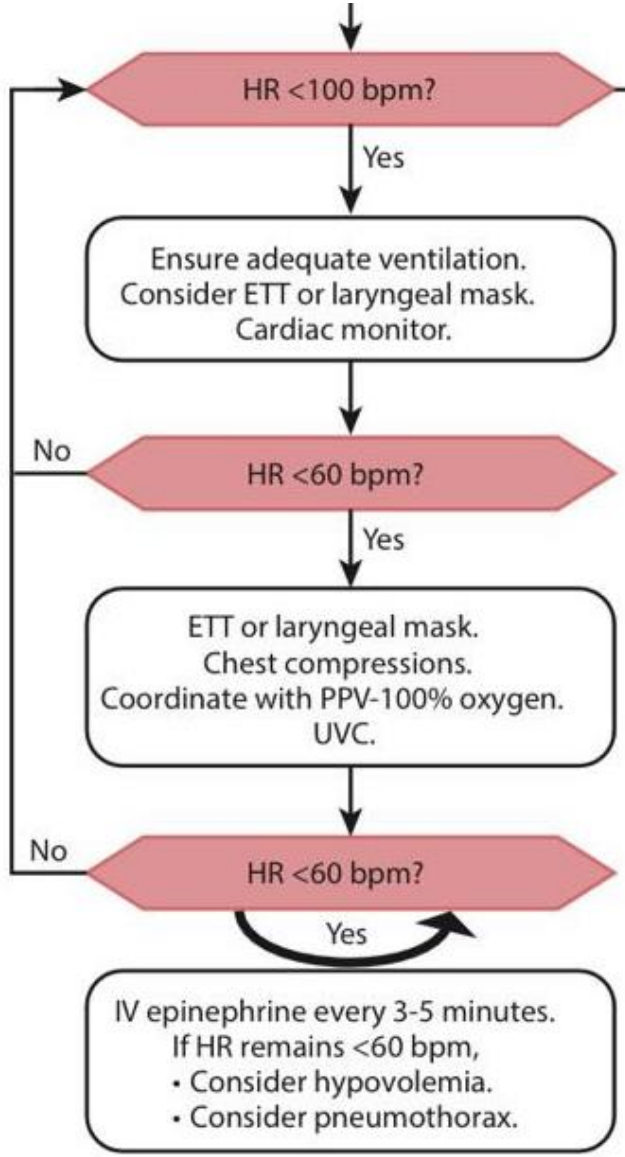
Figure 1.2. Air replaces fluid in the alveoli.

After Birth


Closing ductus arteriosus
Pulmonary artery
Air-filled lung
Right atrium
Closed foramen ovale
Left ventricle
Right - ventricle
Inferior vena cava
Descending aorta

Neonatal Resuscitation Program® 8th Edition Algorithm





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 personnel should be present at delivery?

- Every birth should be attended by at least 1 qualified individual, skilled in the initial steps of newborn care and positive-pressure ventilation (PPV). In the event of unanticipated resuscitation, this team member will initiate resuscitation and call for additional help.

- If any risk factors are present, at least 2 qualified people should be present solely to manage the baby. The number and qualifications of personnel will vary depending on the anticipated risk, the number of babies, and the hospital setting.

4 Pre-Birth Questions

1. Gestational age?
2. Amniotic fluid clear?
3. Additional risk factors?
4. Umbilical cord management plan?

Pre-resuscitation Team Briefing

- Assess risk factors
- Identify team leader
- Anticipate potential complications and plan a team response
- Delegate tasks
- Identify who will document events as they occur
- Determine what supplies and equipment will be needed
- Identify how to call for additional help.

What is Closed loop Communication?

When you give an instruction,

- Direct the request to a specific individual.
- Call your team member by name.
- Make eye contact.
- Speak clearly.
- After giving an instruction, ask the receiver to report back as soon as the task is completed.
- After receiving an instruction, repeat the instruction back to the sender.

Equipment Check

Warm	• Preheated warmer • Warm towels or blankets • Temperature sensor and sensor cover for prolonged resuscitation • Hat • Plastic bag or plastic wrap (< 32 weeks' gestation) • Thermal mattress (< 32 weeks' gestation)
Clear a1rway	• Bulb syringe • 1OF or 12F suction catheter attached to wall suction, set at 80 to 100 mm Hg • Tracheal aspirator
Auscultate	• Stethoscope
Ventilate	• Flowmeter set to 1O L/min • Oxygen blender set to 21 % (21 %-30% if < 35 weeks' gestation) • Positive-pressure ventilation (PPV) device • Term- and preterm-sized masks • 8F orogastric tube and 20-ml syringe • Laryngeal mask (size 1) and 5-ml syringe (if needed for inflation) • 5F or 6F orogastric tube if insertion port is present on laryngeal mask • Cardiac monitor and leads

Equipment Check

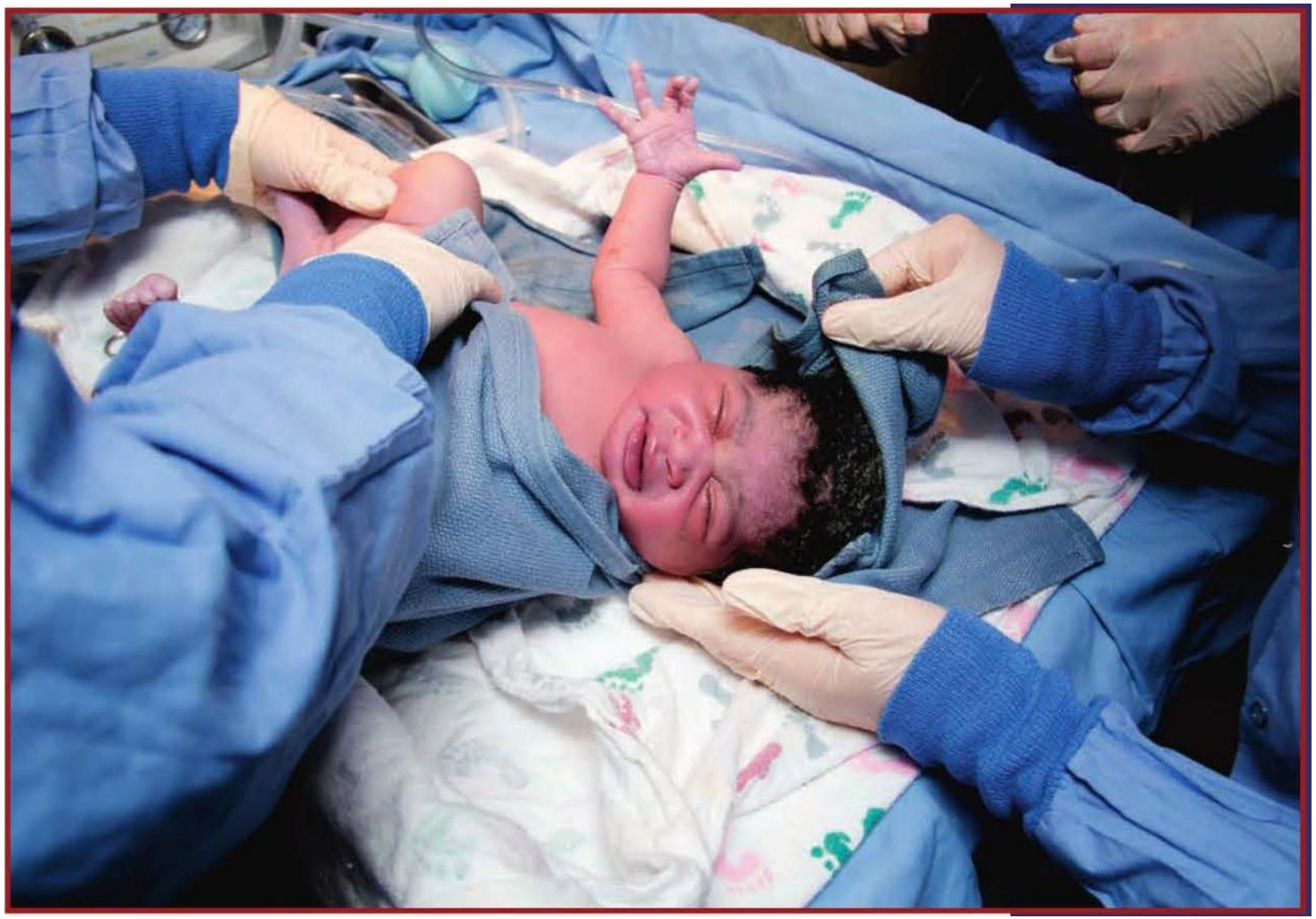
Oxygenate	• Equipment to give free-flow oxygen • Pulse oximeter with sensor and cover • Target Oxygen Saturation Table
Intubate	• Laryngoscope with size O and size 1 straight blades (size 00, optional) • Stylet (optional) • Endotracheal tubes (sizes 2.5, 3.0, 3.5) • Carbon dioxide ($C0_2$) detector • Measuring tape and/or endotracheal tube insertion depth table • Waterproof tape or tube-securing device • Scissors
Medicate	Access to • Epinephrine (0.1 mg/ml= 1 mg/1 O ml) • Normal saline (100-ml or 250-ml bag, or prefilled syringes) • Supplies for placing emergency umbilical venous catheter and administering medications • Table of pre-calcuated emergency medication dosages for babies weighing 0.5 to 4 kg

