Common Pediatric Problems: 

Fever & Respiratory Distress

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Fever
> 38°C
> 100.4°F
For every degree Celsius above 38 (every 1.8 F)

HR increases 10 BPM

RR increases 5 BPM
There is no “number” on a thermometer that requires a trip to the ED

- Kids do not have to maintain a “normal” temperature when ill
- Fever is a normal, healthy way for the body to fight common infections
- Bacteria and viruses cannot successfully replicate in hotter conditions
- Fever is a symptom of illness, not a disease
The severity of fever does not always correspond with the severity of illness.

- The number doesn’t matter
- Pay attention to how the kid looks
- Trends don’t matter either
Fever doesn’t have to be treated

- The goal of antipyretics is not temperature normalization
- They can make a child feel more comfortable which improves eating, sleep etc,
- But don’t delay treatment so that the doctor sees the child with the fever
Half of all parents are dosing antipyretics incorrectly

- Ask which medicine, the formulation (liquid etc.,) and the dose
- Ibuprofen is 10 mg/kg
- Acetaminophen is 15 mg/kg
Fever does not cause brain damage

- The hypothalamus will adjust and maintain the temperature set point
- Fever is different than heat stroke or malignant hyperthermia
Tachycardia after resolution of fever is more worrisome

Is it pain, dehydration, crying, sepsis, cardiac?
The height of the fever matters far less than...

Duration otherwise healthy kids >5-7d

Kids rarely go >41.5 with infections
In children under three years, rectal is more accurate.

Adding a degree to an axillary temp is a common (and wrong) practice.
Does teething cause fever?   Not above 38.5 °C
Is “tactile fever” accurate?

Mothers touching their child's forehead had moderate (46% to 73%) correlation with later documentation of fever in the ED or hospital in two studies.
Table 4.—Duration of Fever Before Admission, During Hospitalization, and Total Duration of Fever in Respiratory Virus Infections*

<table>
<thead>
<tr>
<th></th>
<th>Before Admission</th>
<th>In the Hospital</th>
<th>Total Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Days</td>
<td>n</td>
</tr>
<tr>
<td>Adenovirus</td>
<td>24</td>
<td>3.2 ± 2.5</td>
<td>25</td>
</tr>
<tr>
<td>Influenza A</td>
<td>47</td>
<td>2.1 ± 2.2</td>
<td>47</td>
</tr>
<tr>
<td>Influenza B</td>
<td>27</td>
<td>2.6 ± 2.2</td>
<td>18</td>
</tr>
<tr>
<td>Parainfluenza 1</td>
<td>25</td>
<td>2.0 ± 2.0</td>
<td>25</td>
</tr>
<tr>
<td>Parainfluenza 2</td>
<td>21</td>
<td>0.8 ± 0.8</td>
<td>21</td>
</tr>
<tr>
<td>Parainfluenza 3</td>
<td>53</td>
<td>1.1 ± 1.3</td>
<td>53</td>
</tr>
<tr>
<td>Respiratory syncytial virus</td>
<td>60</td>
<td>1.7 ± 1.7</td>
<td>60</td>
</tr>
</tbody>
</table>

*Values are given as mean ± SD.
Acetaminophen vs Ibuprofen
They both work…

**Perrott et al in 2004** Compared 17 blinded RCTs in children <18 who received either drug for pain or fever

At 2, 4, and 6 hours post treatment Ibuprofen (5-10 mg/kg) reduced temperature more than acetaminophen (10-15 mg/kg) (respective weighted-effect sizes: 0.19 [95% CI, 0.05-0.33], 0.31 [95% CI, 0.19-0.44], and 0.33 [95% CI, 0.19-0.47])

**Goldman et al. in 2004** systematic review - slightly increased benefit in those getting ibuprofen

**Purssell in 2002** no superiority for either drug at 1 hour post administration, but that Ibuprofen had a mean temperature reduction of 0.58 C at 6 hours
Can I give them both at the onset of fever?

The PITCH (Paracetamol plus ibuprofen for the treatment of fever in children) trial compared ibuprofen vs acetaminophen vs both drugs together in a RCT.

