

Handout Materials



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Prehospital Pediatric Pitfalls

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DVD PROGRAM OBJECTIVES:

- Participants will describe and discuss the essential components of a rapid neonatal assessment, as well as the implications of findings
- Participants will describe and discuss the resuscitation priorities utilized with healthy and critically ill newborns
- Participants will describe and discuss the current research findings regarding the assessment of the critically ill pediatric patient
- Participants will describe and discuss the current research findings regarding the initial management of the critically ill pediatric patient

Expressway and Elevator Deliveries

Emergency Newborn Care

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Every child comes with the message that God is not yet discouraged of man
 Rabindranath Tagore

*See that you do not despise one of these little ones, for I say to you that their angels in Heaven
 always look upon the face of my Heavenly father*
 Matthew 18:10

A person is a person, no matter how small!
 Dr. Seuss

Neonatal Resuscitation Overview (The EMS and ER Version)

Who's at risk for neonatal resuscitation?

Neonatal cardiopulmonary physiology and normal circulations

APGAR scores

Resuscitation and a cup of coffee?

Do not delay/withhold resuscitation to obtain scores

Performed at 1 and 5 minutes

Scores range from 0-10

Categories

(A)ppearance

Blue/Pale	0
Body pink	1
Completely pink	2

(P)ulse

Absent	0
Below 100	1
Above 100	2

(G)rimace - reflex irritability to suctioning

Absent	0
Grimace	1
Cough or sneeze	2

(A)ctivity - muscle tone	
Limp	0
Some flexion	1
Well flexed	2
(R)espirations	
Absent	0
Weak/irregular	1
Strong cry	2

The newborn is held so that it should not fall on the earth... How do we assist? We may hold the young so that it should not fall on the ground, blow into its nostrils, and put the teat into its mouth so that it should suck. Hebrew Talmud 200BC-500AD

The baby just came out – all babies

- Warming - Dry and get rid of the wet stuff
- Positioning - Big head, little body syndrome
- Suctioning - Suck out the goobers
 - Mouth and nose - Which one first and why?
 - Trachea?
 - Amniotic fluid status - Just like insulin - clear vs. cloudy
 - You really need to have a meconium aspirator – www.neotechproducts.com
- Is the baby breathing? - Yes/No...
- How is the heart rate? - Good/Bad...
- How is the color? - Pink/Blue... and place a pulse ox on the right hand

The baby just came out - sicker babies

- Tactile stimulation - Get them to cry
- Respiratory interventions - Only two choices in NRP
 - Blow by O2 - Breathing and good heart rate
 - Positive pressure ventilation (PPV) - Not breathing or not breathing very well, therefore bag!
- Heart rate assessments
 - Above 100 - Good - *celebrate*
 - Below 100 - Bad - *do something*
- Colour assessments
 - Pink
 - Centrally pink, extremities blue
 - Acrocyanosis
 - Occurs in >90% of all babies
 - Centrally blue

Bag and mask ventilation

- You really should have a baby bag (preferably with a manometer) www.mercurymed.com
 - Equipment
 - Indications
 - Technique

Determining the heart rate

Auscultation

Palpation

Count for 6 seconds, then multiply by 10**Heart rate decisions (NRP vs. real-life)**

Assessed after spontaneous respirations and/or bagging

Less than 60

Greater than 60, but less than 100

Greater than 100

Below 100 or above 100?

Orogastric (OG) or nasogastric (NG) tubes

Two minutes of bagging

NG/OG placement

ETT placement?

Chest compressions

Indications

Technique

Compressions and ventilations (NRP vs real-life)

No fetus coming into the world before the seventh month of pregnancy can be saved

Hippocrates (460 BC)

Neonatal intubation essentials

Straight vs curved blade

Infants

Everyone else

Endotracheal tube size

16 + age/4

Tapes and/or charts

Gestational weeks

TOT's and BOB's

How small is too small?

