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Fever in the Emergency Department

Special Considerations in Pediatrics

Hannah Smith, MD
Washington University in St. Louis School of Medicine

Objectives

- **Background**
- Pathophysiology
- Definition
- Approach
  - General
  - 0 to 3 months
  - 3 to 36 months
  - Other

Background

- Most frequent chief complaint in children < 3 years
- 10-20% of pediatric visits to emergency department in US
- 20% of these will have no localizing source
- Infants < 3 months of age highest rates of serious bacterial infection (SBI)

Background

- Abnormal elevation of body temperature
- Recognized for centuries as a “sign of disease”
- Problem commonly encountered in pediatrics

Objectives

- Background
- **Pathophysiology**
- Definition
- Approach
  - General
  - 0 to 3 months
  - Greater than 3 months
  - Other

Pathophysiology

- **Complex process**
  - Autonomic
  - Neuroendocrine
  - Behavioral responses
- **Caused by a production of signaling proteins**
  - Or endogenous pyrogens which enter circulation and interact with specialized receptor neurons
- **Results in physiologic changes**
  - Peripheral vasoconstriction minimizing skin heat loss
  - Decreased sweating as vasopressin secretion falls
  - Lowered extracellular fluid volume
  - Shivering, seeking warmer environment

Pathophysiology

- **Benefits of fever:**
  - Impaired replication of microbes, enhanced phagocytic bactericidal activity
  - Glucose metabolism decreases in favor of that based on lipolysis and proteolysis (depriving bacteria of favorite food)
  - Hepatic production of acute-phase reactant proteins bind divalent cations which are growth factors for microorganisms

Objectives

- Background
- Pathophysiology
- **Definition**
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  - Other

Definition

- Difficult to pinpoint lowest temperature elevation considered to be definitely abnormal for all children in all circumstances
- Natural diurnal variations in temperature, peak between 17:00 and 19:00
  - Variation less pronounced in infants

Definition

- **Rectal temperature of 38°C (or 100.4°F)**
  - Appropriately dressed child
  - Child at rest for 30 minutes
  - Optimal technique includes appropriate positioning, 2 to 3cm depth, not in fecal mass
    - Glass probes take 2 to 3 min to equilibrate
- **Oral temperatures are usually about 0.6°C (1°F) lower than rectal temperature**
- **Axillary temperatures are usually about 1.1°C (2°F) lower than rectal temperature**
- **Tympanic membrane are accurate**
- **Pacifiers and forehead strips are not reliable**

Objectives

- Background
- Pathophysiology
- Definition
- **Approach**
  - General
  - 0 to 3 months
  - 3 to 36 months
  - Common things being common
  - Other

Approach

- Major challenge
- Many principal causes of fever
- Systematic approach

Approach

- Magnitude of fever reduction in response to antipyretics does not distinguish children with serious bacterial infection (SBI) from those with viral diseases
  - SBI includes:
    - Meningitis
    - Sepsis
    - Bone and joint infections
    - UTI
    - Pneumonia
    - Enteritis

Approach

- Age-based
- Duration-based
- Accounts for underlying illness
- Varies with vaccine status
- Differs with endemic diseases or travel history

Approach

- All febrile children who are toxic-appearing should be hospitalized for evaluation and treatment of possible sepsis or meningitis
- Toxic-appearing:
  - Lethargy
    - (Level of consciousness characterized by poor or absent eye contact or as the failure of a child to recognize parents or interact with persons or objects in the environment)
  - Signs of poor perfusion or marked hypoventilation
  - Hyperventilation
  - Cyanosis

Evaluation

- 0-3 months
  - Risk of SBI is higher
  - Higher suspicion for possible bacterial etiology
  - Strong consideration of empiric antibiotics is indicated
- Goal:
  - Strategically separate patients into high and low risk groups for SBI based on readily obtained clinical and laboratory data

Why Are Infants at Risk?

