Febrile Infant
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Introduction
Fever is the single most common chief complaint of children presenting to the Emergency Department, accounting for approximately 25% of pediatric visits. Children under two years of age present unique challenges to the clinician due to the difficulty in obtaining a specific history and defining physical findings. The extent of the work-up and the appropriate management will be guided by many factors such as clinical assessment, physical findings, age of the patient, and height of the fever. This chapter will focus on the differentiation of the moderately ill from the seriously ill child. The discussion will be limited to general aspects of the initial Emergency Department evaluation and management of the child with fever. The student is encouraged to review the referenced article for more detailed information on the management of fever without a source in children, particularly focusing on the entity of occult bacteremia.

Temperature Management
Fever in infants and toddlers is a rectal temperature of 38 C/100.4 F or higher. It is important to remember that oral temperatures are generally 0.6 C/1 F lower than rectal temperatures and axillary temperatures are 0.6 C/1 F lower than oral temperatures. Oral temperatures may be useful in a cooperative, older child but can be affected by such factors as respiratory rate and oral intake. The tympanic membrane can be used for temperature measurement but most experts consider “ear thermometers” to be relatively insensitive in detecting fever, particularly in very young children. The rectum remains the most reliable site for temperature measurement in infants and toddlers, and is the preferred site for children less than two years of age who present to the MCG emergency department. The relationship between the height of fever and occurrence of bacteremia has been the topic of much discussion. In general, as the temperature rises above 39 C, the risk of bacteremia and serious bacterial infection increases. Hyperpyrexia is defined as temperature greater than 41 C/105.8 F. Hyperpyrexia may be a sign pointing to serious underlying disease such as meningitis. However, temperature elevations greater than 42 C/107.6 F are most often non-infectious in origin. Cases of extreme temperature elevation of this magnitude can be caused by head injury, ingestion of psychotropic agents, heat stroke, or malignant hyperthermia.

Children often feel uncomfortable during periods of temperature elevation and so it is appropriate to institute measures to directly lower the temperature to achieve symptomatic relief. Also, temperature reduction is important in the initial evaluation of the febrile infant to reliably assess the child’s level of irritability. Children who initially appear ill or irritable may markedly improve with lowering of the temperature. The antipyretics acetaminophen and ibuprofen are commonly used for temperature reduction. The dosage of acetaminophen is 10-15 mg/kg given at 4 hour intervals with a maximum dose of 600 mg. Increasing the dosage beyond this level does not result in better or more sustained effect. Rectal suppositories may be used in the child unwilling or unable to take oral medications. The dosage of ibuprofen is 10 mg/kg given every 6 hours with a maximum daily dosage of 40 mg/kg. Other measures that may facilitate heat loss in a child might include unwrapping a bundled infant or rehydrating a dehydrated child. Tepid baths should never be used without antipyretic medications to bring fevers down, since they can actually increase the temperature if used as the sole method of fever control.

Clinical Findings
Studies have shown that viral infections such as URI, gastroenteritis, or viral pharyngitis are the cause of fever in 95-96% of febrile children. It is the physician’s primary role to identify the 4-5% who have a bacterial infection since these children will need antibiotics for treatment. Most viral infections require only symptomatic care, such as administration of antipyretics.

A good medical history is the most critical part of the evaluation of a febrile child, and can usually identify children likely to have a viral source. It is important to determine whether symptoms related to the respiratory system or gastrointestinal tract are present, since they are the sites for most viral infections in children. Changes in behavior such as irritability or lethargy may be the only presenting symptoms in cases
of urinary tract infections, CNS infections, or sepsis. It is also important to note whether the child has recently attended day care, has had contact with other people with similar symptoms, or has recently received vaccination such as DPT or MMR, since all help to identify a non-bacterial source.

Parents will usually report non-specific changes in behavior such as decreased activity, poor appetite, or the familiar “not acting right.” Parents often use the word “lethargic” to describe their child’s behavior when in fact true lethargy is not present. Febrile children generally are less active or subdued, but still react to environmental stimuli such as ear exam or blood draw. The febrile child who has a markedly diminished response to stimuli such as these is truly lethargic, and is likely to be seriously ill. Similarly, poor appetite is expected during a febrile illness, but a child who has stopped all oral intake is likely to be seriously ill.