Cuffed vs uncuffed tube

Stylet?

2X and 3X the size of the tube...

2X

3X

Where and how to tape the tube

Tube holders – www.neotechproducts.com –www.ambuusa.com – www.laerdal.com – www.portex.comPore tapes - **Transpore** (clear) and **Durapore** (shiny)

Good tapes - Wet-Pruf (Cloth) and Elastoplast

Methods of confirming endotracheal tube placement

Auscultation

Bilateral breath sounds?

Belly sounds?

Do you listen to the lungs or the abdomen first?

Chest x-ray

End-tidal CO₂ - Standard of care in pediatrics and adults

Pedi-Caps or capnography - www.mercurymedical.com

www.nellcor.com • www.medical.philips.com

Purple vs. gold?

Full arrest?

Neonates?

Unpremedicated intubations, which are considered inhumane by the Canadian Council on Animal Care, are more disturbing to the physiology of the high risk neonate and should only be considered under exceptional circumstances

Barrington and Byrne, 1998

Neonatal rapid sequence intubation review

Neonatal vs. Pediatric ICU airway management

Unpremedicated neonatal intubation

197% increase in mean anterior fontanel pressure for 28 seconds

Mean 16.5 cm H₂O increase in ICP

20% increase in systolic blood pressure

More and longer attempts to achieve successful intubation

Summary of medications

Atropine

Prevent bradycardia's associated with:

Intubation and vagal stimulation

Succinylcholine

Cords and face

Sedative and/or analgesic

Short duration paralytic vs. just sedation?

Longer acting paralytics vs. more sedatives/analgesics?

Why are you administering a paralytic...?

Are they really sedated enough?

When in doubt... Knock Them Out!

It is inconceivable that we should ever go back to a practice of allowing infants to cough, gag, choke, and struggle against a laryngoscope and endotracheal tube

Barrington and Byrne, 1998

Neonatal IV access

IV vs. ETT meds

Peripheral vs central access

Scott's law of peripheral IV therapy

Umbilical access sites

Two arteries and one vein

Umbilical vein

Vein is big and gaping open

Located at 12 o'clock position

Umbilical arteries

Arteries are small and spasming

Located at 4 and 8 o'clock positions

Umbilical vein catheter (UVC)

Crashing kid

As sterile as possible technique

20g angiocath (without needle) or 5f feeding tube in vein

Gently advance until able to aspirate blood

Secure with goal post dressing or neo-bridge –

www.neotechproducts.com

Not-crashing kid

Formal UVC access

Sterile technique

Desired final destination of catheter

Inferior vena cava

Above diaphragm

Not in liver

Intraosseous lines and babies? – www.waismed.com • www.vidacare.com

D10W maintenance fluids

Neonatal fluid resuscitation - Play baseball

0.9NS or LR - 10-20 cc/kg, prepare (2) 60 cc syringes

Blood products - 10 cc/kg - Which is thicker, blood or water?

Neonatal emergency medications – You only need to know 3 or 4

Epinephrine 1:10,000 - 0.1 cc/kg, prepare 1 cc in a TB syringe

Narcan (naloxone) 0.4 mg/cc vs. 1.0 mg/cc - 0.1 cc/kg, prepare 1 cc in a TB syringe

Bicarbonate 4.2% - 2 meq/kg, 4 cc/kg, prepare (2) 10 cc syringes

Adult *big people* bicarb, 50 cc syringe, 1 meq/cc

Pediatric *pediatric* bicarb, 10 cc syringe, 1 meq/cc

Infant *infant* bicarb, 10 cc syringe, 0.5 meq/cc

Dopamine/Dobutamine – standardized concentrations as per JCAHO

Neonatal resuscitation overview - Keep them pink, warm, and sweet!

