



We know children.

Delivery & Care of the Newborn

Cindy Japp, APRN-CNS

Which Babies Require Resuscitation?

- Most newly born babies are vigorous
- Only about 10% of newborns require some assistance
- Only 1% need major resuscitative measures (intubation, chest compressions, and/or medications) to survive

Fetal Physiology

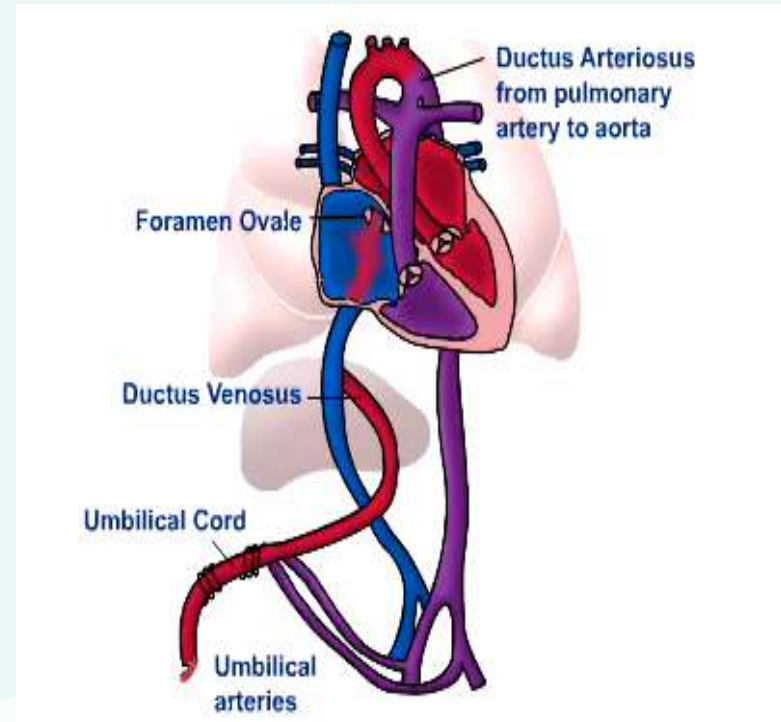
In the fetus

- Alveoli filled with lung fluid
- In utero, fetus dependent on placenta for gas exchange

Fetal Physiology

In the fetus

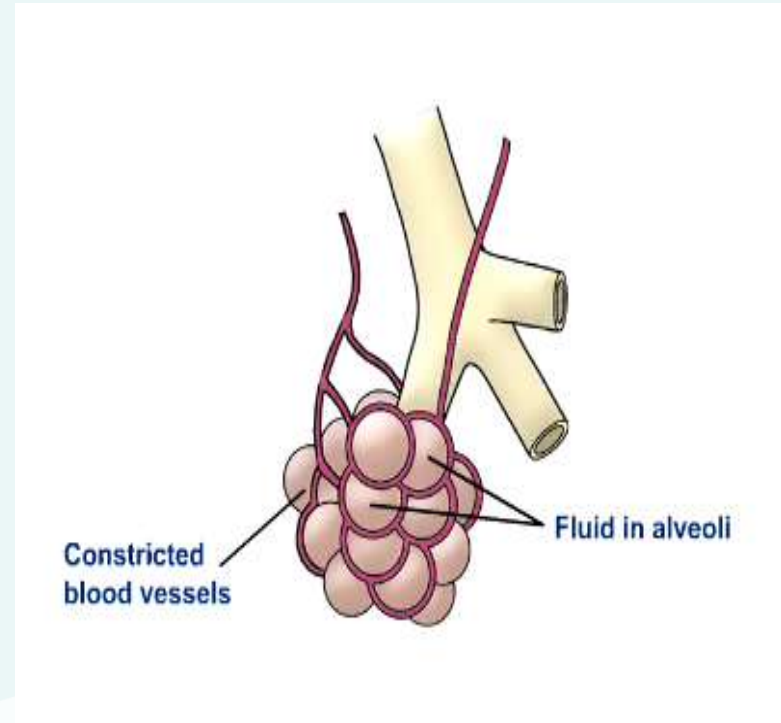
- Pulmonary arterioles constricted
- Pulmonary blood flow diminished
- Blood flow diverted across ductus arteriosus



