



Approach to the Febrile Child

What should you do with the febrile child who “looks great” but has no identifiable source of infection? A cost-effective, age-based approach to the evaluation of a febrile child will be discussed. Current published guidelines for the management of febrile children will be addressed.

- Define an age-based, cost-effective approach to the febrile child.
- Define the role of laboratory tests in the diagnostic evaluation of the febrile child.
- Discuss the value of published guidelines for the evaluation of the febrile child.

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FACULTY

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Controversies in Pediatric Fevers

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Overview: Children with fever are the most common non-traumatic emergency department pediatric presentations. Despite the frequency of these visitors there is no firmly established consensus as to how to managed these patients. Conflicting information, incomplete data and shifting infection patterns combine to prevent the development of a unified approach to febrile children. This session will review some of the controversies surrounding the current treatment of febrile children.

Some definitions:

Fever without a source (FWS): Febrile child with no source of infection on either physical exam or laboratory or x-ray evaluation.

Occult bacteremia (OB): Bacteria present in the blood of a child with no physical evidence of the presence of the bacteria, i.e. non-toxic child.

Serious bacterial infection (SBI): The presence of one of the following: Pneumonia, meningitis, sepsis, septic arthritis, cellulitis, bacterial diarrhea and the like. Some authors will include persistent bacteremia in this group.

Full septic work up: Blood cultures, urine cultures, CBC, U/A, Lumbar puncture, CXR (if symptomatic), stool culture if symptomatic.

Rochester criteria: Set of criteria for evaluation and discharge of febrile neonates between 4 and 8 weeks of age.

Full term	CBC (<15,000)	CXR (optional)
Non-toxic	Bands (<500)	Stool WBC (neg)
U/A & CS	LP	Good Follow up

This session will present the questions most commonly raised in a clinical encounter with a febrile child.

Does this child have a fever?

Traditional definition: Rectal temperature in excess of 100.5 F (38.0 C)

Historical Fevers: Variable accuracy:

If measured with thermometer: More accurate

Individual variability: 67% mothers noted knew how to read a thermometer, 10% accurately read preset thermometers.

Tactile fevers: 84% Sensitive **76%** Specific

Bundling: Elevates tactile temperatures, not core temperatures.

Axillary and Tympanic Temperatures are Unreliable in Infants and Small Children.

Does the child's age matter?

Three traditional age specific variations in evaluation of febrile child.

Age	Diagnostics	Disposition	Management
0-4 wks	Full Septic W/U	Admit all	+/- Antibiotics
4-6 wks	Rochester Criteria	+/- Admit	Antibiotics all
6w-24m	Variable	Discharge	+/- Antibiotics

That used to be easy but now someone's changing the rules.

Age 0-4 weeks: Septic **w/u** (optional LP) **94-99%** accurate in identifying neonates at low risk for SBI and candidates for out patient observation without antibiotics.

Missed infections were 8 **UTI** and 1 meningitis in 634 patients . (Chiu)

In study comparing Emergency Physicians and Pediatric Emergency Physicians, the Emergency Physicians were less likely perform a septic **w/u** compared to **Pediatric** Emergency Physicians. (Schweich)

Age **4-6 wks**: Philadelphia Criteria: (Baker)

Full term, Non-toxic, Negative Physical Exam

CBC: Band / Neutrophil count **<0.2**

U/A: **< 10 WBC/ HPF**, No Bacteria on Gram stain

LP: **<8 WBC/mm³**, No Bacteria on Gram stain

CXR: Negative

Stool smear: Negative blood, Few WBC on smear

422 Patients over 36 months

43 SBI: All identified by Philadelphia Criteria

101Low Risk / 94 Managed as Outpatient No Antibiotics

Age 6 wks to 24 months: Over 200 articles on this topic in last 10 years.

How big is this problem?

Four Basic Febrile Child Scenarios that an Emergency Physician Can Face

Presentation	Evaluation	Disposition	Treatment
Well with source	H/P-Specific Test	Depends on Source	Source Specific
Toxic with source Antibiotics	Septic W/U	Admission	Parental
Toxic no source Antibiotics	SepticW/U	Admission	Parental
Well no source	H/P &?	Discharge	?