Delayed Cord Clamping

- For most vigorous term & preterm newborns, the current evidence suggests that clamping should be delayed for at least 30 to 60 seconds.
- During this time, the baby may be placed skin-to-skin on the mother's chest or abdomen, or held securely in a warm, dry towel or blanket.
- DCC, reduces risk of Blood transfusion, IVH, Mortality, etc.

Initial Steps

1. Provide warmth
2. Dry
3. Stimulate
4. Position the head & neck
5. Clear secretions if needed



If baby is apneic or gasping

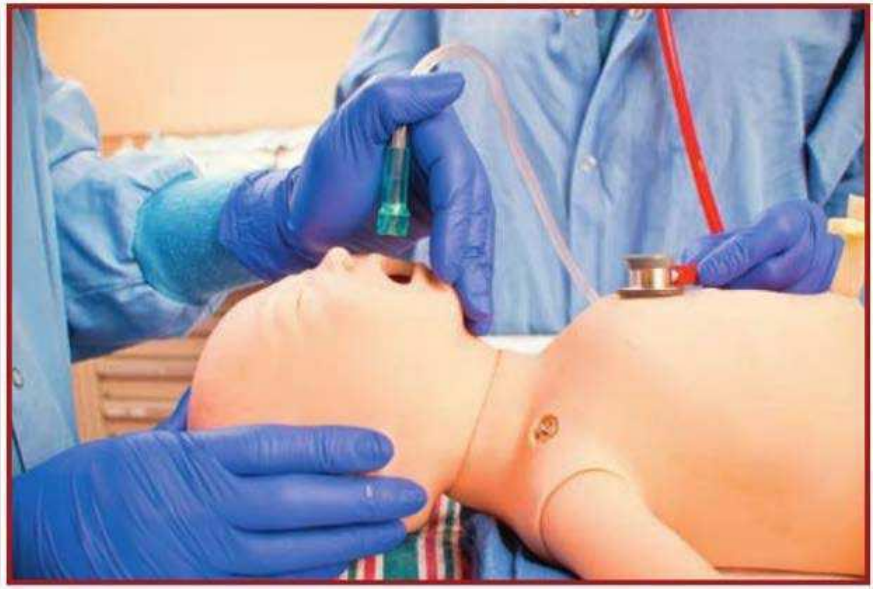
- If the baby has not responded to the initial steps within the first minute of life, do not continue to provide only tactile stimulation.
- If the heart rate is less than 100 bpm, start PPV even if the baby is breathing.
- For babies who remain apneic or bradycardic, delaying the start of PPV beyond the first minute of life worsens outcomes.
- Remember: “Ventilation of the baby's lungs is the most important and effective step during neonatal resuscitation”

When to use supplemental O2?

- When the spo2 is below the target
- Adjust flowmeter to 10L/min

Table 3-1 • Target Pre-Ductal Oxygen Saturation

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



Positive Pressure Ventilation (PPV)

Common terminologies

- PIP (Peak inspiratory pressure)- highest pressure administered with each breath
- PEEP (Peak end expiratory pressure)- gas pressure which is maintained in the lungs between breaths, when baby is receiving assisted breaths

What are the different types of resuscitation devices used to ventilate newborns?

- Self inflating bag
- Flow inflating bag (anesthesia bag)
- T-piece resuscitator (Neopuff)

Self Inflating bag

Flow Inflating bag

T-piece resuscitator

Initiation of PPV

1. Select the correct mask size
2. Place the mask on baby's face- Two-hand hold with jaw thrust
3. Breaths should be given at a rate of 40-60 breaths per minute
4. Use the rhythm "breath two three"; "breath two three"
5. Check baby's heart rate after 15secs of PPV. If increasing continue PPV & recheck response after 30secs. If HR is not improving, check for chest movement. If chest movement present, continue PPV for 30secs. If chest movement not seen, perform ventilation correction steps (MR.SO.PA)

Correct size anatomic

Incorrect (small) anatomic

Incorrect (large) anatomic

Incorrect (upside down) anatomic

Correct size round

Incorrect (small) round

Incorrect (large) round

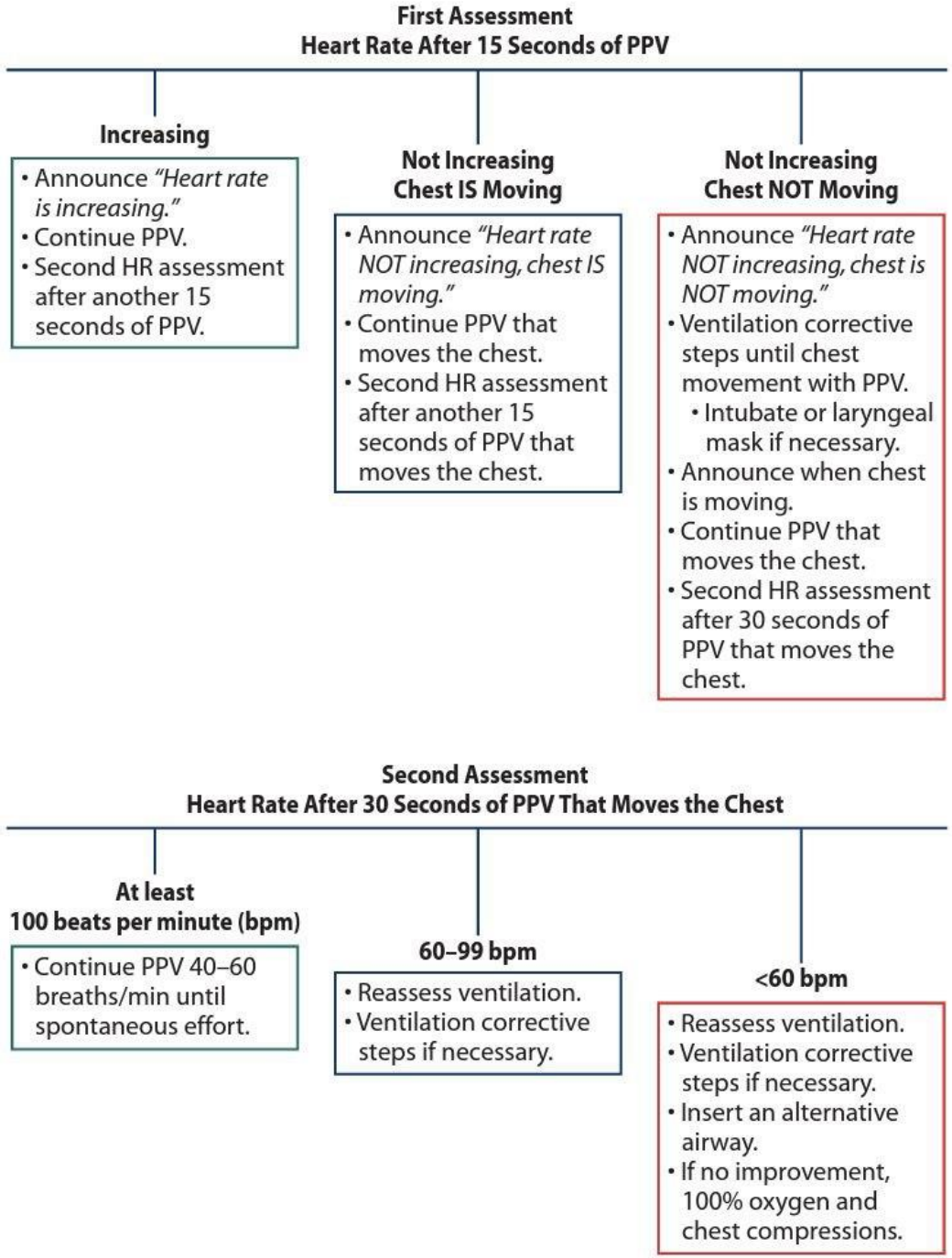
Figure 4.12. Correct and incorrect-sized anatomic and round face masks. The first mask in each row is correct. The remaining masks are incorrect. They are too small, too large, or upside down.

