Pediatric Fever
4th Year EMC

Febrile Infant

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Emergency Medicine Grand Rounds

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Take home points

- Fever is okay
- Dehydration is not
- Immunizations are important
- In general, I don’t care about viruses
- I (we) are looking for the “needle in the haystack” bacterial infection

Febrile Infants

- 11% of ED visits
- Infectious and non-infectious causes
- 20% are without source
  - Serious bacterial causes to rule out (**BC**)
    - THE NEEDLES IN THE "FEVER HAYSTACK"
      - Meningitis, bacteremia, UTIs, pneumonia

What Is Febrile?

- 38C or 100.4F
- Fever should be rectally measured
- Tactile fever
  - mom's are correct 80% of the time when they say there child felt hot (the child actually has a fever)
- Fever (rectal) at home = ED fever
  - 6/63 pts with a bacterial cause in a large study were afebrile at office
    - JAMA 2004;291(10):1203– 12

Interesting Facts

- Bundling makes no difference in core temp
  - Pediatrics 1994;94(5):669–73
- Duration of fever does not change chance of occult bacteremia
  - Pediatr Emerg care 1997; 13(5):317–9
- Response to tylenol/motrin does not change chance of occult bacteremia
  - Arch Ped Adolsc Med 2004, 158(10):9726
- Fever is body's defense mechanism
  - Reduces iron in blood so not available for bacteria/virus replication

Fever Pathophysiology

- Fever
  - the body increases the temperature to try and fight infection (it turns up the thermostat)
  - the body tries to generate heat to meet the new set temperature => shivering and chills
  - antipyretics (Acetaminophen/Ibuprofen)
    - reset the body's thermostat to normal
    - the body tries to lose its extra head => sweating to get rid of heat => "temperature breaking"

H&P

- Record fever and method
  - Higher fever = increased chance of occult bacteremia
    - <3mo with 40.8^0 C/105.4 F, 38% have serious bacterial infection
      - Pediatr Emerg Care 2005;21(5):291 –4.
- Were antipyretics given?
- Are immunizations UTD?
- Underlying medical conditions
  - Premature/indwelling cath/family history
- Sick contacts? Daycare?

H&P

- Smiling?
- Playful/Interactive/Tone/Grasp
  - After tylenol/motrin given?
- Eating/wet diapers (>3 in 24h period)
  - Eating is the hardest a thing child does during day
- Sleeping more than normal

Physical Exam

- Recognizable viral conditions
  - Croup, chickenpox, flu, and stomatitis
    - Decrease prevalence of BC
      - Pediatr infect Dis J 1999;18(3):258– 61
      - Pediatrics 2005; 115(3):710–8
  - AOM does not matter
      - Pediatrics 1991;87(1):48– 53
      - Pediatr infect Dis J 2002; 21(7):669– 74

The Fever

- Identifiable cause
  - Treat condition
- Toxic
  - Full workup
- **FWS but look well after an antipyretic**
  - **The rest of this discussion**

Age Divisions

- Not exact science, but estimates for good reasons

0-28 Day Olds

- Immature immune systems
  - Decreased opsonin activity, macrophage function, and neutrophil activity
- Often appear clinically well until crash
- 4% with a serious bacterial infection manifest only a fever
- Boston/Philadelphia/Rochester criteria all miss important cases
  - 4-8% BC classified as low risk

0-28 Day Olds

- 12% to 28% of all febrile neonates have serious bacterial illness
  - Group B streptococcus (GBS)
    - Menigitis 40% /sepsis 7%
    - Devastating, most common <7d old
  - Escherichia coli
    - UTI, urosepsis
  - Listeria monocytogenes
  - HSV
    - Arch Pediatr Adolesc med 1999;153(5):508–11
    - Pediatr infect Dis J 1997;16(1):59–63
    - Clin Pediatr (Phila) 2000;39(2):81–8

0-28 Day Olds

- Fever mandates full workup regardless if complaint looks or sounds viral
- RSV infections have same rate of serious bacterial infections as RSV negative
  - Unlike in older children where decreased
    - Pediatrics 2004;113(6):1728–34

0-28 Day Olds

- **Full sepsis evaluation:**
  - Blood culture
  - Urinalysis with culture
  - Lumbar puncture
  - CBC with manual differential
  - Chest film (if respiratory symptoms are present)
  - Stool cx and WBC count if diarrhea present
  - Consider HSV studies

0-28 Day Old Plan

- **Admit**
- Empiric antibiotic therapy (IM/IV) <2h:
  - Gentamicin 2.5 mg/kg/day OR
  - Cefotaxime 100-200 mg/kg/day
- Ampicillin 200 mg/kg/day
- Consider acyclovir

1-3 Month Olds

- Minimal benefit from PCV-7
  - Few (<10%) BC from *S pneumoniae*
  - Early for immunizations
- Test proven virus halves the risk of serious bacterial infection (8% to 4%)
  - (enterovirus, respiratory virus, rotavirus, and herpes virus)
  - Most AGE had UTI
    - Pediatrics 2004;113(6):1662–6

Rochester Criteria

- < 60 days old
- Previously healthy, and had no evidence of skin, soft tissue, bone, joint, or ear infections
- WBC 5-15 with normal band counts (<1500)
- UA <10 WBC
- Stool <5 WBC if diarrhea
- Neg PV of 98.9%
- 1-6% BC missed of validation studies
  - Am J Emerg Med 1997;15(3):299 –302.