Click on the image to play video

Lungs and Circulation After Delivery

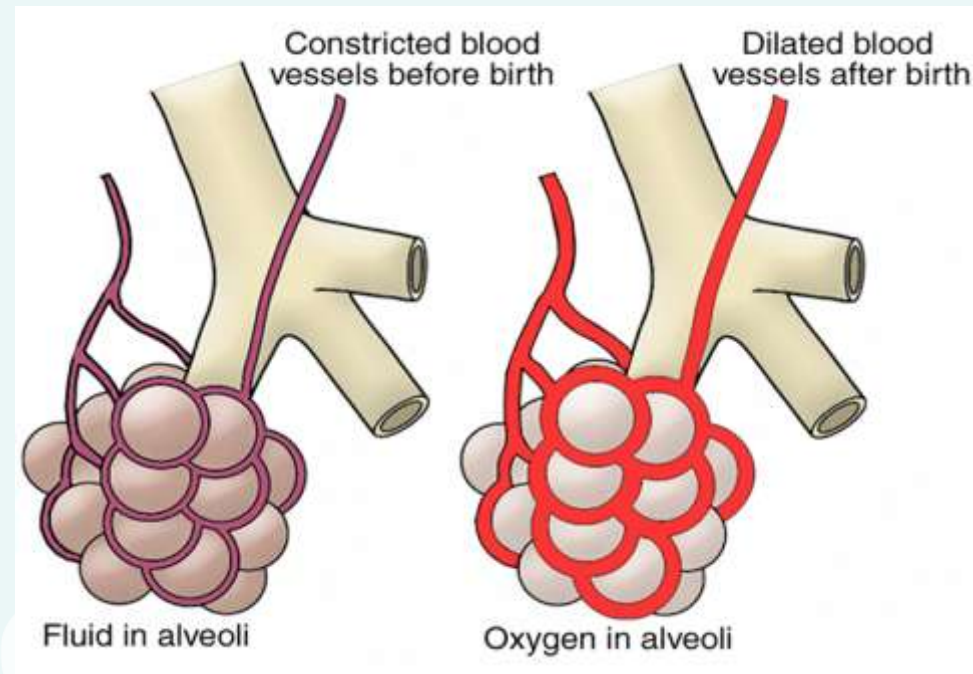
- Lungs expand with air
- Fetal lung fluid leaves alveoli



Click on the image to play video

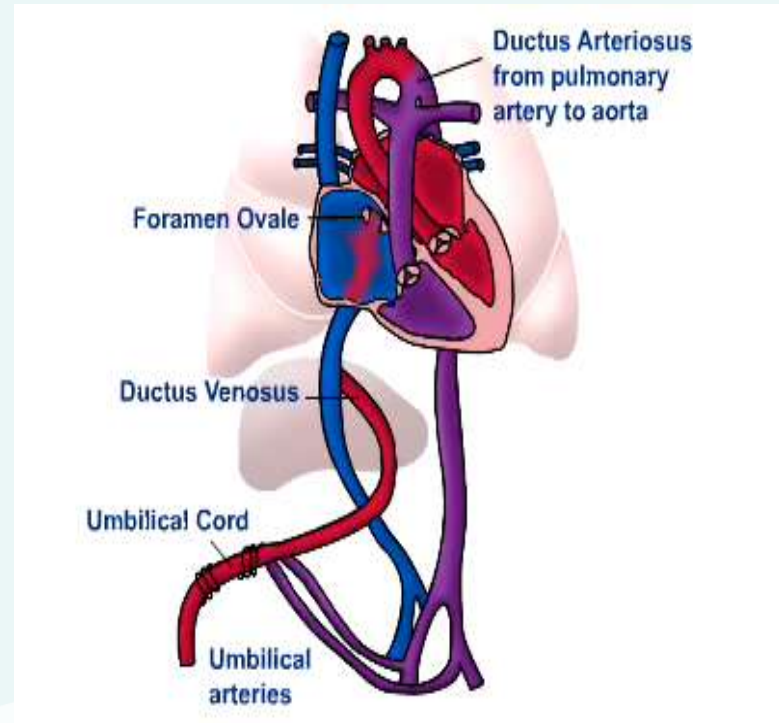
Lungs and Circulation

- Pulmonary arterioles dilate
- Pulmonary blood flow increases



Lungs and Circulation

- Blood oxygen levels rise
- Ductus arteriosus constricts
- Blood flows through lungs to pick up oxygen