- **Immature immune system**
  - Deficiencies in specific antibody, complement, opsonins, phagocyte number and function *{GBS}*
  - Reduced attraction of macrophages to site of infection *{intracellular organisms}*
  - Lack of passively acquired antibodies and decreased activity of nonimmune and immune cellular cytotoxic mechanisms *{HSV}*
- **Neurologic and behavioral immaturity**
- **Variable presentation**

Slide courtesy of and adapted from David Jaffe

Sepsis Presentation

- Varies from toxic-appearing to well-appearing
- Neurologic and behavioral immaturity may confound
- History should focus on changes in infant's behavior
  - Increased or decreased sleeping
  - Decreased feeding
  - Irritability
  - Respiratory distress
  - Agitation
  - Lethargy

Non-Toxic Appearing Febrile Infants (0-3 Months)

- Incidence of SBI: 8 – 10%
- Bacteremia < 3%
- Meningitis ≤ 1%
- UTI ≈ 7%
- Some multiple site infections
- Large majority presumed or confirmed viral
- Risk stratification important

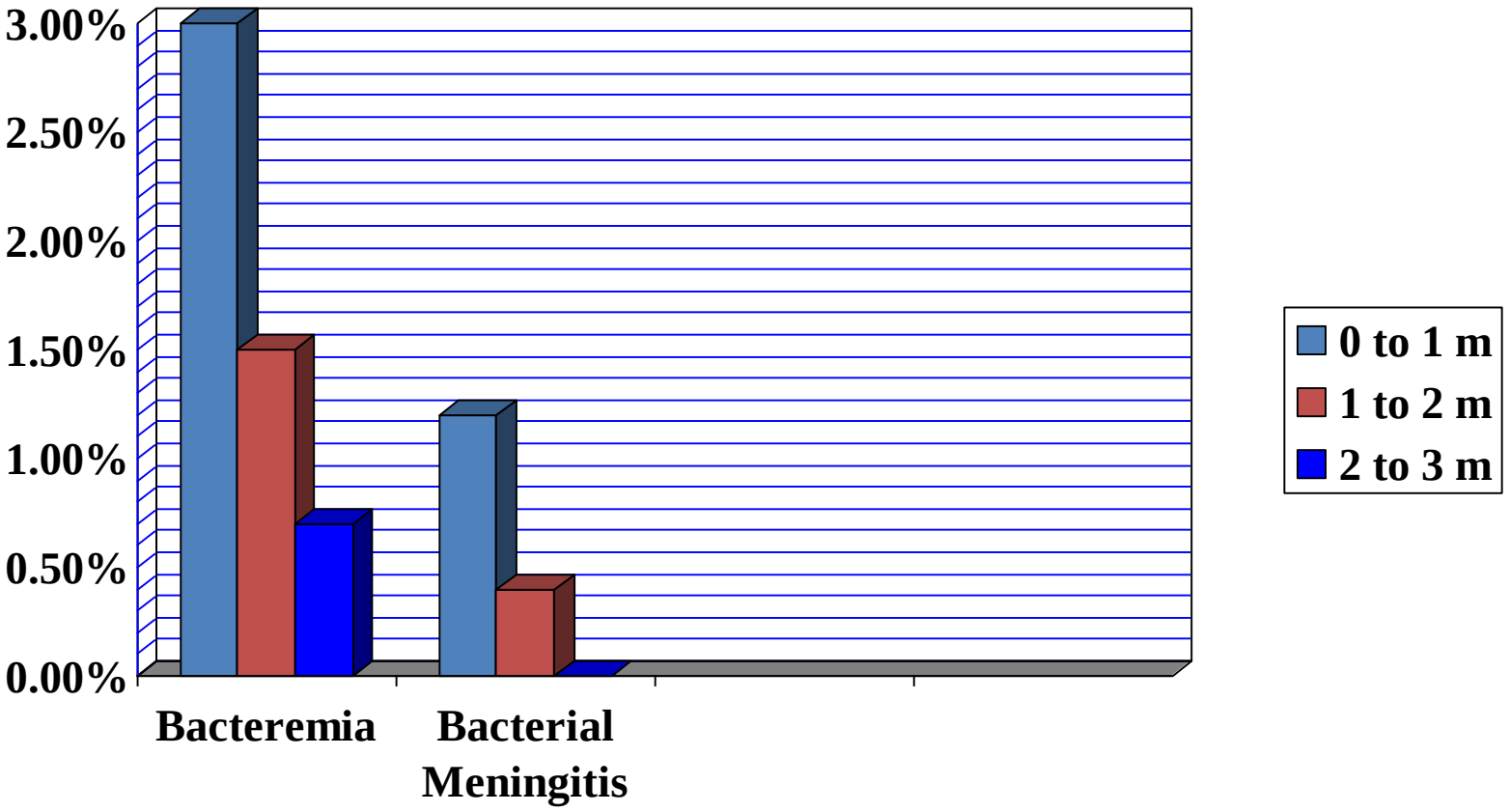
Baraff, LJ et al. Practical Guideline for the Management of Infants and Children 0 to 36 Months of Age With Fever Without A Source. Pediatrics, 92:1-12. 1993.