The physical examination should focus initially on careful observation of the child’s general behavior. A happy, smiling, playful infant that interacts well with his parents is unlikely to have a serious infection such as meningitis or sepsis. However, an irritable, lethargic, or ill appearing child that has a weak cry and is uninterested in his environment demands a rapid assessment. A search for physical findings suggestive of a serious bacterial infection should be performed while the child is distracted with play objects. Observe his general physical appearance and check for abnormalities such as rashes, limited movement of a limb, areas of point tenderness or pain, or signs of increased work of breathing such as retractions or nasal flaring. Nuchal rigidity, Kernig or Brudzinski signs may not be apparent in children under the age of 18 months. The finding of petechiae on physical examination should alert the physician to the possibility of a serious underlying bacterial infection. Poor perfusion can also be a clue to a more serious illness. Pus behind a tympanic membrane suggests acute otitis media, which has a bacterial component in two thirds or more of cases.

The combination of history and physical exam alone generally will suffice to diagnose most viral infections. Most children whose fever started acutely around the same time as respiratory or gastrointestinal symptoms will have a viral infection. Similarly, blanching rashes or pharyngeal findings such as ulcers or tonsillar exudates usually indicate a viral source. Group A streptococcus (GAS) pharyngitis, or “strep throat,” is rare under the age of two years, and even in older age groups GAS causes only about 15% of cases of pharyngitis. While a test for GAS is indicated for children over two years with pharyngitis, blood tests are not usually required for most other clinically apparent viral illnesses.

**Infants Up To 3 Months**

**Diagnosis**

The age of the infant directly influences the extent of the work-up. Infants under 3 months of age are felt to have a higher risk for serious life-threatening infections, partly because they do not localize infections as well as older children and can deteriorate rapidly. Careful clinical assessment, along with judicious use of laboratory tests, is the key to appropriate management in this age group. History and physical examination may provide clues to the diagnosis. A history of lethargy, irritability, poor eating, or continuous crying suggests a serious infection. A history of recent exposure to other children with viral illnesses would suggest a similar diagnosis in the infant, particularly if the infant’s symptoms mirror those of the other children. The physical examination may reveal a focus of infection such as an inflamed eardrum. Cough, tachypnea, retractions, or nasal flaring with an increased respiratory rate would suggest a lower respiratory infection. However, there may be no specific findings despite the presence of a systemic infection. Increased irritability, lethargy and inconsolable crying is frequently seen in infants with meningitis. Urinary tract infections may not produce symptoms other than fever. The absence of any specific diagnosis based on history and physical examination suggests the need for laboratory testing to detect occult infection. Tests to be considered include a complete blood count with differential, sedimentation rate, blood culture, lumbar puncture, chest x-ray, urinalysis and culture, and a stool culture if there is a history of diarrhea.

**Management**
The appropriate management of the febrile infant under 3 months of age is an area of intense controversy. Most experts currently recommend a full sepsis work-up and hospital admission for febrile children under 1 month of age. Children above 1 month of age who have normal physical examination, history and laboratory results may be monitored as outpatients with or without parenteral antibiotics if follow-up can be assured. All febrile infants with abnormal laboratory results should be hospitalized. The decision not to hospitalize a febrile infant should be made by a clinician experienced in the evaluation of young children, and after assuring that follow-up will occur in the following 12 - 24 hours.

Infants 3 - 24 Months

Diagnosis

The general guidelines used in the evaluation of the infant less than 3 months of age also apply for older children. Clinical judgment is more reliable in the assessment of older infants and remains the most important indicator of toxicity. The examining physician should observe the child’s interactions with his environment. “State variation” refers to a child’s ability to alter his activity state between quiet and agitated depending on the stimulus. A child who cries and fights the exam but then calms in the mother’s arms has good state variation. A child who remains agitated despite comforting from the parent, or who remains quiet or passive even with noxious stimuli such as the ear exam or blood draws, has poor state variation. Poor state variation suggests a more serious illness. “Toxic” generally implies that the child has symptoms consistent with the sepsis syndrome, such as poor perfusion, lethargy, extreme tachycardia, or tachypnea.