Click on the image to play video

Normal Transition

The following major changes take place within seconds after birth:

- Fluid in alveoli absorbed
- Umbilical arteries and vein constrict thus increasing blood pressure
- Blood vessels in lung relax

What Can Go Wrong During Transition

- Lack of ventilation of the newborn's lungs results in sustained constriction of the pulmonary arterioles, preventing systemic arterial blood from being oxygenated
- Prolonged lack of adequate perfusion and oxygenation to the baby's organs can lead to brain damage, damage to other organs, or death



Signs of a Compromised Newborn

- Poor muscle tone
- Depressed respiratory drive
- Bradycardia
- Low blood pressure
- Tachypnea
- Cyanosis



Good tone
with
cyanosis



Bad tone
with
cyanosis

Secondary Apnea

- If oxygen deprivation continues, secondary apnea ensues, accompanied by a continued fall in heart rate and blood pressure
- **Secondary apnea cannot be reversed with stimulation; assisted ventilation must be provided**



Click on the image to play video



Resuscitation of a Baby in Secondary Apnea

Initiation of effective positive-pressure ventilation during secondary apnea usually results in

- Rapid improvement in heart rate



Important Points in the Neonatal Resuscitation

- The ***most*** important and effective action in neonatal resuscitation is to ventilate the baby's lungs
- Effective positive-pressure ventilation in secondary apnea usually results in rapid improvement of heart rate
- If heart rate does not increase, ventilation may be inadequate and/or chest compressions and epinephrine may be necessary

Important Points in the Neonatal Resuscitation

- Heart rate <60 bpm \rightarrow Additional steps needed
- Heart rate >60 bpm \rightarrow Chest compressions can be stopped
- Heart rate >100 bpm and breathing \rightarrow Positive-pressure ventilation can be stopped
- Asterisk (*): endotracheal intubation may be considered at several steps
- Time line: if no improvement after 30 seconds, proceed to next step

Preparation for Resuscitation: Risk Factors

- The majority, but not all, of neonatal resuscitations can be anticipated by identifying the presence of antepartum and intrapartum risk factors associated with the need for neonatal resuscitation

Antepartum Risk Factors

- Maternal Diabetes
- Pregnancy-induced hypertension
- Bleeding in second or third trimester
- Maternal infection
- Maternal cardiac, renal, pulmonary, thyroid or neurologic disease
- Premature rupture of membranes
- Maternal substance abuse
- Age < 16 or > 35 years

Intrapartum Factors

- Breech or other abnormal presentation
- Premature labor
- Precipitous delivery
- Prolonged labor (> 24 hours)
- Macrosomia
- Prolapsed cord
- Abruptio placentae
- Placenta previa



We know children.

