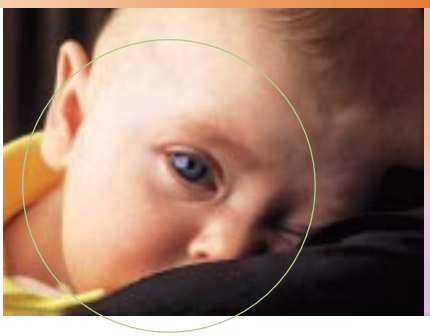

FEVER: THE CLINICAL PERSPECTIVE

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By increasing body temperature to fever levels, the organism attempts to protect itself against germs. Certain bacterial components function as exogenous pyrogens and trigger production of endogenous pyrogens. The purpose of rising temperatures is to inhibit bacterial growth and reproduction. Simultaneously, the bacteria are deprived of important elements such as iron, copper, and zinc, which are sequestered in the reticuloendothelial system. Viremia, too, causes fever through the release of endogenous pyrogens in an effort to make viral replication more difficult. In most cases, therefore, fever is a beneficial reaction and patients should be encouraged to accept it as such. In auto-immune disorders and tumors, hyperthermia procedures can be used to exploit the potential therapeutic benefits of fever as a self-healing process.

The use of fever reducers is not recommended in trivial viral infections and is indicated only when suspicions of serious illness have been confirmed and only in combination with medications (antibiotics or virostatics) that target the pathogens.

INTRODUCTION

The body's normal core temperature is subject to a daily rhythm, fluctuating between 36.3° C/97.3° F during sleep and 37.0° C/98.6° F in the waking state. Only in the body's core – the brain and the interior of the torso – is temperature monitored by sensors and kept at a constant level by brown fat. Additional sensors are located in the skin, which is usually significantly cooler (28-36° C/82.4-96.8° F). Temperature balance is regulated through perfusion of the skin and deep muscle layers of the extremities [3].

DEVELOPMENT OF FEVER

The term "fever" describes a core temperature of more than 38.3° C/100.9° F. Subfebrile temperatures range from 37.5° C/99.5° F to 38.3° C/100.9° F; "high fever" means a temperature of more than 40° C/104° F. To raise core temperatures to the desired levels, the body's central thermoregulatory system restricts heat loss by diverting blood from the skin to deeper vessels [3]. The skin feels cool, and shivering may result from involuntary muscle trembling whose purpose is to increase heat production.

These reactions are triggered by endogenous and exogenous pyrogens, which cause a central resetting of the thermal set point. For the most part, exogenous pyrogens are germ fragments opsonized in complement. Endogenous pyrogens include various interleukins, interferon, tumor necrosis factor (TNF alpha), and the macrophage inflammatory protein MIP 1 [2]. Exposure to excessive external heat and/or inadequate radiant heat loss can also trigger fever. Heavy exertion can also raise core temperatures above 40° C/104° F. As a fever abates, the internal thermostat is reset to normal, and heat is radiated away through increased skin perfusion and evaporative cooling of the skin through perspiration.

In addition to infections, a number of other diseases can trigger feverish reactions (Table 1).

Table 1: Possible causes of fever

- Infections caused by viruses, bacteria, mycoplasmas, parasites, and fungi
  - Sepsis, meningitis, encephalitis, urinary tract infections
  - Sinusitis, bronchitis, pneumonia, otitis media, osteomyelitis
- Auto-immune or connective tissue diseases
  - Rheumatic fever, lupus erythmatosus, sarcoidosis, dermatomyositis
- Dehydration accompanied by circulatory centralization (stage in the development of fever when the body is actively attempting to raise internal temperatures by restricting skin perfusion)
- Instability of the hypothalamic temperature center due to head trauma
- Drug-induced fever
- Aseptic fever following extensive injuries
- Tumors
  - Leukemia, brain tumors

Table 2: Typical fever curves

- **Continual Fever**
  Temperatures remaining around 39° C/102° F with fluctuations of approximately 1° C/1.9° F for several days. Occurs in: viral pneumonia, typhoid fever, scarlet fever, erysipelas.
- **Remittent Fever**
  Fever with fluctuations of more than 1.5° C/3° F. Occurs in: acute rheumatic fever, sepsis, pyelonephritis, tuberculosis. Fever occurs in waves over the course of weeks, rising only gradually: brucellosis (undulant fever), Hodgkin's disease.
- **Recurrent Fever**
  Several days of fever followed by fever-free intervals also lasting several days. Occurs in: malaria (fever peaks daily or every three to four days), African relapsing fever.

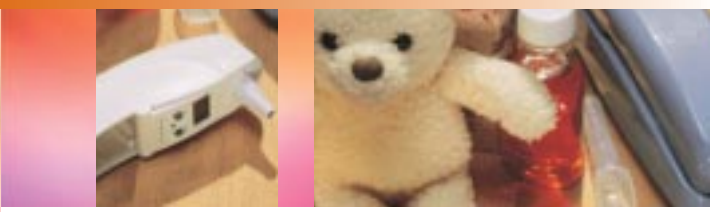
BENEFITS AND RISKS OF FEVER

Fever is a purposeful, infection-inhibiting bodily response, an attempt to kill viral and bacterial invaders or at least prevent them from multiplying. At the same time, plasma levels of metals essential to bacterial reproduction and viral replication drop. These metals (iron, zinc, and copper) are deposited in the reticuloendothelial system and remobilized after the infection is overcome [4]. These mechanisms often adequately combat trivial viral infections, and as a result the fever abates spontaneously after three days. A potentially negative effect of fever is that it places increased demands on the circulatory organs, as evidenced by increases in heart rate. This effect can cause complications in patients with cardiac insufficiency.