Table 4-2. Initial Settings for Positive-Pressure Ventilation

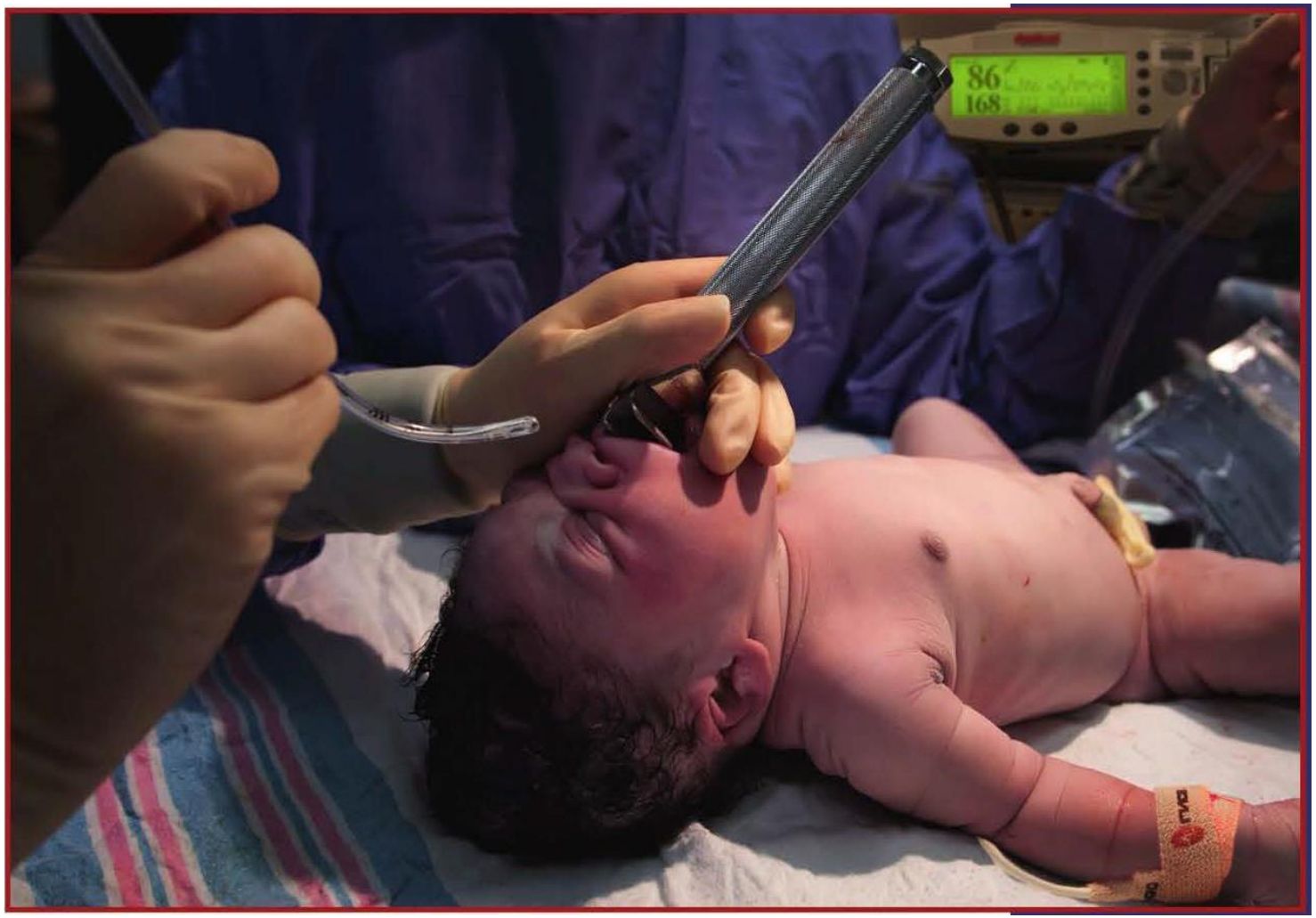
	Component	Initial Setting
Oxygen concentration	≥ 35 weeks' gestation < 35 weeks' gestation	21% 21%-30%
Gas flow		10 L/minute
Rote		40-60 breaths/minute
PIP		20-25 cm H_20
PEEP		5 cm H_20