Occult bacteremia is defined as clinically inapparent bacteremia, and has a peak incidence in febrile children 10-14 months of age. Bacteremia is differentiated from sepsis in that bacteremia does not include the symptoms of the sepsis syndrome, other than fever. These children do not appear toxic, and do not have an obvious bacterial source for the fever. Occult bacteremia by definition cannot be diagnosed by physical exam alone; this is a diagnosis that requires laboratory tests. The specific work-up and management of children with suspected occult bacteremia is beyond the scope of this discussion. Although opinions vary on the most appropriate work-up and management of these children, a few generalizations can be made. A temperature over 39 C has been associated with a higher risk of bacteremia, as has a white blood cell count of 15,000/mm3 or greater. It is important to remember that bacteremia can also occur at lower temperatures and with lower WBC counts. Children under 24 months whose temperature is 39 C or greater, whose WBC is 15, 000 or greater, and who do not have a clinically apparent viral or bacterial source for the fever have an approximately 3-5% risk of occult bacteremia. *Streptococcus pneumoniae* is by far the most common organism responsible for occult bacteremia in children. Up to 65% of cases of occult bacteremia resolve spontaneously, without any specific therapy.

Management

Children in whom a specific bacterial focus of infection has been identified should receive antibiotic therapy directed at the most likely organisms. Some of these children may require hospitalization, depending on the focus of infection and the severity of the symptoms. Those with symptoms consistent with a viral illness should be instructed on appropriate symptomatic care. Controversy surrounds the question of treating children with suspected occult bacteremia. Published fever guidelines suggest a single dose of ceftriaxone and close follow-up for these children. Non-toxic children who have no identified source for their fever and whose WBC is less than 15,000 receive symptomatic care only, along with appropriate follow-up. If ceftriaxone is used, blood and urine cultures should be sent first to identify those who truly have a clinically inapparent bacterial infection. Regardless of which treatment option is chosen, careful follow-up with repeat examination in 12 - 24 hours must be assured before the patient is discharged.

All patients with positive blood cultures should have repeat evaluation with repeat blood culture. If the patient is receiving appropriate antibiotics and is clinically well they should be instructed to complete the course of therapy. If the patient is afebrile and clinically well but has never received antibiotic treatment, antibiotic therapy is not necessarily indicated unless the child develops a specific focus of infection. Any patient with a positive blood culture who remains febrile or does poorly on antibiotic therapy should
receive a complete sepsis work-up including a CBC, blood culture, lumbar puncture, chest x-ray, urine culture, and be hospitalized for parenteral antibiotic therapy.

FEBRILE INFANT

A 6 month old male infant is brought to the Emergency department at 3pm by the child’s parents. They state he has been running a slight fever all day, but had no other symptoms. The mother states that she tried to feed the infant during the day, but was unsuccessful as the child was not acting himself and would not take a bottle. She states that the child is usually a happy child and is awake, alert, and playful at this time of the day. She denies any history of vomiting, diarrhea, cough, ear pulling, or other associated symptoms. The child has had some crying off and on which is unusual for the child. Examination reveals a child who is not interested in his surroundings and does not respond to the examiner’s voice or the examination. The child is somewhat pale and cold to the touch. Vital signs are: Temperature 39 C/102.2 F, Respirations are 50, Pulse is 180/minute, Blood Pressure 80 palpable, HEENT examination reveals clear tympanic membranes and clear posterior pharynx. Anterior fontanalle appears full, but not tense. His eyes appear somewhat sunken, but there is no crying or tearing noted. Lungs are clear and cardiac exam reveals tachycardia. The abdomen is soft without distension. Neurologic exam reveals a child who is somewhat lethargic and not interested in his surroundings. When placed on the stretcher for examination, the child does not interact with the examiner, nor does he cry in response to the examiner’s touch or movements. Spontaneous motor activity is noted in all extremities.

1. Do you feel the infant in the above description is minimally ill or severely ill? What aspects of the history and physical exam lead you to believe this conclusion?

2. What diagnostic studies would be indicated to define the source of fever in this infant?

3. What initial treatments should be started in this child and how rapidly should these interventions be undertaken?

4. With a WBC count of 6,500, with 40% bands, a normal UA, a normal chest x-ray and cloudy spinal fluid, what would be the most likely diagnosis in this child?

