

Project: Ghana Emergency Medicine Collaborative

Document Title: Pediatric Resuscitation: A Practical Overview

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Objectives

- Background/Significance
- Pearls and common mistakes
- Resuscitation board review questions and cases
- Stay within my allotted time

I. BACKGROUND

Leading Causes of Death from Unintentional injuries

Rank	< 1 yr	1-4 yrs	5-9 yrs	10-14 yrs	15-19 yrs
1	Suffocation (66%)	Drowning (27%)	MVT* (37%)	MVT (50%)	MVT (75%)
2	MVT (13%)	MVT (22%)	Pedestrian (14%)	Pedestrian (12%)	Poisoning (7%)
3	Drowning (7%)	Pedestrian (15%)	Fire/burns (13%)	Drowning (10%)	Pedestrian (5%)
4	Fire/burns (4%)	Suffocation (8%)	Drowning (13%)	Fire/burns (6%)	Drowning (5%)

*MVT= motor vehicle trauma

Background:

- Limited data regarding pediatric cardiopulmonary resuscitations
- What's known:
 - WHO?: Young age: median (5 months) and mean of (1.98 yr) (CHOP series)
 - Pediatric codes (majority) respiratory in origin
 - Primary respiratory arrest 80%
 - Data **combined** with resuscitation from **trauma**

Epidemiology

**Epidemiology and Outcomes From
Out-of-Hospital
Cardiac Arrest (OHCA)
in Children**

(Circulation 2009; 119;1484-1491)

Resuscitation Outcomes Consortium



Epidemiology of POHCA (Pediatric OHCA)

- Prospectively collected data:
 - US and Canadian communities
 - 11 regional sites, 148 EMS agencies and 135 hospitals
 - >260 EMS agencies (urban, rural, private)

Study a more accurate estimate of incidence of medical cardiopulmonary arrest in children

Epidemiology of POHCA...

- Trauma patients excluded, but drowning and suffocation included
- Serially enrolled OHCA victims
- Patients < 20 years queried
- 624 subjects < 20 years; 24,405 ≥ 20 years

POHC A– Patient Characteristics

Characteristic	Infants (n=277)	Children (n=154)	Adolescents (n=193)	All Pediatric (n=624)
Age , median (years)	0.2	4.2	17	1.5
Male (%)	59%	92%	69%	62%
Incidence / 100,000 person years (95% CI)	72.71 (62.0 – 83.3)	3.73 (3.0 – 4.4)	6.37 (5.3 – 7.4)	8.04 (7.2 - 8.8)
EMS treated (%)	84%	88%	70%	81%

Pediatric Patient Characteristics- Highlights

- Almost half were infants
- Males predominant (62%)
- 19% received no EMS treatment (defined as anything beyond obtaining vitals)
- Overall incidence of nontraumatic POCHA:
 - Pediatric: **8.04/100,000** person-years
 - Adult: 126 per 100,000 person-years

Event Characteristics-Highlights

- Most occurred in non-public venues
- Bystander CPR in about 1/3rd of the events
- Bystander AED attempts were rare
- EMS entered “no obvious cause” of arrest 2/3rd of the time

Survival to hospital discharge?

- Adults?
 - 4.5%
- Pediatric?
 - Infant:
 - 3.3%
 - Children:
 - 9.1%
 - Adolescents:
 - 8.9%
 - Overall:
 - 6.4%

Survival Outcomes-Highlights

- Survival to hospital discharge for non-traumatic POHCA
 - Pediatric: 6.4%
 - Adult: 4.5%
- Children and adolescents were significantly higher in survival than infants and adults
- Survival for those receiving EMS treatment was a bit higher

Survival Outcomes-Highlights

- Study a more accurate estimate of incidence of medical cardiopulmonary arrest in children
- Previous studies of POHCA included traumatic arrests
 - Survival from **9.1 to 19.7 person-years** per 100,000
 - Traumatic cardiac arrests ~30% of all peds arrests
- Overall rates heavily influenced by poor infant survival

II. PEDIATRIC VITAL SIGNS

Pediatric Vital Signs

Age	Weight (kg)	Respiratory Rate	Heart Rate (bpm)	Systolic BP
Neonate	3-4	30-60	90-160	60 \pm 10
1-6 month	4-6	24-30	110-180	80 \pm 10
1-2 yr	10-13	20-24	90-150	96 \pm 30
2-4 yr	13-17	20-24	75-135	99 \pm 25
4-6 yr	17-20	20-24	60-130	100 \pm 20
6-8 yr	20-25	12-20	60-120	105 \pm 13
8-10 yr	25-30	12-20	60-120	110 \pm 15
10-12 yr	30-40	12-20	60-120	112 \pm 15

Pearl #1: Pediatric Vital Signs

- Get cheat sheet and compare
- Don't forget pain scores (5th vital sign)
- View vital signs in clinical context
- Common Mistake: Don't get lazy
 - Reevaluate if unclear
 - Repeat
 - Abnormalities attributed to “age” or “fever”
 - Becomes “obvious” later at M&M

Develop Quick Approximation:

Age (years)	Weight (kg)
1	10 kg
3	15 kg
5	20 kg
7	25 kg
9	30 kg

Vital Signs

– Broselow tape

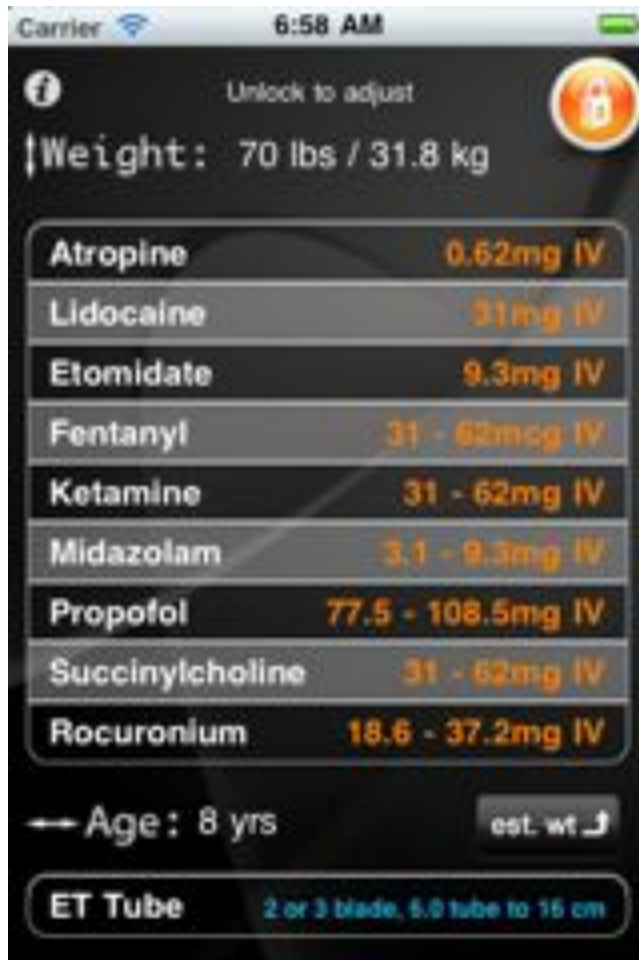
- Helpful even if patient appears “metabolically challenged”
- Why?

RED			PURPLE			YELLOW		
INDUCTION			RESUSCITATION			RESUSCITATION		
RAPID SEQUENCE INTUBATION			RAPID SEQUENCE INTUBATION			RAPID SEQUENCE INTUBATION		
PREMEDICATIONS			PREMEDICATIONS			PREMEDICATIONS		
0.300 mg/0.35 ml	Atropine	0.17 mg	Epinephrine 1st Dose (1:10,000)	0.1 mg/1 ml	Atropine	0.21 mg	Epinephrine 1st Dose (1:10,000)	0.13 mg/1.3
	Pan/Vecuronium	N/A	Epinephrine High Dose/TT (1:1,000)	1 mg/1 ml	Atropine	0.21 mg	Epinephrine High Dose/TT (1:1,000)	1.3 mg/1.3
0.81 mg/0.81 ml	(Defasciculating Agent)	N/A < 20 kg	Atropine	0.21 mg	Pan/Vecuronium	N/A	Atropine	0.26 mg
0.17 mg	Lidocaine	13 mg	Sodium Bicarbonate	10 mEq	(Defasciculating Agent)	N/A < 20 kg	Sodium Bicarbonate	13 mEq
0.5 mg	Fentanyl	25 mcg	Lidocaine	10 mg	Lidocaine	15 mg	Lidocaine	13 mg
0.5 mg			Defibrillation		Fentanyl	32 mcg	Defibrillation	
	INDUCTION AGENTS		First dose	20 Joules	INDUCTION AGENTS		First dose	25 Joules
	Etomidate	2.5 mg	Second dose (may repeat)	40 Joules	Etomidate	3.2 mg	Second dose (may repeat)	32 Joules
17 Joules	Ketamine	17 mg	Cardioversion	10 Joules	Ketamine	21 mg	Cardioversion	13 Joules
	Midazolam	2.5 mg	Adenosine		Midazolam	3.2 mg	Adenosine	
34 Joules	Propofol	25 mg	1st Dose	1 mg	Propofol	32 mg	1st Dose	1.3 mg
9 Joules			2nd Dose if Needed	2.1 mg			2nd Dose if Needed	2.6 mg
	PARALYTIC AGENTS		Amiodarone	52 mg	Seccinycholine (give atropine prior)	20 mg	Amiodarone	85 mg
0.85 mg	Pancuronium	1.7 mg	Calcium Chloride	210 mg	Pancuronium	2.1 mg	Calcium Chloride	260 mg
0.7 mg	Vecuronium	1.7 mg	Magnesium Sulfate	525 mg	Vecuronium	2.1 mg	Magnesium Sulfate	850 mg
42 mg	Rocuronium	8 mg			Rocuronium	19 mg		
170 mg								
	MAINTENANCE							
425 mg	Pancuronium/Vecuronium	0.9 mg			Pancuronium/Vecuronium	1 mg		
	Lorazepam	0.6 mg			Lorazepam	0.5 mg		
KG	9 KG		10 KG		11 KG		12 KG	