Steps in Neonatal Resuscitation

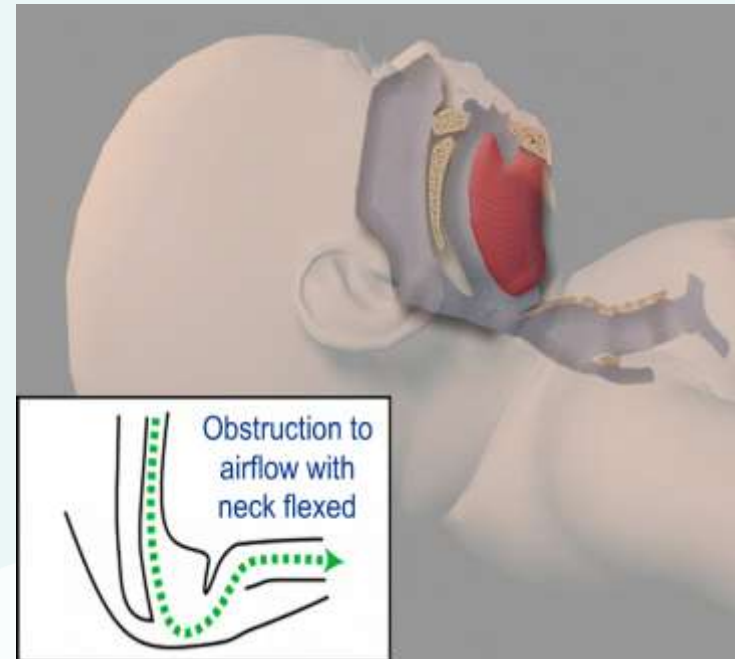
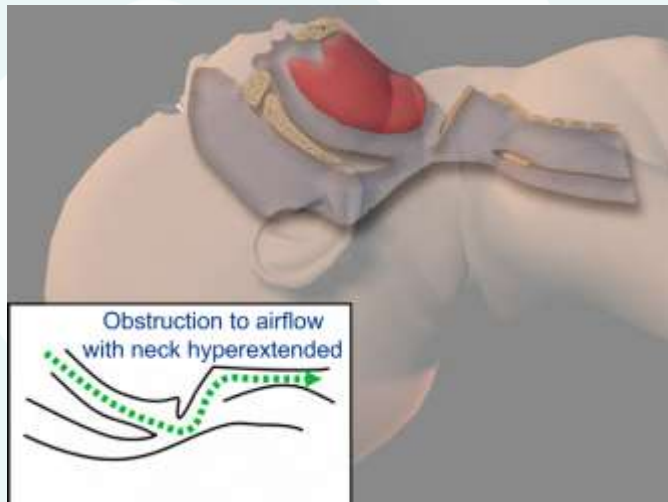
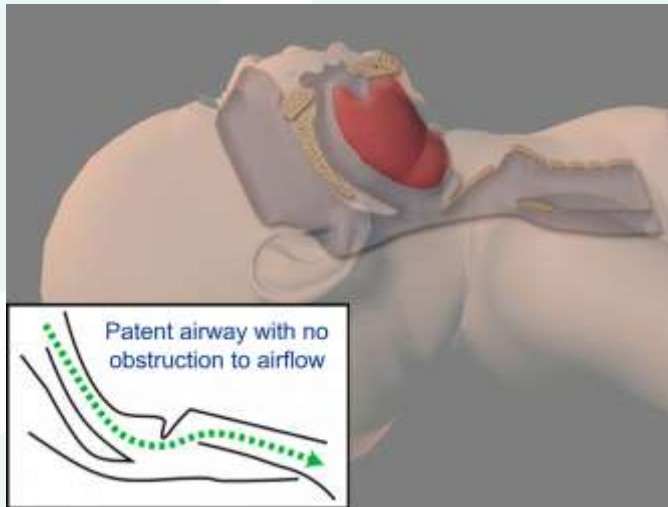
Opening the Airway

Open the airway by positioning the newborn in a “sniffing” position

- Positioning on back or side, slightly extending neck
- “Sniffing” position aligns posterior pharynx, larynx, and trachea



Opening the Airway



Dry, Stimulate to Breathe, Reposition



Evaluation: Respirations, Heart Rate, Color

Decisions and actions during newborn resuscitation are based on Respirations, Heart Rate, and Color



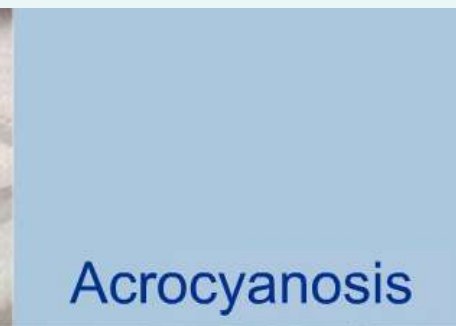
Click on the image to play video



Central Cyanosis and Acrocyanosis



Central Cyanosis



Acrocyanosis



Preparation Checklist

Before beginning positive-pressure ventilation:

- Select appropriate-sized mask
- Be sure airway is clear
- Position baby's head
- Position yourself at baby's side or head