Serious Bacterial Infection (0-3 Months)

- Growth of bacterial pathogen from body fluid:
  - Blood
  - Urine
  - CSF
  - (Joint fluid)
  - (Bone)

- 0 to 3 months:
  - *E. coli*
  - GBS
  - *L. monocytogenes*
  - *S. pneumoniae*
  - *Salmonella*
  - *N. meningitidis*
  - *H. influenzae*
  - *S. aureus*
  - *Klebsiella*

Rates of Bacteremia and Bacterial Meningitis (0-3 Months)



Pantell R, Newman T, Bernzweig J, et al: Management and outcomes of care of fever in early infancy. JAMA 291:1203-1212, 2004.

Slide courtesy of and adapted from David Jaffe

The Need for Risk Stratification

- Variation in evaluation and management
- Many infants have self-limited viral infections
- Problems with routine hospitalization:
  - Costly
  - Increasing antibiotic resistance
  - Iatrogenic complications
    - IV infiltrates
    - Fluid or drug overload
    - Fever due to isolette temperature
    - Distraught mother
    - Thrush/candidiasis
    - Diarrhea
    - Stolen infant

DeAngelis C et al, *Am J Dis Child* 1983;137:1146-1149.

Classic Studies 0-3 months from US

	Boston (2001)	Philadelphia (1993)	Rochester (1985)
Age	1-3 months	1-2 months	0-2 months
Key Idea	All get ceftriaxone; more difficult to be high risk	Low risk go home, no antibiotics; more difficult to be low risk	To identify criteria
Physical Exam	Nontoxic, no focal infection	Infant observation score <10, no focal infection	Appears well, no focal infection
Labs	•WBC <20,000	•WBC <15,000	•WBC 5-15,000
	•UA <10 WBC/hpf or negative LE	•BNR <0.2	•Absolute band <1500/mm^3
	•CSF <10 WBC/mm^3	•Spun UA <10 WBC/hpf, no bacteria	•Spun urine <10 WBC/hpf
	•CXR (if obtained) - no focal infiltrate	•CSF <8 WBC/mm^3, negative gram stain	•Stool (diarrhea) <5 WBC/hpf
		•CXR – no focal infiltrate	
		•Stool (diarrhea) <5WBC/hpf	

Slide courtesy of and adapted from David Jaffe

Prevalence of UTI in Childhood: A Meta-Analysis

	Prevalence	95% CI
Overall	**7.0%**	**5.5-8.4**
Females (0-3 months)	**7.5%**	**5.1-10.0**
Circumcised Males (0-3 months)	**2.4%**	**1.4-3.5**
Uncircumcised Males (0-3 months)	**20.1%**	**16.8-23.4**
White Infants* (0-3 months)	**8.0%**	**5.1-11.0**
Black Infants* (0-3 months)	**4.7%**	**2.1-7.3**

*only 4 studies contributed to ethnicity data

Shaik N et al, PIDJ 2008;27:302-308

Slide courtesy of and adapted from David Jaffe

Current Approach: Infant < 28 Days

- Full septic evaluation for all:
  - Culture blood, urine, CSF
  - CBC, urinalysis, CSF studies (gram stain and differential, glucose/protein)
  - Viral testing per season: Enterovirus, Influenza, RSV, HSV
  - CXR, stool studies as clinically indicated
- Hospitalization
- Parenteral antibiotics
  - Ampicillin
  - Gentamicin or Cefotaxime
  - Acyclovir, if signs of HSV, elevated transaminases, (expectant use for < 21 days sometimes recommended, but controversial)

Current Approach Infant 1 to 2 Months

Screen for risk:

- **CBC, blood culture, UA and urine culture**
- **Viral testing per season**

If LOW RISK*, especially if virus positive

- No antibiotics
- Re-evaluate at 24 hours

If HIGH RISK

- Admit
- Complete sepsis work-up, including LP
- Parenteral antibiotics

*LOW RISK MEETS ALL CRITERIA:

- Non-toxic appearance
- No focus of infection on exam (except otitis media)
- No known immunodeficiency
- WBC <15,000/mm^3
- Band to neutrophil ratio (BNR) < 0.2
- Normal UA
- CSF < 8 WBC/, negative gram stain, normal glucose/protein
  (LP may be deferred based on physician experience)
- Normal chest radiograph (if performed)
- Born at EGA >37 weeks

Infants 2 to 3 months

- Some treat the same as > 3 months
- Not a well-studied subgroup
- UA, urine culture
- Viral testing per season
- Further work-up depends on quality of follow-up
- If follow-up not assured, screen as in younger age
  - High risk: complete sepsis work-up, admit
    - Other options: IV antibiotic or observe
  - Low risk: home, no antibiotics
- Follow-up important

Approach to Febrile Infant 0-3 Months in St. Louis, Missouri

Evaluation and Management of Infants 0 to 3 months with T >38°C

AGE	EVALUATION	MANAGEMENT
0-28 d	**1. Detailed history and complete physical exam** **2. Laboratory evaluation for sepsis:** ▪ Blood: CBC w/diff and culture ▪ Urine: cath urinalysis and culture ▪ CSF: cell ct, protein, glucose, g stain, culture ▪ Chest radiograph (if indicated) ▪ Stool for heme test and culture (if indicated) ▪ Consider HSV and enteroviral PCR for CSF	**1. Admit for IV/IM abx until culture results available:** **Ampicillin:** <1 wk, 100 mg/kg/dose, Q 12 h >1 wk, 50 mg/kg/dose, Q 6 h **Plus cefotaxime:** <1 wk, 50 mg/kg/dose, Q 8 h 1-4 wk, 50 mg/kg/dose, Q 6 h **Or plus gentamicin:** 5 mg/kg/day, Q 24 h **If herpes suspected, acyclovir:** 20 mg/kg/dose, Q 8 h
29-60 d	**1. Detailed history and complete physical exam** **2. Laboratory eval for sepsis:** as for 0-28 d **3. Determine if patient is low-risk for SBI by meeting ALL criteria listed here:** ▪ Non-toxic appearance ▪ No focus of infection on exam (except OM) ▪ No known immunodeficiency ▪ WBC <15,000/mm^3 ▪ Band to neutrophil ratio (BNR) <0.2 ▪ Normal urinalysis ▪ CSF: <8 WBC/mm^3 , - gram stain, nl gluc/prot *(Consult with attending if plan to defer LP)* ▪ Normal chest radiograph (if done)	**1. If toxic-appearing, hosp. for IV/IM abx until cx results available:** **Ampicillin:** 50 mg/kg/dose, Q 6 h **Plus cefotaxime:** 50 mg/kg/dose, Q 6 h (meningitic dose) (Or plus gentamicin 2.5 mg/kg/dose, Q 8 h if meningitis not suspected) **If herpes suspected, acyclovir:** 20 mg/kg/dose, Q 8 h **2. If high-risk, hospitalize for IV/IM abx until cx results available:** **Ampicillin:** 50 mg/kg/dose, Q 6 h **Plus cefotaxime:** 50 mg/kg/dose, Q 6 h (meningitic dose) (Or plus gentamycin 2.5 mg/kg/dose, Q 8 h if meningitis not suspected) **3. If low-risk, choose option after discussion w/attending and PMD:** A. 50 mg/kg ceftriaxone IM and reexam at 24 & 48 h (Must have LP) B. No abx and reexam at 24 & 48 h
61-90 d	**1. Detailed history and complete physical exam** **2. Limited laboratory evaluation for sepsis:** ▪ Blood: CBC w/ diff and culture ▪ Urine: cath urinalysis and culture ▪ LP if clinical concern for meningitis ▪ Chest radiograph (if indicated) ▪ Stool for heme test and culture (if indicated)	**1. If toxic-appearing, perform LP and hospitalize for IV/IM abx until culture results available:** **Ceftriaxone:** 50 mg/kg/dose, Q 12 h **2. If non-toxic appearing:** No antibiotics and reexamination at 24 and 48 h

