Goals and objectives

- Identify risk factors for resuscitation
- Review the physiology of transition
- Review baseline patho for asphyxia
- Identify 3 ways to assist in thermoregulation of the neonate
- Name the ABC of resuscitation in neonates
- Identify strategies and steps of resuscitation
Resuscitation techniques for babies born inside vs. outside hospital

Some of the key principles for applying neonatal resuscitation inside the hospital can be used for strategies outside the hospital. The content outlined in this presentation, however, is not inclusive of the Neonatal Resuscitation program from the AAP 2011 guidelines.

This information is not representative of course completion.
Neonatal resuscitation facts

- Birth asphyxia accounts for about 23% of approximately 4 million neonatal deaths that occur each year worldwide

Neonatal resuscitation facts

- Approximately 10% newborns require some assistance to breathe at birth.
- Fewer than 1% need extensive resuscitation measures to survive
- 10% newborns make the transition from intra to extra uterine transition without difficulty
Pathophysiology - transition to extra uterine life

- Fluid in alveoli is absorbed, oxygen diffuses into blood vessels surrounding alveoli
- Umbilical arteries constrict and then the umbilical arteries and vein are closed when the umbilical cord is clamped
- Blood vessels in the lung tissue relax and there’s an increase in pulmonary blood flow and decrease of flow through the ductus arteriosus
Pathophysiology- transition to extra uterine life

- Baby breathes air and uses lungs to transport oxygen into the blood

- As adequate oxygen enters the blood baby’s skin gradually turns from gray/blue to pink

- Initial steps in normal transition takes place within minutes, the entire process is not completed for hours/days
  - up to 10 minutes to achieve oxygen saturation 90%
  - functional closure of PDA may not occur for 12-24 hours
  - complete relaxation of lung vessels doesn’t occur for months
Pathophysiology with in utero or perinatal compromise

- Hypoxia in utero, the fetus will attempt to breathe.
- Loss of consciousness infant enters primary apnea
- Heart rate remains stable, but soon decreases and reverts to anaerobic metabolism
- Circulation to non-vital organs is reduced
Pathophysiology with in utero or perinatal compromise

- Anaerobic metabolism releases lactic acid

- If the insult continues, infant continues to gasp

- If still in utero, or if for some other reason these gasps fail to aerate the lungs, they move into a period of secondary, or terminal, apnea.
Pathophysiology with in utero or perinatal compromise

- Until now, the circulation has been maintained but once in terminal apnea the biochemical response impairs cardiac function.

- The heart eventually fails and, without effective intervention, the baby dies.
The most urgent requirement for any asphyxiated infant is effective VENTILATION.
• Majority of resuscitation: Established ventilation is the most vital part of resuscitation and increases the heart rate

• In a few cases: if heart rate does not increase with established ventilation, a brief round of chest compressions may be needed

• In very few cases: if established ventilation and compressions does not increase heart rate, medications may be needed

NRP, 2011
- Know your risk factors
- Always be prepared to resuscitate
Risk Factors - Antepartum

- Maternal diabetes
- Hypertension
- Bleeding in second or third trimester
- Maternal infection
- Premature rupture of membranes
- Post term dates
- Multiple gestation
- Maternal substance abuse
- History in pregnancy of identified malformation or anomaly
- Decreased fetal movement
- No prenatal care
- Advanced maternal age
Risk Factors- Intrapartum

Breech
Preterm labor
Precipitous labor
Prolonged rupture of membranes
Macrosomia
Narcotic use
Meconium stained fluid
Prolapsed cord
Abruption
Significant bleeding
Prior to beginning the steps in the NRP Flow Diagram, in the hospital vs. asking the patient, family for relevant perinatal history, including these questions:

- What is the gestational age?
- Was/is the fluid clear?
- How many babies are expected?
- Are there any additional risk factors?
At birth, answer 3 questions to determine the need for initial steps of resuscitation:

- Is the newborn term?
- Is the newborn breathing or crying?
- Does the newborn have good muscle tone?
The following added items should be available for every birth in the hospital:

- Compressed air source
- Oxygen blender to mix oxygen and compressed air with flowmeter
- Pulse oximeter for neonatal use and oximeter probe
- Alternate airway supplies: LMA size 1
Infants Hierarchy of resuscitation

Always needed by newborns

- Assess baby’s risks for resuscitation
- Provide warmth
- Position, open and clear airway if needed
- Dry to stimulate to breath
ABC’s: Initial Block Assessment

- **A** irway- is it open? Is it clear?

- **B** reathing- is it spontaneous? Or do you need to assist?