Boston Criteria

- 1-3 mo old
- They generally appeared to be well (not strictly defined) and had no ear, soft tissue, joint, or bone infections on physical examination
- CSF <10 WBC
- UA <10 or negative LE
- WBC <20k
- ? CXR (<95% sat, tachypnea, rhonchi)
- All got Rocephin 50mg/kg IM
- **27/503 (4.6%) ended up with BC**

Philadelphia Criteria

- 29 and 56 days old
- WBC of <15 with <20% bands
- UA <10 WBC and few bacteria
- CSF <8 and negative
- CXR neg
- ? Stool WBC <5 and neg blood
- No abx
- 65/747 (8.7%) serious infections and all caught
  - Follow up study of 10% of 422 pts caught as well

1-3mo Olds

- Most UTIs
  - E-coli
- Few pneumococcal (5-7%)
  - Little benefit from PCV-7
- ? LP →strongly consider
  - Rochester no/ Philadelphia/Boston yes
    - Incidence 4.1/1000
      - Consider abx if LP done
        - Acad Emerg med 2005;12(4):303–9

1-3mo Old With Negative Workup

- May d/c home if:
  - Work up negative and child looks well
  - Reliable follow-up within 24 hours
  - Parents have a way of immediately accessing health care prn
  - Parents and PMD understand and agree with this plan of care
  - ***May do Ceftriaxone 50mg/kg if LP done, otherwise no abx***

3mo or Older

- Exam more helpful now
  - Smiling, eating well, playing, interactive
- Toxic, ill, vs well-appearing children
  - 92% versus 26% versus 3%, respective risk of serious infection
    - Pediatrics 1982;70(5):802–9

Hib Vaccine

- Pre-vaccine era
  - Hib was 13% of BC with 42% complication rate
- Post-vaccine era
  - Combining Boston/Philadelphia BC
    - 0% were Hib
  - Hib was 1.6% of BC

Other Sources of BC

- E-coli
  - Most in 3-6mo old
  - Most if not all have UTIs
- Salmonella
  - 4-8% of BC (0.1% of FWS)
  - 95% have GI symptoms and >50% nl WBC
  - 41% had persistent + BC (no change with abx)
- Meningococcal
  - Most common cause of meningitis
  - 0.02% of pts non-toxic with fever >39C
  - Most very toxic appearing
  - Empiric treatment for high risk (petechia,contacts)
    - Arch Pediatr Adolesc med 2000;154(6):556–60

What about testing?

- WBC?
- Blood cultures?
- Clinical judgment?
- UA?
- CXR?

Should we get a WBC?

- Abnormal
  - >15K-20K
  - <5K
  - >20% bands
- ANC
  - 8% with ANC >10,000/mm occult pneumococcal bacteremia,
  - 0.8% with ANC <10,000/mm3 have occult pneumococcal bacteremia
    - Ann Emerg Med 1998;31(6):679–87

The WBC...the test to nowhere

- Increased risk of bacteremia with an increasing WBC
  - WBC of 15K
    - Sensitivity 74% to 86%
    - Specificity 55% to 77%
      - Arch Pediatr Adolesc med 1998;152(7):624–8
      - Pediatr infect Dis J 2006;25(4):293–300
- WBC showed no difference vs controls with:
  - Salmonella, staphylococcus aureus, and Neisseria meningitidis bacteremia

Do We Need Blood Work?

- Increasingly low rates of bacterial illness
- Vast majority have E. coli UTIs
- Rarity of meningococcemia and salmonella bacteremia
- Limits of WBC
- FP>TP (further unnecessary testing)
  - < Contaminate in separate draw of culture
    - JAMA 2003;289(6):726– 9

Blood Work If Any

- Blood culture if anything
  - # Of blood cultures ordered by pediatricians (but not by ED physicians) has fallen by 35% in the northern California Kaiser Permanente system
- WBC limited screening tool
- Address parental preferences

Is Clinical Judgment Good Enough?

- Lee and colleagues
  - When prevalence rate of pneumococcal bacteremia dropped to 0.5% (the present rate):
    - No testing or abx was the most cost effective
      - Pediatrics 2001;108(4):835–44
    - In the Post PCV7 era, we start at a 0.7% bacteremia rate

Clinical judgment is good enough except for those with...

