

# **WELL-APPEARING INFANTS WITH FEVER**

**Division of Pediatric Emergency Medicine  
NY-Presbyterian Morgan Stanley Children's Hospital  
Columbia University Medical Center**

**Supported by a grant from the R-Baby Foundation**

# TABLE OF CONTENTS

Definitions.....	3
Vital Signs.....	4
Heights of fever to know.....	4
Rationale for stratifying infants according to age and height of fever.....	5
The four stratification groups (according to age and height of fever).....	5
Overview of management.....	6
Details of sepsis and bacteremia workups.....	7
Why are babies 0-28 days old always admitted.....	8
Low risk criteria for discharge of babies 29-60 days old.....	9
Rationale for management of 61-90 days old.....	10
Detailed evaluation of infants $\geq 91$ days old.....	11-15
Bibliography.....	16-17

# I. Definition of Terms:

1. Sepsis: Fever or other evidence of infection in a toxic-appearing infant or child.
2. Bacteremia: Presence of bacteria in the bloodstream of a well-appearing infant or child.
3. Complications of Bacteremia:  
**“Serious Bacterial Infections” (SBI):**
  - Fulminant septicemia
  - DIC
  - Shock and multiple organ failure
  - Meningitis
  - Bacterial gastroenteritis
  - Serious focal infections
  - Death

## **CLINICAL CONCERN:**

**IDENTIFYING THOSE WELL-APPEARING INFANTS WITH FEVER WHO MAY BE BACTEREMIC AND PROGRESS TO DEVELOP A LIFE-THREATENING SERIOUS BACTERIAL INFECTION (SBI)**

4. “Partial Sepsis Workup”:  
(Infants  $\geq$  61 days old)
  1. CBC and differential
  2. Blood culture
  - Only if indicated:
    - CXR
    - Stool culture
    - Urinalysis and urine culture
5. “Full Sepsis Workup”:  
(Infants  $\leq$  60 days old)
  1. CBC and differential
  2. Blood culture
  3. Straight-cath urine for urinalysis and culture
  4. Lumbar puncture
  - Only if indicated:
    - CXR
    - Stool gram stain & culture

**A full sepsis workup is essentially a Partial Sepsis workup (always including urine) plus an L.P.**

## II. Normal Vital Signs in Infants

NORMAL VITAL SIGNS IN INFANTS			
AGE	RR	HR	SYSTOLIC BP
Full-term newborn (≤ 1 month)	40-60	100-170	60 (FT newborn)
2-5 months	30-50		↓
6-12 months	20-40		70 (12 months)

**NOTE:** Respiratory rates should always be counted for 30 seconds, because infants have irregular periodic breathing (due to immature respiratory centers). Counting for < 30 seconds will produce falsely high, normal, or low results.

## III. Heights of Fever You Should Know:

100.4<sup>o</sup> Triggers workup in infant ≤ 90 days old.

102.<sup>2</sup> Lowest fever ever shown to be associated with risk of bacteremia or SBI in well appearing infants ≥ 3 months old.  
Triggers workup only if unreliable follow-up, or incompletely immunized, or < 6 months old, or prolonged for several days.

105.<sup>o</sup> Higher fever than usually seen with most viral illnesses.  
Triggers workup even in well appearing infants who are fully immunized and have good follow-up.

Children with history of documented fever who are afebrile in the emergency department should be considered to be febrile to the degree reported by history.

Temperature in the ED should be measured using a rectal thermometer, because axillary, oral and tympanic thermometers are unreliable in infants and young children.

#### IV. Evidence-Based Rationale for Risk Stratification of Infants According to Age and Height of Fever:

Evidence-Based Rationale	Risk Stratification Decision
Younger infants ( $\leq 90$ days old) have less well-developed immune systems and are more immunocompromised than older infants.	Lower fever ( $\geq 100.4$ ) triggers workups in younger infants ( $\leq 90$ days old).
	Changes consistent with illness (decreased suck/feeding or irritability/somnolence) triggers a workup in younger infants, even in absence of fever.
Higher risk of bacteremia at higher fevers.	Higher levels of fever trigger workups even in older more immunocompetent infants.
Very young infants ( $\leq 60$ days old) do not clinically demonstrate signs of meningitis.	Lumbar puncture always performed as part of fever evaluation in infants $\leq 60$ days old with or without any clinical signs of meningitis.

