

2006 PEDIATRIC ADVANCED LIFE SUPPORT

A. RESPIRATORY FAILURE and SHOCK

1. Airway – patent or not, C-spine
2. Breathing – color, effort, rate, entry
3. Circulation – LOC, pulses, temp, BP, UO

B. Anatomical Airway Differences

1. Size and location
 - a. much smaller than an adult
 - b. child's tongue is much larger in relation to the oropharynx
 - c. in infants and toddlers it is much more cephalad
 - d. epiglottis is narrow, short and angled away from the long axis of trachea
 - e. vocal cords attach lower and anterior
 - f. under age 10, narrowest portion is below the vocal cords at the cricoid membrane
 - g. larynx is funnel shaped
2. Consequences of the differences
 - a. small amounts of edema or obstruction can impede airway, increase resistance and breathing workload
 - b. tongue can cause significant obstruction in the unconscious child
 - c. high position of the larynx causes acute angle to tube placement. straight blade creates a better visual plane.
 - d. epiglottic control with laryngoscope blade is more difficult
 - e. selection of ETT based on cricoid ring not glottic opening. slight air leak should be present with 20 - 30 cm H₂O inspiratory pressures, if tube is right size.
 - f. easily obstructed with mucus, blood, and pus or pressure differences between upper and lower airway passages.
 - g. upper airway obstruction may lead to tracheal collapse during inspiration
 - h. lower airway obstruction -- deep foreign body or asthma

C. Facts about Airway Management

1. ****LMA – Laryngeal Mask Airway is recommended as a ALS airway**
2. ****PRIMARY** confirmation of ETT accomplished by end tidal CO₂ detector, capnometry or esophageal bulb indicator
3. Needle thoracotomy can be done at 2nd intercostal space (ICS) at midclavicular line (MCL) or 4th ICS midaxillary line (MAL). Consider MAL for very small children
4. Cricothyrotomy is not recommended in children under age 8. If one is to be done - needle crico would be preferred as opposed to surgical
5. OPA (oropharyngeal) are for unconscious patients and NPA (nasopharyngeal) for semiconscious (to avoid gag reflex)
6. BVM is working if chest rises and falls, color improves and heart rate increases
7. INTUBATION is required if remains apnea, difficult to control airway, HR does not improve with BVM technique
8. ****Recommend commercial securing device to hold ETT in place**
9. **Use OG/NG (orogastric/nasogastric) tubes if continuous BVM has been occurring**
10. Oxygen powered breathing devices are not recommended for children

D. Facts about Vascular Access

1. Attempt peripheral lines first, then if unsuccessful proceed to INTRAOSSEOUS
2. ****There is no age limit for the use of an Intraosseous (IO) needle**
3. Avoid scalp veins if at all possible, but use if it is the only site available
4. If the patient has an existing patent IV site, USE IT
5. **Decompensated shock** is defined as **HYPOTENSION** with all the other shock sx/sx

IV FLUID CHALLENGE = 20 mL/kg every 10-20 mins until normovolemic

- a. 1st challenge – 20 mL/kg of NS or LR
- b. 2nd challenge – 20 mL/kg of NS or LR – check a glucose after this challenge
- c. 3rd challenge – 20 mL/kg of NS or LR **OR** Packed RBC's 10 mL/kg MR (may repeat) q 20-30 mins **OR** Whole blood 20 mL/kg – MR q 20-30 mins

IV FLUID MAINTENANCE = **<10kg** = 4 mL/kg/hr x kg = mL/hr

****D5-1/2NS**

10-20kg = 40mL/hr + 2 mL/kg/hr (for ea kg between 10-20)

>20kg = 60 mL/hr + 1mL/kg/hr (for ea kg above 20)

i.e. 40 + 2 x 5kg = 50 mL/hr **OR** 60 + 1 x 5kg = 65 mL/hr

6. **Fluid challenge** choices are NS or LR, **NOT D5 anything**

E. Quick Medication Information

1. LEAN – lido, epi, atropine, naloxone = drugs down the ETT
2. Epinephrine easy dose = 0.1 mL/kg no matter what delivery system or concentration
3. Sodium Bicarb used for:
 - a. Tricyclic Antidepressant Overdose (TCA OD)
 - b. Pre-existing metabolic acidosis, i.e. diabetes, ASA toxicity
 - c. Hyperkalemia
4. Naloxone – cautious use in newborns of addicted mothers – may precipitate Sz and exacerbate withdrawal symptoms. Better to allow the NICU to manage
5. Dextrose 50% = 25 gms of sugar. Dilute 1:1 to get D25 or 12.5 gm sugar: then give 2-4 mL/kg or D10 (dilute 1:4) at 5-10 mL/kg = delivers 0.5-1 gm/kg of glucose