5. How would the laboratory tests described above affect your disposition of this child?

FEBRILE INFANT

A 16 month old female is brought to the Emergency Department at 10 pm by her parents with a 2-day history of fever to 104 F. The mother states that the child has had diarrhea today, but has had no other symptoms. The mother denies any history of vomiting, ear pulling, coughing, difficulty breathing or abdominal pain. Upon entering the examination room, you notice a well appearing female child, running about the room playing with toys on the floor. The child immediately runs up to you and waves at you trying to say, “Hi.” The child appears to be very happy, playful and in no acute distress. The vital signs are stable with a recorded temperature of 39 C/102.2 F. There is no apparent focus of infection on physical exam. The parents state that they were going to take the child to the pediatrician tomorrow, but wanted to make sure the child was “ok” until then. The parents appeared concerned and reliable.

1. What other historical factors would be important in the evaluation of this child?
What specific physical findings would you look for?

2. What laboratory test if any would be ordered on this child and explain the rational for there use?

3. Assuming a WBC count of 4500, with a normal differential and a normal urinalysis, what would be your disposition of this patient? Explain why?

Febrile Infant

1. When is a child considered to have a fever?

2. Define hyperpyrexia and differentiate this condition from fever.

3. Discuss the various methods of temperature measurement and the accuracy of each.

4. List some aspects of the history and physical examination which may provide clues to the diagnosis of the cause of fever. Which of these findings would suggest a serious source of infection?

5. Identify aspects of the clinical assessment which reliably differentiates seriously ill from non-toxic infants.

6. What is the correct dose of acetaminophen and ibuprofen for fever control in the febrile infant?

7. Identify what other appropriate measures to use for fever control in addition to antipyretic therapy.

8. Identify specific laboratory tests and radiographic examinations which should be undertaken in a full septic work-up.
9. Discuss some of the differences in the management of infants under the age of 3 months versus infants 3 - 24 months.

10. Outline possible discharge plans for an infant 7 months old with a fever greater than 39 C and a WBC count greater than 15,000. Include a discussion of follow-up planning.

Bibliography


Appendix I: Rapid Physical Assessment of the Irritable/Lethargic Febrile Pediatric Patient

<table>
<thead>
<tr>
<th>System</th>
<th>Key Finding</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>Airway</td>
<td>grunting</td>
<td>ominous sign, occurs with meningitis, sepsis and pneumonia</td>
</tr>
<tr>
<td></td>
<td>stridor</td>
<td>consider epiglottitis and tracheitis</td>
</tr>
<tr>
<td></td>
<td>wheezing and decreased breath sounds</td>
<td>must R/O pneumonia</td>
</tr>
<tr>
<td></td>
<td>rales</td>
<td>often not heard in infants with pneumonia</td>
</tr>
<tr>
<td>Breathing</td>
<td>tachypnea</td>
<td>rate elevated by fever and anxiety (repeat/repeat)</td>
</tr>
<tr>
<td></td>
<td>pulse ox</td>
<td>normal indicates that there is no respiratory decompensation but it does not R/O pneumonia</td>
</tr>
<tr>
<td>Circulation</td>
<td>decreased peripheral perfusion</td>
<td>caution: early septic shock may present as “warm” shock with warm extremities and strong pulses and normal capillary refill</td>
</tr>
<tr>
<td></td>
<td>abnormal BP</td>
<td>look for a low diastolic or a low elevated pulse pressure as early warning signs of septic shock long before mean BP is abnormal</td>
</tr>
<tr>
<td></td>
<td>petechiae</td>
<td>look closely for this early warning sign of septic shock</td>
</tr>
<tr>
<td>Neck</td>
<td>meningismus</td>
<td>not reliable in infants, often difficult to evaluate in the irritable toddler</td>
</tr>
<tr>
<td></td>
<td>firmness</td>
<td>an ominous sign, however, a bulging but soft fontanelle, is often secondary to fever alone and is probably not in itself a reason to perform a LP</td>
</tr>
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| Fontanelle | firmness                        | an ominous sign, however, a bulging but soft fontanelle, is often secondary to fever alone and is probably not in itself a reason to perform a LP |