

Fever in Children: Friend or Foe?

ABSTRACT: Fever is perhaps the most ancient hallmark of disease. Since the beginning of civilization itself, fever has been regarded as a prime clinical feature of illness. It is the most common symptom in children for which parents seek medical attention. It was Sir William Osler in the early twentieth century who declared that “of the three great scourges of mankind, fever, famine and war, fever is by far the most terrible”.

Fever, also known as pyrexia, is a protective defense mechanism the body employs to fight infection. Fever is a manifestation of illness, but not an illness itself. It simply denotes “all is not well” and helps physicians diagnose disease. However, parents consider fever to be an illness and expect it to be controlled at its onset. In fact, very few symptoms worry parents more than a child’s high fever. Physicians also often worry about high fever (over 103°F) since it can signal a potentially dangerous infection, and treat it aggressively. Nevertheless, it is important to realize that by itself, fever is not a serious illness. Fever almost never kills. It is the cause of fever that may endanger life.

Key words: fever, pyrexia

WHAT IS FEVER?

Fever is the body’s response to a variety of factors that is reflected in an increase in body temperature above the normal range. The most common cause of fever is infection. However, other causes of fever should always be kept in mind, such as non-infective conditions associated with inflammation, such as rheumatoid

arthritis, and malignancy. Environmental heat, toxins, drugs and abnormalities of the temperature regulating system itself rarely result in fever.

IS FEVER BENEFICIAL?

Yes. Fever enhances several immune reactions such as chemotaxis, phagocytosis, leukocyte migration, lymphocyte transformation and increased interferon production. Up to a certain value, it also stimulates the processes of antibody production. Fever also restricts the proliferation of microorganisms. During the pre-antibiotic era, neurosyphilis and gonococcal urethritis were treated by inducing high fever. Critically-ill patients with fever are known to survive better than those without fever. One should try to note the pattern of fever, as it has been appreciated for centuries by clinicians as an important diagnostic aid.

IS FEVER HARMFUL?

Yes. Fever can be harmful in instances of high temperature especially if the fever lasts too long, and the patient happens to be suffering from some other disease as well. High fever may lead to intracellular dehydration that can be reversed by proper hydration. Fever increases metabolic activity as it is associated with an increase in oxygen consumption, carbon dioxide production, cardiac output and the requirement of calories. This may exacerbate cardiac insufficiency in patients with cardio-respiratory conditions and severe anemia. Thus, fever in critically ill children must be controlled as soon as possible. High fever may also result in neurological manifestations such as irritability, delirium, hallucinations and/or disorientation. Luckily, all the effects of high fever are reversible after the fever is controlled.

In children between the ages of 6 months and 5 years, high fever may lead to febrile convulsions within the first 24 hours of fever onset. Convulsions are short-lasting and self-limiting and do not cause any brain damage nor are they responsible for future epilepsy. Recurrent simple febrile convulsions can be prevented by the administration of oral diazepam given during the first 48 hours of fever onset, up until 5 years of age. Hyperpyrexia, defined as an abnormally high body temperature greater than or equal to 105°F is considered a medical emergency as it may indicate a serious underlying condition or lead to significant side effects such as brain damage. It should be treated as quickly as possible by antipyretic drugs and cooling with tepid water sponge baths or ice water enemas, although the latter treatment is rare and could be dangerous.

MEASURING BODY TEMPERATURE

It is important to measure body temperature to assess the degree of fever and also the pattern of temperature changes as it may occasionally hint at the diagnosis. Core temperature is the actual temperature of an organism, specifically in deep structures of the body such as the liver, but it is not necessary to measure except in neonates or in critically ill children with shock. The traditional gold standard measurement used to estimate core temperature is rectal temperature. Axillary temperature is routinely used and ideal in children although in older children and adults, temperature can also be recorded in the mouth. Ear drum temperature is not as accurate as rectal temperature and should be avoided in younger children. Normally mercury thermometers or electronic thermometers are used. Both are fairly acceptable measurement devices. In contrast, plastic measurement strips placed on the forehead are not reliable, as the temperature recorded depends to a great extent on ambient air temperature and local circulation effects.