F. Trauma

1. ****Leading cause of death in children**
2. **C-spine must be considered part of airway management and maintained**
3. Hypotension will not occur until end stage shock – **MANAGE SHOCK EARLY**
4. Leave in C-spine until evaluated by neurologist or orthopedist

G. Newly Born Resuscitation

1. **Dry, Warm, Position, Suction, tactile Stimulate, Ventilate**
2. Ventilate at 40-60 breaths w/o compressions ---- Compression ratio 3:1
3. If HR will not rise above 60 with good ventilation, then do compressions.
4. Umbilical vein can be a peripheral source for IV fluids during resuscitation
5. IV fluids run at 10-20 mL/kg
6. **AIRWAY and COMPRESSIONS FIRST ----- MEDICATIONS LAST**

I. Post-resuscitation care and transport

1. **Frequent cardiopulmonary assessment = REASSESS, REASSESS, REASSESS**
2. Continue O2, IV, Medications
3. Maintain temperature and glucose levels – treat glucose if less than 40-60 range
4. **ARRANGE TRANSPORT EARLY, EARLY, EARLY**
5. Do not delay transport for paperwork – **FAX**

PEDIATRIC ASSESSMENT TECHNIQUES

ANATOMICAL DIFFERENCES:

1. Metabolic rate is about 2x higher
2. Requires more O₂ due to higher energy consumption
3. 25% more blood volume by weight than adults
4. Do not increase stroke volume for compensation, but increase heart rate
5. Head is greater BSA than in adults
6. Anterior fontanel may remain open for up to 24 months
7. Tongue is large in comparison to mouth
8. Trachea is shorter, more anterior and more narrow than adults
9. Cricoid ring is narrowest portion of airway
10. Thoracic cavity is more compliant and softer
11. Due to abdominal cavity size, decreased protection available
12. Use abdominal muscles to aid in breathing, so swallow more air

APPROACHING THE PEDIATRIC PATIENT:

1. If not detrimental, have the child in the presence of the parent
2. Use distraction or games for the younger children
3. Keep voice well modulated
4. **EXPLAIN EVERYTHING YOU DO**
5. **DO NOT LIE ABOUT PAIN OR PROCEDURES**
6. Allow them to check equipment and set some guidelines
7. Highly suggestive, so use those techniques
8. Make sure equipment and hands are warm when touching patient
9. Know when to be firm & take charge versus allowing the child some input
10. Save facial exam till last
11. Ask children about "hurts" not pain – could use poker chips
12. Be careful of "inappropriate touching".

PEDIATRIC VITAL SIGNS

AGE	HEART RATE	AVE RATE	RESP RATE	BP
Premature	100-180	145	40	42/21
New 1-2 kg	100-180	135		50/28
New 2-3 kg	100-180	125		60/37
1 month	100-180	120	24-35	80/46
6 months	100-180	130		89/60
1 year	100-180	130	20-30	96/66
2-3 years	100-180	120		99/64
4-5 years	60-150	100		99/65
6-8 years	60-130	100	12-25	102/72
10-12 years	50-110	75	12-18	113/77

FORMULAS:

1. KG WT= $8 + (\text{age in years} \times 2)$ i.e. $8 + (2 \text{ yr} \times 2) = 8 + 4 = 12 \text{ kg}$
2. ET size = $\frac{16 + \text{age in years}}{4}$ i.e. $16 + 4 \text{ years} = 20/4 = 5.0 \text{ ET}$ or $4 + \frac{\text{age}}{4}$

RULE OF THUMB: ET size for newborn = 3.5 and a 1 year old = 4.0

3. Respiratory Rate - upper limit is 40 - child's age. i.e. $= 40 - 3 \text{ y.o.} = \text{RR } 37$
4. BP = $2 \times \text{years} + 70 = \text{systolic}$, diastolic is $2/3$ of systolic (ages 1-10 years)
i.e. $2 \times 3 \text{ yr} + 70 = 76 \text{ systolic}$, diastolic $76/3 \times 2 = 51$ ----- 76/51
USING 70 TO ADD WITH GIVES YOUR **LOWEST** LIMIT FOR BP