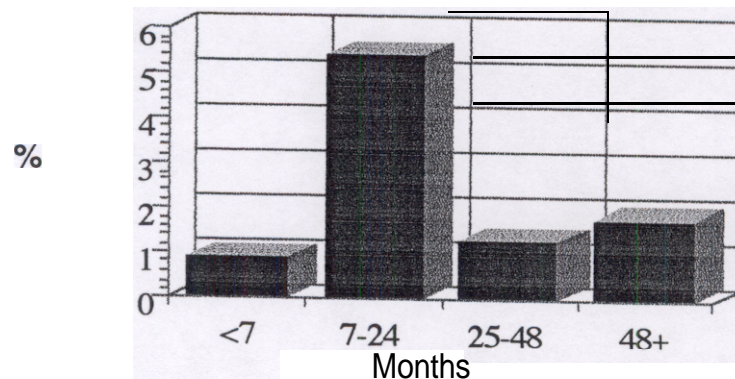
What am I looking for in the Fever Without a Source Child?

Two conditions: Occult Bacteremia and Serious Bacterial Infections.

Occult Bacteremia occurs in 1.3% to 9.8% of febrile children less than 24 months.

There are some trends: Age of presentation

Age of Presentation



Age < 24 months single predictor of **occult** pneumococcal bacteremia in a febrile population.

Effect of Temperature	
Temperature	% Bacteremic
38-39.9 C (102-103.9 F)	3-5%
40-40.5 C (104-104.9 F)	7%
40.5-41 C (105- 105.8 F)	13%
> 41.1 C (106 F)	26%

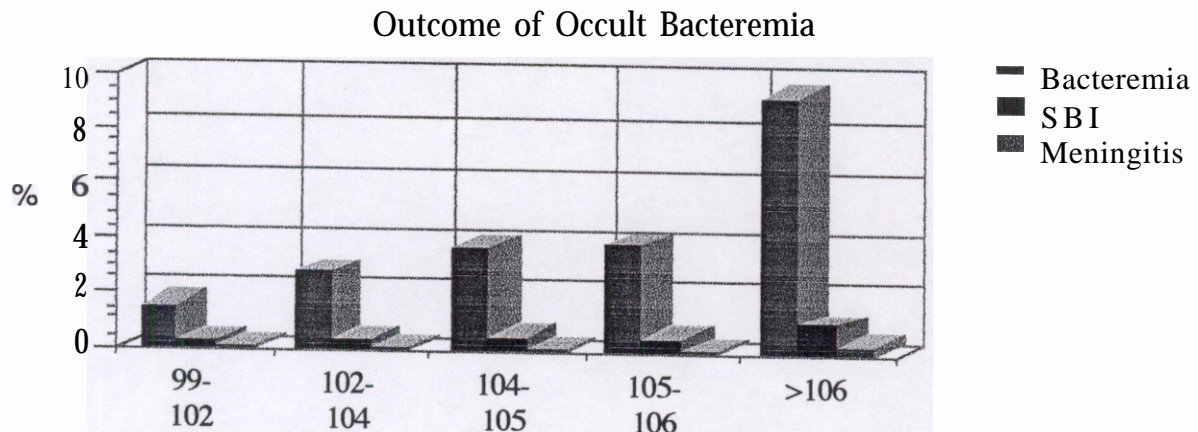
There is no statistically significant difference between 38 C to 41.1 C making a temperature distinction unreliable.

Occult Bacteremia is also a moving target. With introduction of HIB vaccine, incidence of H. influenza has decreased from 15% of OB in 1985 to < 2% in 1995. Currently up to 98% of O.B. is now caused by S. pneumoniae.

Effect of Temperature Pneumococcal Bacteremia	
Temperature	% Bacteremic
39.0-39.4 c	1.2 %
39.5-39.9 c	2.5%
40.0-40.4 c	3.2%
>40.4 c	4.4%

Bacteremia more common in children with fever c 1 day, but not statistically significant.