Note: *The evaluation and management of febrile infants 29-60 days of age is particularly challenging due to behavioral immaturity and lack of clear and convincing medical literature.*

Approach to Febrile Infant 0-3 Months in St. Louis, Missouri

Summary: Evaluation and Management of Well-appearing Febrile Infant

AGE	INFECTION FOCUS	EVALUATION	ABX	*ADMIT?
<28 d	None	**B, U, C	IV/IM	Yes
<28 d	OM	B, U, C	IV/IM	Yes
<28 d	Bronchiolitis, Influenza	B, U, C	+/-	+/-
1-2 m	None	(a) B, U, C (b) B, U, ± C	IV/IM No	+/- +/-
1-2 m	OM (unequivocal)	B, U	Oral	No
1-2 m	Bronchiolitis, Influenza	U	If UTI	No
2-3 m	None	B, U, ± C	No	No
2-3 m	OM (unequivocal)	Not necessary	Oral	No
2-3 m	Bronchiolitis, Influenza	U	If UTI	No

*Discuss disposition/treatment plans with EU attending and available PMDs
**B=cbc and blood culture U=cath UA and culture C=CSF
NOTE: LP indicated for all toxic-appearing pts or those in whom meningitis is suspected

Utah Algorithm (0-2 months)

- History, PE, FBC, UA, blood and urine culture for all
- Use modified Rochester criteria to classify low vs. high risk
  - Age < 28 days or preterm (< 37 weeks)
  - Chronic medical conditions
  - Abnormal CBC (WBC < 5,000 or > 15,000)
  - Abnormal UA (> 10 WBC /HPF)
- **<u>If low risk</u>**, no antibiotics, no admission to hospital

Byington CL et al. Costs and Infant Outcomes After Implementation of a Care Process Model for Febrile Infants. Pediatrics: 130, e16-e24. 2012

Slide courtesy of and adapted from David Jaffe

Utah Algorithm (0-2 months)

If high risk:

- Admit and begin antibiotics
- Viral diagnostic testing
  - Respiratory viruses by NP (DFA or PCR)
  - Enterovirus by PCR, June-November or if CSF pleocytosis
- Duration of antibiotics and length of stay (LOS) based on results of testing at 24 hours
- If culture negative and viral positive, discharge at 24 hours and stop antibiotics
- If culture negative and viral negative, discharge at 36 hours *(as long as patient is well appearing, able to eat and follow-up arranged)*
- If culture positive, treat for appropriate infection

Byington CL et al. Costs and Infant Outcomes After Implementation of a Care Process Model for Febrile Infants. Pediatrics: 130, e16-e24. 2012

Slide courtesy of and adapted from David Jaffe

Utah Algorithm (0-2 months)

- Outcomes
  - More infants had definitive diagnosis of UTI or viral infection
  - More admitted infants positive for SBI
  - No missed SBI
  - Low risk infants more often managed without antibiotics
  - Hospital admissions shortened by 27%
  - Mean cost per admitted infant decreased from $7,178 to $5,979 (-17%)

Byington CL et al. Costs and Infant Outcomes After Implementation of a Care Process Model for Febrile Infants. Pediatrics: 130, e16-e24. 2012

Slide courtesy of and adapted from David Jaffe

Approach to 3 to 36 months

- History and physical give important clues
  - Learn length of febrile illness, pattern of fever
- General impression obtained in a few moments key
  - Decide if child toxic or nontoxic in appearance as you observe them
- Immunizations make a difference!

Approach to 3 to 36 months

- Concentration on:
  - Discovering cause of fever
  - Treat underlying illness
- Any fever may signify serious infection, but hyperpyrexia (temperature of 41.1°C (106°F) or higher) is more often associated with diagnoses of pneumonia, bacteremia or meningitis

Approach to 3 to 36 months

- Risk of occult bacteremia with fever without a source 3-11% with mean probability 4.3% in children 3 to 36 months with temp >39^{o}C

Baraff, LJ et al. Practical Guideline for the Management of Infants and Children 0 to 36 Months of Age With Fever Without A Source. *Pediatrics*, 92:1-12. 1993.