- **C** irculation of oxygenated blood

- **D** (Drug)
NRP 6th Edition Flow Diagram
Thermoregulation

Preterm (< 29 weeks or 1500 grams)

- Do not dry
- Plastic wrap or 1 gallon plastic bag (food grade)
- Polyethylene bag (food grade)
- Sandwich baggies
- Chemically activated warming pad
- Turn up the heat - 77-80F

nature.com
Thermoregulation

Term

- Dry with blankets, towels
- Skin to skin with mom
- Apply a hat

lovehomegrowgarden.info
After clearing the airway if necessary, drying (term), remove wet towels/blankets, reposition and stimulate, evaluate respirations and heart rate (not color).
Uncomplicated Term delivery

Cord is clamped and cut
Active and crying while drying?
Good muscle tone?

Place on the mother’s chest to keep warm and to continue transition and note color becoming pinker

Routine Care
- Provide warmth
- Clear airway if necessary
- Dry
- Ongoing evaluation of HR, tome, respiratory rate
Suctioning following birth (including bulb suctioning with a bulb syringe) should be reserved for babies who have obvious obstruction to spontaneous breathing or who require positive pressure ventilation.

• Suction the mouth before the nose
NRP 2011 Raising the bar...Science changes

• Suctioning options outside of hospital bulb syringe
• Wipe the mouth and nose with a clean cloth wrapped around your finger

NRP 2011 Raising the bar...Science changes

Meconium present? Baby vigorous?
Normal muscle tone, normal respiratory effort, HR>100

Yes- continue to provide warmth, clear mouth and nose of secretions, dry and stimulate

newborns.stanford.edu

mothering.com
NRP 2011 Raising the bar…Science changes

Meconium present? Baby vigorous?

No- Suction mouth and trachea with catheter or bulb and then insert ETT into trachea
Attach ETT to meconium aspirator and suction several seconds
If HR falls < 100, initiate PPV
NRP 2011 Raising the bar…Science changes

- If HR is less than 100 bpm, or if newborn is apneic or gasping, begin positive-pressure ventilation.
- If HR is more than 100 bpm and respirations are labored, consider CPAP, especially for preterm newborns.
Positive pressure ventilation

Supplies: masks for VLBW preterm (<1000 grams), flow or self-inflated bags, preterm and term masks, manometer, and stethoscope, oxygen/air source

- Look for chest movement (nose sniffing position? chin off chest?)
- Auscultate breath sounds
- Starting inspiratory pressure 20 cm H2O
- Resting PEEP 4-6 cm H2O
NRP 2011 Raising the bar…Science changes

Alternate ways for ventilation for babies outside the hospital

- Bag and mask
- Mouth-to-mouth-and-nose resuscitation
- Place baby in sniffing position
Resuscitation of term newborns may begin with 21% oxygen.

Resuscitation of preterm newborns may begin with a somewhat higher oxygen concentration with blended air from 21-100%.

Deliver initial breaths 40-60 breaths per minute.

Breathe…… Two……Three……Breathe……Two……(Squeeze)
NRP 2011 Raising the bar...Science changes

Use MR SOPA to help you remember the ventilation corrective steps in order:

**M**: Adjust the mask on the face.
**R**: Reposition the head to ensure an open airway. Re-attempt ventilation.
If not effective,
**S**: Suction the mouth and nose
**O**: Ventilate with the baby’s mouth slightly open and lift the jaw forward. Re-attempt ventilation
*If not effective,*
**P**: Gradually increase pressure every few breaths, (cautiously, and to a maximum of 40 cm H20), until there are bilateral breath sounds and visible chest movement.
If still not effective,
**A**: Consider airway alternative (endotracheal tube or laryngeal mask airway)
Subsequently, evaluation and decision-making are based on respirations, HR, and oxygenation (per pulse oximetry).

- Pre-ductal to right hand or right wrist
### Targeted Pre-ductal Spo2 After Birth

<table>
<thead>
<tr>
<th>Time</th>
<th>Target Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 min</td>
<td>60-65%</td>
</tr>
<tr>
<td>2 min</td>
<td>65-70%</td>
</tr>
<tr>
<td>3 min</td>
<td>70-75%</td>
</tr>
<tr>
<td>4 min</td>
<td>75-80%</td>
</tr>
<tr>
<td>5 min</td>
<td>80-85%</td>
</tr>
<tr>
<td>10 min</td>
<td>85-95%</td>
</tr>
</tbody>
</table>
NRP 2011 Raising the bar…Science changes
Take ventilation corrective steps

Alternate airways - Intubate

**Attempts within 30 seconds** (not 20 seconds).

Do not administer free-flow oxygen during the intubation procedure to an apneic newborn.

