FEVER: THE LONG AND SHORT OF IT

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How is body temperature controlled?

Neurons in the preoptic region of the anterior hypothalamus function as a thermostat that determines body temperature by regulating heat production and heat loss. Generally, the body produces more heat than is required to maintain body temperature. Hence, body temperature is maintained by regulating heat loss.
- **Heat production**
  - Basal metabolic rate (influenced by body mass, age, environmental temperature, thyroid hormone, intake of food)
  - Muscle contraction e.g exercise, shivering

- **Heat loss**
  - Radiation (60%): influenced by vasodilatation
  - Evaporation (30%) e.g. sweating, sponging
  - Convection (10%): transfer of heat to the air
  - Conduction (2%): transfer of heat via physical contact

**What is normal body temperature?**

- **There is a diurnal variation in body temperature**
  - Lowest between 2 - 6am
  - Highest between 5 - 7pm

- **Children have higher body temperatures than adults**

- **Women have higher body temperatures than men**

- **Commonly used cut-offs include**
  - Oral: 37.8°C
  - Rectal: 38.0°C
  - Axillary: 37.2°C
  - Aural: 38.0°C

  Note: These cut-offs are not supported by very strong scientific/medical evidence.

**What is fever, hyperthermia and hyperpyrexia?**

Fever is a regulated rise in core body temperature in response to a physiological threat to the body. It is mediated mainly by cytokines, usually <41°C and shows diurnal variation.

Hyperthermia is an unregulated rise in core body temperature and is the result of disturbances in the body’s thermoregulatory mechanisms (i.e. perturbation in heat production and/or heat loss). Examples include heat stroke, malignant hyperthermia, thyroid storm. It is usually >41°C and does not show diurnal variation.

Hyperpyrexia is the term used when body temperature is >41°C.

**What are the effects of fever?**
- **Benefits**
  - Fever plays an important role in facilitating host defense by stimulating the production of important immunomodulatory molecules and augmenting the function of immune cells.
  - Studies in humans have shown that fever during bacterial infections is associated with a better prognosis. Studies in animal models also support the beneficial role of fever in host defense.

- **Harmful effects**
  - Increased physiological stress on the body
  - Increase oxygen consumption
  - Increase workload on cardiovascular system
  - Increase in intracranial pressure due to increase in blood flow
  - Induces catabolism

- **Potential risks**
  - For febrile seizures in children
  - For exacerbating neurological insult in children with traumatic brain injury

**What are the risks of a serious infection when a person has a fever?**

<table>
<thead>
<tr>
<th>Immunocompetent Individual</th>
<th>At risk for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonate (&lt;28 days old)</td>
<td>Sepsis and meningitis due to group B Streptococcus, <em>Escherichia coli</em>, <em>Listeria monocytogenes</em>, and herpes simplex virus</td>
</tr>
<tr>
<td>Infant (&lt;3 months old)</td>
<td>Serious bacterial disease in 10-15%. Bacteremia occurs in 5%, of febrile infants who are &lt;3 months old</td>
</tr>
<tr>
<td>Infant and child between 3 and 36 months old</td>
<td>Occult bacteremia occurs in 1.5%; risk is increased if temperature is &gt;39°C and white blood cell count is &gt;15,000/μL</td>
</tr>
</tbody>
</table>

*Table adapted from Behrman: Nelson Textbook of Pediatrics, 17th ed.*

**Fever phobia**

A term coined by Schmitt to describe the anxieties and misconceptions associated with fever.

- **Fever phobia is**
  - Highly prevalent in parents
  - Also prevalent amongst doctors including paediatricians

- **Common misconceptions include**
  - Fever causes brain damage
• Fever causes seizures
• Fever causes death

When to treat fever?

- **Fever**
  - Is a good marker of the progress or recovery of a patient
  - May be associated with faster recovery and better prognosis
- **Hence, suppressing it unnecessarily may mean that we may be potentially depriving ourselves of an important clinical sign and an important biological defense tool**
- **Treat the fever if**
  - There is hyperpyrexia (>41°C)
  - There is evidence of organ malfunction or risk for organ injury e.g. fever in the patient with brain injury
  - There is a risk for febrile fit
  - Child is uncomfortable

How to treat fever?

- **Treat the underlying cause if possible or indicated**
- **Symptomatic relief**
  - Hydration
  - Sponging
    - Use tepid water
    - Leave a film of water
    - Efficacy depends on surface area covered
  - Paracetamol
    - 10-15mg/kg/dose
    - Maximum 60mg/kg/day
    - Common precautions to keep in mind
      * Contraindicated in persons with hypersensitivity to paracetamol
      * Avoid use in infants
      * Avoid use in persons with liver dysfunction or failure
      * Dose adjustment may be required for renal impairment or failure
  - Ibuprofen
    - 5-10mg/kg/day
    - Use only if infant >6months old
    - Common precautions to keep in mind
      * Contraindicated in persons with hypersensitivity to non-steroidal anti-inflammatory drugs (NSAIDs)
Avoid use in persons with bleeding tendencies, gastrointestinal bleed
Avoid use in persons with renal impairment or failure

Importance of Educating Parents

Parental anxiety about fever is real and common. Treating a child’s fever so as to reduce the parent’s anxiety is not the ideal way of helping them deal with their concerns. Parents will benefit if doctors educate the parents about the role of fever, the benefits and the harms, address their misconceptions, and give clear instructions as to when to seek medical attention.

References

Behrman: Nelson Textbook of Pediatrics, 17th ed


Schmitt BD. Fever in Childhood. Pediatrics 1984;74(5 Pt 2);929-36.