Evaluation

- Blood film for malaria parasites
- FBC – examine a thin film for morphology
- HIV test
- UA including micro
- Mantoux
- Chest radiograph
- Blood culture
- Lumbar Puncture

Evaluation

- CBC
  - White blood count (WBC) has been recommended as a screening tool since 1970s
  - WBC remains a useful screening tool
    - Rapid to perform
    - Widely available
  - Total WBC count, absolute neutrophil count and absolute band counts have all been shown to be associated with SBI

Values for WBC

- **WBC counts > 15,000 are associated with SBI**
  - Sensitivity 40 - 52%, Specificity 76 - 84%
  - Likelihood ratio 2.11 - 2.5 in infants < 2 months
  - Area under ROC 0.70 in infants < 2 months
- **Elevated absolute band counts and absolute neutrophils counts are also associated with SBI, in infants < 12 months**
- **Elevated ANC slightly better than WBC**

Andreola B, PIDJ 2007; Bilavsky E, Acta Paediatrica 2010; Al-Gwaiz LA, Med Princ Prat 2007.

Slide courtesy of and adapted from David Jaffe

Evaluation and Treatment Strategy 3 - 36 months

- Routine testing (FBC and blood culture) not indicated for well-appearing children age 3 - 36 months with fever without focal source
- Universal antibiotic administration for possible occult bacteremia not indicated
- Pneumococcus pneumonae and Haemophilis influenzae vaccines reduce risk

Baraff, LJ et al. Practical Guideline for the Management of Infants and Children 0 to 36 Months of Age With Fever Without A Source. *Pediatrics*, 92:1-12. 1993.

Evaluation and Treatment Strategy 3 - 36 months

- Empiric IV antibiotics (ceftriaxone) may be given when patient has close follow up, BUT blood cultures must be obtained pre-treatment
  - Blood cultures means of differentiating between viral from bacterial meningitis and partial treatment from occult bacteremia from viral syndrome in event child deteriorates
- Empiric IV antibiotics without LP
  - Must consider consequences of partially treated meningitis and delayed diagnosis
  - May be used in non-toxic appearing children with fever without a source, particularly in those with *H. influenzae* type B vaccine

Baraff, LJ et al. Practical Guideline for the Management of Infants and Children 0 to 36 Months of Age With Fever Without A Source. *Pediatrics*, 92:1-12. 1993.

Evaluation and Treatment Strategy 3 - 36 months

- In the event of a positive blood culture result, child should be recalled for re-evaluation
- Repeat blood culture and LP, admit and continue IV antibiotics for:
  - Children who are still febrile
  - Children who appear ill
  - Children with blood cultures positive for Neisseria meningitidis or H. influenzae
- May consider repeat IV/IM Ceftriaxone and PO course penicillin for pneumococcus positive blood cultures
- Patients with positive urine cultures who are afebrile and tolerating PO may do course of oral antibiotics

Baraff, LJ et al. Practical Guideline for the Management of Infants and Children 0 to 36 Months of Age With Fever Without A Source. *Pediatrics*, 92:1-12. 1993.

Common Things Being Common

UTI

- Consider UA and culture for boys < 6 months and girls < 2 years, risk stratify per AAP guidelines
  - Common in boys during young infancy due to posterior urethral valves

AAP = American Academy of Pediatrics

AAP UTI Guidelines

- In febrile infant, obtain UA and culture if antimicrobial therapy being given for pressing reason
- Assess likelihood of UTI
  - If low, follow-up without testing
  - If not low, obtain UA and culture
    - Catheter or suprapubic aspirate (SPA)
    - Bag for UA and obtain catheterized specimen or SPA if UA suggests UTI
- Diagnosis based on pyuria and at least 50,000 CFU per mL of a single uropathogen

AAP Subcommittee on Urinary Tract Infection, *Pediatrics* 2011;128:595

Slide courtesy of and adapted from David Jaffe

AAP UTI Guidelines

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
≤1%	No more than 1
≤2%	No more than 2

Individual Risk Factors: Boys
Nonblack race
Temperature ≥ 39°C
Fever > 24 h
Absence of another source of infection

Probability of UTI	No. of Factors Present	
	Uncircumcised	Circumcised
≤1%	a	No more than 2
≤2%	None	No more than 3

FIGURE 2

Probability of UTI Among Febrile Infant Girls[28] and Infant Boys[30] According to Number of Findings Present. [a]Probability of UTI exceeds 1% even with no risk factors other than being uncircumcised.