VARIATIONS IN BODY TEMPERATURE

The temperature reading depends on which part of the body is being measured. In general, rectal body temperature is 1°F higher than oral temperature, which is 1°F higher than axillary temperature. A higher difference between core and skin temperature suggests alterations in blood circulation. Infants and children have a slightly higher body temperature than adults. In infancy, the head appears warmer than the rest of the body. Normally body temperature is 1°F higher in the evening as compared to the morning. This is due to our normal circadian rhythm. Strenuous exercise results in a significant increase in body temperature. In addition, there may be seasonal variation in body temperature especially in young children who exhibit a higher temperature in summer than in winter.

FEVER PATTERN

Classical text books describe the fever pattern as continuous, remittent and intermittent. However, with the universal use of antipyretics, the fever pattern has changed and consequently, this type of description does not help a clinician. Instead, it is important to note the degree of fever at the onset of illness, its rhythm, its response to antipyretic treatment, the behavior of the child during the interfebrile period and the progress of the fever on day 3 to 4. Generally, such details offer a clue to the fever's probable cause as shown in **Table 1** and **Figures 1A-1E**.

TABLE 1 - FEVER PATTERN IN COMMON INFECTIONS

	Bacterial	Viral	Malaria
Onset of fever	Moderate	High	High
Rhythm	Regular	Regular	Irregular
Response to antipyretic	Not so good	Usually good	Erratic
Interfebrile period	Sick	Normal	Normal
Progress on Day 3-4	Worse	Better	Erratic
Extent of involvement	Localized	Generalized	-

However, there are always exceptions to the rule. For example, acute bacterial infection may begin with a high fever when the disease occurs at the site of entry of organisms, as in acute tonsillitis or acute bacillary dysentery. Few acute viral infections do not get better by day 4 and actually take longer time.

Generalized involvement is a feature of acute viral infection. Respiratory system infection usually presents with congested eyes, congested throat and

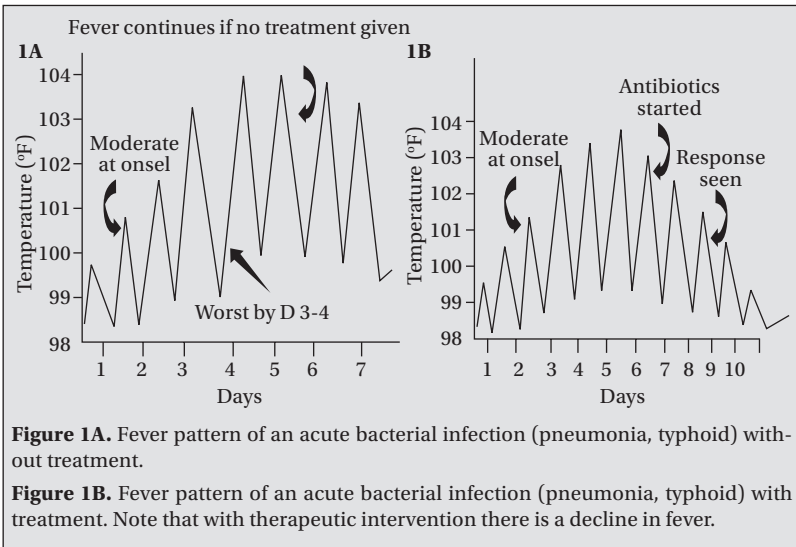


Figure 1A. Fever pattern of an acute bacterial infection (pneumonia, typhoid) without treatment.

Figure 1B. Fever pattern of an acute bacterial infection (pneumonia, typhoid) with treatment. Note that with therapeutic intervention there is a decline in fever.