Table 4-3. The MR. SOPA Ventilation Corrective Steps

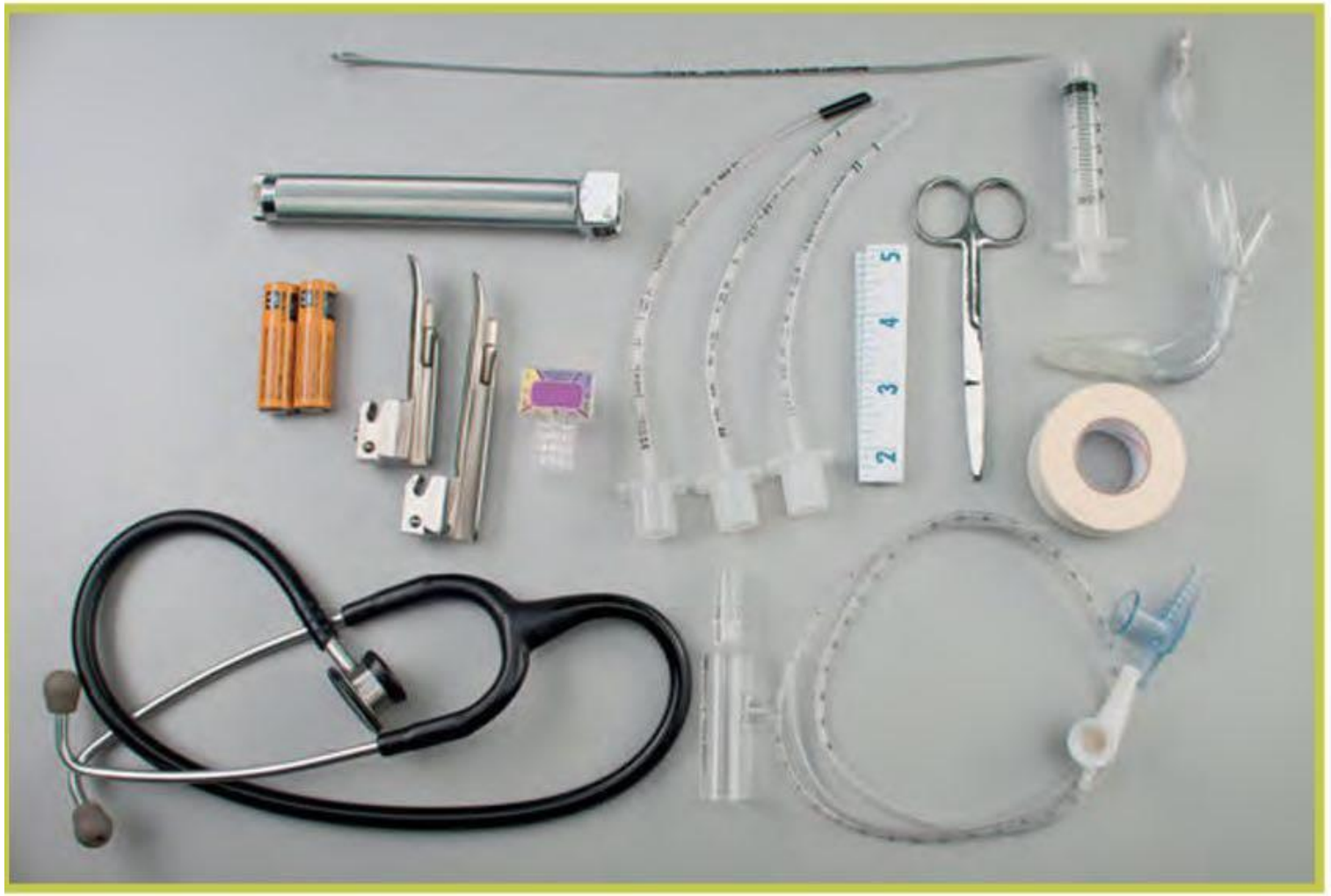
	Corrective Step	Actions
M	Mask adjustment.	Reapply the mask and lift the jaw forward. Consider the 2-hand hold.
R	Reposition the head and neck.	Place head neutral or slightly extended.
Give 5 breaths and assess chest movement. If no chest movement, do the next steps.		
S	Suction the mouth and nose.	Use a bulb syringe or suction catheter.
O	Open the mouth.	Use a finger to gently open the mouth.
Give 5 breaths and assess chest movement. If no chest movement, do the next step.		
P	Pressure increase.	Increase in 5-1 O cm H_20 increments to maximum recommended pressure. • Max 40 cm H_20 term • Max 30 cm H_20 preterm
Give 5 breaths and assess chest movement. If no chest movement, do the next step.		
A	Alternative airway.	Insert a laryngeal mask or endotracheal tube.
Try PPV and assess chest movement and breath sounds.		


First Assessment
Heart Rate After 15 Seconds of PPV
Increasing
• Announce "Heart rate is increasing."
• Continue PPV.
• Second HR assessment after another 15 seconds of PPV.
Not Increasing
Chest IS Moving
• Announce "Heart rate NOT increasing, chest IS moving."
• Continue PPV that moves the chest.
• Second HR assessment after another 15 seconds of PPV that moves the chest.
Not Increasing
Chest NOT Moving
• Announce "Heart rate NOT increasing, chest is NOT moving."
• Ventilation corrective steps until chest movement with PPV.
• Intubate or laryngeal mask if necessary.
• Announce when chest is moving.
• Continue PPV that moves the chest.
• Second HR assessment after 30 seconds of PPV that moves the chest.
Second Assessment
Heart Rate After 30 Seconds of PPV That Moves the Chest
At least
100 beats per minute (bpm)
• Continue PPV 40–60 breaths/min until spontaneous effort.
60–99 bpm
• Reassess ventilation.
• Ventilation corrective steps if necessary.
<60 bpm
• Reassess ventilation.
• Ventilation corrective steps if necessary.
• Insert an alternative airway.
• If no improvement, 100% oxygen and chest compressions.

Endotracheal Intubation



Neonatal Airway supplies & equipment



ETT Size/Depth/Fix

Table 5-1. Endotracheal tube size for babies of various weights and gestational ages

Weight (g)	Gestational Age (wks)	Endotracheal Tube Size (mm ID)
Below 1,000	Below 28	2.5
1,000-2,000	28-34	3.0
Greater than 2,000	Greater than 34	3.5

Depth of ETT is calculated by measuring NTL + 1 cm (Nasal septum to Tragus length)

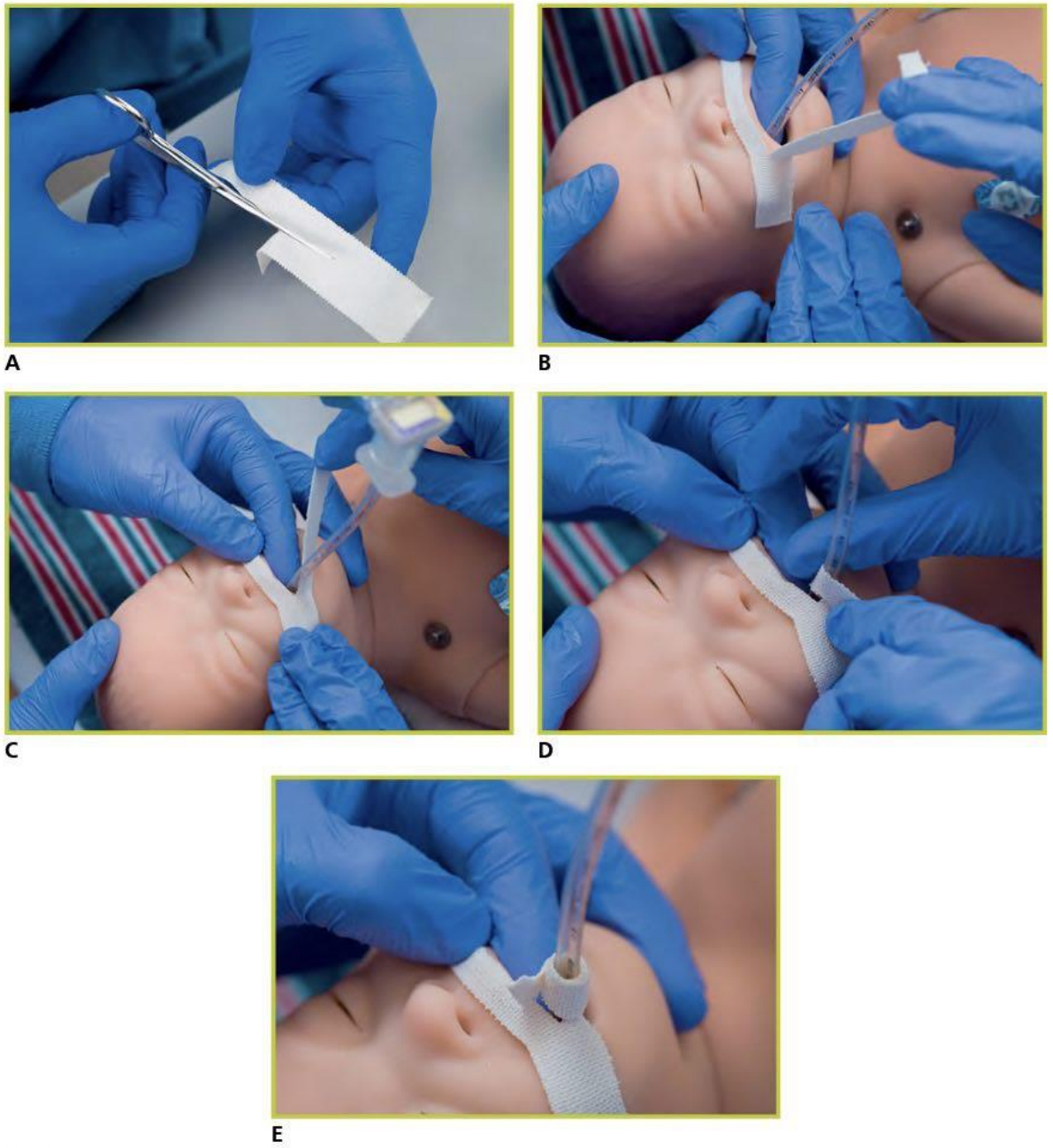


Figure 5.28. Split the tape along half its length (A). Place the uncut section on the baby's cheek close to the corner of the mouth and the upper "leg" of tape above the baby's lip (B). Wrap the lower "leg" of tape around the tube (C and D). Leave a small tab of tape folded over at the end to assist removal (E).