AAP Subcommittee on UTI, *Pediatrics* 2011;128:595-610

Slide courtesy of and adapted from David Jaffe

Child with Fever and Rash

- Febrile, toxic-looking child with poor perfusion and hemorrhagic or petechial rash
  - Concern for SBI
    - Rickettsial
    - Spirochetal disease
- Carefully obtain blood culture, WBC and start antibiotics – do not delay!
- Gram stain exam of buffy coat and fluid from pustular or petechial skin lesions

Meningitis

Early diagnosis and treatment is essential!

In the history	In the exam
Fever	Stiff neck
Vomiting	Irritability
Irritability	Convulsions
Headache	Lethargy
Neck ache or back pain	Bulging fontanelle
Convulsions	Skin rash - petechiae
Recent head injury	Ear discharge
Recent infection	Kernig's & Brudzinski signs
	Signs of raised ICP
	Irregular breathing
	Posturing
	Unequal pupils
	Focal neuro signs

Slide courtesy of and adapted from Malawi College of Medicine

Bacterial Meningitis in Africa in Children > 2 months

- Most prevalent to least:
  - *Streptococcus pneumoniae*
  - *Haemophilus influenzae*
  - *Salmonella typhi and enteritidis*
- Less common:
  - *Staph aureus, Neisseria meningitidis, E. coli*
- Consider also:
  - TB meningitis (prolonged fever)
  - Cryptococcal meningitis (headache without neck stiffness, HIV positive, Dx: India ink stain)

Slide courtesy of and adapted from Malawi College of Medicine

Septic Arthritis or Osteomyelitis

- Child refusing to bear weight or move affected extremity
  - Children <3 years
    - *Haemophilus influenzae* type B
    - *Strep pneumoniae*
    - *S. pyogenes* group A
    - *Salmonella*
    - *Klebsiella kingae*
  - Children >3 years
    - Staph aureus
- If suspected, use sterile needle to obtain culture
- Treat with appropriate antibiotics until extremity regains mobility, patient can bear weight and fever resolved
  - {Clinical pearl: Do <u>not</u> discharge someone who cannot walk}

Other

{Clinical Pearls}

Child With Fever

- Is the child seriously ill?
- If yes, is there an obvious source of infection?

- Past History: HIV (pneumocystis, TB), sickle cell (pneumococcus), nephrotic syndrome (pneumococcus), rheumatic fever (SBE)
- Current Illness: Duration and type of fever, recent tick or louse bites (relapsing fever, rickettsia), water source (typhoid), living conditions –rats, fleas (plague, leptospirosis), infectious contacts (TB, influenza)

Diagnostic Clues

- Fever pattern
  - Relapsing fever
  - Remittent fever
- Fever with anemia
- Fever with jaundice
- Fever with an obvious rash
- Fever with lymphadenopathy
- Fever with white blood cell abnormalities
  - Eosinophilia
  - Neutrophilia
  - Neutropenia

Fever Pattern

- Relapsing Fever
  - Malaria
  - Visceral leishmaniasis (protozoan parasite)
  - African trypanosomiasis (parasitic protozoan trypanosomes)
  - Brucellosis
  - Filariasis (roundworm)
  - Lyme disease
- Remitting Fever
  - Tuberculosis
  - Infectious mononucleosis
  - Typhoid
  - Visceral larva migrans (roundworm)
  - HIV infection
  - Bacterial endocarditis
  - Amebiasis
  - Trichinosis (roundworm)

Malaria

- Uncomplicated vs Complicated
- You know more about this than I do!