Pink - Supplemental oxygen - as little or as much as needed, retinal damage with high percentages of oxygen not usually an immediate resuscitation concern, CO2 detectors

Warm - Cover their heads, warmed isolette, minimize handling once in isolette, wrapped warm packs under infant, Saran wrap, Zip-Lock bags

Sweet - Check heel stick glucose often, bolus with 2-4 cc/kg D10W as needed for blood sugar <40-50, sedation and analgesia as needed

Emergency Care of Crashing Kids

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- I. Review of Rapid Pediatric Assessment Components
 - A. Neurologic
 1. Level of consciousness - pediatric style
 2. Muscle tone / Activity level
 3. Fontanelles
 4. Parental assessment - only two kinds of parents
 - B. Respiratory - "Watch them breathe"
 1. Breath sounds
 - a. Wheezing
 - b. Rales
 - c. Rhonchi
 2. Respiratory rate - "Bad"
 3. Retractions - "Worse"
 4. Grunting - "Worst"
 - C. Cardiovascular - "Feel their feet!"
 1. Peripheral pulses
 2. Capillary refill
 3. Rhythm - Three "typical" types
 - a. Too...
 - b. Too...
 - c. Not...
 - D. GI/GU
 1. Is the abdomen distended?
 2. Are they peeing?
 - E. Skin
 1. Pink, warm, and dry is good
 2. Any variation of pink, warm, and dry is bad
 - F. Vital signs
 1. "Normal" heart rates
 2. "Normal" respiratory rates
 3. "Normal" blood pressures
 4. Pulse oximetry? (www.nellcor.com - www.masimo.com – www.medical.philips.com)

"*Resuscitate*" - to revive from an apparent state of unconsciousness - not to be confused with
 "*Resurrect*" - to raise from the dead (Webster's)

II. Pediatric Resuscitation Overview

A recent review of 300 urban children suffering cardiac arrest revealed that **54% were younger than 12-months old**

Children's Hospital of Philadelphia study found the **median/mean age of arresting children to be 5-months to 2-years**

- A. Suggestions for successful pediatric resuscitations
 - 1. Broselow "Rainbow" pediatric resuscitation tape, bags, and carts
 - a. Armstrong Medical Corporation
 - b. www.armstrongmedical.com
 - c. www.colorcodingkids.com
 - 2. "Color-coded" collars and the Peds Papoose
 - a. Ossur, formerly Jerome Medical
 - b. www.ossur.com
 - 3. "Valium for Everyone!"
- B. Pediatric oxygen delivery methods
 - 1. Blow-by oxygen and binkies
 - 2. Nasal cannulas vs. non-rebreather masks
Nebulizers – www.westmedinc.com – www.boundtree.com
 - 3. Intubation
- C. Obtaining and maintaining patent airways
 - 1. Positioning: "Big heads and little bodies"
 - 2. Intubation
 - a. Nasal intubation
 - b. Oral intubation
 - c. Intubation essentials
 - (1) Straight vs curved blade
 - (a) Infants
 - (b) Everyone else
 - (2) Endotracheal tube size
 - (3) Cuffed vs uncuffed tube
 - (4) Stylet?
 - (5) 2X, and 3X the size of the tube...
 - (a) 2X

- (b) 3X
 - (6) Where and how to tape the tube
 - (a) "Pore" tapes - **Transpore** (clear) and **Durapore** (shiny)
 - (b) "Good" tapes - Wet-Pruf (Cloth) and Elastoplast
 - (7) Methods of confirming endotracheal tube placement
 - (a) Auscultation
 - i) Bilateral breath sounds?
 - ii) Belly sounds?
 - iii) Do you listen to the lungs or the abdomen first?
 - (b) Chest x-ray
 - (c) Esophageal detection devices – www.wolfetory.com
 - (d) End-tidal CO2
 - i) Pedi-Cap vs. StatCO2 vs. waveforms
 - ii) www.nellcor.com – www.medical.philips.com – www.mercurymedical.com
 - iii) Gold vs. purple
 - iv) Full arrest?
 - v) Neonates?
- D. Rapid sequence intubation review: "Which drug, when, and why?"
1. **Atropine**
 - a. Prevent bradycardia's associated with
 - (1) Intubation and vagal stimulation
 - (2) Succinylcholine
 - b. Cords and face
 2. Lidocaine?
 3. Defasciculating neuromuscular blocker? (pick one)
 4. **Analgesia** (pick one) - I highly recommend Fentanyl
 5. **Sedation** (pick one) - I highly recommend Etomidate
 6. **Short acting paralytic** (now there really only is one)
 - a. Succinylcholine "Sux"
 - b. Mivacurium "Miv" discontinued by manufacturer 2006
 - c. Rapacuronium "Rap" recalled by manufacturer 2001
 7. **Longer acting paralytics** (pick one)