#### V. Risk Stratification of Infants According to Age and Height of Fever:

When evaluating a well-appearing infant with fever, the first step is to note patient's age (calculate age in days, if infant  $\leq 90$  days old) and height of fever, and see which of the following risk groups the patient falls into:

GROUP	AGE	HEIGHT OF FEVER TO TRIGGER WORKUP
I.	0-28 DAYS	100.4°
II.	29-60 DAYS	
III.	61-90 DAYS	
IV.	$\geq 91$ DAYS	UNIMMUNIZED OR $< 6$ MO: 102.2°
		IMMUNIZED & $\geq 6$ MO: 105°.

## VI. Overview of Management

### An Overview of the Evaluation and Treatment of Well-appearing Febrile Infants

Group	Age Cutoff	Fever Cutoff	Evaluation	Results	Treatment	Disposition
I	0-28 Days	$\geq 100.4^{\circ}$	<b>Full Sepsis workup</b> (Blood, urine & LP)	All Patients	IV Antibiotics	Admit
II	29-60 Days	$\geq 100.4^{\circ}$	Full Sepsis workup (Blood, urine & LP)	Low risk criteria met*	IM or IV Antibiotics	Discharge
				Low risk criteria NOT met*	IV Antibiotics	Admit
III	61-90 Days	$\geq 100.4^{\circ}$	Partial Sepsis Workup (blood & urine only)	UTI Cellulitis Pneumonia (focal infiltrate)	IV Antibiotics	Admit
				All other patients	IM or IV Antibiotics	Discharge
IV	3-6 Months  Or $\geq 6$ Months AND not immunized OR No reliable follow up	$\geq 102.2^{\circ}$	Partial Sepsis Workup (blood & urine only)	ALL PATIENTS	Antibiotics IF: WBC $\geq 15K$ (IM or IV) or positive urine (PO)	Discharge
		ANY fever ( $\geq 100.4^{\circ}$ ) lasting $\geq 4$ Days	Urine Only**			
V	$\geq 6$ Months  And immunized AND reliable follow up	$\geq 105^{\circ}$ or Fever $\geq 4$ days with a Tmax $\geq 102.2^{\circ}$	Partial Sepsis Workup (blood always; & test urine if at high risk for UTI**)	ALL PATIENTS	Antibiotics IF: WBC $\geq 15K$ (IM or IV) or positive urine (PO)	Discharge
		ANY fever ( $\geq 100.4^{\circ}$ ) lasting $\geq 4$ Days	Test Urine Only if at high risk for UTI:** Girls < 2 years circumcised boys < 6 months uncircumcised boys < 1 year history of UTI in the past.			

### SUMMARY

- Well-appearing febrile patients are stratified by age into 5 groups, corresponding to their risk of bacteremia and SBI.
- Fever cutoff (to initiate a workup is  $100.4^{\circ}$  in groups I, II, III)
- All babies 0-28 days old (Group #I) get a full sepsis workup and get admitted.
- All babies 29-60 days old (group #II) get a full sepsis workup and get admitted, unless they meet ALL low risk criteria for discharge\*.
- All well-appearing patients  $\geq 60$  days old (Groups III, IV, and V) are discharged to outpatient management. (If no UTI, cellulites, or lobar pneumonia).
- Febrile infants  $\geq 91$  days old (Group IV and V) represent the largest group of febrile children seen in the ED, with the most variation in diagnostic and management options.

\*see below box on Low Risk Criteria

## VII. Workups:

<b>FULL SEPSIS WORKUP FOR ALL 0-60 DAY OLDS:</b>	
CBC and differential	
Blood culture	
Catheterized urine:	Dipstick & microscopic urinalysis, Gram stain and culture
Lumbar puncture:	Cell count & differential Protein/glucose Gram stain and culture
Stool gram stain and culture	> if clinically indicated
Chest X-ray	

<b>PARTIAL SEPSIS WORKUP FOR OLDER INFANTS (≥ 61 DAYS OLD)</b>	
CBC and Differential	
Blood culture	
Urinalysis and urine culture:	Girls < 2 yo Boys: Circumcised < 6 mo Uncircumcised < 1 y.o.
CXR Stool gram stain and culture	> only if indicated

## VIII. GROUP #I: 0-28 DAYS OLD:

Why have these babies (0-28 days) been singled out as a group?