Pearl #2 Useful Apps: Pedi STAT



Useful App: Peds Airway



III. AIRWAY/BREATHING

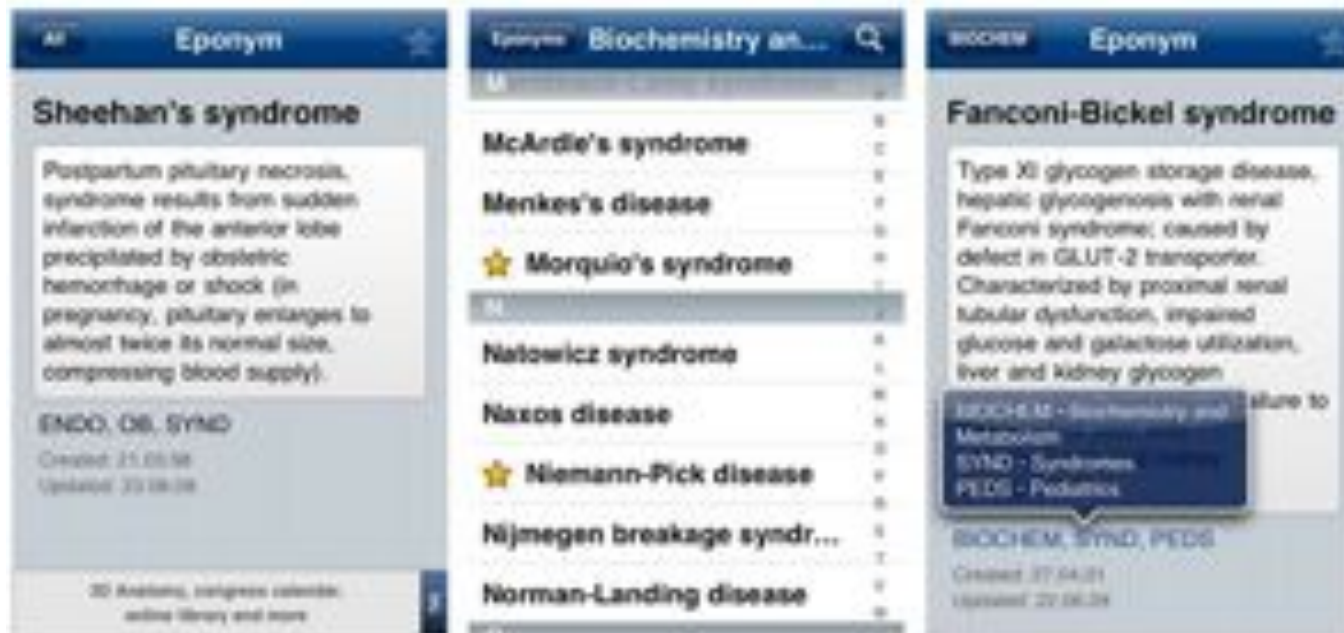
Tip #1: Think Ahead

- What problems do I anticipate?
- What tools can I use?
- What would I do with an airway issue?

At risk?

- Welcome to U of M: Tertiary Center
- Helpful to know some high-risk airway syndromes
- May need back up/secure airway electively

Pearl #3 Useful App: Eponyms



Beckwith Wiedemann



- Large Tongue

Klippel Feil



- Cervical anomalies (fusion)
- Short neck
- Cleft palate

Treacher Collins

Image removed of child with Treacher Collins Syndrome.

See similar image at

[http://www.flickr.com/
photos/friendlydoc/
5623707179/](http://www.flickr.com/photos/friendlydoc/5623707179/)

- Mandibulofacial dysostosis
- Hypoplastic facial bones
- Abnormal dentition
- +/- Cleft palate

Pierre Robin

Image removed of child with
Pierre Robin Syndrome. See
similar image at

[http://www.flickr.com/
photos/
35659142@N04/329982185
8/](http://www.flickr.com/photos/35659142@N04/3299821858/)

- Micrognathia
- Relative large tongue
- Larynx can almost be invisible with conventional equipment

Hurler's Syndrome

Image removed of child with Hurler's Syndrome. See similar image at

http://drugline.org/img/term/syndrome-hurler-14489_3.jpg

- Mucopolysaccharidoses
- Large tongue
- Tonsillar hypertrophy
- Short neck
- Narrowed nasal passages
- Cervical spine, TMJ abnormalities

Goldenhar

Image removed of child
with Goldenhar
Syndrome. See similar
image at

[http://www.flickr.com/
photos/ellagumma/
2400220179/](http://www.flickr.com/photos/ellagumma/2400220179/)

- Oculo-Auriculo-Vertebral
- Cervical spine
- Mouth/soft palate

Assessing Risk: Anatomy

- Limited mouth opening
- Cervical spine immobility
- Small mouth
- Prominent incisors
- Short mandible
- Short neck
- Large tongue
- Obese patients
- Laryngeal edema
- Facial trauma