*"Why are you administering a paralytic...?
Are they really sedated enough?"*

- E. IV Placement and Fluid Resuscitation
1. Where to put an IV: "Scott's Law of Peds IV Therapy"
 - a. Peripheral access - Average success rate to place a peripheral IV in an arresting child is only **17%**
 - b. Intraosseus (IO) lines - Average success rate for placement of an IO line on first attempt is **80-100%**
 - (1) Commonly utilized until age 6
 - (2) Now acceptable for any age group
 - (3) www.waismed.com – www.vidacare.com
 2. What size to place
 3. What kind of fluids to hang
 - a. Maintenance
 - (1) "D5 point something"
 - (2) Don't bolus with "D5 point anything"
 - b. Isotonic fluid boluses
 - (1) "Count their fingers and toes"
 - (2) 20 cc/kg of 0.9NS or LR
 - (3) "Play baseball"
 - c. Blood product boluses
 - (1) "Which is thicker..."
 - (2) 10 cc/kg
- F. IV medications - "Same as for big people, but decimal points make a difference!"
- G. Endotracheal tube medications
1. NAVEL is now LEAN
 2. Amount to be given IV vs ETT?
 3. Do they work?
- H. Electrical Therapy : "*Count the paddles*"
1. Do kids really ever go "V-fib" or do they only go "flat line?"
 - a. 10-20% VF initially!
 - b. Brady-asystole for the rest, but...
 - c. If you can get them while still in VF...
 2. Defibrillation
 - a. 2J/kg first time
 - b. 4J/kg second and subsequent times (up to 10j/kg or adult max)
 3. Cardioversion
 - a. 0.5-1J/kg first time
 - b. 2J/kg second and subsequent times
 4. Adult vs pediatric paddles

5. AED's and kids?
 - a. "Joules the bear"
 - b. www.medical.philips.com – www.medtronic.com – www.zoll.com

III. Summary: "Keep 'em Pink, Warm, and Sweet"

- A. Temperature maintenance
- B. Hypoglycemia prevention
- C. Sedation and analgesia

IV. Transport to a pediatric ICU

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Highlights of 2010 American Heart Association **New** Advanced Cardiac Life Support (ACLS) Guidelines (That potentially impact crashing kids)

http://circ.ahajournals.org/content/vol122/18_suppl_3/

Adult BLS Changes

ADULT BLS: BLS algorithm has been simplified and there is no more “look, listen and feel.” These steps are inconsistent and time consuming. Want immediate EMS activation and compressions.

ADULT BLS: Encourage HANDS ONLY compressions (at least 100 per minute) for lay people.

ADULT BLS: ABC’s are no longer ABC’s. Now it’s CAB! COMPRESSIONS before airway and breathing; START with 30 compressions, rather than 2 ventilations.

ADULT BLS: Depth of compressions is made deeper to at least 2 inches.

ADULT BLS: Resuscitation tasks should be preformed simultaneously by healthcare providers.

ADULT BLS: Early recognition: assess responsiveness and absence of normal breathing. Guppy breathing does not count. Lay people are confused by this. If not normal breathing/unresponsive, start compressions.