### **REASONS WHY BABIES 0-28 DAYS OLD ARE HIGHEST-RISK GROUP FOR LIFE-THREATENING BACTERIAL DISEASE AND ALWAYS GET ADMITTED**

High prevalence of bacteremia and (SBI): 5% -17 %

Pathogens not community-acquired, so prevalence not reduced in immunized populations

Immune system immature:

More susceptible to invasive disease  
Unable to localize infections well  
Do not demonstrate symptoms early in illness observation  
Appearance and exam unreliable

\*Screening tests/labs not sensitive

3-10% of bacterial disease miss by currently available screening criteria.

**\*THEREFORE, ANY FEVER ( $\geq 100.4^{\circ}$ ) IN THIS AGE GROUP MANDATES A FULL SEPSIS WORKUP FOLLOWED BY ADMISSION FOR IV ANTIBIOTICS: \*\***

**IV Cefotaxime (50mg/kg) q6H + Ampicillin (50mg/kg) q6H.**

**\*\*Add IV Acyclovir if any of the following:**

- Ill-Appearance
- Maternal h/o HSV
- Presence of vesicular or pustular lesion(s)
- Associated seizure

## **IX. GROUP #2: 29-60 DAYS OLD**

### **Low-Risk Criteria for Discharge from ED:**

#### **LOW RISK CRITERIA FOR DISCHARGE OF INFANTS 29-60 DAYS OLD:**

##### **HISTORY:**

**Previously healthy, full-term  
Normal behavior and feeding  
Reliable caretaker with phone access  
Caretaker able to return to ED if recalled for positive culture**

##### **EXAM:**

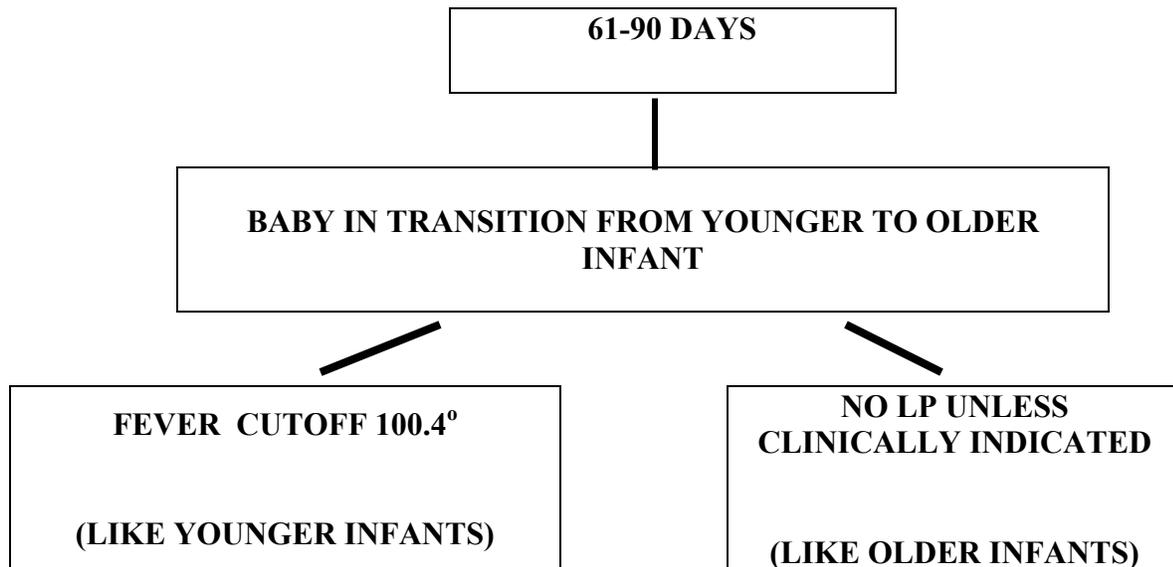
**Well-appearing  
Normal vital signs and exam**

##### **LABS:**

**Blood: WBC  $\geq$ 5,000 and  $<$  15,000 and band to neutrophil ratio  $<$  .2  
Urine: Negative gram stain, negative dipstick urinalysis, and micro  $<$  10 WBC/HPF  
CSF:  $<$  8 WBC/HPF, negative gram stain, and normal protein & glucose  
Stool:  $<$  5 WBC/HPF on gram stain (obtain only if diarrhea)  
CXR: Normal (obtain only if respiratory symptoms)**

- Any infant 29-60 days old who does not meet all of these low-risk criteria must be admitted for IV antibiotics and observation.
- For discharged patients, antibiotic coverage (ceftriaxone 50mg/kg IM) is optional.
- Discharged patients must be re-examined every 24 hours by PMD or ED physician for next 48 hours until cultures negative and then followed closely until fever resolves.
- Caretaker must be deemed reliable by examining physician, accessible by phone (in case cultures become positive and patient needs to be recalled for admission), and instructed to return immediately if any decreased feeding or change in baby's appearance or behavior.
- If blood, urine, or CSF culture becomes positive (or change in feeding, appearance, or behavior) admit for IV antibiotics.