$80 + (\text{age in years} \times 2)$ is expected average systolic BP for ages 1-10 years

$90 + 2 \times \text{years} = \text{Typical systolic pressure (50}^{\text{th}} \text{ percentile)}$ for ages 1-10 years
THIS IS LOWEST LIMIT OF BP FOR CHILDREN > 10 YEARS OF AGE

PEDIATRIC GLASGOW COMA SCALE

EYES OPENING	Spontaneous	4
	To speech	3
	To pain	2
	No response	1
BEST MOTOR RESPONSE	Spontaneous	6
	Localizes pain	5
	Withdraws to pain	4
	Abnormal flexion	3
	Abnormal extension	2
	No response	1
BEST VERBAL RESPONSE	Oriented	5
If above age of 2	Confused	4
	Inappropriate	3
	Incomprehensible	2
	No response	1
OR use this if under age of 2	Social smile, orients to sound, follows objects	5
	Cries, consolable	4
	Inappropriate, persistent cry	3
	Agitated/restless	2
	No response	1
TOTAL		3-15

(Adapted from scale developed by David Beyda, MD)

PEDIATRIC PSYCHOSOCIAL ASPECTS

Age: 4-12 WEEKS

- Tracts objects
- Body needs are urgent
- Birth weight starts to double
- Sucking predominant – uses a pacifier
- Responds to mouth, skin and sense modalities
- Is completely dependent
- Develops trust in adults

Age: 6 – 18 months

- Eye hand coordination
- Raises arms to parent when they hold out their arms
- Sitting, standing and walking begins
- Responds appropriately to angry/friendly voices
- Strong selective tie to primary caregiver
- Stranger anxiety
- By 12 months – has 10-15 words,
- By 18 months – has 50-75 words
- By 18 months understand simple concepts – like stick out your tongue
 - 25% of speech is intelligible

Age: 18 – 36 months

- Motor development, always on the move
- Can answer simple questions
- Avoid “no” answers
- Tell them something will hurt
- By 24 months – 1200 – 1500 words = 60% intelligible
 - Follows simple directions
 - Understands “soon”, “bye-bye”, “all gone”, “uh oh”
 - 60% intelligible – play games to distract
- By 30 months - asks questions
- By 36 months – 85% intelligible

Age: Toddler and Preschool – under 5

- Actions somewhat modified by thought
- Dependence on parents and separation fears
- Desire to please – use it
- Questions birth and death – fear of monsters, strangers and mutilation
- Cannot reason with them

Age: 5 to 12 years

Pride and self confidence – less dependence on parents
Better impulse control
Be honest, protect their privacy and tell them what is wrong
Ambivalent about dependency, separation and new experiences
Aware of the world – life, death, birth, science
Regard for collective obedience to social laws, rules and fair play
Advancing to concrete operational level of thinking – responds to teaching
Speech becomes reasoning and expressive tool
Thinking is still egocentric

Age: 12 to 15 years – early adolescence

Body changes
Pay attention to nonverbal communication clues
Inconsistent, unpredictable, and paradoxical behavior
Eagerness for peer approval – do not humiliate them
Strong moral and ethical perceptions – very black and white
Anxiety over loss of parental nurturing

BLS FOR HEALTHCARE PROVIDERS:

1 and 2 RESCUER CHILD SEQUENCE:

Step	Action
1	Assess scene safety
2	Assess the victim for response. If no response, shout for help
3	If you are alone AND WITNESS ARREST - activate EMS and get AED if available
4	Open the victim's airway (Head-tilt/chin-lift) and check breathing (take 5-10 seconds)
5	If no adequate breathing, give 2 breaths – deliver each breath over 1 second
6	Check the victim's pulse (take 5-10 seconds) – IF UNSURE ABOUT PRESENCE OF PULSE - START CPR
7	If no pulse, perform 5 cycles of 30:2 compressions/ventilation (rate of 100/min)
1	PUSH HARD AND FAST, RELEASE COMPLETELY
PERSON	<u>MINIMIZE THE NUMBER AND LENGTH OF INTERRUPTIONS OF COMPRESSIONS</u>
8	If no pulse, perform 5 cycles of 15:2 compressions/ventilation (rate of 100/min)
2	PUSH HARD AND FAST, RELEASE COMPLETELY
PERSON	<u>MINIMIZE THE NUMBER AND LENGTH OF INTERRUPTIONS OF COMPRESSIONS</u>
9	AED or Defibrillator arrives – check for shockable rhythm
10	If NOT SHOCKABLE CONTINUE CPR FOR 5 CYCLES (2 mins) AND CHECK RHYTHM
11	If shockable – GIVE 1 SHOCK – then RESUME CPR IMMEDIATELY