Anatomy: Larynx

- High position
 - Infant: C1
 - 6 months: C3
 - Adult: C5-6
- Anterior position

Children are different

Adult



Child



Pearl #4: Optimize position

Yours and patient

Intubation

Sedations

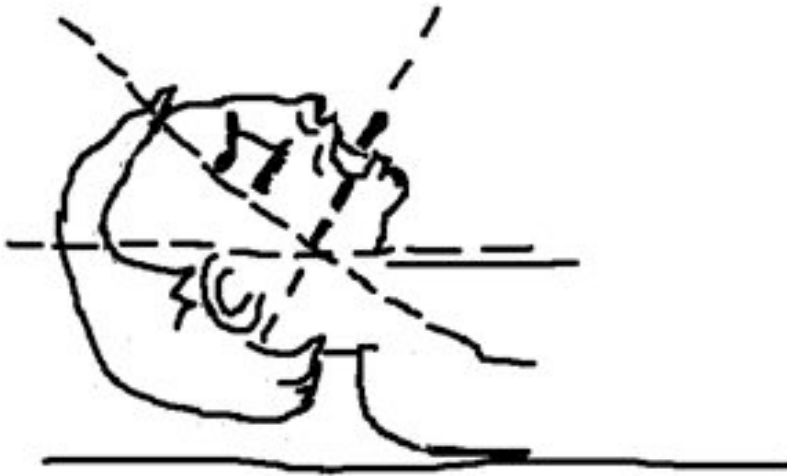
Procedures

Anatomy



Positioning

Age under 3 years



Large occiput causes
hyperflexion of the
neck on the chest

Axes pass through
divergent planes

Positioning

Folded towel under shoulders



Reduce hyperflexion
Align pharyngeal and
laryngeal axes

Positioning

Sniffing position

Slight extension of A-O joint

Alignment of
three axes



Kids Uniquely at Risk for Respiratory Failure

- Prematurity
- Young age
- BPD
- Congenital anomalies
- FTT
- GI disorders
(potential for aspiration)
- Muscular Dystrophy
- Neurologically devastated kids
- Cystic fibrosis
- Cardiac
- Young age
(infants have less reserve)

Preparation

- **U** Universal Precautions
- **M** Monitors
- **S** Suction
- **O** Oxygen
- **A** Airway
- **P** Pharmacy/Positioning

Oxygen

- Pre-oxygenation
- 70-90 seconds
- Wash out nitrogen
- Spontaneous or synchronous preferred over controlled mask ventilation



Bag Mask Ventilation



Single most valuable asset available to the clinician is proficiency at bag-mask ventilation



Time to Desaturation

Infants

- FRC: 25 ml/kg
- O₂ consumption: 5-8 ml/kg/min

...time to desaturation to 90% for a 2-5 year old is one quarter of the time to desaturation in 11-18 year old.....

Adults

- FRC: 42 ml/kg
- O₂ consumption: 2-3 ml/kg/min

Can J Anesth 41:771 1994



Intubation Technique



Better in younger children with a floppy epiglottis

Straight Laryngoscope Blade

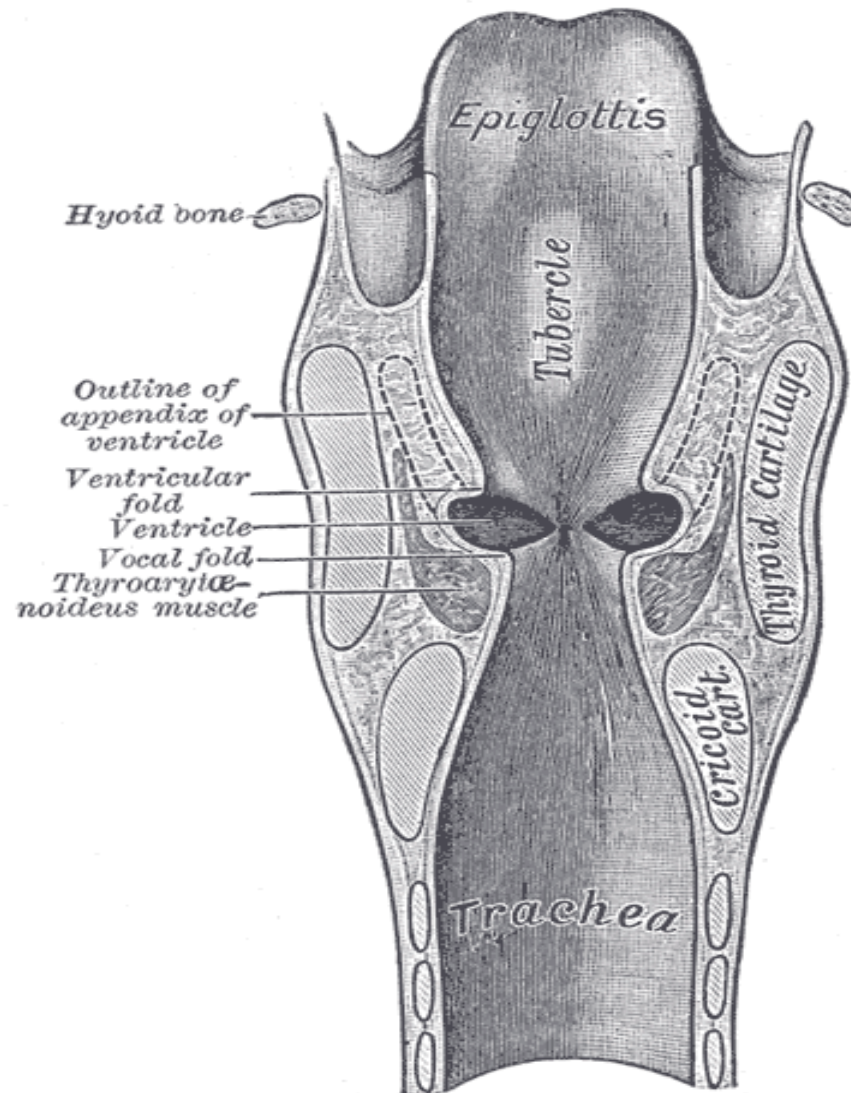
- Used to pick up the epiglottis

Intubation Technique



Better in older children who have a stiff epiglottis

Curved Laryngoscope Blade
- Placed in the vallecula



Kids Uniquely at Risk for Respiratory Failure

- Prematurity
- Young age
- BPD
- Congenital anomalies
- FTT
- GI disorders
(potential for aspiration)
- Muscular Dystrophy
- Neurologically devastated kids
- Cystic fibrosis
- Cardiac
- Young age
(infants have less reserve)