Bag and Mask: Equipment

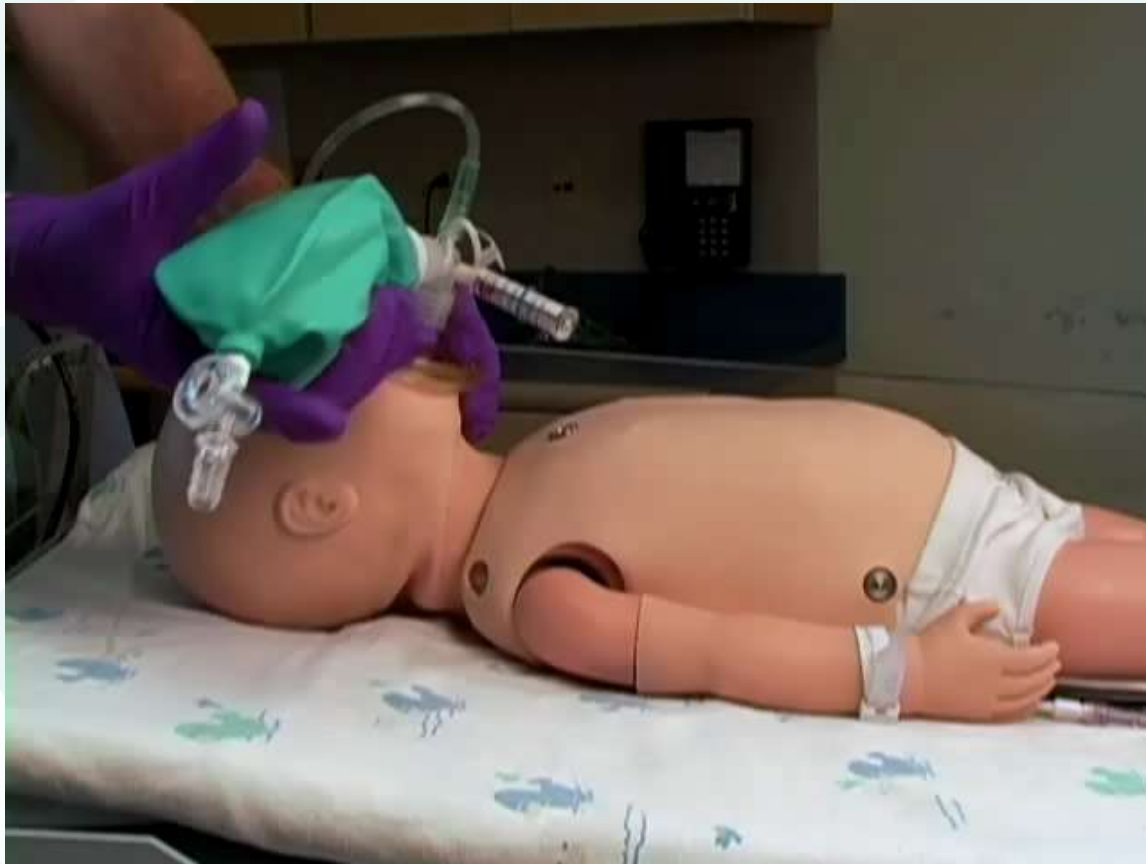
Mask should cover

- Tip of Chin
- Mouth
- Nose



Frequency of Ventilation:

40 to 60 breaths per minute



CI

Signs of Improvement

- Improved Heart Rate, color breathing, tone and oxygen saturation

Causes and Solutions for Inadequate Chest Expansion

Condition

Inadequate seal

Blocked airway

Not enough pressure

Actions

Reapply mask to face and lift jaw forward

Reposition the head
Check for secretions; suction if present

Ventilate with the newborn's mouth slightly open

Increase pressure until there is a perceptible chest movement
Consider endotracheal intubation



Chest Compressions

Chest Compressions

- Temporarily increase circulation
- Must be accompanied by ventilation
- Should use 100% oxygen

Chest Compressions: Indications

Heart rate remains less than 60 beats per minute (bpm) despite 30 seconds of effective positive-pressure ventilation