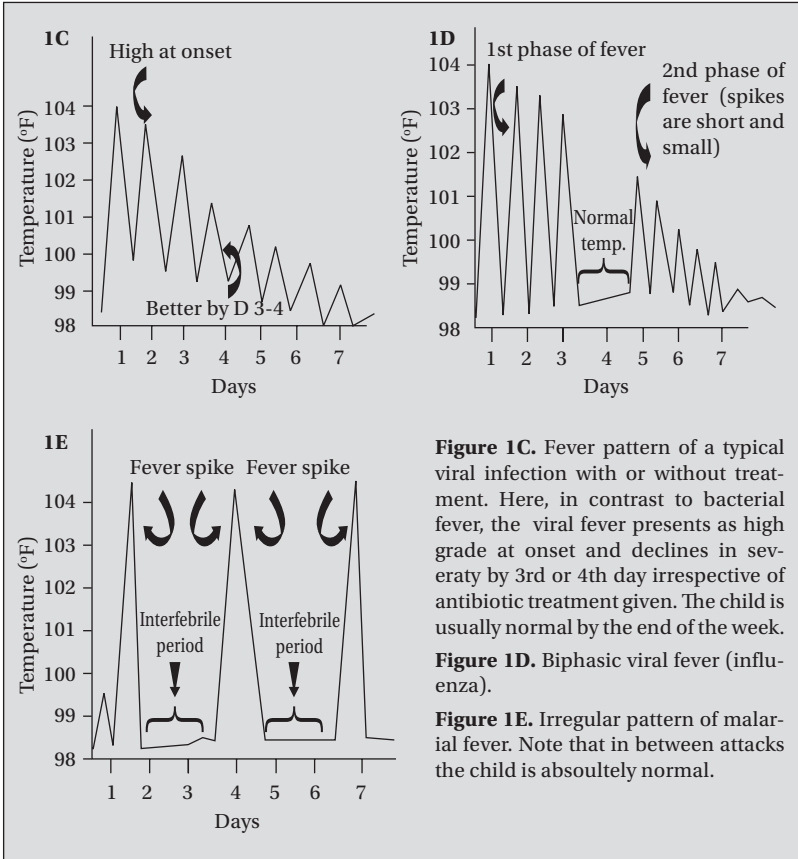


Figure 1C. Fever pattern of a typical viral infection with or without treatment. Here, in contrast to bacterial fever, the viral fever presents as high grade at onset and declines in severity by 3rd or 4th day irrespective of antibiotic treatment given. The child is usually normal by the end of the week.

Figure 1D. Biphasic viral fever (influenza).

Figure 1E. Irregular pattern of malarial fever. Note that in between attacks the child is absolutely normal.

bilateral chest signs although it may also be accompanied by generalized GI symptoms such as vomiting and diarrhea. Very often there is a history of similar acute viral illness in the family. In general, acute viral infections spread quickly from one member of a family to another, and finally to other members of the community.

Localized involvement is a feature of acute bacterial infection. Thus, in acute tonsillitis, there are no chest signs or runny nose and in pneumonia there are no throat signs. In addition, pneumonia is localized to a single part of the lung. In fact, bilateral lung involvement is rarely of acute bacterial origin.

FEVER WITH RIGOR OR CHILLS

A rigor (shivers) is an episode of shaking due to muscle contractions that is intended to raise body temperature to a high degree in a short time. Chills are produced by peripheral vasoconstriction that helps preserve heat loss and is useful to raise body temperature to a smaller degree. Both mechanisms are meant to raise body temperature but to a different level and the body reacts as per the need. Neither rigors nor chills are characteristic of any particular illness. While rigors are common in malaria and urinary tract infection, they may also present in typhoid fever or any other infections but only if the body senses the need to raise body temperature to a significantly high level. It is also equally true that malaria and urinary tract infection may present without rigors or chills.

SHORT DURATION FEVER

Children presenting with short duration fever is the most common problem in routine clinical practice. While accurate diagnosis of short duration fever is often not possible in the first 3-4 days, it is important to rule out evolving “serious” conditions. It is not difficult if one looks closely for the following “red alert” signs (See Box below):

1. Behavior – lethargy, irritability, and/or confusion suggests brain dysfunction that may result from intracranial infection, dehydration, hypoxia, as in pneumonia, or shock, as in dengue shock syndrome.
2. Tachypnoea and chest retraction denotes pneumonia.
3. Disproportionate tachycardia and tachypnoea is evidence of sepsis (normally there is an increase of 10 heart beats and 3-4 respiratory movements for every 1°F rise in body temperature).

“RED ALERT” SIGNS

- Behavioral abnormalities
- Tachypnoea and chest retraction
- Disproportionate tachycardia and tachypnoea
- Oliguria / anuria
- Increased CRT and core-skin temperature difference
- Purpuric, hemorrhagic or bullous rash

4. Urine output – oliguria indicates dehydration, circulatory or renal failure.
5. Increased capillary refill time and increased difference between core and skin temperature denotes circulatory failure (normally when you press the nail, it becomes white and when you release the pressure, the nail becomes pink again within 1-2 seconds).
6. Purpuric, hemorrhagic or bullous skin rash indicates probable serious underlying condition.

If “serious” conditions are ruled out, one can proceed according to **Figures 1A-1E** to define the probable cause of fever and treat accordingly. Viral infection is treated with antipyretics only. Antibiotics are prescribed only for bacterial infection. If on days 3-4, there is no clue to probable diagnosis than relevant laboratory tests may be ordered before starting empirical antibiotic therapy. Such tests include CBC and peripheral smear, urinalysis and chest x-ray. Blood culture is ideal when one suspects typhoid fever.