So is Occult Bacteremia a Bad Thing?



Depends on the cause. H. influenza and N. meningitis will generally lead to a serious bacterial infection in most cases of occult bacteremia. S. pneumoniae, produces an SBI in only approximately 3-8% of cases.

Well then how do I approach a febrile child?

History and Physical Exam: Can this be quantitated?**Yale Observation Scale:**

Item	Normal (1)	Moderate (2)	Severe (3) Impairment
Cry	Strong	Whimpering	Weak
Parent Reaction	Consolable	Cry on & off	Inconsolable
State Variation	Awake	Diff. awaken	Not arousable
Color	Pink	Pale limbs	Mottled
Hydration	Normal	Dry mouth	Dehydrated
Response	Smile or alert	Brief smile	No smile

Score greater > 11 generally indicative of serious illness.

Ability to identify ill children is variable and experience dependent.

YOS	Sensitivity to Identify Bacteremia	Specificity
>8	16.7 %	91.6 %
>10	5.5 %	96.7 %
>12	0.5 %	98.8 %

That's why they call it occult bacteremia.

Simple Hospital Triaging System: Sensitivity 91% Specificity 72%

Pallor	Decreased Activity Drowsiness	Chest Wall Recession Feeding < 50% normal
Hospital Intervention	Number of Variables	
38%	1	
69%	3	

Response to antipyretics?

Ibuprofen and Acetaminophen equally effective

Sponging is of no value

Decrease in temperature does not indicate the absence of an SBI

Lack of a decrease implies an SBI

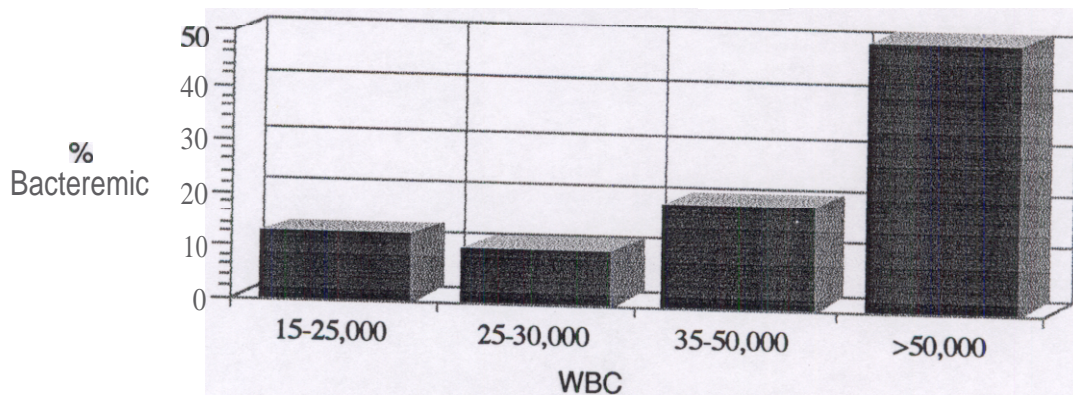
i.e.: Lack of effect is specific but not sensitive.

Are Laboratory Studies of Any Value? CBC, Cultures, U/A, LP, etc.**CBC: A great discriminating test for febrile children?**