Cuffed Endotracheal Tubes

Advantages

- Decreased risk of aspiration
- Increased reliability of ETCO₂
- Decreased repeat laryngoscopy for tube fit
- Other anesthesia benefits that do not lend themselves to intubations in the ED

Disadvantages

- Increased risk of mucosal injury

Airway:

- Practice, practice, practice:
 - Clinical
 - Simulation
- Konrad et al. 1998
 - First year anesthesia residents
 - Mean 57 attempts (learning curve) to reach 90% success rate

Success: Pediatric ED

- Study using from database 11 university-affiliated ED's (prospective)
- Success at intubation 1st attempt
 - PEM fellows and EM residents 77%
 - Pediatric residents 59%
- Overall success
 - PEM fellows and EM residents 89%
 - Pediatric residents 69%

ETT size and depth

$$\text{ETT: } (16 + \text{age})/4$$

$$\text{Depth: ETT} \times 3$$

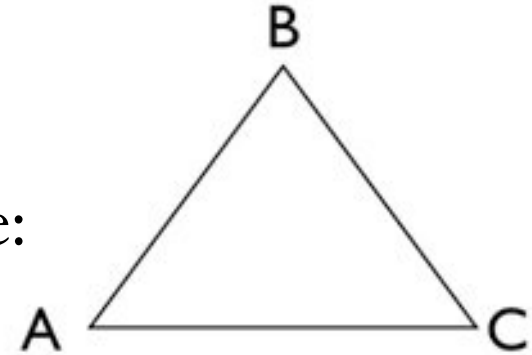
Pediatric Assessment Triangle



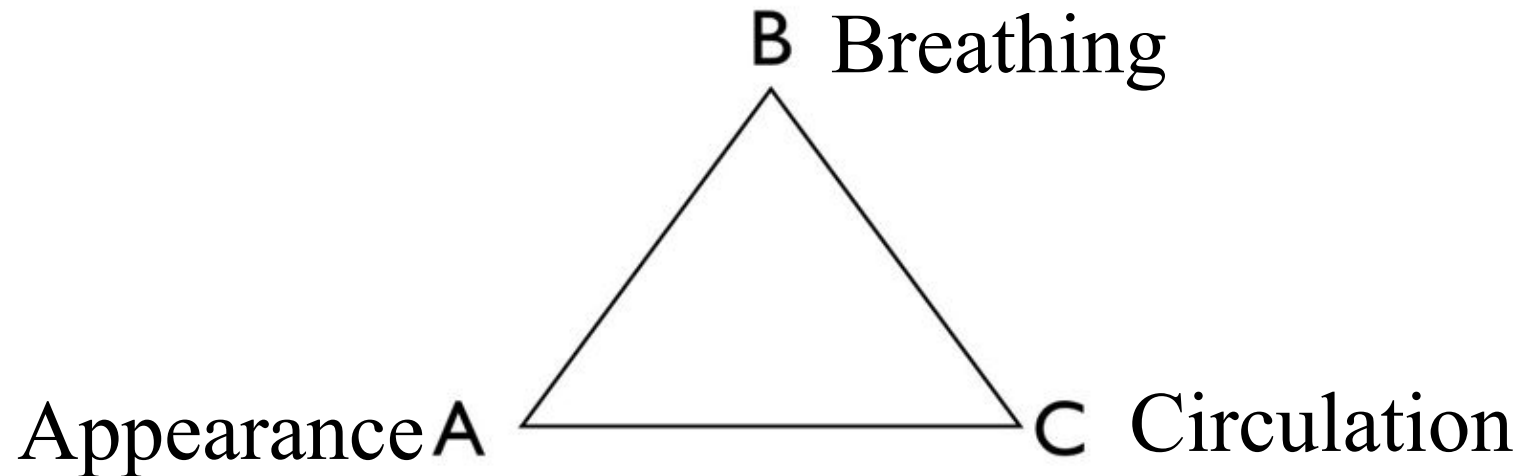
- Appearance:

- Breathing:

- Circulation:



Don't Fail Me Now...



- Respiratory Distress:
 - will only see a change in breathing.
- Respiratory Failure:
 - will start to see change in appearance.

IV. CASES

Case #1

- Brief History
 - 2 month old male
 - Limp and blue in crib
- Assessment:
 - A: Pale, limp, difficult to arouse
 - B: WOB: Labored with subcostal/substernal
 - C: Skin: Mottled

Case #1

Vital Signs

- HR 180
- RR: 44
- BP: 95/70
- T: 38° C

Physical Examination

- A: Weak cry, moderate secretions
- B: Labored, no wheeze, crackles
- C: Mottled, cool extremities, cap refill < 4 seconds
- D: Eyes closed, do not open with painful stimuli; pupils normal
- E: Normal

Case #1

- Assessment?
- DDX?

