ACUTE LIFE THREATENING EVENTS IN CHILDREN

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NORMAL VITALS IN INFANTS

<table>
<thead>
<tr>
<th>AGE</th>
<th>PULSE (BPM)</th>
<th>RR (BPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>90-160</td>
<td>30-60</td>
</tr>
<tr>
<td>3-6 days</td>
<td>90-170</td>
<td>25-40</td>
</tr>
<tr>
<td>1-3 weeks</td>
<td>100-180</td>
<td>20-40</td>
</tr>
<tr>
<td>1-2 months</td>
<td>120-180</td>
<td>20-40</td>
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<tr>
<td>1-3 years</td>
<td>90-140</td>
<td>20-40</td>
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CASE PRESENTATION

- A 4 week old male presents with the complaints of turning blue in the face, followed by “floppiness” for a few minutes. The mother initiated CPR. On medic arrival the patient was alert, interactive with normal VS
- In the ED, the baby is appropriate and is breast-feeding when you walk in. What should be your management approach?

APNEA/ALTE


- **Apnea**—cessation of breathing for more than 20 seconds or any duration associated with pallor, cyanosis or bradycardia
- **ALTE**—An episode that is frightening for the observer and is characterized by some combination of apnea, color change, choking or gagging, change in muscle tone. Occurs in 3% of all children
APNEA/ALTE

Obstructive apnea - vascular ring, vocal cord paralysis, REF, GER, webs, BPD
Central apnea - Seizures, AVM, tumor, CNS immaturity, increased ICP
Periodic breathing - breathing pattern in which there are three or more respiratory pauses of greater than 3 seconds duration with less than 20s of respiration between pauses

SIDS

• Death in an infant less than 1 year of age which is unexplained despite a thorough investigation
• Occurs in 0.56/1000 live births in the US
• 2-4% have a record of apnea and less than 7% have a history of a preceding ALTE
• Infants with apnea during sleep have up to a 10% mortality
• No definitive cause found in 50%
• 2-3X the incidence in African Americans and American Indian/Alaska Native children

SIDS RISK FACTORS

• Prone sleeping position
• Sleeping on a soft surface
  – Prone sleep plus soft bedding- OR 21!
• Maternal smoking during pregnancy
• Overheating
• Late or no prenatal care
• Young maternal age
• Preterm or low birth weight
• Male gender

SLEEP LOCATION


• Infant deaths in adult beds 8.1X higher in 1990s than 1980s.
• Infant deaths on sofas and chairs 17.2X higher in 1990s than 1980s
• Overall risk of suffocation in adult beds is 40X higher than in cribs
  – Entrapment between bed and wall, headboard or footboard and mattress or between bedrail
• Overlying deaths on beds more common in infants less than 2 months of age and on sofas/chairs average age was 3.2 months
HOW TO REDUCE THE RISK

• Back to Sleep-supine sleep
• No side sleeping
• Firm surface for sleep-no pillows, stuffed toys, or thick bumper pads
• No smoking
• Separate but proximate sleep location until 6 months of age

HOW TO REDUCE THE RISK

• Avoid overheating
• Home monitors do not prevent SIDS but are useful in patients with ALTE’s
• Pacifier use at nap time and bedtime
  – Do not reinsert after baby is asleep
  – Do not force the pacifier
  – Delay until 1 month of age in breast feeding babies

ALTE/APNEA

Differential diagnosis

• Breath holding spell
• Choking (5%)
• Child abuse/HI
• CHD
• Hypoglycemia
• Seizures
  – Afebrile-25%
  – Febrile-12%
• Sepsis
• GER(18%)
• False alarms-90%
• Anemia
• Electrolyte imbalance
• Foreign body
• Poisoning
• QT prolongation
• Dysrhythmias
• Airway abnormality
• Pertussis (6%)

Out-of-Hospital ALTE’s


• Sixty (7.5%) of 804 infants encountered by EMS during the study period met criteria for an apparent life-threatening event.
• Mean age was 3.1±3.3 months
• Of the infants with apparent life-threatening event, 50 (83.3%) infants appeared to be in no distress, 8 (13.3%) infants were in mild distress, and 2 (3.3%) infants were in moderate distress.
Out-of-Hospital ALTE’s

- Critical conditions associated with apparent life-threatening event included pneumonia or bronchiolitis (12%), seizure (8%), sepsis (7%), intracranial hemorrhage (3%), bacterial meningitis (2%), dehydration (2%), and severe anemia (2%).
- Infants with ALTE’s and significant diagnoses may not be symptomatic on ED arrival, attention to the paramedic and caregiver report is imperative

APNEA/ALTE

Important history

- What happened immediately before the episode?
- Was there a change in color or tone?
- Length of time?
- Time of patient’s last meal?
- Was the child asleep or awake at the time?
- Position of the child?
- What interventions were performed?