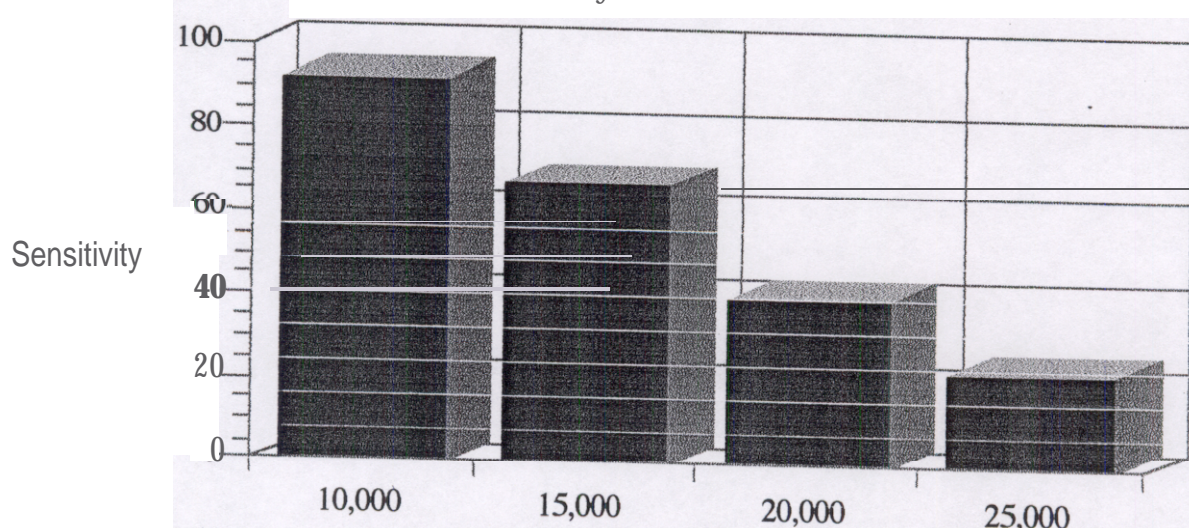
CBC is a relatively specific test if elevated but not a sensitive test.

i.e. if it is high the patient is like to have a bacteremia if it is not high it does not mean the patient does not have a bacteremia.

Incidence of Occult Bacteremia with WBC



Sensitivity of WBC



Other studies have shown sensitivities of 48-77%

Procop GW: Am J Clin Path. 1997
 155 with CBC vs 838 without CBC
 Sensitivity CBC 70%
 WBC > 15,000 Specificity 77%
 PPV for antibiotic use 94%

Sensitivity for specific illness:

Virus	25%
Pneumonia	64%
UTI	62%
Meningitis	50%

Prior to H. flu vaccine WBC had no discriminating ability. H. flu infections frequently had normal CBCs. With decrease in H. flu infections CBC more sensitive. Still the case with meningococcal disease.

Kupperman N: CBC revisited
 381 Children with meningococcal disease vs 6414 controls
 No difference in temperature, WBC, Absolute Neutrophil Count
 Difference in Absolute Band Count

Kupperman N: Closer look at immature neutrophils:
 100 patients: 31 Bacterial Infections, 69 Viral Infections
 No difference % Bands, Absolute Band Count, Band/Neutrophil Ratio

For pneumococcal infections the incidence of occult bacteremia is:

WBC < 15,000: 1.3 %-2.6% bacteremic
 WBC > 15,000: 8.2 %-13% bacteremic

For Pneumococcal Occult Bacteremia:

WBC 15,000 Sensitivity 70-87% Specificity 68-71%
 ANC 10,000 Sensitivity 66-84% Specificity 76-79%

Blood Cultures?

20-40% false positive

24-48 hour response time

58% of children return prior to culture results

False positive may not be known until 30 hrs. compared to
19 hrs. for true positives

43% (162 of 375) patients were either hospitalized, received parental therapy
or had a change in therapy based on false positive cultures.

98% Strep pneumoniae: 2% Will return with SBI prior to culture results.

Urinalysis?

UTI: 5% Fever Without Source patients

Females 2.27 x's male rate

Age	Incidence		Circumcised 0.2-0.4%
	Male	Female	
<1	3.3%	6.5%	
1-2	1.9%	8.1%	

Urine Culture: Suprapubic or Catheterization

Standard U/A: False negative

Test	Sensitivity	Specificity
Leukocyte esterase	83%	78%
Nitrite	53%	98%
LE or Nitritie Positive	93%	72%
Microscopy: WBC	73%	81%
Microscopy: bacteria	81%	83%
LE or Nitritie or Microscopy Positive	99.8%	70%