Tube size (mm) Weight Gestational Age (g) (wks)
(Inside diameter)

2.5 Below 1,000 Below 28
3.0 1,000–2,000 28–34
3.5 2,000–3,000 34–38
3.5–4.0 Above 3,000 Above 38

Laryngoscope Blades 00 VLBW, preterm 0, Term 1
Tip to lip measurement: weight in kg plus 6
Utilize CO2 detector
NRP 2011 Raising the bar…Science changes
Take ventilation corrective steps

Alternate airways

- Laryngeal Mask Airway size 1 >2.5 kg

- Flow controlled t-piece resuscitator (set PIP and PEEP)
NRP 2011 Raising the bar…Science changes

• Establishing effective ventilations is the highest priority and single most effective step in cardiopulmonary resuscitation of the compromised newborn.

• The most important indicator of successful PPV is rising heart rate.
NRP 6th Edition Flow Diagram
Do not start chest compressions without first establishing effective ventilation (defined by audible bilateral breath sounds and chest movement).

If heart rate is still below 60 bpm despite 30 seconds of effective positive pressure ventilation, increase the oxygen concentration to 100% and begin chest compressions.
• When the heart rate is below 60 bpm, the oximeter may not function.

• When chest compressions begin, **increase the oxygen concentration to 100%** until the oximeter is giving a reliable signal and can guide the appropriate adjustment of supplemental oxygen.
Reevaluate HR, starting chest compressions

- Interruption of chest compressions to check the heart rate may result in a decrease of perfusion pressure in the coronary arteries.

- Continue chest compressions and coordinated ventilations (3:1) for at least 45-60 seconds before stopping briefly to assess the heart rate.
NRP 6th Edition Flow Diagram
Reevaluate- HR<60, giving emergency medication

Heart rate < 60 bpm after 30 seconds of effective assisted ventilation (preferably via endotracheal tube) and at least another 45-60 seconds of coordinated chest compressions and effective ventilation?
NRP 6th Edition Flow Diagram
Reevaluate- continued HR <60, giving emergency medication

Obtain IV access

In OR/DR- insert an emergent umbilical catheter

- Point a saline filled catheter with stopcock and syringe attached towards heart- up
- Insert tip a short distance < 2 cm until a point blood can be aspirated

5 French

resuscitation-guidelines.articleinmotion.com
Give epinephrine
Recommended concentration: **1:10,000** (0.1 mg/mL)
Recommended route: Intravenous.
Give rapidly – as quickly as possible.
Recommended IV dose: 0.1–0.3 mL/kg
Follow IV administration of epinephrine with 0.5 – 1 mL flush of normal saline.

Consider endotracheal route ONLY while IV access being obtained
**Recommended intratracheal dose: 0.5 – 1 mL/kg** per ETT
Check the newborn heart rate about **1 minute** after administering epinephrine (longer if given endotracheally).

Epinephrine dose may be repeated every 3-5 minutes.
Heart rate audible and remaining below 60 with effective ventilation and chest compressions?
Persistent bradycardia? History of possible blood loss?

- Consider normal saline bolus 10 ml/kg over 5-10 minutes, may repeat without significant improvement
Air leak- pneumothorax, pleural effusion
Blockage of airway- choanal atresia
Pharyngeal airway malformation - Robin syndrome,
Other rare conditions- laryngeal web, cystic hygroma or goiter
Congenital diaphragmatic hernia
Pulmonary hypoplasia
Extreme immaturity
Congenital pneumonia
NRP 2011 Raising the bar…Science changes

Special considerations

Continued bradycardia or cyanosis with equal chest rise and fall, and good breath sounds, increase oxygen to 100%

- Failed spontaneous respirations with PPV increasing heart rate
- Brain injury (hypoxic-ischemic encephalopathy (HIE), congenital defect of brain or neuromuscular disorder
- Sedation due to suspected drug use of narcotics or methadone maintenance from mother or unknown maternal history - do not administer Naloxone hydrochloride
The “Born-Alive Infants Protection Act of 2001” (H.R. 2175) became Public Law No. 107-207 on August 5, 2002. The purpose of this law is to establish that “infants who are born alive, at any stage in development (and regardless of the circumstances of their birth), are persons who are entitled to the protections of the law.”

The legislation defines the term “person” to include “an infant who is completely expelled or extracted from his or her mother and who is alive, regardless of whether or not the infant’s development is believed to be, or is in fact, sufficient to permit long-term survival, and regardless of whether the infant survived an abortion.” Furthermore, the law defines an infant who is born alive as one who, “at any stage of development, is expelled from the mother’s body and displays any of several specific signs of life—breathing, a heartbeat, and/or definite movement of voluntary muscles.”
NRP 2011 Raising the bar…Science changes

Post Resuscitation Stabilization

- Temperature control
- Close monitoring of vital signs
- HR 120-160, SpO2 85-95%, blood pressure- MAP around GA
- Assess for potential complications
- IV Fluids continued at cautious rate
Questions??????
References

- Resuscitation Council (UK) [www.resus.org.uk/pages/nls.pdf](http://www.resus.org.uk/pages/nls.pdf)
Thank-You Local Heroes

advimg.com

pregnancy.about.com