Fever in Children

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Introduction

- Fever is most common presenting complaint in pediatrics: 10-20% visits
- Majority of children presenting with fever < 3 years old
- Both minor and life-threatening infectious diseases common in this age group
  - respiratory infections
  - occult bacteremia
  - meningitis

Introduction (continued)

- Distinguishing viral illness from occult bacteremia can be difficult
- Children with occult bacteremia treated as outpatients without antibiotics can develop bacterial meningitis or other focal bacterial infections
- Management of young febrile children must minimize unfavorable outcomes

Fever

- Definition:
  - rectal temperature >= 38.0^{o} C (100.4^{o} F)
- Pathophysiology: 3 causes
  - Raising of hypothalamic set point in CNS
    - Infection, collagen vascular disease, malignancies
    - lowered by antipyretic medication and removing heat
  - Heat production exceeding heat loss
    - salicylate overdose, hyperthyroidism, environmental heat
  - Defective heat loss
    - ectodermal dysplasia, heat stroke, poisoning with certain drugs

Fever: Treatment

- Antipyretics: lower the central set point
  - inhibit cyclo-oxygenase enzyme, prevent synthesis of prostaglandin
  - do not interfere with immune response to infection
- Doses:
  - Acetaminophen: 15 mg/kg every 4 hours
  - Ibuprofen: 10 mg/kg every 6-8 hours

Fever: Treatment: adjunctive measures

- adequate hydration
  - fever can cause excessive heat loss
  - better heat disipation with adequate intravascular volume
  - careful not to overhydrate and cause hyponatremia
- comfortable surroundings: temperature 72^{o} F (22^{o} C)
- Not bundled in extra clothing or blankets
- sponging with tepid water
  - temperature around 80^{o} F (27^{o} C)
  - ice baths or alcohol should be avoided: lead to shivering which may increase body temperature and is uncomfortable

Differential diagnosis of acute fever

- Upper Respiratory Tract Disease
  - Viral respiratory tract disease
  - Otitis media
  - sinusitis
- Lower Respiratory Tract Disease
  - Bronchiolitis
  - Pneumonia
- Gastrointestinal Disorders
  - Bacterial gastroenteritis
  - Viral gastroenteritis

Differential diagnosis of acute fever (con’t)

- Musculoskeletal Infections
  - Cellulitis
  - Septic arthritis
  - Osteomyelitis
- Urinary Tract Infections
- Bacteremia
- Meningitis

Physical exam

- General appearance: for experienced clinician, the most important aspect of exam
- Vital signs
  - temperature
    - > 40°C (104°F) marker for increased risk of bacteremia
  - respiratory rate
    - tachypnea out of proportion to fever suggests pneumonia
  - blood pressure
  - pulse rate
  - oxygen saturation if available

Physical exam (continued)

- State of hydration
- Peripheral perfusion
- Detailed mental status exam needed to diagnose CNS infection
- Head to toe exam
  - physical abnormalities
  - tenderness to palpation
- Toxic appearing: definition

Physical exam (continued)

- Toxic appearing
  - clinical picture consistent with sepsis
  - lethargic: decreased level of conciousness, poor eye contact, failure to recognize parents or interact with environment
  - poor perfusion
  - hypoventilation or hyperventilation
  - cyanosis

Fever without a source: definition

Acute febrile illness in which the etiology of the fever is not apparent after a careful history and physical exam

Serious bacterial infection: definition

Serious bacterial infections include meningitis, sepsis, bone and joint infections, urinary tract infections, pneumonia, and enteritis

Practical guidelines in management of infants/children 0-36 mo

- Expert panel of pediatricians, infectious disease specialists and emergency medicine physicians formed to develop guidelines to assist in managing infants and children with fever without a source
- Guidelines are evidence-based: comprehensive literature review and statistical analysis performed
- Guidelines published in Pediatrics in 1993 and used across the United States since then

Infant < 28 days old

- immune system immature at this age
- risk of acquiring infection during delivery
  - onset of symptoms can be delayed days to weeks
- risk of overwhelming sepsis
- clinical evaluation inadequate to determine which infants at risk for serious bacterial infection

Evaluation of infant < 28 days old with fever

- Physical exam
- Laboratory screen:
  - CBC and blood culture
  - catheterized urinanalysis and urine culture
  - lumbar puncture for CSF analysis and culture
- Screening chest XRAY unnecessary if no signs of pneumonia
- If diarrhea, stool for WBC
  - culture if bloody or if >5 WBC/highpower field

Management of infant < 28 days old with fever

- Following evaluation, all febrile neonates should be hospitalized pending culture results
- Parenteral antibiotics should be given while awaiting culture results
- In low risk infants, hospitalization and observation without antibiotics may be considered while awaiting culture results
- Antibiotics may be discontinued if culture results negative at 48 to 72 hours

Low risk criteria for febrile infants

- Clinical criteria
  - Previously healthy
  - Nontoxic clinical appearance
  - no focal bacterial infection
- Laboratory screen
  - WBC of 5000 to 15,000/mm^3
  - bands less than 1500/mm3
  - normal urinalysis
  - CSF analysis negative
  - if diarrhea present, stool < 5 WBC/highpower field

