Fever in Adults — Pathophysiology and Treatment

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Fever is an elevation in the body temperature which is above the normal temperature range. The temperature is considered elevated when it is higher than 100°F (37.8°C) when measured by an oral thermometer or higher than 100.8°F (38.2°C). It is a characteristic feature of a variety of infections. Tissue injury, bacterial or viral infections and many other causes can be a triggering factor for the body, which may lead to fever. The body’s immune system defends itself against the “pyrogen”, such as viruses, bacteria, fungi, drugs or hazardous toxins, by responding with fever.

Definition

Fever is an elevation in the body temperature which is above the normal temperature range. The normal body temperature is 98.6°F (37°C), but the body temperature fluctuates throughout the day. It gets to its lowest at early mornings and highest in the late afternoon.

Fever is the body’s natural response to fighting off infections when it’s in a healthy condition.
That is the reason why it is not always advisable to bring the fever down too quickly.

Different Types of Fever in Adults

Fevers have different types, and each type could be associated with a particular type of diseases and infection. The following are types of fever, along with the associated disease.

<table>
<thead>
<tr>
<th>Type of Fever</th>
<th>Associated Disease (Examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Fever</td>
<td>• Pneumonia</td>
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<td></td>
<td>• Urinary tract infection</td>
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<td></td>
<td>• Typhoid</td>
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<td></td>
<td>• Brucellosis</td>
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<td></td>
<td>• Typhus</td>
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<tr>
<td>Remittent Fever</td>
<td>• Typhoid infection</td>
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<tr>
<td></td>
<td>• Infective endocarditis</td>
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<tr>
<td>Intermittent Fever</td>
<td>• Parasitic or bacterial infection</td>
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<tr>
<td></td>
<td>• Malaria</td>
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<td></td>
<td>• Septicemia</td>
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<tr>
<td>Hyperpyrexia</td>
<td>• Kawasaki syndrome</td>
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<td></td>
<td>• Thyroid storm</td>
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<tr>
<td>Relapse Fever</td>
<td>• Borellia infections</td>
</tr>
</tbody>
</table>

Apart from these, other types of fever are:

- **Pel Ebstein fever:** In this type, there is a regular variation of recurrent periods of fever and afebrile periods. The temperature might take 3 – 4 days to rise, then remains high for almost 3 days and then remits in 3 days, which is followed by a 9 day period of apyrexia.

- **Low grade fever:** In this type, the temperature is present on a daily basis, especially in the evening and it does not exceed 37.8° C. It is mostly seen in tuberculosis.

- **Inverse fever:** In this type, the temperature mostly rises in the early hours of the morning. It is mostly seen in Miliary Tuberculosis.

- **Neutropenic fever:** It is most commonly present in immune compromised patients, like the one who is undergoing chemotherapy, dialysis, or an organ transplant patient.

- **Rheumatic fever:** This type of fever is caused by streptococcal bacteria which causes throat infections. When the throat infection is left untreated, it leads to a painful fever.

Epidemiology of Fever in Adults

Fever is a very common problem these days. Adult’s infections and cancer account for 25 – 40% of fever cases and autoimmune disorders account for almost 10 – 20% of the cases.

Most fevers are diagnosed within one week of evaluation or 3 outpatient visits.
fever persists beyond this point, then it may be caused by common conditions that are presenting themselves in an uncommon manner.

Causes of fever can differ based on their geographical location. This can be based on regional exposures, economic development, and available diagnostic tools. An example for this is that, in developed countries, infections may predominate, whereas, in developing countries, non-infectious inflammatory and malignant conditions are dominant.

Pathophysiology of Fever in Adults

During a 24 hour (whole day) period, the temperature fluctuates from low levels to high levels that are low in the early morning to highest in late afternoon. The maximum variation is about 0.6° C. The body temperature is determined by the balance maintained between heat creation by tissues, particularly the liver and muscles, and heat loss from the periphery.

The body temperature gets regulated by the thermoregulatory center which is located in the hypothalamus. This hypothalamic thermoregulatory center maintains the internal temperature between 37° C and 38° C.

The thermoregulatory center balances the excess heat production of the body, which results from the metabolic activities occurring in the muscle and liver, along with the heat dissipation from the skin and lungs. This system helps the body to maintain a steady temperature.

Fever results when there are triggering factors or a substance which raises the hypothalamic thermoregulatory center. It is induced by a substance called pyrogen. Pyrogens come from outside of our body including:

- Bacteria
- Virus
- Fungi
- Drugs
- Toxins

Whenever there is a triggering factor for pyrogen, it leads to the release of Prostaglandin E2 (PGE2), which acts on the hypothalamus. Once the hypothalamus gets activated, it stimulates a systemic response from the body which leads to an increase in body temperature.