Chest Compressions:

- Compress the heart against the spine
- Increase intrathoracic pressure
- Circulate blood to vital organs, including the brain



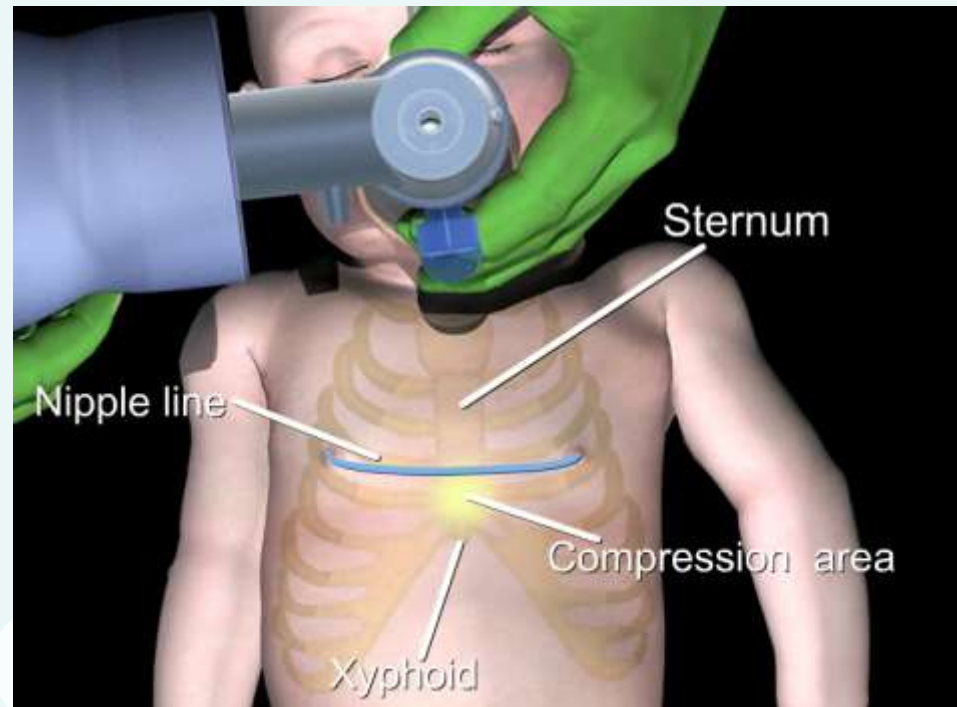
Chest Compressions: 2 People Needed

- One person compresses chest
- One person continues ventilation



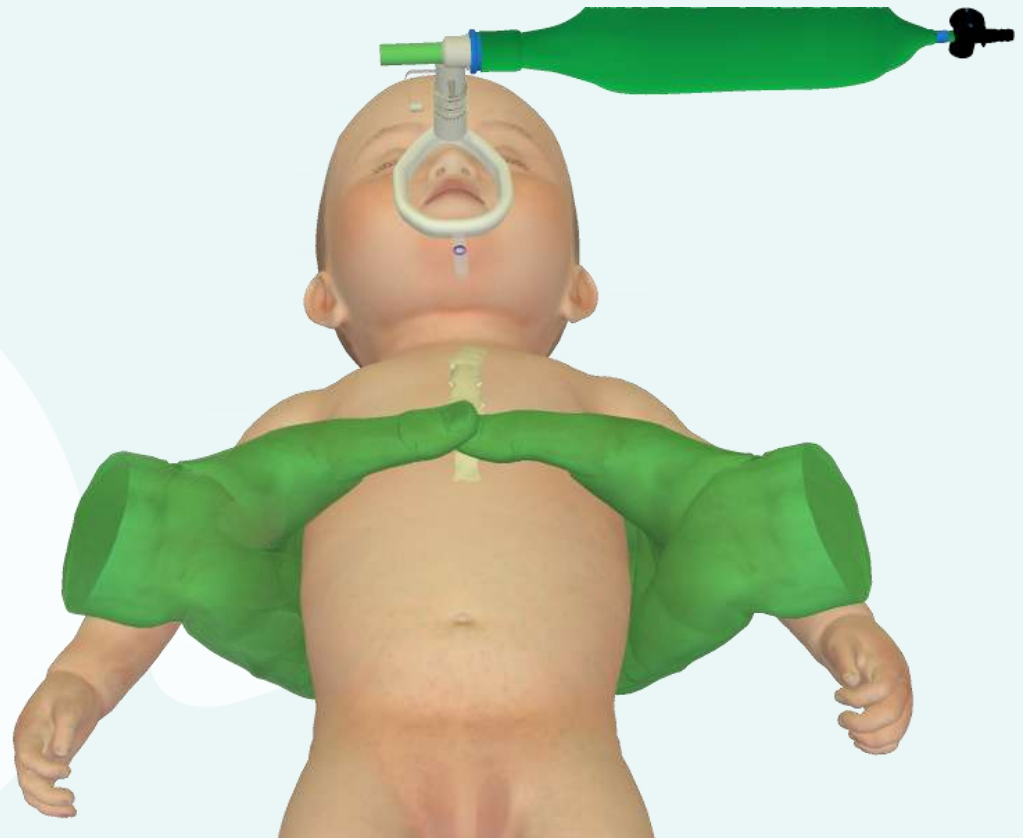
Chest Compressions: Positioning of Thumbs or Fingers