Evaluation of infants 28 - 90 days old with fever

- Physical exam
- Laboratory screen:
  - CBC and blood culture
  - catheterized urinanalysis and urine culture
  - lumbar puncture for CSF analysis and culture
  - Screening chest XRAY unnecessary if no signs of pneumonia
- If diarrhea, stool for WBC
  - culture if bloody or if . 5 WBC/highpower field

Management of infants 28 - 90 days old with fever

- Hospitalize and protect with parenteral antibiotics while awaiting 48 to 72 hour culture results
- In this age group can consider outpatient management in low risk infants
  - Clinical criteria
    - previously healthy
    - nontoxic clinical appearance
    - no focal bacterial infection (except otitis media)
  - Laboratory screen
    - WBC of 5000 to 15,000/mm^3
    - bands less than 1500/mm3
    - normal urinalysis
    - CSF analysis negative
    - if diarrhea present, stool < 5 WBC/highpower field

Management of infants 28-90 days old with fever (continued)

- Parents must be reliable
- Must have good access to medical care
  - less than 30 minute travel time to emergency department
  - telephone available
- Cover with parenteral Ceftriaxone 50 mg/kg daily
- Recheck in 18 - 24 hours
  - at recheck give repeat dose Ceftriaxone until culture negative at 48 to 72 hours
- If cultures become positive, infant must be hospitalized

Management of infants 28-90 days old with fever (continued)

- If infant low risk, especially if close to 90 days old, can consider not performing lumbar puncture
- Can observe (inpatient or outpatient) and await blood and urine culture results without starting antibiotics
- If start antibiotics must perform lumbar puncture to avoid partially treating meningitis

Child 3- 36 months old with fever

- Incidence of fever without a source
  - most visits for fever less than 39^{o}C (102.2^{o}F)
- Risk of bacteremia
  - risk greatest if fever greater than 39^{o}C (4.3%)
  - bacteria isolated most often:
    - S pneumoniae (85%)
    - H influenzae type b (10%)
    - Neisseria meningitidis (3%)

Child 3- 36 months old with fever (continued)

- Outcome of bacteremia if sent home without antibiotics:
  - risk of persistent fever: 56%
  - risk of persistent bacteremia: 21%
  - risk of meningitis: 9%

Child 3- 36 months old (continued)

- Blood culture:
  - should be considered if fever >39^{o}C without a source
  - WBC result can help determine if blood culture necessary
  - not necessary if presumptive diagnosis of a viral syndrome supported by benign clinical appearance

Child 3- 36 months old (continued)

- Lumbar puncture
  - indicated in any child suspected of sepsis or meningitis based on history, observation or physical exam
  - no other test can exclude meningitis
  - approximately 1% of children with a normal CSF WBC, chemistries and gram stain will have a positive CSF culture

Child 3- 36 months old (continued)

- Urinalysis and urine culture
  - Urinary tract infection occurs in
    - 7% male infants <= 1 year old with fever without source
    - 8% female infants <= 1 year old with fever without source
  - 20% young children with UTI have normal urinalysis
  - only a urine culture can establish or exclude diagnosis of UTI
  - catheter or suprapubic aspiration to obtain specimen

Child 3- 36 months old (continued)

- Chest Radiographs
  - usually negative in children if no signs of lower respiratory tract infection
    - tachypnea
    - cough
    - rales
    - rhonchi

Child 3- 36 months old (continued)

- Stool cultures
  - valuable only if have diarrhea
  - common causes of bacterial diarrhea:
    - Salmonella
    - Campylobacter
    - Shigella
    - Yersinia
    - enteroinvasive or toxigenic strains of E coli
  - if signs of invasive bacterial diarrhea (bloody or mucoid diarrhea or 5+ WBC/hpf): empiric antibiotic therapy

Child 3- 36 months old with fever without source: empiric antibiotic therapy

- Options:
  - all children with temperature >= 39^{o}C: blood culture and antibiotics
  - temperature >= 39^{o}C and WBC count >= 15,000: blood culture and antibiotics
- Parenteral antibiotics reduce risk of subsequent bacterial meningitis significantly more than oral antibiotics: 0.3% vs 8.2%
  - Ceftriaxone 50 mg/kg
- Risk of partially treating meningitis if start empiric antibiotics without lumbar puncture

Child 3- 36 months old with fever without source: empiric antibiotic therapy

- If blood or urine culture positive, must recall child for re-evaluation
  - if blood culture positive for S pneumonia and afebrile and well-appearing: can repeat Ceftriaxone and treat as outpatient with 10 d oral penicillin
  - if blood culture positive for H influenzae or N meningitidis, repeat blood culture, perform lumbar puncture and admit for parenteral antibiotics
  - if only urine culture positive, consider outpatient antibiotics if afebrile and well-appearing

Conclusion

- Appropriately managing fever without a source in infants and children essential to minimizing risks of serious bacterial infection
- Guidelines presented do not eliminate all risk
- Physicians may individualize therapy based on clinical circumstances

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