The hypothalamus acts as a thermostat for the body; hence, once the hypothalamus gets activated, it, in turn, activates the neurons present in the vasomotor center to start the vasoconstriction and the warm-sensing neurons to slow their firing rate. This ultimately increases the heat production in the periphery.

This vasoconstriction generates a visible cold sensation in the hands and feet. While the blood gets propelled away from the periphery to the internal organs, this ultimately leads to a decrease in heat loss from the skin making the patient feel cold.
As our body starts working to meet the new temperature set-point, the person feels the common symptoms associated with fever, for example, feeling cold, increased heart rate, increased muscle tone and shivering.

Causes of Fever in Adults

There are various conditions, illnesses and even medicines that can cause fever. These include:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infections and infectious diseases</td>
<td>• Influenza, common cold, Malaria, HIV infectious mononucleosis, gastroenteritis</td>
</tr>
<tr>
<td>Medicines</td>
<td>• Antibiotics, narcotics, barbiturates, anti-histamines</td>
</tr>
<tr>
<td>Illegal drugs</td>
<td>• Amphetamines, cocaine</td>
</tr>
<tr>
<td>Trauma or injury</td>
<td>• Heart attack, stroke, heatstroke, heat exhaustion, burns</td>
</tr>
<tr>
<td>Tissue damage</td>
<td>• From hemolysis, surgery, heart attack, hemorrhage, crush syndrome</td>
</tr>
<tr>
<td>Other conditions</td>
<td>• Skin inflammation, arthritis, hyperthyroidism, cancers, inflammatory bowel syndrome, blood clots, metabolic disorder, gout, embolism</td>
</tr>
</tbody>
</table>

Symptoms of Fever in Adults

The sign and symptoms of fever will vary according to the cause of the fever, but the common indications for fever in a person include:

- Elevated body temperature
- Shivering, chills, shaking
- Intermittent or excessive sweating
- Flushing of skin
- Palpitations
- Lethargy and sleepiness
- Weakness
- Loss of appetite
- Increased pain sensitivity
- Inability to concentrate
- Feeling dizzy or faint

Investigations and Diagnosis of Fever in Adults

The final diagnosis for the cause of the fever will depend on the clinical inspection followed by investigations. The approach to the patient presenting with fever will be explained in the following detailed history:

1. When taking the history of the patient, it is important to have a note about the pattern of fever. Typical fever patterns such as intermittent, relapsing sustained, and temperature-pulse, will be useful, but are not used for giving a confirmatory diagnosis.
2. While noting the history, it is also important to have a focus on the patient’s recent travel history, work environment, and recent contact with a person having similar
symptoms.
3. There should be a note of the family history for ruling out any possibility of hereditary causes of fever.
4. **Medical history also needs to be paid attention to.** It must include any history of lymphoma, rheumatic fever, previous abdominal disorder, and a history of medications.

### Physical examination

A physical examination is helpful in providing with the diagnostic clues. A careful examination should be done including:

- Skin
- Mucous membrane
- Lymphatic system
- Abdominal palpitation

### Laboratory investigations

Based on the history and physical examination, investigations are advised. Preliminary investigations include:

- **Complete blood count (CBC)**
- Liver function test (LFT)
- Erythrocyte sedimentation rate (ESR)
- Urinalysis
- Basic cultures

Based on these results, further investigations are advised.

<table>
<thead>
<tr>
<th>Investigations</th>
<th>Possible Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest X-rays</td>
<td>• To rule out the possibility of tuberculosis, malignancy, pneumonia</td>
</tr>
<tr>
<td>CT (abdomen or pelvis)</td>
<td>• Abscess, malignancy</td>
</tr>
<tr>
<td>(With a contrast agent)</td>
<td>• Infection, malignancy</td>
</tr>
<tr>
<td>MRI (brain)</td>
<td>• Occult septicemia</td>
</tr>
<tr>
<td>PET Scan</td>
<td>• Acute infection and inflammation of bone or soft tissue</td>
</tr>
<tr>
<td>Transthoracic or transesophageal echocardiography</td>
<td>• Malignancy</td>
</tr>
<tr>
<td>Venous Doppler study</td>
<td>• Autoimmune conditions</td>
</tr>
<tr>
<td>Endoscopic procedures</td>
<td>• Malignancy</td>
</tr>
<tr>
<td>Invasive procedures like lumbar puncture or biopsy</td>
<td>• Inflammation</td>
</tr>
<tr>
<td></td>
<td>• Bacterial endocarditis</td>
</tr>
<tr>
<td></td>
<td>• Venous thrombosis</td>
</tr>
<tr>
<td></td>
<td>• Inflammatory bowel diseases</td>
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<td></td>
<td>• Sarcoidosis</td>
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<td></td>
<td>• This is performed only when the source of fever remains unidentified</td>
</tr>
</tbody>
</table>