Both drugs cleared fever 23 minutes faster than acetaminophen alone, but no faster than ibuprofen.

The combo when given regularly together over 24 hours also resulted in less time with fever vs either drug alone.

The benefit isn’t startlingly great and may lead to medication confusion.
Alternating?

Kramer et al 2008 prospective randomized double-blind placebo controlled RCT that alternating had significant differences in the temp at 4 hours (38.0°C vs 37.4°C; $P = .05$) and 5 hours (37.1°C vs 37.9°C; $P = .0032$)

Alternating increases complexity

Advise and education

Reevaluate the need to alternate every 12 hours
Febrile Infant
The Bottom Line

28 days old and under = full septic workup

29-60 days we can opt to exclude LP if baby is low risk
Fever defined as temperature $\geq 38^\circ C / 100.4^\circ F$ (rectal)

Viral URI Sx do NOT count as a fever source
H&P are not reliable to rule-out serious bacterial infection (SBI)
12-28% of febrile neonates have SBI

- UTIs (12-20%)
- Bacteremia (3%)
- Meningitis (<1%)
Other causes

• Bacterial gastroenteritis
• Gonococcal keratoconjunctivitis
• Omphalitis
• Osteomyelitis
• Peritonitis
• Pneumonia
• Septic joint
≤28 days

- IV access
- CBC, blood culture
- Cath UA, urine culture
- LP + CSF studies
- Glucose if needed
- Chest XRay if clinically warranted
- Consider need for HSV testing
- Enterovirus CSF PCR in the summer
- Stool Culture if mucous or gross blood in the stool
- Respiratory PCR and influenza
Lumbar puncture

LP success rate increases with early stylet removal and use of lidocaine.

Family presence does not alter success rate.

Residents get 2 attempts.

Take a supervisor with you.
Early stylet removal

CSF

Blood
Lumbar puncture

**CSF Analysis**
- Tube 1  Culture and Gram stain
- Tube 2  Glucose, protein
- Tube 3  Cell count and differential
- Tube 4  Viral Studies or to be saved for further studies
Labs

**Blood**
- WBC $\leq 5,000$ or $\geq 15,000$
- Bands $>1,500$
- Band:Neutrophil $<0.2$
- Bands/Bands + Neutros

**Urine**
- $<10$ WBC/hpf
- Negative gram stain

**CSF**
- 0-28d - WBC $<19/\mu L$
- 29-60d - WBC $<9/\mu L$
- Normal glucose or protein
- Gram stain
Low Risk for Bacterial Meningitis

29-60 days old
Full-term (≥37 weeks gestation)
No prolonged NICU stay
No chronic medical problems
No systemic antibiotics within 72 hours
Well-appearing and easily consolable
No infections on exam
Blood and urine studies reassuring
Empiric Acyclovir
Strongly consider for ALL infants ≤ 21 days
and for infants 22 to 40 days with ≥ 1 of the following:
• Ill Appearing
• Abnormal neurologic status, seizures
• Vesicular rash
• Hepatitis
• Mom known to have primary HSV infection at delivery

Labs
HSV PCR in CSF and blood
HSV PCR of SEM lesions
Liver profile, BMP

HSV?
Antimicrobials
0-21d  Ampicillin/Cefotaxime +/- Acyclovir
22-28d  Ampicillin/Cefotaxime
29-56d  Cefotaxime or Ceftriaxone (>6 weeks and no jaundice)
Additional Considerations
Add Vancomycin if