Case #1

Additional History

- 32 week preemie
- Reflux
- Cough/congestion 3 days
- Afebrile
- Home with mom's boyfriend
—four hours
- Mother came home found him
limp and blue

Physical Examination

- Anterior fontanelle: bulging
- Eyes: Retinal Hemorrhages
- Heart: tachycardic
- Abdomen: Soft

Case #1

- Interventions?

Case #1

- HR: 95
- RR: 12
- BP: 100/70
- Sats: 82% with 100%
oxygen face mask

Case #1

RSI:

- Miller blade: #1
- 3.5 ETT
- Atropine (0.01 to 0.02 mg/kg)
- Lidocaine 1mg/kg
- Etomidate 0.3 mg/kg
- Succinylcholine

Chest X-ray



Case #1

Progression

- Unresponsive to painful stimuli
- Right pupil 7mm fixed
- Left 5 mm reactive
- Decerebrate posturing on left

Repeat VS

- HR: 60
- RR: ventilated at 40
- 125/85
- Assessment?

- Management?

Case #1

Repeat VS

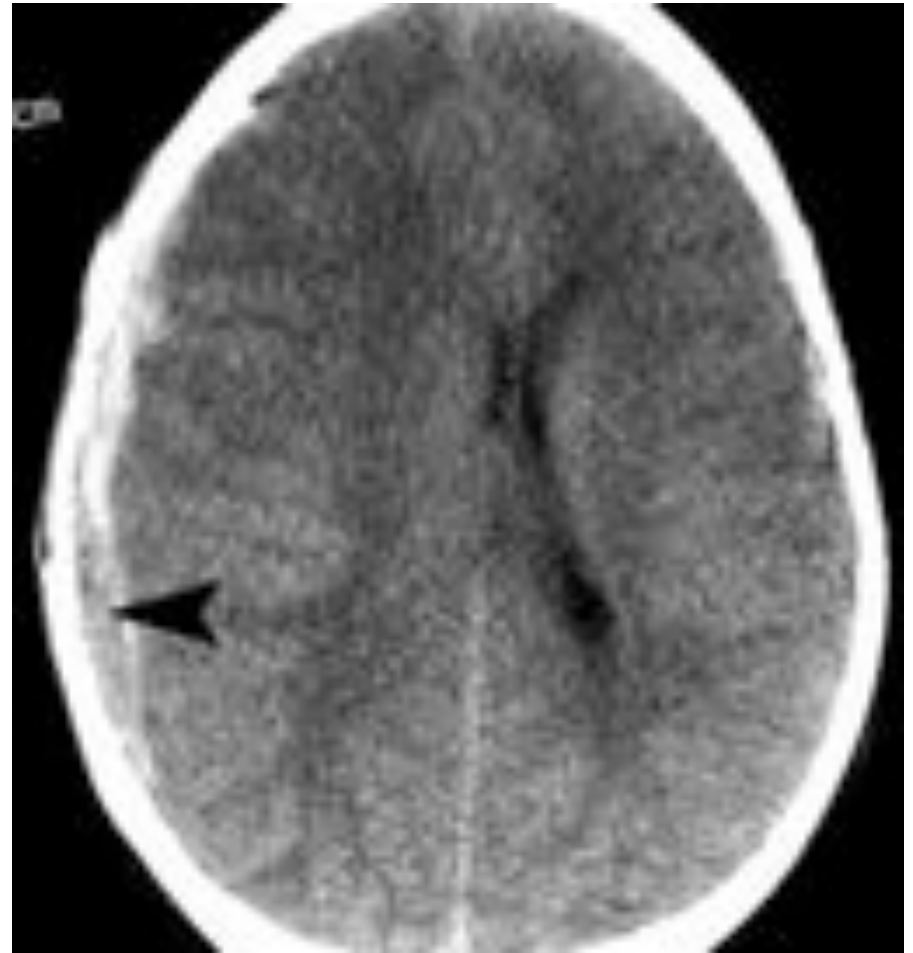
- HR: 160
- RR: 60
- BP 100/75

Exam:

- Posturing resolves
- Pupils equal and reactive
- Management?

Case #1

- CT Head:



Case #1

- Recognize non-accidental trauma
- Recognize evolving respiratory failure
- Recognize and initiate management of ICP

Case #2

- 18 month old male
- Brought in by parents to local ED
- Increasingly less responsive
- Vomiting and diarrhea for 5 days
- “Glassy eyed”
- Rapid breathing



Vital Signs

Pulse: 190

RR: 55

Sats: 90% RA

BP: 64/38

T: 38.9 C
(102°F)

Wt: 9.3 kg

- A: Open, clear
- B: Rapid, deep, equal sounds. Nothing focal.
- C: Tachycardic. Thready pulses stronger centrally than peripherally. Capillary refill 5 seconds. Extremities cool.
- D: Eyes open, gaze not fixed. Responds only to painful stimuli with a whimper. Pupils equal and reactive.

History

PMH: negative

Meds: None

Shots: UTD

SH: Parents with
same symptoms

Physical Exam

- Eyes Sunken
- Mucous membranes dry
- Skin tents when pinched
- Diaper contains diarrhea, non bloody, watery.
- No bruising or trauma

Initial Assessment?

A: Altered Mental Status

B: Tachypnea (Kussmaul respirations)

C: Shock

Acute Interventions?

Oxygen

Needs fluids emergently!

Attempt IV access –

Unable after 3 attempts, 2 min

What Next?