Other Studies

Enhanced U/A-Hemocytometer

10 WBC/cm - 96% Sensitive

Pyuria may occur secondary to fever alone

43% Febrile patients

6% Afebrile patients

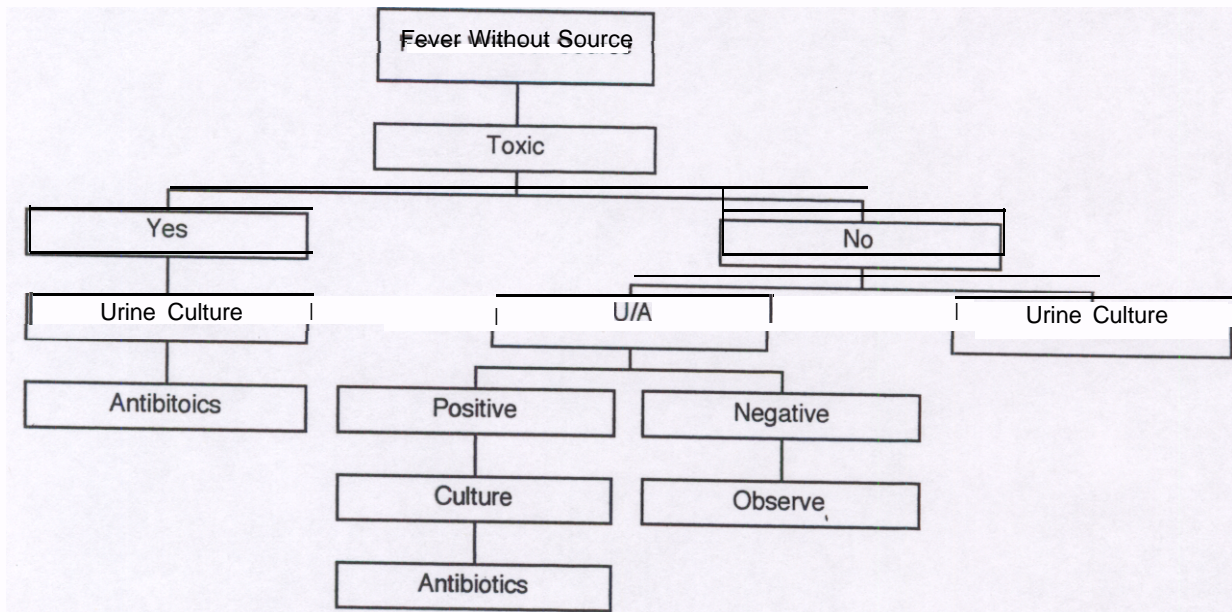
Diaper Specimens

WBC- 40-70% of catheterization specimens

100% Sensitive

94% Specific

Gold Standard is Urine Culture from Straight Cath or Suprapubic Aspiration
 Bagged Specimen 85-99% False Positive Incidence



Chest X-rays:

Clinical Indications

Rales	Ronchi	RR > 50 pm
Wheezing	Retractions	Coryza
Stridor	Nasal Flaring	Cough

Most sensitive seem to be respiratory rate > 60 pm.

Bachur R: Annals Emerg Med.

146 patients: Temp > 39.0, FWS, WBC > 20,000

+ CXR: 40% with Positive Physical Exam

25% with Negative Physical Exam

Occult Pneumonia Indidence 19%

Lumbar Puncture: Protocol Driven < 6 weeks. Clinically Driven > 6 weeks.

Analysis

Latex agglutination: Inaccurate

Urine dip stick: 97%

Systemic Illness

18% Abnormal CSF

33% infection proximity to CSF

Other Studies:

C-reactive protein

Erythrocyte Sedimentation Rate

10-15% PPV

Urine Latex Agglutination

Sensitivity 7.3-61.1%

Treatment: How should I treat the febrile child without a source?

Since no diagnostic study can effectively predict which patients will develop an SBI, the management of these patients must to some degree be expectant.