**X. GROUP #3: 61-90 DAYS OLD:**



# **XI. GROUP #4 and Group #5: OTHERWISE HEALTHY AND WELL-APPEARING INFANTS ≥ 3 MONTHS OLD (≥ 91 DAYS OLD):**

## **1. What distinguishes these infants as distinct groups?**

These infants represent the largest group of febrile babies seen in the ED, with the most variation in diagnostic and management options. The purpose of this section is to demystify their evaluation and management.

## **2. A clarification about the following discussion:**

There are always 4 types of fever that can occur in otherwise well-appearing infants:

1. A typical viral-like picture:  
Fever that is not too high (< 105°) and not too long duration (< 5 days) in an otherwise healthy infant (no significant PMH).
2. Prolonged fever (≥ 5 days)
3. Very high fever (≥ 105°)
4. Fever in patients with co-morbidities.  
(Sickle cell, cancer, HIV, DM, indwelling central lines, etc.)

Therefore, you will always need to classify your patient with fever into one of these four categories, because the approach to each type of fever is different. However, the following discussion applies only to the first type of fever:

The otherwise health infant (no co-morbidity) who appears well, with a typical fever (< 105° and < 5 days duration). This type of fever comprises the majority of ED visits by infants for fever.

## **3. What are the main issues to focus on when evaluating an infant with fever?**

4 major issues must be addressed in ALL patients with fever:

1. Hydration status
2. Is the patient septic?
3. Is the patient bacteremic?
4. Does the patient have a focal bacterial infection\* that requires antibiotics?

### **\* Focal Bacterial Infections:**

Meningitis  
Otitis media  
Strep, pharyngitis  
Pneumonia  
UTI  
Petechiae  
Cellulitis



always fully undress patient and examine skin

Therefore, your history and physical should always focus on these 4 issues. We will now discuss each of these 4 issues individually:

## 1. HYDRATION STATUS

**HISTORY:** 1) Quantify change, if any, in po intake:

Is baby breast-feeder or bottle-feeder?

**If bottle-feeder:** How many oz does baby normally (pre-illness) feed? How often?

During present illness, how many oz per feed and how often is baby feeding?

**If Breast-feeder:** Normally (pre-illness), how many minutes is baby feeding on each breast? How often?

During present illness, how many minutes on each breast and how often?

2) Is the baby still sucking vigorously during feeds? Does the baby get SOB during feeds (have to stop feeding in middle of feed due to trouble breathing)? These can be early signs of more significant illness in a baby who otherwise appears well.

3) Is there any vomiting or diarrhea?

If yes, quantify color (? bloody or bilious), number of episodes per day, and volume. This information will help you decide if patient is a candidate for p.o. hydration (i.e. decreasing frequency/volumes of vomiting/diarrhea), or needs IV hydration (large volumes, not holding po liquids, or increasing frequency of vomiting and/or diarrhea).

4) Quantify frequency of urine output (#of wet diapers per day) compared to normal.

5) Ask about any change in activity or playfulness (for babies < 90 days old, ask if baby is waking up for feeds and sucking well, and level of alertness and consolability).

**Earliest signs of significant dehydration:**

1. Decreased urine output (less wet diapers/day)
2. Decreased activity

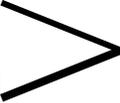
A less vigorous suck, decreased feeding, or SOB while feeding can be early signs of more significant illness in an otherwise well-appearing infant.

## 2. ? SEPSIS

If vitals are stable (normal for age) and infant well-appearing, patient not septic.