FEVER IN EXANTHEMATOUS CHILDHOOD DISEASES

The biphasic fever curve of measles and chicken pox is a typical response to the first and second stages of viremia. The fever peaks in the second stage, which also coincides with the appearance of the characteristic generalized skin rash. In measles, large, bright red spots appear first behind the ears and then spread over the torso to the extremities, while the chicken pox rash is characterized by blisters and papules that develop from pale red spots.

In three-day fever, a rapid rise in fever is noted, but exanthema (fine spots) appears only after the fever declines on the third day. In scarlet fever, onset of fever is rapid in response to streptococcus toxins, and the fleeting rash of



small spots appears only two to four days later. In Kawasaki disease, the fever is high and of long duration and does not respond to antipyretics; generalized exanthema is uncharacteristic. Typical symptoms of rubella include slight fever (up to 38.5° C/101.3° F) accompanied by swollen lymph glands and, seven days later, by a rash of fine spots appearing first on the face.

Fever patterns in other diseases: occasionally, conclusions about the cause of an illness can be drawn from the course of the fever over several days (Table 2), assuming, of course, that no fever reducers or antibiotics have been administered.

OTHER CAUSES OF FEVER

In infants, fever develops relatively rapidly in response to dehydration when daily fluid intake is less than the required 120 to 140 ml per kg (2.2 pounds) per day.

Heat stroke triggers fever as a result of excessive influx of heat into the body. Inadequate heat loss (due to excessively warm clothing, for example) can also produce core temperatures above 40° C/104° F.

COMPLICATIONS OF HIGH FEVER

In children under five years of age, sudden onset of fever can induce so-called febrile seizures (generalized tonic-clonic convulsions with loss of consciousness). A febrile convulsion is considered "complex" rather than "simple" when it lasts more than 15 minutes or recurs within 24 hours, or in a child younger than one year or older than five years.

The mental disturbance (confusion and hallucinations) that may accompany a rapid rise in fever is known as delirium.

DIAGNOSTICS

Core body temperature is measured either rectally or sublingually. Taking the temperature in the outer auditory canal with an electronic thermometer is relatively reliable and more acceptable to children.

After extensive inquiry into the patient's symptoms and medical history, a thorough physical examination is obligatory. Laboratory testing is not necessary for simple viral infections but should be conducted whenever a serious illness is suspected. It should include a blood count, differential blood count, erythrocyte sedimentation rate (ESR), and urinalysis.

Hemoculture (to diagnose sepsis) is indicated in case of high fever. If meningitis is suspected, lumbar puncture should be performed.

THERAPY

Subfebrile temperatures do not require medication. Fluid intake must be increased and extra losses taken into account if the patient develops diarrhea or vomiting. Adequate mineral intake is important. A high-protein diet tends to increase body temperature and is therefore not helpful. Bed rest is usually gladly accepted by the patient, who generally feels tired and enervated.

The temperature of the patient's room should not exceed 20° C/68° F. A vaporizer helps counter increased water loss through insensible perspiration.

CONVENTIONAL THERAPY

Allopathic antipyretics (paracetamol/acetaminophen, ibuprofen, or acetylsalicylic acid) may be used to reduce temperatures above 39° C/102° F. Antibiotics may be used for targeted treatment of confirmed bacterial infections; they are useless against viral infections.

If febrile convulsions occur, the patient must be sedated immediately. Diazepam administered as a rectal solution is suitable for this purpose. Children with a history of febrile seizures can be treated prophylactically with rectal suppositories of chloral hydrate at the first hint of a recurrence.

ANTIHOMOTOXIC THERAPY

Antihomotoxic therapy for fever over 39° C/102° F, especially in the early stages of viral infections, consists of either Aconitum-Homaccord® or Ferrum phosphoricum-Injeel® (also as drinking ampules). Belladonna-Homaccord® is indicated for localized feverish inflammations of the throat or middle ear. Common colds respond to Gripp-Heel®. Viburcol® suppositories have proved effective for restlessness in feverish infants[2]. Lymphomyosot/Lyphosot® may be helpful in expelling pyrogens from the extracellular matrix.

HOMEOPATHY

In homeopathic therapy, Aconitum 6X and Ferrum phosphoricum 6X are used to reduce fever. Combination medications that include both of these remedies are also available.

ADJUVANT THERAPY

Supplementary external therapy can include the use of cold compresses on the lower legs or cool body wraps to cool the skin. These measures are useless, however, in circulatory centralization. Full baths in warm water that is gradually cooled are advisable only if the patient's circulatory status is stable.

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