- Ill Appearing
- CSF
  - WBC elevated w/abnormal glucose or protein
  - Gram positive organism on Gram stain
<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acyclovir</td>
<td>20 mg/kg IV every 8 hours</td>
<td></td>
</tr>
<tr>
<td>Ampicillin</td>
<td>50 mg/kg IV every 6 hours Note: every 12 hours for &lt; 7 days of age</td>
<td></td>
</tr>
<tr>
<td>Cefotaxime (Clafonan®)</td>
<td>50 mg/kg IV every 8 hours for presumed bacteremia 50 mg/kg IV every 6 hours for presumed meningitis Note: every 12 hours for &lt; 7 days of age</td>
<td></td>
</tr>
<tr>
<td>Ceftriaxone (Rocephin®)</td>
<td>50 mg/kg IV or IM every 24 hours for presumed bacteremia 100 mg/kg IV or IM every 24 hours for presumed meningitis</td>
<td>Contraindicated in neonates with hyperbilirubinemia and in neonates requiring or who may require IV calcium-containing solutions</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>0-30 days: 3 mg/kg IV every 24 hours 31-60 days: 2.5 mg/kg IV every 12 hours</td>
<td></td>
</tr>
<tr>
<td>Vancomycin</td>
<td>15 mg/kg IV every 12 hours</td>
<td>Consider in patients at risk for <em>S. aureus</em> infection</td>
</tr>
</tbody>
</table>
What about?

Procalcitonin and CRP do not improve confidence to completely rule out SBI at this time.
Disposition

All babies under 28 days are admitted on empiric antibiotics for 36 hours.

Babies 29-60 days with normal CBC and urine can be discharged home off antibiotics.

You can get blood, urine and CSF on a baby 29-60 days and D/C home if normal - but NO antibiotics!
Babies discharged home must have PMD follow up within 24 hours

Also, trustworthy caregivers with reliable transportation

Always call the PMD

If you can’t reach them - baby from out of town consider admission
Fever 3 to 36 months
The Bottom Line

A child under 3 without an obvious source for their fever has a 5% chance of bacterial infection - mostly UTI

Occult bacteremia in post HiB Prevnar is <1-2%

Most children have viruses
SBI include

Bacteremia, UTI, meningitis, periorbital cellulitis, septic arthritis, pneumonia, and focal skin infections
Lee Arch Pediatric Adol Med, 1998

Prospective study of 1911 children 3-36 mos with fever >39 C and no source

Frequency of bacteremia 1.5%

WBC >10K 86% sensitive and 77% specific
Kupfermann, Annals of EM 1998

Multicenter, prospective observational study of 6579 children, 3 to 36 months of age w/ fever without a source ≥39°C

frequency of bacteremia 2.5%

CBC

WBC ≥15 80% sensitive and 69% specific

ANC ≥1076% sensitive and 78% specific

Logistic regression - ANC independent predictor of bacteremia with adjusted odds ratio (OR) 1.15 (95% CI 1.06-1.25) for each 1000 cells/mm increase in the ANC
Herz, Pediatric Infectious Dis 2006

Multicenter retrospective observational study of 41,948 children, 3-36 months who had blood cultures

**CBC**

Frequency of bacteremia (was 1.6%, contamination 1.8%)

WBC ≤15 NPV 99.5%
WBC >15K and ANC >10K are associated with incr risk of SBI
Blood Culture

Mean time to positive for pathogen 15 hours - for contaminant 31 hours
Urinalysis

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity (Range), %</th>
<th>Specificity (Range), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukocyte esterase test</td>
<td>83 (67–94)</td>
<td>78 (64–92)</td>
</tr>
<tr>
<td>Nitrite test</td>
<td>53 (15–82)</td>
<td>98 (90–100)</td>
</tr>
<tr>
<td>Leukocyte esterase or nitrite test positive</td>
<td>93 (90–100)</td>
<td>72 (58–91)</td>
</tr>
<tr>
<td>Microscopy, WBCs</td>
<td>73 (32–100)</td>
<td>81 (45–98)</td>
</tr>
<tr>
<td>Microscopy, bacteria</td>
<td>81 (16–99)</td>
<td>83 (11–100)</td>
</tr>
<tr>
<td>Leukocyte esterase test, nitrite test, or</td>
<td>99.8 (99–100)</td>
<td>70 (60–92)</td>
</tr>
<tr>
<td>microscopy positive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Individual Risk Factors: Girls

- White race
- Age < 12 mo
- Temperature ≥ 39°C
- Fever ≥ 2 d
- Absence of another source of infection