- Run your fingers along the lower edge of the rib cage until you locate the xyphoid
- Place your thumbs or fingers on the sternum, above the xyphoid and on a line connecting the nipples



Chest Compressions: Thumb Technique

- Thumbs compress sternum
- Fingers support back



Chest Compressions: Coordination With Ventilation

- One cycle of 3 compressions and 1 breath takes 2 seconds
- The breathing rate is 30 breaths per minute and the compression rate is 90 compressions per minute. This equals 120 “events” per minute

Positive-Pressure Ventilation Fails to Produce Adequate Ventilation

Mechanical blockage of airway

- Meconium or mucus plug
- Choanal atresia
- Airway malformation (eg, Robin syndrome)
- Other rare conditions

No Improvement After Resuscitation. Three Categories

The appropriate action for a baby who fails to respond to resuscitation will depend on the presentation

- Failure to ventilate
- Persistent cyanosis or bradycardia
- Failure to initiate spontaneous breathing

Baby Remains Cyanotic or Bradycardic

Persistent cyanosis and bradycardia are rarely caused by congenital heart disease. More commonly, the persistent cyanosis and bradycardia are caused by inadequate ventilation

- Ensure chest is moving with ventilation
- Listen for equal bilateral breath sounds
- Confirm 100% oxygen is being given
- Consider congenital heart block or cyanotic heart disease (rare)

Failure to Initiate Spontaneous Respirations

Consider

- Brain injury (hypoxic ischemic encephalopathy)
- Severe acidosis, congenital neuromuscular disorder
- Sedation secondary to maternal drugs

Post-resuscitation Care


Baby requires:

- Close monitoring
- Anticipatory care
- Laboratory studies



Post-resuscitation Problems

A baby who has required resuscitation must have close monitoring and management of

- Pulmonary hypertension
- Pneumonia and lung complications
- Metabolic acidosis
- Hypotension
- Fluid management
- Seizures or apnea
- Hypoglycemia
- Feeding problems
- Temperature management 

Premature Babies: Additional Risks

- Excessive heat loss
- Vulnerability to hyperoxic injury
- Immature lungs and diminished respiratory drive
- Vulnerability to infection
- Immature brains that are prone to bleeding
- Small blood volume, increasing the implications of blood loss

Keeping Premature Babies Warm

- Increase delivery room temperature
- Preheat radiant warmer
- Use warming pad
- Consider polyethylene bag for babies <28 weeks' gestation



Oxygen Administration

- Hyperoxic/reperfusion injury may be more significant in preterm babies
- Oxygen blender, air source, and pulse oximeter recommended for babies born at <32 weeks' gestation.