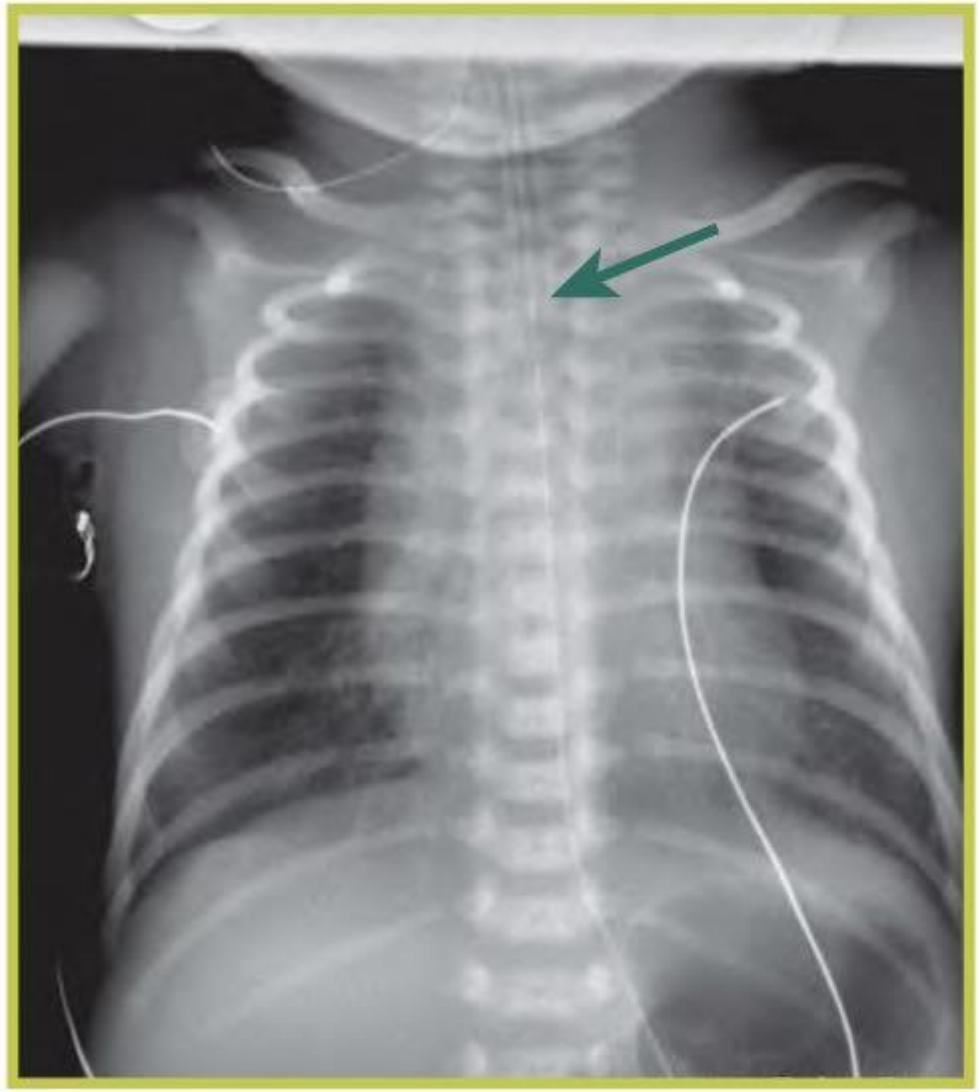


Figure 5.29. Correct placement of endotracheal tube with tip adjacent to the second thoracic vertebra

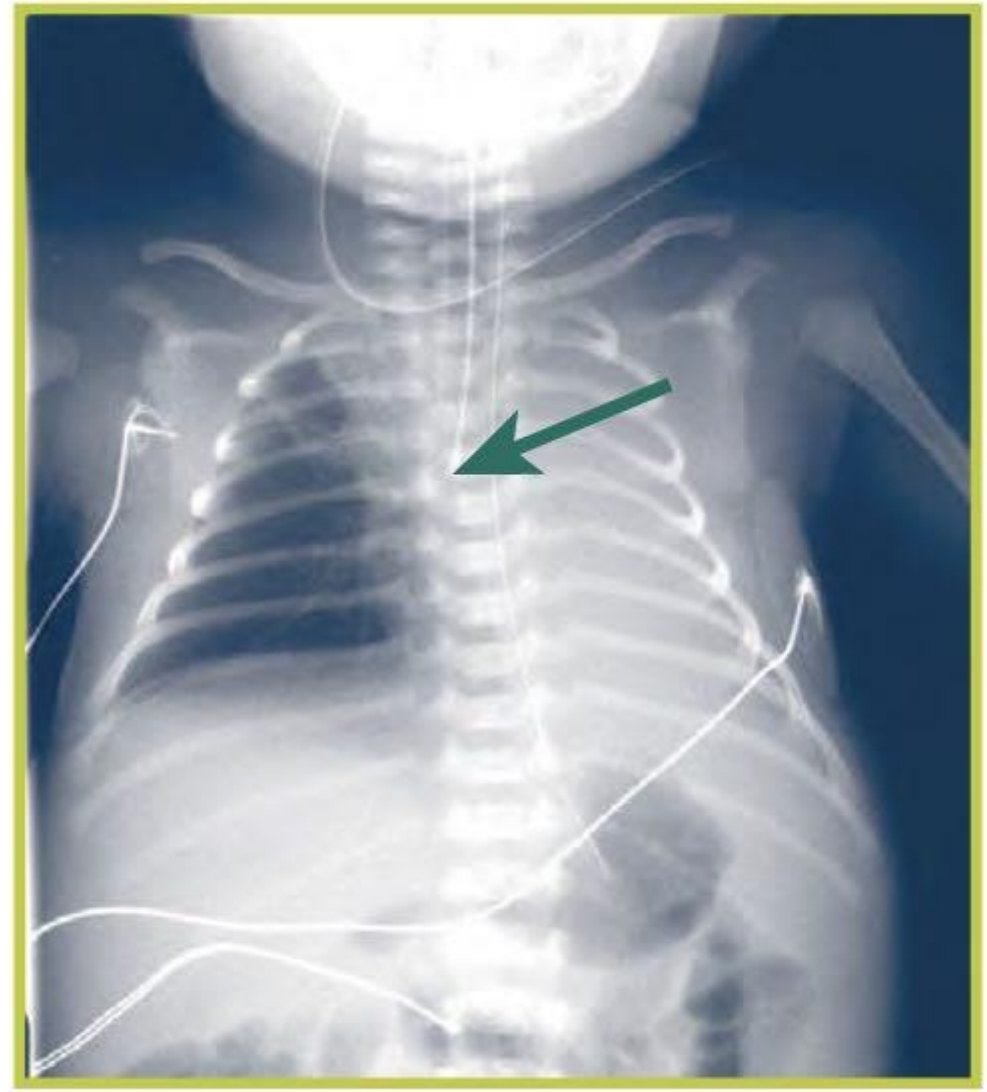
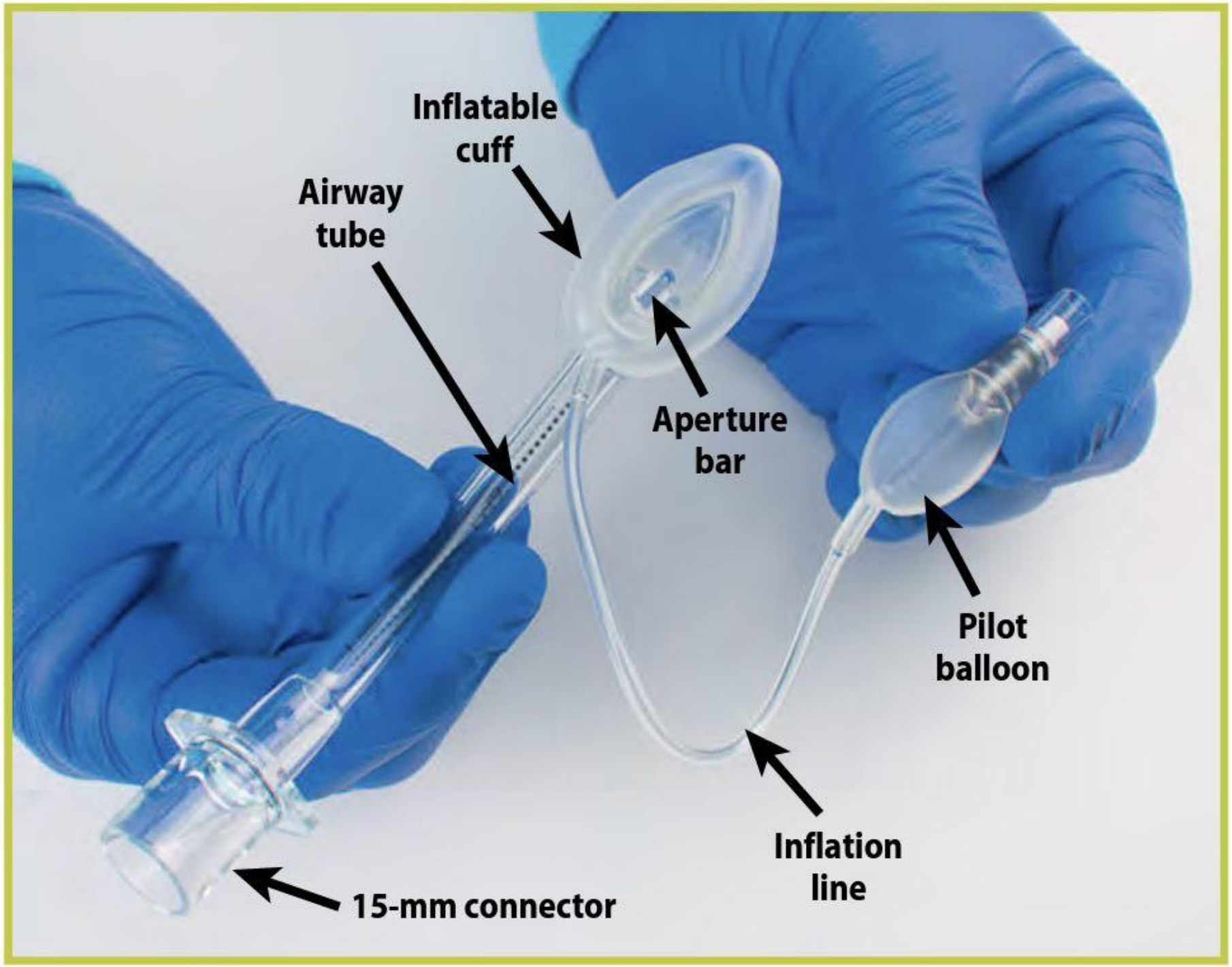