APNEA/ALTE

Claudius. Pediatrics

- 59 Previously healthy patients <12 months of age presenting
- These patients were then observed for subsequent events, significant interventions, or final diagnoses that would have mandated their admission (eg, sepsis).
- 5 children met the aforementioned outcome measures, thus requiring admission
- The high-risk criteria of age of <1 month [corrected] and multiple apparent life-threatening events yielded a negative predictive value of 100% to identify the need for hospital admission.
- CONCLUSIONS: Our study suggests that >30-day-old infants who have experienced a single apparent life-threatening event may be discharged safely from the hospital, which would decrease admissions by 38%.
APNEA/ALTE
Claudius. Pediatrics

- Very strong statement, considering there were only 59 patients!
- Consider our medicolegal environment before making the decision to discharge home!
- This study did not address the medicolegal burden of sending home an infant from the ED who subsequently dies because a thorough investigation has not been made.

Base the workup on the H & P
- Perform septic workup, electrolytes, glucose, magnesium, calcium, CXR, EKG, consider head CT/US, pertussis and RSV swabs
- ADMIT all patients with an ALTE even with a negative workup. The history will help differentiate between a simple choking episode, periodic breathing and a breath-holding spell.

ALOC
“Tips From The Vowels”

- T-Trauma/Tumor
- A-Alcohol/Abuse
- E-Epilepsy/Encephalopathy
- I-Intussusception
- P-Poisoning/Psychogenic
- S-Shock
- I-Infection/ Inborn Errors of Metabolism
- O-Opiates
- U-Uremia

Causes of ALOC in the Newborn
“THE MISFITS”

- T-Trauma/NAT
- H-Heart disease/ Hypovolemia
- E-Electrolyte disturbances
- M-Metabolic disturbances ( CAH)
- I-Inborn errors of metabolism
- S-Sepsis
- F-Formula dilution or over concentration
- I-Intestinal catastrophes
- T-Toxins ( home remedies)
- S-Seizures/CNS abnormalities
TREATMENT OF HYPOGLYCEMIA

• Normal BS: >30mg/dl in infants, >40mg/dl in older children
• Replace with 0.25-1 gm/kg of dextrose
• Newborns use D10 to avoid ICH and vein damage: 3-10cc/kg
• Infants and young children use D25: 2-4cc/kg

CASE PRESENTATION

• A one week old female presents with cyanosis, sweating with feeds, no history of fever or preceding illness. Her O2 saturation is 85% on room air. When you apply oxygen her saturation does not increase. What underlying diagnosis should you suspect?

CONGENITAL HEART DISEASE

• Occurs in 8/1000 live births
• Blue baby: right to left shunting ex: TOF, TGA, TAPVR, single ventricle, pulmonary atresia, TA, Truncus Arteriosus
• Mottled or gray baby: systemic outflow tract obstruction ex: Coarctation, aortic stenosis
• Pink baby: CHF with left to right shunting ie VSD, PDA, endocardial cushion defect
NEONATAL CIRCULATION

CONGENITAL HEART DISEASE
Clinical Presentation

- Difficulty feeding
- Sweating with feeds
- Tachypnea
- Sudden onset of pallor, lethargy or central cyanosis
- Poor weight gain
  - Most infants lose 10% of birth weight in first week and then gain 20-30 gms day for 1-2 months. Birth weight should be regained by 10-14 days of life

CONGENITAL HEART DISEASE
Diagnosis: CXR Findings

- Boot shaped heart: TOF, tricuspid atresia
- Egg on a string: TGA
- Snowman or figure of 8: TAPVR
- 3 sign: Coarctation of the aorta
- Decreased pulmonary markings: TOF, Tricuspid atresia, Pulmonary atresia/stenosis
- Cyanotic with increased pulmonary markings: TGA, TA, TAPVR, single ventricle
- Acyanotic with increased markings: VSD, PDA
CONGENITAL HEART DISEASE

Diagnosis- ABG’s

• Hyperoxia test: Obtain baseline ABG & repeat in 10 minutes
  – Increase of 30 torr or more, and O₂ saturation increase greater than 10% implies pulmonary process
  – Minimal or no increase in PaO₂ or saturation implies possible cardiac lesion