SYMPTOMATIC THERAPY FOR CONTROL OF FEVER

As mentioned above, fever is beneficial and hence one should not be aggressive to suppress fever. Consequently, antipyretics should not be used to suppress fever but to prevent fever from rising to a dangerously high level. In addition, antipyretics can be used if a child is uncomfortable because of the fever. It is like a pain-killer that does not kill the pain but makes the pain more tolerable. Generally, fever less than 100°F should not be treated with antipyretics as the child is usually comfortable in spite of the fever. Between 100°F and 102°F, antipyretics are used if the child is uncomfortable. Above 102°F, it is ideal to keep the temperature under control so that it does not rise to a dangerously high level.

Parents should be informed that fever is not expected to go down to normal nor is it ideal to do so because fever has beneficial effects. It is often the body’s way of fighting infection. Paracetamol (acetaminophen) is the drug of choice for reducing fever and should be used in a dose of 15 mg/kg body weight, which may be repeated every 6 hours if necessary. Ibuprofen is an acceptable alternative and so is mefenamic acid, although there is no advantage of either drug over paracetamol. Nimesulide, a relatively COX-2 selective, non-steroidal anti-inflammatory drug should not be used as an antipyretic in children.

LONG DURATION FEVER

Fever persisting for more than a week without any clue as to its origin is often not an emergency but definitely a diagnostic challenge. One should rule out subacute progressive infections such as tuberculosis, mycoplasma, leptospirosis, Epstein-Barr virus, Cytomegalovirus infections and Brucellosis. Besides these infections, systemic inflammatory diseases and malignancy are other causes of long duration fever that need specific laboratory tests and expert help.

In summary, fever is a friend and not a foe. One must not worry too much about fever but try to find out its cause. Once “serious” conditions are ruled out, simple guidelines help one to follow a rational approach. ■

CIS CME

Clinics India School of Continuing Medical Education



CME questions on
“Fever in Children: Friend or Foe?”

QUESTIONS

- 1** **Fever may be caused by:**
 - a) Drugs
 - b) Toxins
 - c) Environment
 - d) All of the above
 - e) None of the above
- 2** **Viral infection can be differentiated from bacterial infection by:**
 - a) Height of fever
 - b) Duration of fever
 - c) Age of the child
 - d) Frequency of fever episodes
 - e) Behavior during interfebrile period
- 3** **Fever may be accompanied with rigors in:**
 - a) Typhoid fever
 - b) Pneumonia
 - c) Viral infection
 - d) All of the above
 - e) None of the above
- 4** **“Red alert” signs in fever include:**
 - a) Diarrhea
 - b) Jaundice
 - c) Headache
 - d) All of the above
 - e) None of the above
- 5** **Ideal single dose of paracetamol is:**
 - a) 5 mg/kg
 - b) 10 mg/kg
 - c) 15 mg/kg
 - d) 20 mg/kg

Answers to CME questions on
Fever in Children: Friend or Foe?"

ANSWERS

- 1 The correct answer is (d).** Drugs, toxins and environment—all of them may cause fever. Fever does not mean infection though infection is the commonest cause of fever in clinical practice. However, it is important to remember non-infective causes of fever.
- 2 The correct answer is (e).** When fever is controlled even partially by paracetamol, child suffering from viral infection becomes comfortable and does not look sick. As against child suffering from acute bacterial infection continues to be toxic and sick looking during interfebrile period. Height, duration of fever and age of the child do not differentiate between acute viral and bacterial infection.
- 3 The correct answer is (d).** Fever may be accompanied with rigors in any infection that demands high degree of rise in body temperature. Hence it does not necessarily suggest malaria. In fact malaria may not present with rigors if rise in body temperature is not so high. Thus rigors do not suggest any particular etiology.
- 4 The correct answer is (e).** Red alert signs in fever do not include diarrhea, jaundice or headache. While diarrhea and jaundice are mere localizing signs of specific organ involvement, they may not suggest seriousness. Headache is non-specific symptom often accompanying any high fever and in such cases headache is relieved with control of fever.
- 5 The correct answer is (c).** Ideal dose of paracetamol is 15 mg/kg as a single dose. It may be repeated every 4-6 hours only if necessary. It is not merely fever that demands use of paracetamol, it is the discomfort due to fever that needs relief and not just fever.