Figure 5.30. Incorrect placement. The tip of the endotracheal tube is in too far. It is touching the carina, approaching the right mainstem bronchus, and the left lung is collapsed.

Alternative: Laryngeal Mask Airway (LMA)



Chest Compressions

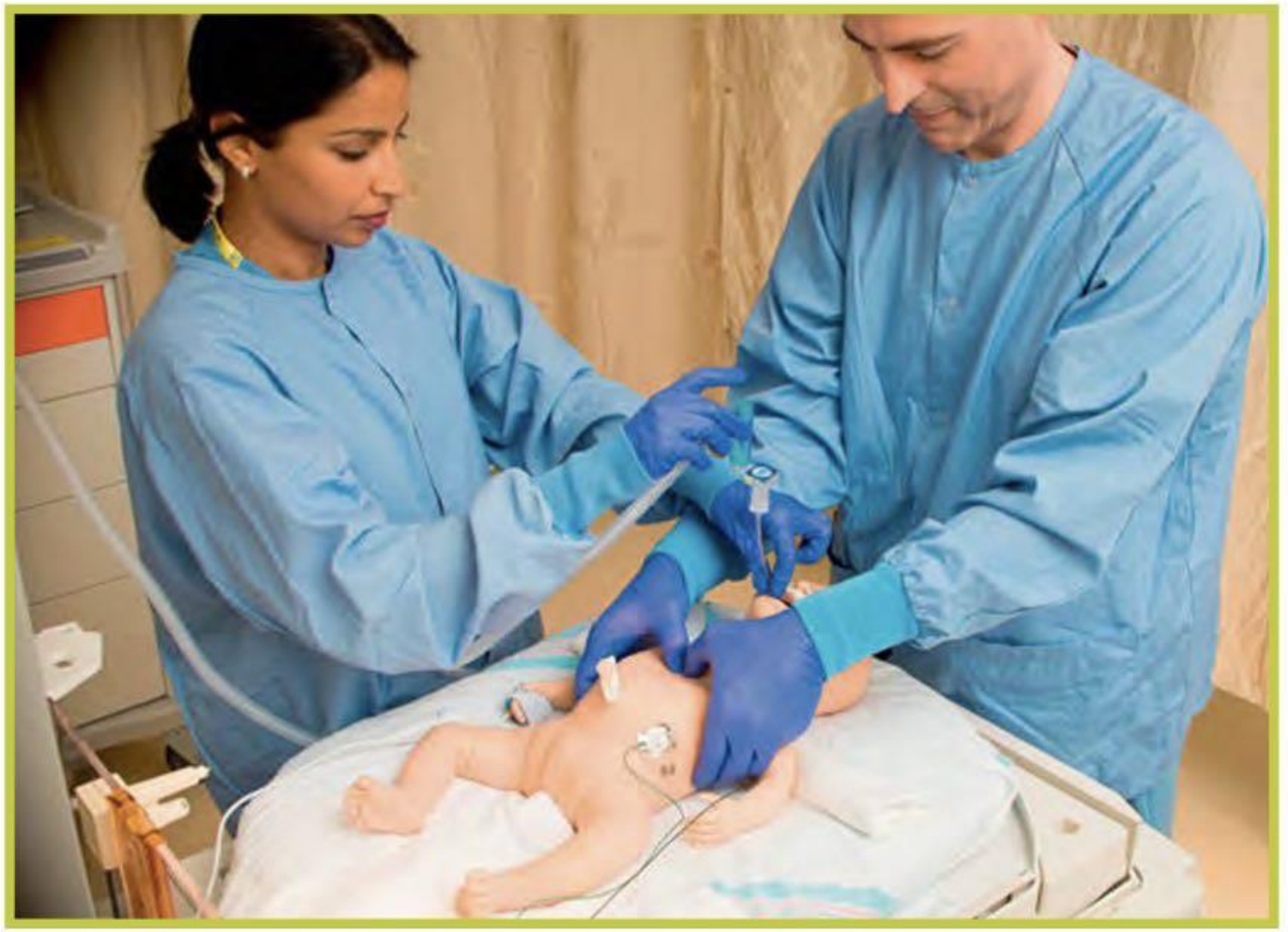


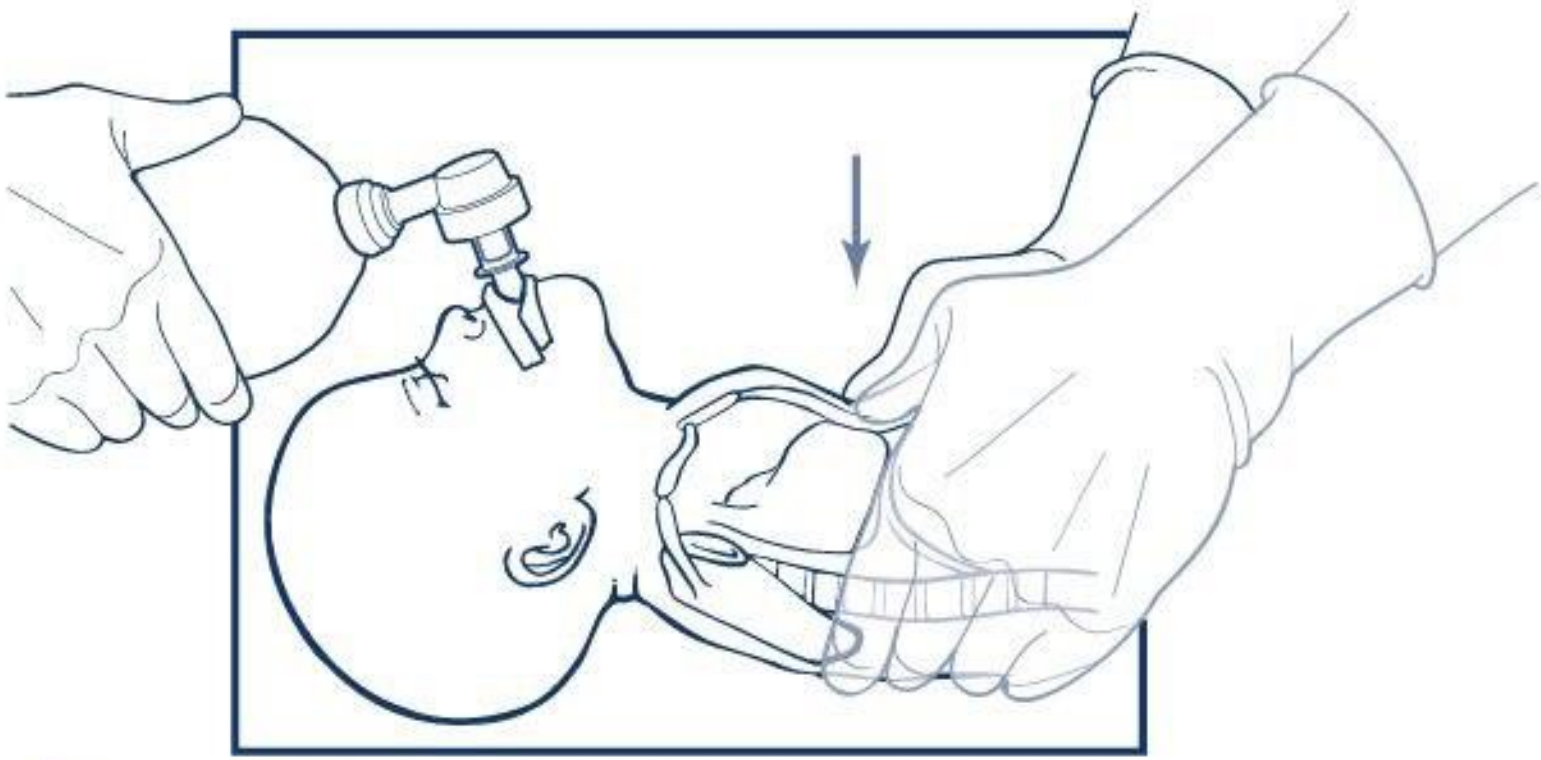
Figure 6.2. Compressor standing at the head of the bed

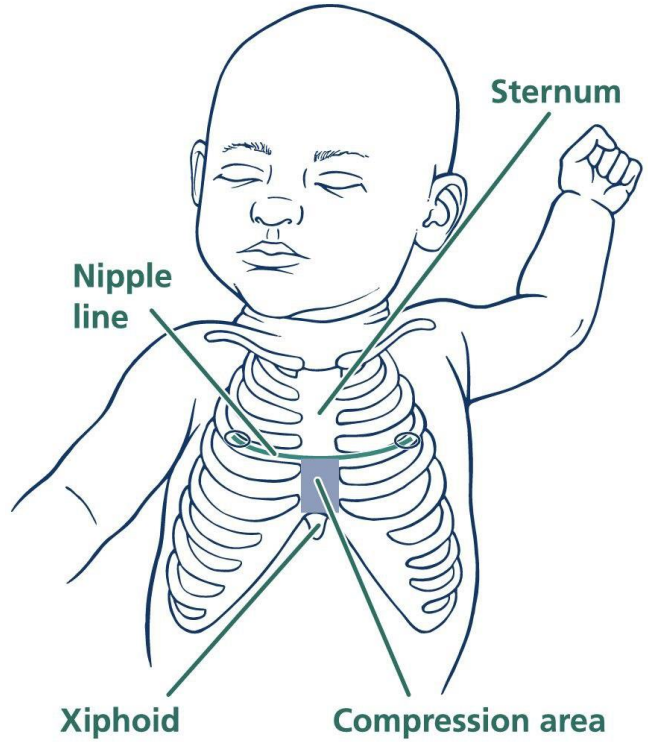
3:1 Compression:Ventilation Rhythm

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

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

*One-and-Two-and-Three-and-**Breathe-and**...*





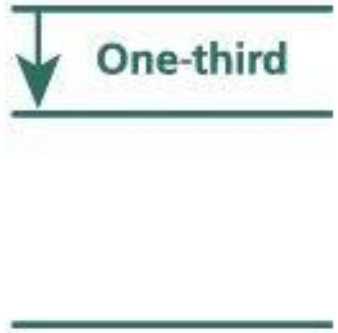


Figure 6.5. Compression depth is approximately one-third of the anterior-posterior diameter of the chest.

Medications

Epinephrine Summary

Concentration
1:10,000 epinephrine (0.1 mg/mL)

Route
Intravenous (preferred) or Intraosseous
Option: Endotracheal only while intravenous or intraosseous access is being obtained

Preparation
Intravenous or Intraosseous = 1-mL syringe labeled "Epinephrine-IV"
Endotracheal = 3- to 5-mL syringe labeled "Epinephrine-ET only"

Dose
Intravenous or Intraosseous = 0.1 to 0.3 mL/kg
Endotracheal = 0.5 to 1 mL/kg

Administration
***Rapidly*—as quickly as possible**
Intravenous or Intraosseous: Flush with 0.5 to 1 mL normal saline
Endotracheal: PPV breaths to distribute into lungs
Repeat every 3 to 5 minutes if heart rate remains less than 60 bpm.

In preterm newborns less than 30 weeks' gestation, rapid administration of a volume expander may increase the risk of intracranial hemorrhage.