### Complications of Fever in Adults

Fever makes a person feel very uncomfortable and, if treated timely, it will not cause any problems; whereas high fever (>103° F or 40° C), prolonged bouts of fever or fever treated untimely may lead to the following complications:
- Severe dehydration
- Hallucinations
- Fever induced seizures

If a person is suffering from a very high grade fever, which has started all of a sudden or which has occurred over a prolonged period of time, it can turn out to be very dangerous and lead to serious complications ranging from brain damage to death.

Management of Fever in Adults

Fever is our body’s response to defense against infections. Fever makes a person feel miserable, although it itself is usually harmless. Fever can be taken care of by first ruling out the cause that is getting the diagnosis done.

Fever can be taken care of by conventional methods or by taking medication. Before beginning any of these, it is important to check the body temperature.

How to measure body temperature?

Body temperature is measured by using a thermometer, which is placed in the mouth, arm, ear or anus. Body temperature will also vary according to the following circumstances:

- Time of day it is being taken
- Changes after eating
- After high intense activity with different clothing
- Different clothing
- Room temperature
- Smoking etc.

<table>
<thead>
<tr>
<th>Area</th>
<th>Average Temperature</th>
<th>Fever</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth</td>
<td>98.2°F (36.8°C)</td>
<td>99.5°F (37.5°C)</td>
</tr>
<tr>
<td>Armpit</td>
<td>97.6°F (36.4°C)</td>
<td>99.0°F (37.2°C)</td>
</tr>
<tr>
<td>Anus, vagina, ear</td>
<td>99.6°F (37.6°C)</td>
<td>100.4°F (38.0°C)</td>
</tr>
</tbody>
</table>

Conventional Treatment of Fever in Adults

- It is advised to increase fluid intake as this will help cool down the body and also prevent dehydration.
- Light foods are advised as they are easy to digest.
- Rest.
- It is advised to take a slightly warm bath (lukewarm) or apply a slightly damp washcloth to the forehead, wrists and sole (cold water should not be used).
- Dress lightly (even while experiencing chills) and use a light sheet.

Therapeutic Treatment of Fever in Adults

This is recommended when:
| Up to 102° F (38.9° C), when measured orally | • Conventional treatment.  
• Medication not required.  
• Visit a doctor if the fever is accompanied by headache, stiff neck, shortness of breath or any unusual symptoms. |
| Above 102° F, when taken orally | • If a patient feels uncomfortable, over-the-counter medication like acetaminophen, ibuprofen or aspirin should be taken.  
• If the fever does not respond to these medications and is constantly 103° F or more, a doctor should be called. |

**Note:** It is important to be under medical supervision if high fever lasts for 3 days or more.

### Key Points for Fever in Adults

Some key points which need to be kept in mind are:

- Fever, also called pyrexia, is a condition in which there is an abnormally high body temperature or a disease is present for which the characteristic feature is an elevated body temperature.

- **Fever is mostly associated with the presence of an infection or pathologic states,** such as cancer, coronary artery occlusion, and also disorders of the blood.

- It can also result from physiological stress factors, such as vigorous exercise, ovulation, or environmentally induced heat exhaustion or heat stroke.

- **Fever raises the body temperature which helps boost the immune response** and it increases the production WBCs and interferon proteins.

- Fever may also slow down the multiplication of some of the pathogens such as bacteria etc.

- When a person is suffering from fever, the blood and urine volumes become reduced as a consequence of a loss of water, caused by increased perspiration, which makes the person feel dehydrated.

- While treating fever, it is **essential to determine the underlying cause of the condition.**

- If the patient is suffering from mild to moderate fevers, they are best treated by a dosage of aspirin or other antipyretic drugs, as they will be able to wield their effect on the temperature-regulating areas of the brain.

- If the fever is due to exposure to hot climatic conditions or over-exertion, for example, heat stroke, hyperthermia, and heat exhaustion, then neither acetaminophen nor ibuprofen will be effective.

- In this condition, **the person affected needs to be cooled down immediately.**

- It has been noted that most fevers in healthy people are caused by viral respiratory tract infections or GI infections.

- To have an accurate evaluation of the causative factors for fever, it is important to **localize symptoms thoroughly.**

- One must **consider the underlying chronic disorders, particularly those impairing the immune system** to rule out the possible causes of fever.

### References


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