### Probability of UTI & No. of Factors Present

<table>
<thead>
<tr>
<th>Probability of UTI</th>
<th>No. of Factors Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1%</td>
<td>No more than 1</td>
</tr>
<tr>
<td>≤2%</td>
<td>No more than 2</td>
</tr>
</tbody>
</table>

### Individual Risk Factors: Boys

- Nonblack race
- Temperature ≥ 39°C
- Fever > 24 h
- Absence of another source of infection

### Probability of UTI

<table>
<thead>
<tr>
<th>Probability of UTI</th>
<th>Uncircumcised</th>
<th>Circumcised</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1%</td>
<td>a</td>
<td>No more than 2</td>
</tr>
<tr>
<td>≤2%</td>
<td>None</td>
<td>No more than 3</td>
</tr>
</tbody>
</table>

*FIGURE 2*

Probability of UTI Among Febrile Infant Girls\(^{28}\) and Infant Boys\(^{30}\) According to Number of Findings Present. *Probability of UTI exceeds 1% even with no risk factors other than being uncircumcised.*
UTI Disposition

Admit UTI <2mos

>2 mos DC home if OK

Low risk of concurrent meningitis if UTI in healthy

Ceftriaxone/cefdinir
In FUS patients with tachypnea, respiratory distress or O2 sat <95% consider a chest radiograph.

WBC >20K without focal findings also suggests pneumonia.

Occult pneumonia is more common with fever >5d, cough >10d as well.
Limited sensitivity and specificity in this population

**CRP**

- >80 high risk - sens 50% spec 90%
- <20 low risk - sens 80% and spec 70%
Early studies indicate improved sens/spec vs WBC and CRP

**PCT**

>2 high risk - sens 50% spec 90%

<0.5 low risk - sens 80% and spec 70%
Initial approach III appearing

Blood and urine Cx

Empiric antibiotics

CSF studies if warranted
Initial approach well appearing & incompletely immunized*

Risk of occult bacteremia is <5%

If well appearing and <24 hours may elect to get no tests

Otherwise consider CBC and B/C

Urine and U/C for girls <24 months, uncircumcised boys <12 mos & circumcised boys <6 mos

CXR if WBC >20K
Empiric treatment well appearing & incompletely immunized

If WBC >15K give IM or IV Ceftriaxone

If allergic Clinda 10mg/kg IV with an oral dose 8 hours later

PMD follow up in <24 hours

This is AAP rec and based on meta analyses
Initial approach well appearing & immunized

Risk of occult bacteremia is <1%

Labs and empiric antibiotics do not make a difference

Get U/A in high risk groups
What if the blood culture comes back positive?

If persistently febrile get blood, urine and CSF

Children that didn’t get antibiotics but are still febrile have a 33-42% chance of bacteremia and a 4% chance of meningitis

Well, afebrile kids w/ S. pneumoniae have a 9% risk of persistent bacteremia if no antibiotics given

Get another blood culture and continue outpatient PO antibiotics
Fever for a month / He’s been sick since January

First take a good history. Is the temp >100.5 every day?

Multiphasic illnesses are common

Kids have 10-12 unique infections a year
Older children & FUO
Many normal older children have febrile illnesses
Almost none of them have a serious bacterial infection
The febrile fully-immunized child >24-36 months is primarily evaluated by H&P

Toxic, lethargic, excessively irritable, or very ill appearing child is the most reliable clinical predictor of sepsis after 2 to 3 months of age

Remember the risk of bacteremia in fever >39 C is as high as 4-5%, but most of that spontaneously clears in immunized kids
Fever of unknown origin >8 days with no apparent source after H&P

Fever without a source lasting <7 days without focus on H&P
**FUO** has an extensive differential

Usually common disorders with unusual presentations (infections, connective tissue disorders)

Fever frequently revolves without a specific cause found

Most common identified etiology is EBV
Diagnostic approach to FUO

Start with a thorough H&P - gown the child

Assure that the child has indeed had fever

CBC, Blood culture UA and Urine culture, ESR, CRP, Chest Xray, PPD, Renal, Liver, HIV