Volume Expander Summary

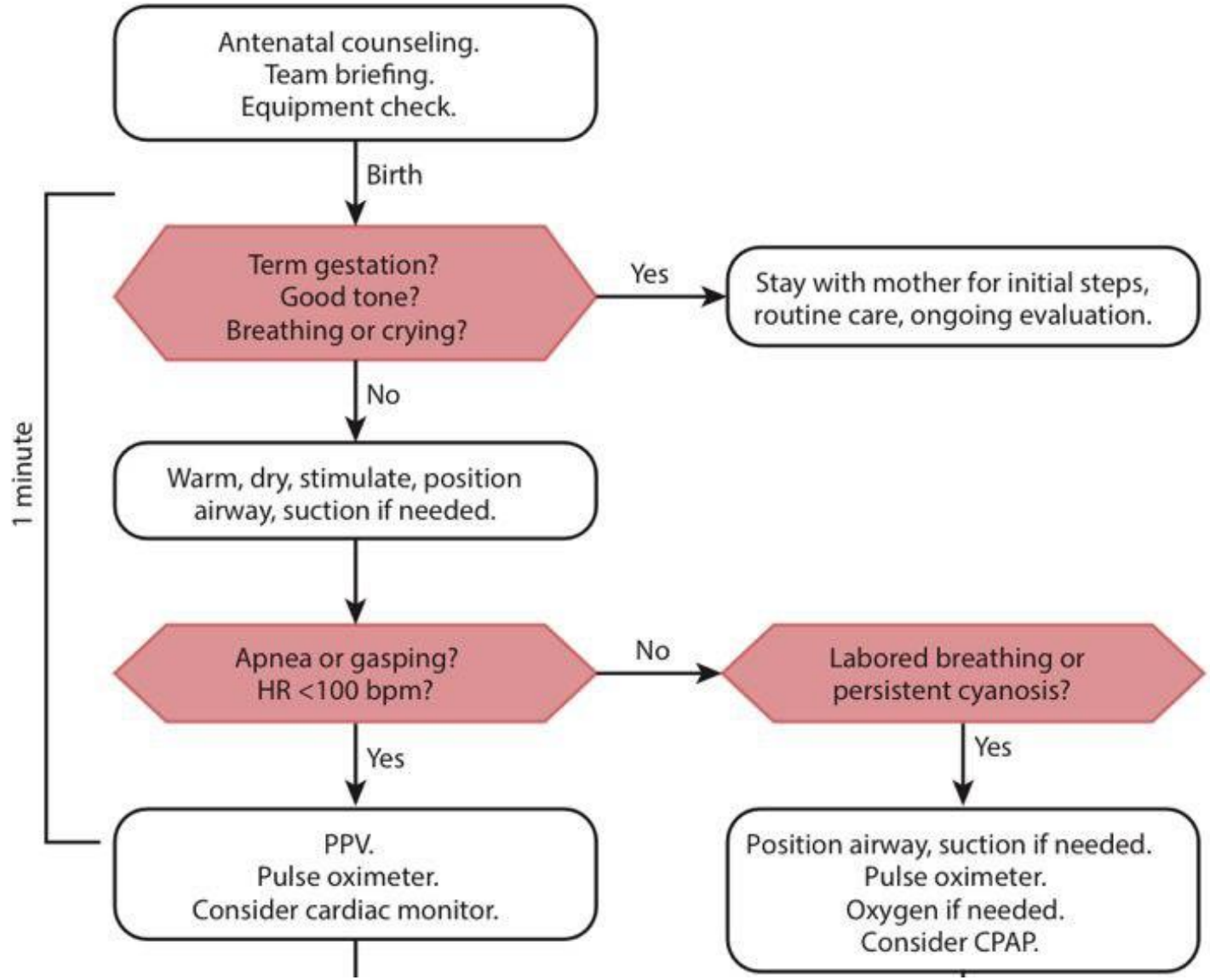
Solution
Normal saline (0.9% NaCl)
Suspected anemia: O-negative packed red blood cells

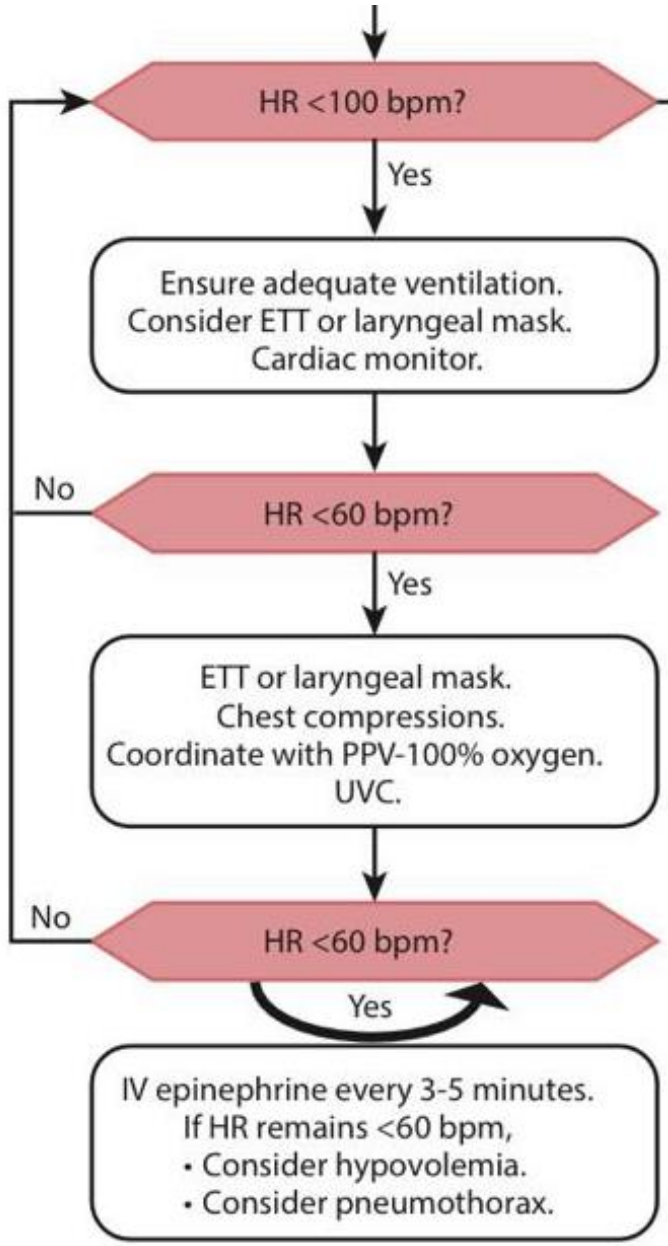
Route
Intravenous or Intraosseous

Preparation
30- to 60-mL syringe (labeled)

Administration
Over 5 to 10 minutes
(Use caution with preterm newborns less than 30 weeks' gestation.)

Neonatal Resuscitation Program® 8th Edition Algorithm





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Initial oxygen concentration for PPV	
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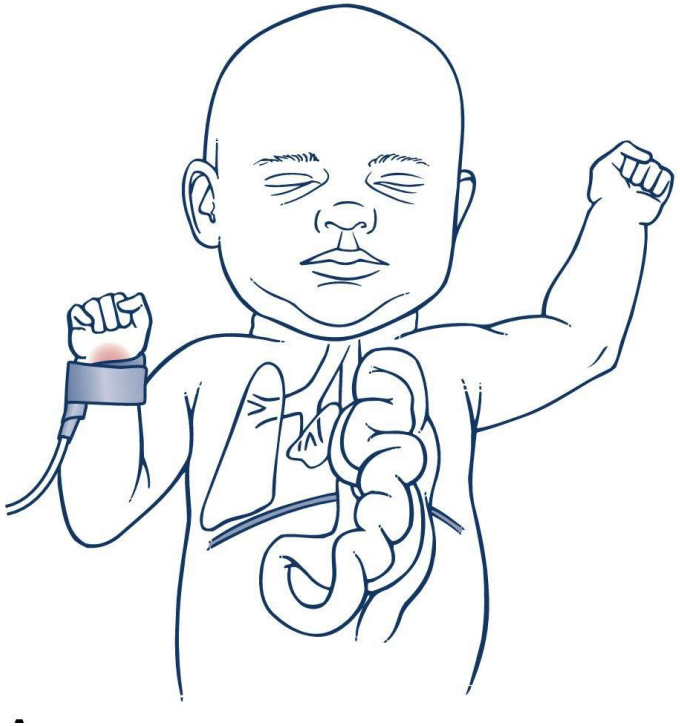
Resuscitation of preterm babies <32 weeks

A B

Figure 9.2. Polyethylene plastic bag (A) and wrap (B) for reducing heat loss. (Figure 9.2B used with permission of Mayo Foundation for Medical Education and Research.)

Special considerations

Congenital Diaphragmatic hernia



Congenital hypoplasia of lung