V. CIRCULATION

IO Access

- Tips:
 - Go slow for small infants and children with chronic disease
 - Use local lidocaine if awake
 - If marrow obtained: USE IT.
 - Good venous correlation
 - Lytes, hgb, drug, blood type, renal fxn;
 - Less: PCO₂, P0₂ and LFT' s;
 - Dog models: Less correlation to serum after 30 minutes

EZ-IO®



AD Needle Sets – for patients 40 kg and greater

Size: 25 mm; 15 gauge

PD Needle Sets – for patients 3 to 39 kg

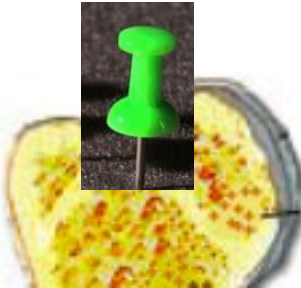
Size: 15 mm; 15 gauge

If overweight, think about using adult size

Common mistakes

WRONG

25 mm



RIGHT

5 mm



~~15 mm~~



5 mm



~~45 mm~~



5 mm



I/O Color Challenge



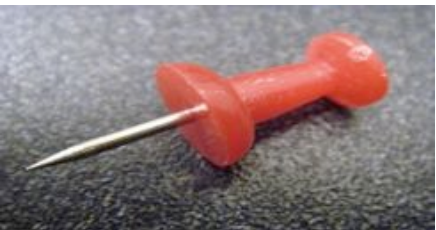
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I/O Color Challenge



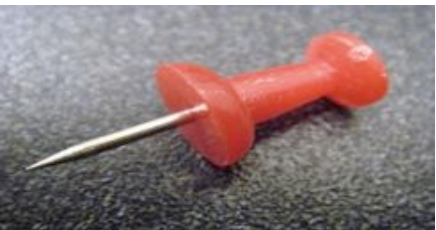
15mm (Pink) 3-39 kg.



25mm (Blue) 40 kg and greater



45mm (Yellow) Proximal humerus on patients greater than 40kg, and patients with excessive tissue .



NOT STERILE! Training (Red)

IO contraindications?

IO contraindications

- Fracture
- Infection
- Compartment syndrome
- Previous attempt same bone

Case #3

Brief History

- 3 month old male
- URI x 3 days
- Coughing, then crying, then turned blue while in the ED waiting room

Assessment

- Appearance:
 - Minimally responsive
- Breathing:
 - Tachypnea, hyperpnea
- Circulation:
 - Profoundly cyanotic

Vital Signs

- Pulse: 180
- BP: 76/44
- RR: 65
- T: 37.6 °C
- Sats: 52% room air

Physical Exam

- A: Patent, moving air freely, no secretions
- B: Deep, gasping respirations, lungs clear without wheeze
- C: Skin cool, deeply cyanotic, cap refill < 2 seconds
- D: Eyes close, pupils reactive

Case #3

- Assessment?
- Interventions?

Case #3

- Other details
- NSVD
- History of heart murmur
- GERD/hypocalcemia at birth
- PE: Tachycardia/no murmur
- Sats: 60% while on 10L oxygen (closed)

Case #3

- Chest x-ray



Case #3

- Most likely diagnosis?

Case #3

- Hypercyanotic spell (Tet spell)
 - Increased right to left shunting
 - Trigger debated
- Interventions?
 - Oxygen
 - Knee to chest
 - IV fluids (10-20 ml/kg)
 - Morphine sulfate (0.1mg/kg)
 - Phenylephrine (0.5 to 5 mcg/kg/min) continuous
 - Other: propranolol/general anesthesia/surgery

Case #3

- Cyanosis, hyperpnea, agitation, mental status changes
- More common in morning, intercurrent illness
- Precipitated by crying or occur spontaneously
- Disappearance of murmur
- Kids with BT shunt/cyanosis/disappearance of murmur = clotted BT shunt;

VI. BOARD QUESTIONS

Board Question #1:

You have decided to apply for a multiyear federal research grant for a study designed to reduce childhood mortality in the United States. Of the following, the area of focus that has the GREATEST potential for absolute mortality reduction is:

- A. early recognition and treatment of sepsis
- B. firearm safety
- C. pedestrian and motor vehicle safety
- D. prevention of accidental drowning
- E. reducing sports-related head injuries

Board Question #2:

- A 4 month-old evaluation of difficulty breathing.
- Worsening progressively over the past 3 weeks.
- No fevers, rhinorrhea, or drainage from the eyes or ears.
- More frequent episodes of vomiting after feedings and has been feeding poorly for the past several days.
- The parents have noted rapid breathing, retractions, and sweating with feedings but no cyanosis or apnea.

Board Question #2:

- Infant's temperature is 37.0C, heart rate is 168 beats/min, respiratory rate is 70 breaths/min, blood pressure is 78/60 mm Hg, and PO₂ is 94% on room air.
- Alert, mild respiratory distress, and chest examination reveals subcostal retractions and fine wheezes and rales throughout both lung fields.
- Cardiac examination shows a normal S1 and S2 and a prominent S3 but no murmurs.
- The liver is palpable 4 cm below the right costal margin.