Also consider EBV, CMV, stool, bartonella

ANA in FH of rheumatic disease - if + suggests underlying connective tissue disorder
Diseases to remember

Fever >5d, conjunctivitis, rash etc., Kawasaki

Nasal discharge and facial pain in sinusitis

Recurrent pharyngitis with ulcers PFAPA

GI complaints? Salmonella, intraabdominal abscess (perf appy), hepatosplenic cat scratch, IBD

Limb/bone pain osteo or leukemia
Empiric treatment and disposition

Avoid antibiotics if possible

Use NSAIDs for suspected JIA

Outcome is generally good - most patients can be discharged home

Always call the PMD!
Common Pediatric Problems: Fever & Respiratory Distress

Brad Sobolewski, MD, MEd
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Respiratory Distress
Respiratory distress accounts for up to 10% of Pediatric ED visits.

Respiratory arrest is the most common cause of cardiac in children.

In infants and young children the key symptoms are tachypnea and retractions.
Babies and small children have a very compliant chest wall with more cartilage.

Baseline respiratory rate, and ability to become tachypneic and the nature of retractions can be impressive.

Baseline oxygen consumption in an infant is 2x adults: 6 mL/kg/min vs 3 mL/kg/min.
Pay careful attention to the child’s mental status

Know normal development and ask parents about baseline in special needs patients

Early air hunger restless and agitated

Late somnolence and true lethargy
Anxiety and crying increases the WOB in young children

Decreasing upper airway diameter

Resistance can increase 4 fold

Increases metabolic demand for oxygen
Sats?

≤90 percent indicate significant tissue hypoxemia

Pulse oximetry is generally accurate to ≥ 70% SpO2

Methemoglobinemia, carboxyhemoglobinemia) result in erroneous readings – use a co-oximeter in the case of suspected carbon monoxide poisoning

Poor probe placement - location affects response time

Averaging takes place over at least 5-20 seconds

tells you nothing about ventilation…
Falsely low sats

Probe removal by the patient, improper placement, or motion artifact

Poor peripheral perfusion

Severe anemia (hemoglobin <5 g/dL)

Hypothermia

Venous congestion

Fingernail polish
Cyanosis is seen more often with poor cardiac output/shock and low arterial oxygen.
Vitals are vital!
Normal RR varies by age

Respiratory distress leads to increased sympathetic tone and thus Tachycardia

Bradycardia in a hypoxemic child is ominous and suggests impending badness and arrest
Upper airway obstruction
Upper airway obstruction
Sniffing position
Nasal flaring
Prolonged inspiration
Supraclavicular & suprasternal retractions
Hoarseness
Hot potato voice
Stridor
Barky cough
Airway Foreign Body

Choking, gagging, or changes in voice, and/or stridor, are likely to have an upper airway obstruction

History of possible swallowed foreign body is often present

Keep them calm!

If stable OR with ENT

If hypoxic and AMS immediate airway control (Critical Airway team)

“Awake look” with ketamine
Epiglottitis

Rare in the post HiB vaccine era

Child is toxic, anxious appearing, febrile, drooling with muffled voice

Sniffing position

Immediate intubation - consider “awake” ketamine + topical lido and your best intubator
Bacterial tracheitis

Staph

Abrupt intermittent oxygen desaturations - purulent material clogs and ball-valve

Intubate the very sick/toxic

Neck radiographs reveal shaggy tracheal border due to tracheal edema, and tracheal foreign body due to sloughing of tracheal mucosa
Retropharyngeal cellulitis/abscess

Usually doesn’t cause airway obstruction unless very significant and toxic child

Toxic children can’t tolerate being supine
Croup
Laryngotracheobronchitis

Viral inflammatory condition of the subglottic airway (80% Parainfluenza)

6 months - 5 years

Hoarse voice, “barky” cough, low-grade fever, stridor, resp distress

Peak time of presentation 10PM to 4AM

Daytime patients are more likely to be admitted
General pearls

Keep the child calm

Airway resistance increases 4-fold in the crying child
Dexamethasone

0.6 mg/kg PO

NNT to prevent one additional return visit to ED is 5, 10 or 13 (depending on which study you read)

It also reduces croup scores 6 hours after treatment, decreases LOS, and decreased need for racemic epi

Give it to everyone with croup - especially mod-severe
Racemic epinephrine

Reduces airway edema through local vasoconstriction

Use in stridor at rest

Observe 2-3 hours after administration
Children with impending respiratory failure have...