Empiric Antibiotics:

Advocates for antibiotics:

Barraff; Pediatrics: 1993

Bayesian **meta** analysis 22 articles

Probability meningitis

No Antibiotics: 9.8%

Oral Antibiotics: 8.2%

Parenteral Antibiotics: 0.3%

Harper: Ped Infect Dis: 1995

Retrospective review positive cultures

No antibiotics

Improved: 32% / New focus: 34%

Antibiotics

Improved 83% / New focus: 9%

Bulloch: AEM: 1997

Meta Analysis of Antibiotic Use

Trend to decrease SBI (OR- 0.60)& Menin (OR- 0.12)

Not statistically significant

More pronounced in group later found to be bacteremic.

Oral vs Parenteral

Bass: Ped Infect Dis: 1993

IM ceftriaxone afebrile (97% vs 77%)

Fleisher: J Ped: 1994

IM ceftriaxone/ amoxil 2 meningitis /
5 meningitis

NOT SO FAST?

Vaccinated children oral as good as parenteral

Probably don't prevent meningitis

Close follow up may be as good

Treat thousands uninfected children to prevent
one SBI

Long; J Ped: 1994

Abnormally high + blood cultures (12.8%)

No control for toxic vs well children

Included OM

IM ceftriaxone does not prevent meningitis

2 patients still got meningitis

Jaffe; NEJM: 1987

Prospective oral vs no antibiotic

New infections

10.5% treated

12.5% non treated

Rothrock; Pediatrics: 1997

Repeat with toxic children removed

Antibiotics minimally decrease risk subsequent infection

Do not decrease risk of meningitis

Commentaries; Pediatrics: July 1997
 Studies include H. flu
 Favorable classification schemes
 Analysis only on bacteremic children
 Eliminated all non-bacteremic children

Rothrock, AEM: June 1998
 Parenteral vs Oral Antibiotics in Occult Pneumococcal Bacteremia
 Oral Group: SBI / Meningitis
 3.4% / 0.7%
 Parenteral Group SBI/ Meningitis
 2.3% / 0.9%
 No difference- (Based on only 4 studies in 30 years)

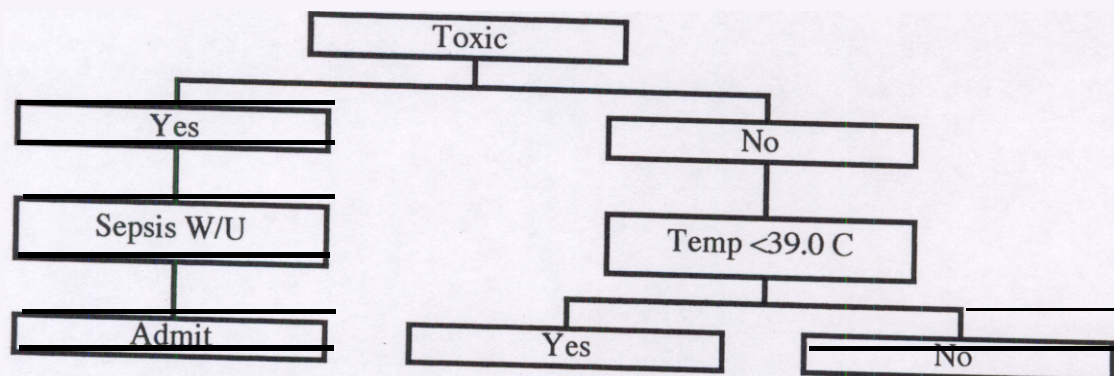
Lee, Arch Ped Adol Med July 1998
 Using WBC Screening
 WBC > 15,000: Treat 19 children without bacteremia for
 every 1 child with bacteremia
 If SBI occurs in 5% of bacteremic children treat 400 children
 for every 1 to develop an SBI

Now I'm really confused.