Of the following, the MOST appropriate next steps to establish the diagnosis are to



- A. obtain blood for ABG and electrolyte assessment
- B. obtain respiratory specimens for influenza and RSV rapid antigen testing
- C. obtain specimens for blood and urine culture
- D. order electrocardiography and echocardiography
- E. perform endotracheal intubation and bronchoscopy

Anomalous left coronary artery arising from the pulmonary artery (ALCAPA)



Board Question #3

- A 7-day old-male infant with poor feeding, lethargy, and difficulty breathing for the past 18 hours.
- Born at term; mom without prenatal care
- The mother states that her breastfed infant has had no fever or vomiting.

Board Question #3: Physical exam

- T: 36C; HR: 190 beats/min, RR: 70 breaths/min, blood pressure is 65/40 mm Hg in the upper extremity and 50/30 mm Hg in the lower extremity, Pulse ox: 90%.
- The infant appears ill, listless, and grey, and he demonstrates labored respirations, weak peripheral pulses, and a capillary refill time of 5 seconds.
- There are no abnormal odors, dysmorphic features, or abnormal genitalia. Point-of-care arterial blood gas reveals:

Board Question #3: Labs

ABG:

pH of 7.1

- Po_2 of 55 mm Hg
- Pco_2 of 50 mm Hg
- Base excess of -15 mEq/L

- Electrolyte measurements:
 - Bicarbonate of 11 mEq/L (11 mmol/L)
 - Sodium of 130 mEq/L (130 mmol/L)
 - Potassium of 6.6 mEq/L (6.6 mmol/L)
 - Chloride of 100 mEq/L (100 mmol/L)
- Glucose measures 42 mg/dL (2.3 mmol/L).

Of the following, after administration of intravenous glucose and a crystalloid bolus, the therapeutic intervention that is MOST likely to provide immediate benefit is



- A. acyclovir
- B. alprostadil
- C. cefotaxime
- D. hydrocortisone
- E. sodium benzoate

Board Question #4

A 13-y/o boy collapses after being struck in the chest by a baseball during a baseball game. He is unresponsive, with agonal breathing. CPR is started on the field, while emergency medical services is called. He has mild asthma. His sports physical 1 month ago included (ECG) that revealed no cardiac abnormalities. Of the following, the MOST appropriate next step in management is

- A. defibrillation
- B. endotracheal intubation
- C. intramuscular epinephrine
- D. intraosseous epinephrine
- E. nebulized albuterol

Board Question #5:

- A 4-year-old girl presents to the emergency department in status epilepticus of 30 minutes duration.
- She has a history of developmental delay, cerebral palsy, seizure disorder, and failure to thrive that required gastrostomy tube placement.

Board question #5

- Physical examination findings include perioral cyanosis, heart rate of 150 beats/min, blood pressure of 90/55 mm Hg, temperature of 40.0°C, and oxygen saturation of 85% on room air.
- She has coarse breath sounds bilaterally and is experiencing a generalized tonic-clonic seizure.
- You apply a non-rebreather mask and nasopharyngeal airway and administer 2 mg intravenous lorazepam.

Board Question #5

- In 3 minutes, the girl's RR decreases to 10 breaths/min, prompting bag-mask ventilation.
- After 10 minutes of bag-mask ventilation, her seizure stops and her respiratory rate improves to 35 to 40 breaths/min.
- She is taking rapid, shallow breaths and her oxygen saturation is 91% on bag-mask ventilation.
- Some oral secretions with coarse breath sounds bilaterally with decreased air entry at the bases. Her abdomen is distended, pupils are reactive to light, and extremity movements are spontaneous.

Board Question #5:

Of the following, the MOST appropriate next step to relieve this girl's respiratory distress is to

- A. continue bag-mask ventilation
- B. perform endotracheal intubation
- C. remove the nasopharyngeal airway
- D. switch to non-rebreather oxygenation support
- E. vent the gastrostomy tube

Board question #6:

- 4-week-old neonate
- Presents with lethargy, pallor, vomiting, and poor oral intake of 3 weeks' duration.
- Term without any prenatal complications.
- Infant with progressively worsening vomiting after every feeding described as non-bilious.
- Today he has been sleeping and has had no wet diapers for 24 hours.

- Temp of 37.0°C, HR: 185 beats/min, RR: 18 breaths/min with slow and shallow breaths, SBP of 55 mm Hg, O₂ sat 97% room air, and capillary refill of 2 seconds.
- Lethargic and pale infant has sunken fontanelles, dry mucous membranes, clear breath sounds, sinus tachycardia, palpable femoral pulses, a non-distended abdomen with peristaltic waves, and normal-appearing genitalia.

Bedside capillary blood analysis results are:

- pH, 7.59
- Pco₂, 63 mm Hg
- Po₂, 33 mm Hg
- Bicarbonate, >50 mEq/L (50 mmol/L).
- VBG:
- Sodium, 131 mEq/L
- Potassium, 2.8 mEq/L (
- Chloride, 50 mEq/L
- Bicarbonate, 60 mEq/L
- Blood urea nitrogen, 156 mg/dL
- Creatinine, 2.1 mg/dL
- Glucose, 156 mg/dL (8.7 mmol/L)
- Anion gap, 21

After 20 cc/kg bolus, of the following, the MOST appropriate next step in management is?

A. Complete sepsis evaluation with antibiotic administration



B. Continued fluid and electrolyte resuscitation followed by elective abdominal surgery

C. Emergent exploratory laparotomy

D. Emergent intubation with hyperventilation

E. Passage of a nasogastric tube and administration of oral rehydration solution