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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

<table>
<thead>
<tr>
<th>Rank</th>
<th>&lt; 1 yr</th>
<th>1-4 yrs</th>
<th>5-9 yrs</th>
<th>10-14 yrs</th>
<th>15-19 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Suffocation (66%)</td>
<td>Drowning (27%)</td>
<td>MVT* (37%)</td>
<td>MVT (50%)</td>
<td>MVT (75%)</td>
</tr>
<tr>
<td>2</td>
<td>MVT (13%)</td>
<td>MVT (22%)</td>
<td>Pedestrian (14%)</td>
<td>Pedestrian (12%)</td>
<td>Poisoning (7%)</td>
</tr>
<tr>
<td>3</td>
<td>Drowning (7%)</td>
<td>Pedestrian (15%)</td>
<td>Fire/burns (13%)</td>
<td>Drowning (10%)</td>
<td>Pedestrian (5%)</td>
</tr>
<tr>
<td>4</td>
<td>Fire/burns (4%)</td>
<td>Suffocation (8%)</td>
<td>Drowning (13%)</td>
<td>Fire/burns (6%)</td>
<td>Drowning (5%)</td>
</tr>
</tbody>
</table>

*MVT= motor vehicle trauma

2000-2005; Ludwig 2010
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)
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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Infants (n=277)</th>
<th>Children (n=154)</th>
<th>Adolescents (n=193)</th>
<th>All Pediatric (n=624)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, median (years)</strong></td>
<td>0.2</td>
<td>4.2</td>
<td>17</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Male (%)</strong></td>
<td>59%</td>
<td>92%</td>
<td>69%</td>
<td>62%</td>
</tr>
<tr>
<td><strong>Incidence/100,000 person years (95% CI)</strong></td>
<td>72.71 (62.0 – 83.3)</td>
<td>3.73 (3.0 – 4.4)</td>
<td>6.37 (5.3 – 7.4)</td>
<td>8.04 (7.2 - 8.8)</td>
</tr>
<tr>
<td><strong>EMS treated (%)</strong></td>
<td>84%</td>
<td>88%</td>
<td>70%</td>
<td>81%</td>
</tr>
</tbody>
</table>
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 $\frac{1}{3}$ of the events

• Bystander AED attempts were rare

• EMS entered “no obvious cause” of arrest $\frac{2}{3}$ 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

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight (kg)</th>
<th>Respiratory Rate</th>
<th>Heart Rate (bpm)</th>
<th>Systolic BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonate</td>
<td>3-4</td>
<td>30-60</td>
<td>90-160</td>
<td>60 ± 10</td>
</tr>
<tr>
<td>1-6 month</td>
<td>4-6</td>
<td>24-30</td>
<td>110-180</td>
<td>80 ± 10</td>
</tr>
<tr>
<td>1-2 yr</td>
<td>10-13</td>
<td>20-24</td>
<td>90-150</td>
<td>96 ± 30</td>
</tr>
<tr>
<td>2-4 yr</td>
<td>13-17</td>
<td>20-24</td>
<td>75-135</td>
<td>99 ± 25</td>
</tr>
<tr>
<td>4-6 yr</td>
<td>17-20</td>
<td>20-24</td>
<td>60-130</td>
<td>100 ± 20</td>
</tr>
<tr>
<td>6-8 yr</td>
<td>20-25</td>
<td>12-20</td>
<td>60-120</td>
<td>105 ± 13</td>
</tr>
<tr>
<td>8-10 yr</td>
<td>25-30</td>
<td>12-20</td>
<td>60-120</td>
<td>110 ± 15</td>
</tr>
<tr>
<td>10-12 yr</td>
<td>30-40</td>
<td>12-20</td>
<td>60-120</td>
<td>112 ± 15</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 kg</td>
</tr>
<tr>
<td>3</td>
<td>15 kg</td>
</tr>
<tr>
<td>5</td>
<td>20 kg</td>
</tr>
<tr>
<td>7</td>
<td>25 kg</td>
</tr>
<tr>
<td>9</td>
<td>30 kg</td>
</tr>
</tbody>
</table>
Vital Signs

– Broselow tape
  • Helpful even if patient appears “metabolically challenged”
  • Why?

Source unknown
Pearl #2 Useful Apps: Pedi STAT

http://www.qxmd.com/apps/pedi-stat-for-iphone-android
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

Noble, Frawley, Wikimedia Commons
Treacher Collins

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

Image removed of child with Treacher Collins Syndrome. See similar image at http://www.flickr.com/photos/friendlydoc/5623707179/
Pierre Robin

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

Image removed of child with Pierre Robin Syndrome. See similar image at
http://www.flickr.com/photos/35659142@N04/3299821858/
Hurler’s Syndrome

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

Image removed of child with Hurler’s Syndrome. See similar image at http://drugline.org/img/term/syndrome-hurler-14489_3.jpg
Goldenhar

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

Image removed of child with Goldenhar Syndrome. See similar image at
http://www.flickr.com/photos/ellagumma/2400220179/
Assessing Risk: Anatomy

- Limited mouth opening
- Cervical spin 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

Alex, Wikimedia Commons

Alex, Wikimedia Commons
Pearl #4: Optimize position

Yours and patient

Intubation
Sedations
Procedures
Anatomy

Chris Dodds, Wikimedia Commons
Positioning
Age under 3 years

Large occiput causes hyperflexion of the neck on the chest

Aaxes 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
• 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

**Adults**
- FRC: 42 ml/kg
- O₂ consumption: 2-3 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.....

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

Hfastedge, Wikimedia Commons
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%

Sagarin, Pediatric Emergency Care 2002
ETT size and depth

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

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.

Diagram: A (Appearance) → B (Breathing) → C (Circulation)
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
If overweight, think about using adult size

<table>
<thead>
<tr>
<th>AD Needle Sets – for patients 40 kg and greater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size: 25 mm; 15 gauge</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PD Needle Sets – for patients 3 to 39 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size: 15 mm; 15 gauge</td>
</tr>
</tbody>
</table>
Common mistakes

WRONG

25 mm

WRONG

15 mm

WRONG

45 mm

RIGHT

5 mm

RIGHT

5 mm

RIGHT

5 mm

Mugwump12, [Wikimedia Commons](https://commons.wikimedia.org/w/index.php?from=Commons)

Zachary Dylan Tax, [Wikimedia Commons](https://commons.wikimedia.org/w/index.php?from=Commons)
I/O Color Challenge

Lander777, Wikimedia Commons
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 37.0°C, heart rate is 168 beats/min, respiratory rate is 70 breaths/min, blood pressure is 78/60 mm Hg, and PO$_2$ 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: 36°C; 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
- Pco$_2$, 63 mm Hg
- Po$_2$, 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