{Clinical pearl: Always check blood sugar in someone that is obtunded}

Fever with Anemia

- Malaria
- Incidental pre-existing anemia
- Bartonellosis
- Babesiosis

Fever with Jaundice

- Viral hepatitis
- Epstein-Barr virus (infectious mononucleosis)
- Malaria
- Typhoid
- Leptospirosis
- Cytomegalovirus

Fever with an Obvious Rash

- Meningococcemia
- Rickettsial spotted fevers
- Viral hemorrhagic fevers
- Dengue and similar arboviruses
- Leptospirosis
- Secondary syphilis
- Collagen-vascular disease and drug reactions

Fever with Lymphadenopathy

- Fever and Cervical Lymphadenopathy
  - Primary toxoplasmosis
  - Bartonella (cat scratch disease)
  - Atypical TB
- Fever and Generalized Lymphadenopathy
  - Epstein-Barr virus (infectious mononucleosis)
  - Trypanosomiasis (parasitic protozoan trypanosomes)
  - Toxoplasmosis
  - HIV infection
  - Filariasis
  - Leptospirosis
  - Leukemia/lymphoma
  - Juvenile rheumatoid arthritis
  - Drug reactions
  - Secondary syphilis

Fever with White Blood Cell Abnormalities

- Eosinophilia
  - Fasciola hepatica (liver fluke)
  - Filariasis (roundworm)
  - Visceral larva migrans (roundworm)
  - Trichinosis (roundworm)
  - Severe strongyloidiasis (roundworm)
  - Drug reactions
- Neutrophilia
  - Pyogenic abscess
  - Leptospirosis (a spirochaete bacterium)
  - Relapsing fever (louse-born bacteria *Rickettsia* and *Borrelia*)
  - Amebic liver abscess
  - Collagen-vascular disease
- Neutropenia
  - Viral infections
  - Rickettsial infections
  - Typhoid

Collagen-vascular diseases

- Rheumatic Fever
- Juvenile Rheumatoid Arthritis (JRA)
- Kawasaki's disease

Other Fevers

- Drug reactions
- Tumors
- Familial fevers

Child With Fever

- **Fever <u>With</u> Localizing Signs**
  - **Meningitis** – *bulging fontanel, stiff neck, irritable*
  - **Otitis Media** – *ear pain or discharge*
  - **Mastoiditis** – *tender swelling behind the ear*
  - **Osteomyelitis** – *refusal to bear weight, tender area over bone*
  - **Septic Arthritis** - *hot swollen, tender joint*
  - **Infectious Endocarditis** - *heart murmur, enlarged spleen, petechiae, anemia, weight loss, splinter hemorrhages (under nail), microscopic hematuria*
  - **Miliary TB** – *enlarged spleen ± liver, anorexia, night sweats, weight loss, family history of TB, fine infiltrates on chest radiograph* {Note: Mantoux test often negative with Miliary TB, severe malnutrition or HIV}
  - **Acute Rheumatic Fever** – *heart murmur, heart failure, arthritis/arthralgia, tachycardia, pericardial friction rub, migrating rash, chorea, history of sore throat*
  - **Skin and Soft Tissue Infection** - *erythema, tenderness, warmth, swelling, pus drainage*
  - **Pneumonia** – *fast breathing, grunting, crackles, retractions, nasal flaring*
  - **Viral URI** – *cough and rhinorrhea, no systemic symptoms*
  - **Retropharyngeal Abscess** – *refusal to move neck, pharyngitis, refusal to drink*
  - **Sinusitis** – *tenderness and pain over affected sinus*
  - **Hepatitis** – *jaundice*
  - **Rash** - *petechiae, purpura, maculopapular; cellulitis, pustules*

Child With Fever

- **Fever <u>Without</u> Localizing Signs**
  - **Malaria**
  - **Septicemia**
    - Primary bacteremia, plague
  - **Malignancy**
  - **Typhoid**
    - Particularly consider if fever persists >7 days and malaria has been excluded
    - Complications: acute abdomen, coma, convulsions, cardiac failure, shock
  - **Urinary Tract Infection**
  - **Infection Associated with HIV**
  - **Other protozoa**
    - Babesiosis (parasitic disease via ticks)
    - Toxoplasmosis (parasitic disease from protoazoan)
  - **Bartonella species**
    - Carrion's disease (Peruvian warts via sandflies); Cat scratch disease
  - **Arboviral fevers**
    - Dengue fever
  - **Hemorrhagic fevers**
    - Lassa fever, Marburg virus disease, Ebola virus disease, Dengue hemorrhagic fever group, Congo-Crimean fever

Fever Follow Up

- Advise patient to come back if fever persists, overall worsening, unable to drink or to take medications due to persistent vomiting

Sources

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