Fever in Adults — Pathophysiology and Treatment

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Fever is an elevation in the body temperature above the normal temperature range which is 97°F (36.1°C) to 99°F (37.2°C). Fever is a common symptom with a wide etiology that includes infection, trauma, autoimmune disorders, malignancies, and drug-related among others. Fever is a protective mechanism of our body to protect against the pathogens that have entered our body.

Definition

Fever is an elevation in the body temperature above the normal range.

The normal body temperature ranges from 97°F (36.1°C) to 99°F (37.2°C). 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 fight off infections. The increased temperature helps to kill the pathogens that have entered our body.

How to measure body temperature?

Body temperature is measured by using a thermometer, which is placed in the mouth,
arm, ear or anus. The temperature measured in the armpit is about 1°F less than that measured in the mouth, while the temperature measured in vagina or rectum is about 1°F higher than that measured in the mouth. Body temperature will also vary according to the following circumstances:

- Time of day it is being taken
- After a high intense activity
- Different clothing
- Room temperature

<table>
<thead>
<tr>
<th>Area</th>
<th>Average Temperature</th>
<th>Fever</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth</td>
<td>98.6° F (37° 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>
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</table>

**Different Types of Fever in Adults**

Fever has 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 diseases:

<table>
<thead>
<tr>
<th>Type of Fever</th>
<th>Associated Disease (Examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Continuous Fever</strong></td>
<td>• Pneumonia &lt;br&gt;• Urinary tract infection &lt;br&gt;• Typhoid &lt;br&gt;• Brucellosis &lt;br&gt;• Typhus</td>
</tr>
<tr>
<td>Temperature continuously remains above normal and does not fluctuate &gt;1°C throughout the day</td>
<td></td>
</tr>
<tr>
<td><strong>Remittent Fever</strong></td>
<td>• Typhoid infection &lt;br&gt;• Infective endocarditis</td>
</tr>
<tr>
<td>Temperature continuously remains above normal and fluctuates &gt;1°C throughout the day</td>
<td></td>
</tr>
<tr>
<td><strong>Intermittent Fever</strong></td>
<td>• Parasitic or bacterial infection  &lt;br&gt;• Malaria &lt;br&gt;• Septicemia</td>
</tr>
<tr>
<td>Temperature remains above normal only for a certain period, later returning back to normal.</td>
<td></td>
</tr>
<tr>
<td><strong>Hyperpyrexia</strong></td>
<td>• Kawasaki syndrome &lt;br&gt;• Thyroid storm</td>
</tr>
<tr>
<td>Extreme elevation of body temperature &gt;40 °C (104°F)</td>
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</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**: Temperature does not exceed 37.8° C. It is mostly seen in tuberculosis.
- **Neutropenic fever**: It is most commonly present in immunocompromised patients with decreased neutrophil counts.
Epidemiology of Fever in Adults

Fever is a very common symptom and sign seen in the clinical setting. About 25 – 40% of cases of fever are due to infections and cancer. Autoimmune disorders account for almost 10 – 20% of the cases.

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

Pathophysiology of Fever in Adults

The body temperature gets regulated by the thermoregulatory center, located in the hypothalamus. The thermoregulatory center acts as a thermostat for the body. It 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 that raise 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

Pyrogen 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 to generate more heat and reduce heat loss, resulting in an increase in the body temperature (fever).

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.

Etiology of Fever in Adults

Fever is a common clinical feature caused by a variety of etiologies. 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, heat stroke, 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>
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</table>
Clinical Features of Fever in Adults

The sign and symptoms of fever will vary according to the cause of the fever, but the common symptoms of fever are:

- Elevated body temperature
- Shivering, chills, shaking
- Sweating
- Flushing of skin
- Palpitations
- Lethargy and sleepiness
- Weakness
- Loss of appetite
- Increased pain sensitivity
- Inability to concentrate
- Dizziness

Investigations and Diagnosis of Fever in Adults

The etiology of the fever is established depending 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 continuous, intermittent, and relapsing fever provide a useful clue to reach the 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</td>
</tr>
<tr>
<td></td>
<td>• Infection</td>
</tr>
<tr>
<td></td>
<td>• Malignancy</td>
</tr>
<tr>
<td>MRI (brain)</td>
<td>• Malignancy</td>
</tr>
<tr>
<td></td>
<td>• Autoimmune conditions</td>
</tr>
<tr>
<td>PET Scan</td>
<td>• Malignancy</td>
</tr>
<tr>
<td></td>
<td>• Inflammation</td>
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<tr>
<td>Transthoracic or transesophageal echocardiography</td>
<td>• Bacterial endocarditis</td>
</tr>
<tr>
<td>Venous Doppler study</td>
<td>• Venous thrombosis</td>
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<tr>
<td>Endoscopic procedures</td>
<td>• Inflammatory bowel diseases</td>
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<td></td>
<td>• Sarcoidosis</td>
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<tr>
<td>Invasive procedures like lumbar puncture or biopsy</td>
<td>• This is performed only when the source of fever remains unidentified</td>
</tr>
</tbody>
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Complications of Fever in Adults

**If timely diagnosed and treated, fever does not cause any problems.** Hyperpyrexia, prolonged bouts of fever or fever treated untimely may lead to the following complications:

- Severe dehydration
- Hallucinations
- Fever-induced seizures
- Brain damage, and even
- Death

Management of Fever in Adults

Conventional Treatment of Fever in Adults

- Increase fluid intake and prevent dehydration.
- Light foods are advised as they are easy to digest.
- Rest
- Dress lightly (even while experiencing chills) and use a light sheet.

Therapeutic Treatment of Fever in Adults

This is recommended when:

<table>
<thead>
<tr>
<th>Fever</th>
<th>Treatment</th>
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</table>
| Up to 102° F (38.9° C), when measured orally | • Conventional treatment.  
• Medication not required.  
• Visit a doctor if the fever is accompanied by a headache, stiff neck, shortness of breath or any unusual symptoms. |
Above 102° F, when measured 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 a high fever lasts for 3 days or more.

**References**


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