Consider sepsis if:

**Ill-appearing**  
**Unstable vitals**  
**\*Persistent or marked tachycardia**  
**Wide pulse-pressure**  
**Mottled skin or delayed capillary refill**



**Even if patient appears otherwise well**

**\*Differential diagnosis of tachycardia out-of-proportion to degree of fever:**

**Hypoxemia – (check pulse ox)**

**Dehydration – (give IV fluids and reassess)**

**Sepsis - (if remains very tachycardic, even after antipyretics and IV fluids)**

**Myocarditis – (if new heart murmur or EKG changes or cardiomegaly on CXR)**

### 3. ? BACTEREMIA

**Definition:** Presence of bacteria in the blood of a well-appearing child.

**Risk:** 1) Unimmunized infant, < 6 months old, with rectal temperature  $\geq 102.2^\circ$ .  
2) Immunized infant,  $\geq 6$  months old, with rectal temperature of  $105^\circ$  F.

**Rationale:**  $\geq 97\%$  of bacteremia in children  $\geq 3$  months old caused by pneumococcus or H. flu. The H. flu (HIB) and pneumococcus (prevnar) vaccines are given at 2, 4, and 6 months of age. Risk of bacteremia in a “fully immunized” infants (s/p 3 vaccines) is about 0.68% (very low). Therefore, infants  $\geq 6$  mo old who are well appearing do not require a bacteremia workup.

**Strategy:** If infant is 3-6 months old (not completely immunized, since 3<sup>rd</sup> vaccine not given until 6 months old), get CBC and blood culture (and urine). If WBC < 15,000 low risk of bacteremia: no antibiotics, 48 hour follow-up. (make sure patient has access to follow-up).

If infant/child  $\geq 6$  months old, appears well, has at least 2 immunizations, and reliable follow up, no workup is needed (meaning no CBC & blood culture) unless baby has one of the indications listed in the table below:

<b>IMMUNIZED (HIB VACCINE, PREVNAR) PATIENTS <math>\geq 6</math> MONTHS OLD FOR WHOM BACTEREMIA WORKUP AND ANTIBIOTIC TREATMENT SHOULD BE CONSIDERED:</b>
<b>1. Ill-appearance</b>
<b>2. Very high fever (<math>\geq 105^\circ</math>) OR prolonged fever (<math>\geq 4</math> days, if T max <math>\geq 102.2</math>)</b>
<b>3. Unreliable follow-up</b>
<b>4. Patients with co-morbidities:</b> Hemoglobinopathies Congenital heart disease Immunocompromised or debilitated: HIV DM CNS Disease
<b>5. Incompletely immunized (&lt; 2 immunizations)</b>

#### 4. ? FOCAL BACTERIAL INFECTIONS (≥ 3 MONTHS OLD):

##### MENINGITIS –

Consider LP if:      **Lethargic**  
                                 **Irritable or difficult to console**  
                                 **Bulging fontanelle**

OTITIS MEDIA –              **Dx by exam**

STREP PHARYNGITIS – **no testing needed if < 3 y.o.**  
**(since no significant risk of rheumatic fever in < 3 y.o, no**  
**need for strep testing before this age)**

PNEUMONIA -              **consider CXR if:**  
   **Tachypnea (after defervescence)**  
   **Localized lung findings on auscultation**  
   **Retractions**  
   **Hypoxemia (pulse ox)**  
   **Significant cough**  
   **WBC ≥ 20,000**

UTI -                      **Consider straight-cath urinalysis and culture if fever ≥ 105° for:**  
  
   **Circumcised boy < 6 mo**  
   **Uncircumcised boy < 1 y.o**  
   **Girl < 2 y.o**  
   **or h/o UTI in past**

CELLULITIS -              **Consider admission if cellulitis is source of fever**

PETECHIAE -              **Always undress and examine entire infant for presence of**  
**petechiae with fever. If any petechiae, draw blood culture, CBC**  
**with differential (to r/o both ITP and neutropenia), and give**  
**ceftriaxone (50mg/kg) IV or IM.**

**If no progression of petechial rash while observed in ED, may be**  
**discharged to 24 – hour follow-up.**

**If many petechiae present or petechial rash increases while**  
**observed in ED, admit for IV antibiotic and observation to r/o**  
**meningococemia.**