CONGENITAL HEART DISEASE

Treatment

• ABC’s! No PEEP as this decreases PBF
• Start PGE1 infusion: 0.05μg/kg/min
• Administer Lasix 1mg/kg if CHF present, also consider dopamine, morphine, dobutamine
• Perform septic workup and start antibiotics
• Admit to PICU/NICU
CONGENITAL HEART DISEASE
PGE1 Complications

- Apnea in up to 12% of patients
  - Be prepared to intubate!
- Hypotension
- Seizures
- Fever

CASE PRESENTATION

- A one month old female presents with irritability, poor feeding, possible seizure today. Vital signs reveal a heart rate of greater than 220 BPM, 02 saturation is 96% on room air and RR is 40 BPM.

SUPRAVENTRICULAR TACHYCARDIA

- Narrow complex with heart rates greater than 220 BPM in infants, >180 BPM in kids
- P-waves difficult to see
- 50% are idiopathic, 20% acquired, 20% anatomic
- History is nonspecific: poor feeding, lethargy, sweating, pallor
- Sinus tachycardia usually has an identifiable cause- fever, hypovolemia, anxiety
SVT
Treatment
• Vagal maneuvers
• Adenosine: 0.1mg/kg then 0.2mg/kg
• Cardioversion with 0.5-1J/kg
• No verapamil in infants
• Digoxin: 10ug/kg IV initial load, then second dose in 6 hours, third dose at 24 hrs
• Procainamide: 10-15mg/kg over 30-45”
• Amiodarone- 5mg/kg over 20-60 minutes

SEPSIS
Herpes Simplex Findings
• Check the presenting part for lesions, especially the scalp electrode site
• Culture CSF
  – CSF will show pleocytosis and/or high protein but no organisms
• Start Acyclovir 20mg/kg q 8 hours if CSF suspicious; pt has lesions, focal neurologic findings, hepatitis or pneumonitis; or mother has history of herpes

SEPSIS
Workup and Treatment
• Check all body fluids; blood for CBC and culture, catheterized urinalysis and culture, CSF for gram stain, protein, glucose, cell count and culture. Check plasma glucose
• CXR if pt symptomatic
• Admit all pts less than 28 days of age regardless of lab data
• Start antibiotics: Ampicillin and cefotaxime 100 mg/kg/day
PERIPHERAL WBC & LPs  

- 5353 consecutive CSF samples from infants 3-89 days of age
- 22 patients had bacterial meningitis
- Highest rate was in pts 3-28 days of age
- Median WBC for pts with meningitis was 10.2K vs 11.2K for pts without meningitis
- Using >15K as high risk stratification would have missed 73% of pts, using 20K would miss 96%
- Using 5-15K to classify pts as low risk, would have missed 41% of pts with meningitis

Case Presentation

- A 28 day old female presents with vomiting, lethargy and seizures. She appears to be encephalopathic on examination. An ABG reveals a low pH and bicarbonate. Head CT and septic workup is negative. What diagnosis should you consider? What additional labs should be ordered?

PERIPHERAL WBC & LPs  

- Higher incidence in pts with WBC <5K (risk increased 3-35 times)
- Bottom line: DO NOT USE PERIPHERAL WBC TO DECIDE IF YOU NEED TO DO AN LP!!
INBORN ERRORS OF METABOLISM
What are they?

• Biochemical disorders that result in an altered protein structure or amount of protein synthesis
• Usually a result of an enzyme deficiency which results in an excess of a metabolite

INBORN ERRORS OF METABOLISM
Pertinent history

• Consanguinity. History of male deaths or unexplained deaths in the family
• Acute deterioration after a normal period
• Unusual odors- musty, sweaty, fruity
• Abnormal movements? Tongue thrusting, opisthotonus, apnea, lip smacking, bicycling

INBORN ERRORS OF METABOLISM
Clinical Presentation

• Vomiting without diarrhea
• Lethargy/poor feeding
• Seizures/encephalopathy
• Hepatomegaly
• Metabolic acidosis/ hypoglycemia
• IVH or pulmonary hemorrhages
• Peculiar odor

ALGORITHM FOR DIAGNOSIS OF INBORN ERRORS OF METABOLISM
TAKE HOME POINTS

• “Tips from the vowels”
• “THE MISFITS”
• Admit all pts with ALTE or apnea
• Full septic workup in infants less than 2 months of age, regardless of how they look!

TAKE HOME POINTS

• Suspect abuse or intussusception in infants with vomiting and no diarrhea or fever