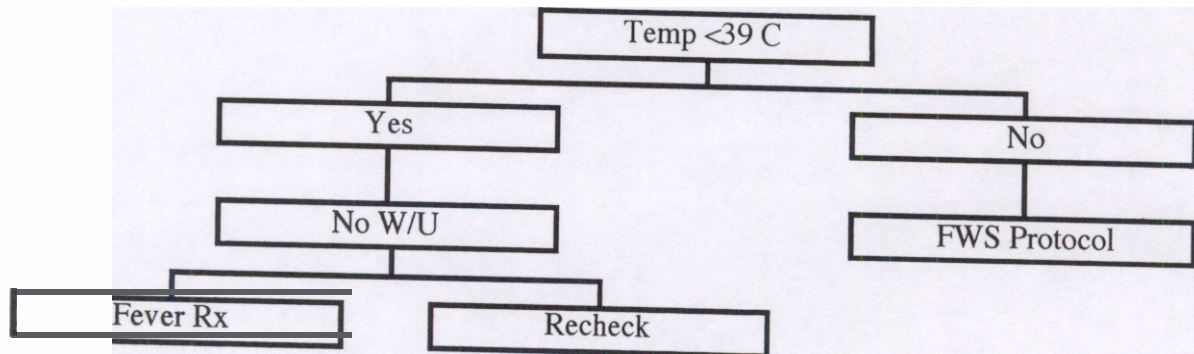
Management Approaches

ACEP Guidelines: 1997 Revisions
 1993 Consensus Paper: Febrile Child Without Source
 Annals Emergency Medicine
 Pediatrics

Fever Without Source



Pediatric Fever



Urine Culture

Males < 6 months

Females < 24 months

Uncircumcised males < 24 months

Stool culture

Blood or WBC

CXR

Chest findings

Antipyretics

Other thoughts

Fever Protocol

Blood Cultures

Option 1: All children > 39.0 C

Identify **3-7%**

98% *S. pneumoniae*

97% no sequelae

Fever Protocol

Blood Cultures

Option 2:

Use Option 1 only if WBC > 15,000

Miss 35% bacteremic children

Fever Protocol

Empiric Antibiotics

All children > 39.0 C

Temp > 39.0 C and **WBC** > 15,000

Over treat vast majority children

Limited protective value with *S. pneumoniae* infections

24 hour follow up

Positive Blood Cultures

S. pneumoniae: re-evaluate

Other: full work up and admit
Urine culture positive
Admit if still febrile

Browne; Arch Dis Child: 1997
Australian study, temp > 39.5 C
WBC > 20,000
RX: IM ceftriaxone

Liu; J Ped: 1991-Cost Effective Rx
No therapy
2 day amoxicillin
BC only
BC + amoxicillin * Best option in this study
Amox if WBC > 10,000
Clinical guidelines

Commentary: Pediatrics July 1997
Careful examination
Treat toxic children
Analyze urine
Close follow up

Yamamoto: AJEM: March 1998
Liu: revisited
Decreased incidence of H. flu.
15% SBI with **PnOB**
Long term effects of antibiotic resistance
Conclusions

1. If you believe negative consequences of treatment are low
Empiric highly efficacious antibiotics
i.e. High bacteremia rate / low **HiB** vaccine rate
2. If you believe negative consequences of treatment are high
Use screening with WBC
i.e. Low bacteremia rate / high **HiB** vaccine rate
3. If you believe negative consequences of treatment very high
No test / No treat
i.e. Increasing pneumococcal resistance

Who's doing what?

1994 survey EM Section AAP

- 11 different temp cut offs for work up
- 17 different age intervals
- 26% no diagnostics
- 45% Blood cultures
- 80% PRN antibiotics

1991 survey Peds & EM residency directors

No therapy for fever without source

1995 survey pediatricians in Utah

- 60-80% practice outside guidelines
- < 5 years in practice more likely follow guidelines.

McGill University

- Number diagnostics studies
- Proportional to years in practice
- Odd ratio 0.81 > 10 yrs. practice

Baker: 6% of Patients 4-8 weeks age managed outside Philadelphia Protocol

Major Urban Pediatric Hospital

- 4.9% Undertreated
- 1.1% Overtreated

Conclusion: There is no conclusion.

Any approach has advantages and disadvantages.

For a non-toxic, febrile infant options include:

Urine culture, CBC, if WBC > 15,000 empiric ceftriaxone.

Urine culture & observation

Anything in between

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