Adjusting Oxygen

- In utero, fetal oxygenation saturation approximately 60%
- Full-term babies may take >10 minutes for saturation >90%
- Optimum saturation for preterm babies in first minutes of life unknown
- 95% oxygen saturation may be too high for preterm babies

Decreasing Brain Injury

- Handle the baby gently
- Avoid the Trendelenburg position
- Avoid high airway pressures when possible
- Adjust ventilation gradually based on physical examination, oximetry, blood gases
- Avoid rapid intravenous fluid boluses and hypertonic solutions

Special Precautions After Resuscitation

- Monitor and control blood sugar
- Monitor for apnea, bradycardia, or deviation from target oxygen saturations (either high or low) and intervene promptly
- Monitor and control oxygenation and ventilation
- Consider delaying feeding if perinatal compromise was significant
- Increase your suspicion for infection



Pre-Transport Stabilization

- “...(with newborns) the major emphasis is on stabilization of the patient and later transfer.”
 - “Stabilization should be in process as the transport team is en-route, and then it is continued by the team upon arrival.”

L. Joseph Butterfield, MD (1990) Current Therapy in Neonatal-Perinatal Medicine 2

The S.T.A.B.L.E. Mnemonic

Sugar

Temperature

Artificial/Assisted breathing

Blood pressure

Lab work

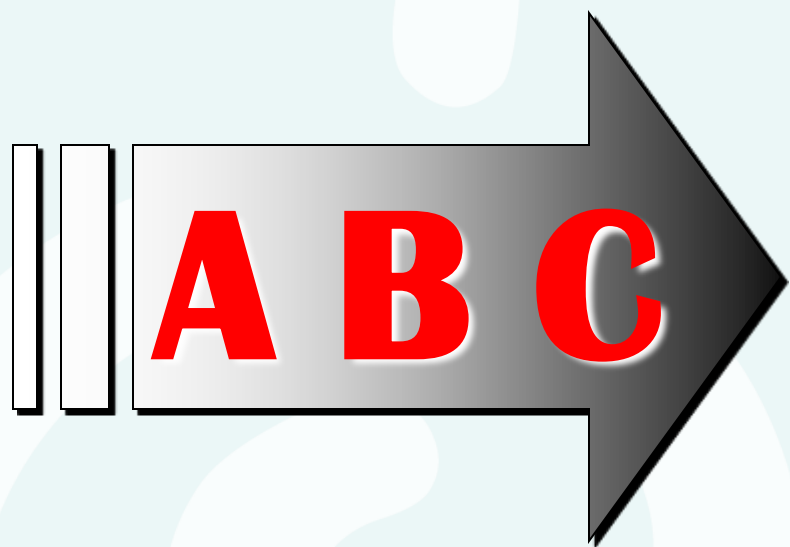
Emotiona**L** support

Why Use a Mnemonic?

We know children.

- Remembering “what to do” may be difficult when faced with little opportunity to use skills or information
- Mnemonics can enhance
 - ◆ Learning
 - ◆ Recall
 - ◆ Organization of information

The Basics Come First!



S.T.A.B.L.E.

- Initial IV therapy
 - Fluid rates and calculations
- Glucose monitoring
 - Hypoglycemia assessment and interventions
 - Practice session (calculator needed)
- Umbilical catheters
 - Placement and safe use

Temperature

We know children.

- Detrimental effects of cold stress
- Vulnerable infants
- How body heat is lost
- Pulmonary vasoconstriction and shunting
- Warming severely hypothermic infants
 - Case study in this unit

Artificial/Assisted Breathing

We know children.

- Evaluating respiratory distress
- Indications for positive pressure ventilation and endotracheal intubation
- Assisting with intubation
 - ET tube sizes
 - Securing tubes
 - Location on chest x-ray
- Evaluating for pneumothorax

Blood Pressure

We know children.

- Types and signs of shock
- Treatment of shock
 - Hypovolemic
 - Cardiogenic
 - Septic
- Dopamine infusion
 - Calculations and safe use
 - Practice session

Lab Work

We know children.

- Pre-transport lab evaluation
- Clinical signs of sepsis
- CBC interpretation
- Antibiotic therapy
 - Ampicillin
 - Gentamicin

Emotional Support

We know children.

- Understand how the family may react during the crisis of a neonatal transport
- Understand ways health care providers can support families of sick or transported infants