- Premature with complications
- Prolonged hospital stays after birth
- Underlying medical conditions
- Indwelling medical devices
- **Fever > 5 days**
  - **Kawasaki**
- **Patients already on antibiotics (last 48h)**

Antibiotics in Pre-PCV-7 Era

- Ceftriaxone
  - 284 NNT of proven BC to prevent 1 meningitis
    - Acad Emerg med 1997;4(7):679–83
  - Most BC resolve spontaneously
    - 17% BC go on to focal infection/2-4% meningitis
      - Pediatrics 2000;106(3):505–11
      - Pediatrics 1997;99(3):438–44
      - Pediatrics 1993;92(1):140–3
  - **>2500 NNT** post-PCV7 to prevent 1 meningitis

UTI

- Gorelick and Shaw Clinical Decision Rule
  - When to get a UA?
  - 95-99% sensitivity

UTI Gorelick and Shaw Clinical Decision Rule

- UA/UC in:
  - 1. All children ≤6 months
  - 2. Girls <24 months if 1 or more of:
    - Fever ≥2 days
    - White race
    - No alternative source of fever
  - 3. Uncircumcised boys <12m
  - 4. Patients with temperatures 38.3-38.9°C if they have two or more of the above risk factors

UTI Complications

- Vesicoureteral reflux in 30% to 50% of kids with UTIs
- Scarring
  - 30% can develop HTN
  - 10-20% of children with ESRD had pyelo at some point

UTIs

- Overall prevalence in children is 2% to 5%.
  - 5% of febrile episodes in infants <1y.
  - 16% of white girls <2yo with temp of 39C and FWS.
    - Uncircumcised 9x higher risk UTIs
  - 2.7% to 3.5% of febrile children, even when there were other potential sources of fever.
- Outpatient abx (Cefixime or cephalexin).
  - for 7-14 days.

CXR

- 1. Obtain CXR:
  - If patient has hypoxia, tachypnea, respiratory distress, abnormal breath sounds regardless of temperature
- 2. Consider CXR
  - If no other source identified, temp 39°C and WBC >20,000/mm3 (if obtained), prolonged cough or fever

Is it Pneumonia?

- Clinical picture with CXR
  - Tachypnea, crackles, respiratory distress, or decreased breath sounds
- Don’t depend on just CXR
  - Variability in the interpretation even between pediatric radiologists
  - Not reliable in distinguishing between bacterial and nonbacterial causes
    - Pediatr infect Dis J 1996;15(7):600–4
    - Clin Pediatr (Phila) 1989;28(6):261–4
    - Clin Pediatr (Phila) 1981;20(11):686–91

Pneumonia ABX

- Most can go home if good follow up situation and doing well
- Amoxicillin
  - (80 mg/kg/d divided twice or three times daily)
- Macrolides
  - zithromax
- Treatment duration **7 to 10** days

Positive Blood Culture

- Toxic or febrile on repeat exam
  - Admit
  - Repeat blood culture
  - LP
- Well appearing and afebrile on repeat exam
  - High rate of contamination (FP>TP)
    - Pediatrics 2000;106(3):505–11
  - High rate of spontaneous clearance
  - Outpatient observation:
    - Repeat blood culture and oral antibiotics

Future in Peds Fevers

- Less likely to order blood work or abx
- New/broader PCV in development
  - Nonvaccine serotype pneumococcal
- New tests in pipeline to detect bacterial causes

Summary

- 0-28 day olds:
  - Full septic workup regardless of findings
  - Admit with broad spectrum abx
- 28-60 day olds:
  - Same with strongly considered LP
  - CXR/stool: when clinically indicated
    - **Any tests abnormal: admit with ceftriaxone 50-100mg/kg**
    - **All tests normal: Consider home with close and reliable follow up**
      - **No antibiotics if no LP!!**

Summary

- 60-90 day olds:
  - May go either way
  - If feel comfortable with skills treat as 3-6mo
- 3mo – 6mo with Immunizations UTD :
  - If look well:
    - UA/UC via catheterization if rule/indicated
    - Consider CXR/stool if clinically indicated
      - If all negative: consider home with close/reliable follow up
- >6mo and Immunizations UTD
  - Same as 3-6mo but feel even more comfortable with home close/reliable follow up

Summary

- Toxic patients
  - Full workup, antibiotics, admit
- More work up if:
  - Immunocompromised/special pts discussed
  - Communication barrier
  - Immunizations not UTD
  - Follow up problems

Summary

- **These are guidelines**
  - They do NOT replace clinical judgment
- **Talk with the parents**
  - Be familiar with the data to help them **understand**
  - No test is perfect
    - Things change. If for the worse, come back
  - **Close follow up is the key**
- **We are not Burger King**
  - We should not be bullied into useless WBCs, etc.

Summary

- Fever is okay.
- Look for a source.
- We don’t want to miss a bacterial cause...but if your immunizations are UTD odds are small its bacterial
- If the source is a virus...We can’t fix it...that includes the flu.
- Avoid dehydration with the fever.

Thanks…

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