- Fatigue and listlessness, depressed mental status
- Marked retractions
- Decreased or absent breath sounds
- Tachycardia out of proportion to fever
- Cyanosis or pallor
Other therapies

Cool mist doesn’t really make a difference

Intubate with care - and with a 0.5 to 1-0 size smaller ETT

Can give continuous racemic epi
Discharge criteria

No stridor at rest
Normal sat
Good air exchange
Normal color
Normal level of consciousness
Tolerated PO
Reliable caregivers
Lower airway obstruction
Lower airway disease

- Nasal flaring
- Prolonged expiration
- Intercostal & subcostal retractions
- Grunting
- Wheezes
- Rales
- Pulsus paradoxus
- Pleural rub
- Tripod position
Pro-Tip Anaphylaxis can have upper and lower airway obstruction
Bronchiolitis
Rare in the first month of life

Peak 2-5 months

90% of kids will have it by age 2

**URI Symptoms**
- Rhinitis

**LRTI Symptoms**
- Tachypnea
- Cough
- Wheezing
- Crackles
- Accessory muscle use
- Nasal flaring
- Fever in only 30%
Adapted from Swingler GH, Arch Pediatr Adolesc Med 2000
If they have a fever...

1/33 risk of UTI

More likely that it is d/t bronchiolitis alone or AOM
<table>
<thead>
<tr>
<th>Therapies that help</th>
<th>Therapies that don’t really help</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suctioning</td>
<td>Albuterol</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Racemic epi</td>
</tr>
<tr>
<td></td>
<td>Hypertonic saline</td>
</tr>
<tr>
<td></td>
<td>Corticosteroids</td>
</tr>
<tr>
<td></td>
<td>CPT</td>
</tr>
<tr>
<td></td>
<td>Antibiotics (duh)</td>
</tr>
</tbody>
</table>
Infants at risk for rapid progression

Adjusted gestational age <42-44 weeks
<3 months old
Gestational age <34 weeks
Congenital heart disease
Respiratory rate ≥70
O2 sat <95%
Infants with apnea or severe distress may benefit from HFNC
Discharge Criteria

RR generally <70
O2 Sats >90% when awake
Adequate oral intake
Mild to moderate increased work of breathing
Reliable caretaker
Able to secure follow up
Asthma
Bronchoconstriction

Mucous plugging

Airway inflammation
Patients predisposed to near fatal asthma

Reduced sensation of airway resistance

and

Decreased hypoxic ventilatory drive
Type I 80%

Slow onset fatal asthma

Inadequate therapy, compliance and psych factors

Progressive obstruction in patients already using bronchodilators but undertreated with systemic corticosteroids

Maximal bronchodilation - but persistent airway inflammation

Further Beta agonists don’t help
Type II 20%

Rapid onset fatal asthma

Sudden asphyxia

Little to no mucous plugging and inflammation

Higher incidence of resp arrest, mucous plugging and low pH

But - they get better faster with aggressive beta agonist use
Assessment of severity in the ED

At CCHMC we are moving to Pediatric Respiratory Assessment Measure (PRAM) from WARM-E
WARM-E was designed to wean frequency of albuterol (inpatient goal)

**PRAM has...**

Been validated in multiple pediatric EDs

Good inter-rater reliability

Strong ability to predict need for admission
<table>
<thead>
<tr>
<th>Criteria</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen Saturation</td>
<td>≥ 95%</td>
<td>92-94%</td>
<td>&lt; 92%</td>
<td></td>
</tr>
<tr>
<td>Suprasternal Retractions</td>
<td>Absent</td>
<td>Present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scalene (Neck muscle) Use</td>
<td>Absent</td>
<td>Present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Entry *</td>
<td>Normal</td>
<td>↓ at the base</td>
<td>↓ at the apex and the base</td>
<td>Minimal or absent</td>
</tr>
<tr>
<td>Wheezing $</td>
<td>Absent</td>
<td>Expiratory only</td>
<td>Inspiratory (+/- expiratory)</td>
<td>Audible without stethoscope or silent chest (minimal or no air entry)</td>
</tr>
</tbody>
</table>
PRAM