CHILD CONSCIOUS CHOKING:

<u>MILD</u> DO NOT INTERFERE If persists – CALL 911	Good air exchange, responsive and can cough forcefully, may wheeze
<u>SEVERE</u> <u>ACTIVATE EMS</u> <u>INTERVENE</u>	Poor or no air exchange, weak ineffective cough, no cough at all, high pitched inhaling noises, NO noise at all, cyanosis, increased respiratory distress, unable to speak or move air, universal choking sign
1	Stand or kneel behind or beside (if lying down) victim and wrap arms around waist – <u>IF OBESE OR PREGNANT – USE CHEST THRUSTS INSTEAD OF ABDOMINAL THRUSTS</u>
2	Make fist with 1 hand and place thumb side against abdomen
3	Grasp fist with other hand and pull upward quickly
4	Repeat until object is expelled or victim becomes unresponsive
5	Give each thrust a distinct, individual movement to relieve the obstruction

CHILD UNCONSCIOUS CHOKING:

<u>Became unresponsive</u>	Look for and remove object, <u>ACTIVATE EMS</u> , BEGIN CPR
<u>Found unresponsive</u>	<u>ACTIVATE EMS</u> , open airway, remove visible object, BEGIN CPR

LOOK FOR OBJECT EACH TIME GOING TO OPEN AIRWAY TO GIVE 2 BREATHS

BLS FOR HEALTHCARE PROVIDERS:

1 and 2 RESCUER INFANT SEQUENCE:

Step	Action
1	Assess scene safety
2	Assess the victim for response. If no response, shout for help
3	If you are alone AND WITNESS ARREST - activate EMS
4	Open the victim's airway (Head-tilt/chin-lift) and check breathing (5-10 seconds)
5	If no adequate breathing, give 2 breaths – deliver each breath over 1 second
6	Check the victim's pulse (take 5-10 seconds) – IF UNSURE ABOUT PRESENCE OF PULSE - START CPR
7	If no pulse, perform 5 cycles of 30:2 compressions/ventilation (rate of 100/min) – <u>2 FINGERS STERNUM</u>
1 PERSON	PUSH HARD AND FAST, RELEASE COMPLETELY <u>MINIMIZE THE NUMBER AND LENGTH OF INTERRUPTIONS OF COMPRESSIONS</u>
8	If no pulse, perform 5 cycles of 15:2 compressions/ventilation (rate of 100/min) <u>2 THUMBS ENCIRCLING CHEST</u>
2 PERSON	PUSH HARD AND FAST, RELEASE COMPLETELY <u>MINIMIZE THE NUMBER AND LENGTH OF INTERRUPTIONS OF COMPRESSIONS</u>
9	AED or Defibrillator arrives – check for shockable rhythm
10	If NOT SHOCKABLE CONTINUE CPR FOR 5 CYCLES (2 mins) AND CHECK RHYTHM
11	If shockable – GIVE 1 SHOCK – then RESUME CPR IMMEDIATELY

INFANT CONSCIOUS CHOKING:

<u>MILD</u> DO NOT INTERFERE If persists – CALL 911	Good air exchange, responsive and can cough forcefully, may wheeze
<u>SEVERE</u> <u>ACTIVATE EMS</u> <u>INTERVENE</u>	Poor or no air exchange, weak ineffective cough, no cough at all, high pitched inhaling noises, NO noise at all, cyanosis, increased respiratory distress, unable to speak or move air, universal choking sign
1	Kneel or sit with infant in your lap
2	Hold infant, face down supporting head and neck, resting on thigh or lap
3	Deliver up to 5 back slaps between shoulder blades
4	Turn infant over and deliver 5 quick downward chest thrusts with 2 fingers – just below nipple line
5	Repeat sequence until object removed or infant becomes unresponsive

INFANT UNCONSCIOUS CHOKING:

1	Place infant on flat surface, look in airway, remove object if seen, BEGIN CPR
2	After 5 cycles of CPR (2 mins) (*checking in airway for object before breaths*), ACTIVATE EMS

LOOK FOR OBJECT EACH TIME GOING TO OPEN AIRWAY TO GIVE 2 BREATHS