## BIBLIOGRAPHY

1. Lin PL, Michaels MG, Janosky J, et al. Incidence of invasive pneumococcal disease in children 3-36 months of age at a tertiary care pediatric center 2 years after licensure of the pneumococcal conjugate vaccine. *Pediatrics* 2003;111:896-899.
2. Kaplan SL, Mason EO, Wald ER, et al. Decrease of invasive pneumococcal infections in children among 8 children's hospitals after the introduction of the 7-valent pneumococcal conjugate vaccine. *Pediatrics* 2004;113:443-449.
3. Black S, Shinefield H, Baxter R, et al. Post licensure surveillance for pneumococcal invasive disease after use of heptavalent pneumococcal conjugate vaccine. *Pediatr Infect Dis J* 2004;23:485-489.
4. Kuppermann N. The evaluation of young febrile children for occult bacteremia: time to re-evaluate our approach? (editorial). *Arch Pediatr Adolesc Med* 2002;156:855-857.
5. Klein JO. Management of the febrile child without a focus of infection in the era of universal pneumococcal immunization. *Pediatr Infect Dis J* 2002;21:584-588.
6. Gabriel ME, Aiuto L, Kohn N, et al. Management of febrile children in the conjugate pneumococcal vaccine era. *Clin Pediatr* 2004; 75-82.
7. Baraff LJ. Management of fever without source in infants and children. *Ann Emerg Med* 2000;36:602-614.
8. ACEP Clinical Policies Committee and the Clinical Policies Committee and the Clinical Policies Subcommittee on Pediatric Fever. Clinical Policy for children younger than three years presenting to the emergency department with fever. *Ann Emerg Med*. 2003;42:530-545.
9. Baraff LJ, Bass JW, Fleisher GR, et al. Practice guidelines for management of infants and children 0-36 months of age with fever without source. *Pediatrics* 1993;92:1-12.
10. Kline MW, Lorin MI. Bacteremia in children afebrile at presentation to an emergency room. *Pediatr Infect Dis J*. 1990;9:153-157.
11. Bonadio WA, Hagenbarth M, Zachariason M. Correlating reported fever in young infants with subsequent temperature pattern and rate of serious bacterial infections. *Pediatr Infect Dis J*. 1990;9:158-160.
12. Zengeya ST, Blumenthal I. Modern electronic and chemical thermometers used in the axilla are inaccurate. *Eur J Pediatr*. 1996;155:1005-1008.
13. Brennan DF, Falk JL, Rothrock S, et al. Reliability of infrared tympanic thermometry in the detection of rectal fever in children. *Ann Emerg Med*. 1995;25:21-30.
14. Jaskiewicz JA, McCarthy CA. Evaluation and management of the febrile infant 60 days of age or younger. *Pediatr Ann*. 1993;22:477-483.
15. Kadish HA, Loveridge B, Tobey J, et al. Applying outpatient protocols in febrile infants 1-28 days of age: can the threshold be lowered? *Clin Pediatr*. 2000;39:81-88.

16. Baker MD, Bell LM. Unpredictability of serious bacterial illness in febrile infants from birth to 1 month of age. *Arch Pediatr Adolesc Med* 1999;153:508-511.
17. Baker MD, Bell LM, Avner JR. Outpatient management without antibiotics of fever in selected infants. *N Engl J Med* 1993;329:1437-1441.
18. Bass JW, Steele RW, Wittler RR et al. Antimicrobial treatment of occult bacteremia: a multicenter cooperative study. *Pediatr Infect Dis J* 1993;12:466-473.
19. Long SS. Antibiotic therapy in febrile children: "base-laid schemes". *J Pediatr* 1994;124:585-588.
20. Teach SJ, Fleisher GR, et al. Efficacy of an observation scale in detecting bacteremia in febrile children 3-36 months of age treated as outpatients. *J Pediatr* 1995;126:877-881.
21. Jaffe DM, Fleisher GR. Temperature and total white blood cell count as indicators of bacteremia. *Pediatrics* 1991;87:670-674.
22. Rothrock SG. Occult bacteremia in children: risk assessment, predicting outcomes, and antibiotic therapy. *Emerg Med Reports* 1997;18:75-82.
23. Kuppermann N, Fleisher GR, Jaffe DM. Predictors of occult pneumococcal bacteremia in young febrile children. *Ann Emerg Med* 1998;31:679-687.
24. Hoberman A, Wald ER. Urinary tract infections in young febrile children. *Pediatr Infect Dis J* 1997;16:11-17.
25. Altieri MF, Camarca MA, Bock GH. Pediatric urinary tract infections. *Emerg Med Reports* 1998;19:1-7.
26. Shaw KN, Gorelick MH. Urinary tract infection in the pediatric patient. *Pediatr Clin N Amer* 1999;46:1111-1124.
27. Bachur R, Perry H, Harper MB. Occult pneumonias: empiric chest radiographs in febrile children with leukocytosis. *Ann Emerg Med* 1999;33:166-173.