ADULT BLS: Minimize interruptions of compressions: Healthcare professionals should take no more than 10-seconds to check a pulse. Even if the patient has a pulse, compressions rarely lead to significant injury. Lay people should NOT check for a pulse.

ACLS: EMS: CPR emphasis on adequate rate (at least 100 per minute) and depth of compressions. Adequate recoil, minimal interruptions and no excessive ventilations.

ACLS: Lay Rescuers: Simplify. Compressions only CPR vs. traditional CPR with ventilations shows approximately the same patient outcomes. However, pediatric patients do better with traditional CPR (with ventilations.)

ACLS: Post Cardiac Care: Therapeutic hypothermia improves outcomes for patients with VF and two other studies show benefits from all other collapse rhythms also. Cooling improves outcomes in neonates with hypoxic encephalopathy. Awaiting pediatric studies (Note: Pediatric studies have since been published showing promising results.)

ACLS: **Change from ABC to CAB (COMPRESSIONS, airway and breathing) for adult and pediatric patients (not for neonates)

ACLS: In ABC: Compressions are delayed while rescuer opens airway and gives mouth to mouth or find equipment to bag-mask ventilate. In CAB, compressions are initiated immediately and 30 compressions should be completed within 18-seconds.

ACLS: Only 50% of bystanders will begin CPR with ABC because of concerns with opening the airway and breathing for the patient. With CAB, the hope is more bystanders will begin compressions.

ACLS: Healthcare providers can tailor rescue actions if the etiology is known. For example, if a patient collapses and cardiac etiology is suspected, then get an AED and start compressions. If a respiratory or asphyxia etiology is suspected, such as with a drowning victim, then 5 cycles of traditional CPR would be performed before activating EMS. Neonates are always treated with ABC first, as arrests are most likely to be respiratory in etiology.

ACLS: Ethical issues: Termination of resuscitation or not starting resuscitation should be guided by a validated termination of resuscitation rules.

ACLS: Allow families to be present if a designated staff member can be with them.

ACLS: Withdrawing life support for patients with poor prognostic indicators may not be as reliable if therapeutic hypothermia protocols were used. “Occasionally” some of these patients with poor prognosis have good outcomes.

ACLS: Tissue and organ donation plans should be timely and supportive for patients with confirmed brain death.

ACLS Electrical Therapy Changes

ACLS: 1 shock for VF and minimize interruptions with compressions. If the first shock didn't fix VF, it's unlikely the 2nd or 3rd will be successful. Two minutes of CPR and then try defibrillation again.

ACLS: Biphasic waveforms appear to be more effective than monophasic. However there is no clinical data comparing one biphasic waveform to another. (Escalating vs. fixed dose of energy?) However, consider escalating doses if available and initial shock is unsuccessful.

ACLS: PACING:

- Not recommended for asystole
- Considered for brady-arrhythmias that do not respond to Atropine or other medications.

ACLS Airway Changes

ACLS: Continuous capnography is recommended to confirm ETT placement and to monitor for return of spontaneous circulation.

ACLS: Supraglottic advanced airways (King, LMA's) are supported.

ACLS: Cricoid pressure during airway management is no longer recommended.

ACLS Medication Changes

ACLS: Vascular access, drug delivery and advanced airway placement, while still recommended, should not cause significant interruptions in chest compressions or delay shocks.

Highlights of 2010 American Heart Association New Pediatric Advanced Life Support (PALS) Guidelines

http://circ.ahajournals.org/content/vol122/18_suppl_3/

PALS: The majority of pediatric cardiac arrests are asphyxial in origin, with only 5-15% attributed to ventricular fibrillation. Best outcomes are with a combination of compressions and ventilations.

PALS: If a suspected cardiac etiology, then the emphasis is on chest compressions and early defibrillations.

PALS: Compression only CPR is for bystanders (lay people.)