Max = 12
Mild = 0-3
Moderate = 4-7
Severe = 8-12
Nebulized treatments

3 BTB albuterol + ipratropium nebs reduce the risk of admission (RR=3.2)*

Mild patient can get one neb with reassessment

Moderate to severe? Give all three and use the ED ASTHMA order set
**Indications for Intubation**

- Hypoxia unresponsive to other interventions
- Muscular fatigue (severe, unremitting WOB)
- Depressed/altered mental status, inability to protect or maintain airway
- Respiratory failure is progressing despite maximal therapy
- Severity of illness
  - High risk of death
  - Severe acidosis
  - Hemodynamic instability
  - Arrest

**Corticosteroids**

Early administration reduces LOS

**Dexamethasone vs prednisone?**

No difference in risk of relapse at

- 5 days RR 0.90, 95% CI 0.46-1.78
- 10-14 days RR 1.14, 95% CI 0.77-1.67
- 30 days RR 1.20, 95% CI 0.03-56.93

Patients who got dex vomited less often in the ED - RR 0.29, 95% CI 0.12-0.69 / and at home RR 0.32, 95% CI 0.14-0.74

**In STS? IV, IM or PO**
IV Magnesium

No significant improvements in peak flow overall

In severe patients those receiving Mag have a reduced risk of admission (OR = 0.10, 95% CI: 0.04 to 0.27)

There were no clinically relevant changes in vitals or adverse side effects

You can try Mag and discharge home - but you need an IV
Indications for Intubation

- Hypoxia unresponsive to other interventions
- Muscle fatigue (severe, unremitting WOB)
- Depressed/altered mental status, inability to protect or maintain airway
- Respiratory failure is progressing despite maximal therapy
- Severity of illness
  - High risk of death
  - Severe acidosis
  - Hemodynamic instability
  - Arrest

**Terbutaline**

IV or SQ beta agonist

Mag is used first in general at CCHMC

Ordered from pharmacy in Epic, takes considerable amount of time to prepare, as multiple vials must be broken open to prepare proper bolus dose and drip
**Ketamine**

Direct smooth muscle relaxant (bronchodilator effects)

Use therapeutically or for light sedation, anxiolysis, application of BiPAP, etc.,

**Bolus dose:** 0.5-1mg/kg (max 100mg) IV

**Continuous IV infusion:** start at 1-2 mg/kg/hr and titrate by 1mg/kg/hr, max 8mg/kg/hr (order from pharmacy)

**IM (no IV access):** 3-7mg/kg
When do I get a gas in status asthmatics?

Altered mental status

Persistent hypoxia despite oxygen treatment

Shock
Why do you want to avoid positive pressure/intubation in status asthmatics?

Barotrauma

Increased intrathoracic pressure reduces preload leading to shock
Cardiac
Respiratory symptoms in cardiac disease

Murmurs

Gallop

Rales

JVD

Hepatomegaly

Peripheral edema

Pulsus paradoxus
Myocarditis with heart failure

Fever and be in respiratory distress due to compromised cardiac function

Mimics bronchiolitis - but gets WORSE with IV fluids

Coxsackie B is the most common cause of myocarditis in children

NEW murmur or gallop - very hard to hear when patients are crying/tachypneic

Large cardiac silhouette on CXR

consider bedside US and formal echo + EKG

troponin I can be elevated - specific level not known
Wrap up
LOOK
for signs of air hunger/hypoxia
REMEMBER

that the initial response to respiratory compromise is usually tachypnea
KNOW
that slow / irregular / apneic breathing is an ominous sign
UNDERSTAND that pallor and cyanosis can be seen with hypoxemia, shock or both
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