PALS: ** Despite the importance of ventilation in pediatric arrests, a switch to CAB (compressions, airway, breathing) sequence is recommended for ease of teaching (so it matches BLS and ACLS.) This should only delay ventilations by about 18-seconds for one-person rescuers.

PALS: Chest compressions: Push hard, push fast (at least 100 per minute), minimize interruptions, allow for chest recoil, avoid excessive ventilations.

PALS: COMPRESS: 1/3 of A-P diameter (1 ½ inches/4cm in infants and 2 inches/5cm in most children.)

PALS: De-emphasis on pulse check for pediatrics. It is often hard to assess and healthcare professionals should not check for more than 10 seconds.

PALS: Supraglottic advanced airways (King, LMA's) are supported.

PALS: More data supporting cuffed ETTs in children.

PALS: Cricoid pressure during emergency intubation has been questioned.

PALS: Continuous capnography is recommended to confirm ETT placement and to monitor for return of spontaneous circulation.

PALS: OPTIMAL DEFIBRILLATION ENERGY DOSE IS UNKNOWN IN PEDIATRICS:

VF or pulseless VT: 2-4 J/kg of monophasic or biphasic waveform is “reasonable.” Doses higher than 4 J/kg (especially if delivered by a biphasic defibrillator) may also be safe and effective. Now may defibrillate with up to 10 J/kg or maximum adult energy level.

PALS: “Adult” automatic external defibrillators (AEDs) may be used in infants and children. Ideally, a pediatric adapter should be used to administer a “kid friendly” energy dose. However, if all that is available is an adult AED, it may be used across the lifespan.

PALS: O₂: After return of spontaneous circulation, O₂ should be titrated to limit the risk of hyperoxemia (increasing support of potential harm from high O₂ exposure after cardiac arrest.)

Highlights of 2010 American Heart Association New Neonatal Resuscitation (NRP) Guidelines

http://circ.ahajournals.org/content/vol122/18_suppl_3/

NRP: The etiology of neonatal arrests is nearly always asphyxia, therefore ABC's are still recommended unless there is a known cardiac etiology.

NRP: Once positive-pressure ventilation or supplemental oxygen administration is begun, assessment should consist of simultaneous evaluation of heart rate, respiratory rate, and pulse oximetry.

NRP: Best indicators to cardio-respiratory transition "life outside of mom" and need for resuscitation are increasing HR, effective respirations and good muscle tone.

NRP: If pulse oximetry is used, apply to right upper extremity (pre-ductal sats.) Healthy babies at term start with a SPO₂ (pulse ox) of less than 60%, and many will take over 10-minutes to reach a saturation of over 90%.

NRP: Hyperoxemia can be toxic, particularly to pre-term infants.

NRP: Babies born at term: Best to begin resuscitation with room air rather than 100% O₂. Any O₂ used should be blended with air and titrated as needed.

NRP: No data to support oral (bulb syringe) or tracheal suctioning of active babies, even if meconium is present.

NRP: Available data does not support or refute tracheal suctioning of non-vigorous babies with meconium.

NRP: Chest compressions:

- Compression to ventilation ratio is still 3:1.
- If cardiac etiology is known, should consider 15:2 compression ratio.

NRP: Epinephrine: 0.1-0.3 mg/kg should be administered IV ASAP (does mention ETT dosing, but not intraosseous (IO) dosing.)

NRP: Laryngeal mask airways (LMAs) are discussed.

NRP: Post resuscitation care

Therapeutic hypothermia is recommended for babies born near term with evolving moderate to severe hypoxic ischemic encephalopathy. Need defined protocols.

NRP: Ethics

Duration of resuscitation for newborns with prolonged cardiac arrest: If there is no detectable HR for 10-minutes, it is appropriate to stop resuscitation.

If early gestation, low birth weight and congenital anomalies are associated with almost certain death or high morbidity if there is survival, then resuscitation is NOT indicated.

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