

Revisiting Fever

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Fever is a highly misunderstood phenomenon. Nevertheless, fever is one of the most common reasons that parents seek health attention for their children. This brief article explores some of the issues surrounding fever and answers some frequently asked questions by parents.

***"Fever is Nature's engine which she brings into the field to remove her enemy."
Hippocrates***

What is a fever?

Normothermia ("normal temperature") is typically thought to be a body temperature of 98.6 degreesF (36degC) and is the result of the balance between heat gain and heat loss that allows the body to maintain a constant core temperature. Mean body temperature exhibits a diurnal (twice per day) variation with a peak in the early evening (~6pm) and a low in the early morning (~6am). With fever the central thermostat of the body increases to a new "set point" and heat loss and heat gain again balance at this higher temperature. Fever is not a disease but a nonspecific sign/symptom of some underlying condition or process that involves increased body temperature. Although there is no consensus regarding the exact temperature that denotes fever, it is generally accepted that a rectal temperature of at least 100.4 degreesF (38degC) represents a fever. There is also a lack of clear-cut management guidelines among professionals, which may contribute to patient misconceptions.

Is it true that fevers are harmful?

Fever is extremely common in childhood, and parents have been shown to have unrealistic fears in this regard, resulting in vigorous and unnecessary treatment (1). They are unable to define a fever accurately, overestimate its dangers, and make inappropriate telephone calls and unnecessary office visits, leading to excessive utilization of health-care services (1-2). It has generally been accepted that this "fever phobia" might be diminished by physician education of parents (1-2). Such suggestions assume that doctors have a good understanding of fever and its consequences, yet it is recognized that doctors tend to treat fever vigorously and without a documented rationale (3-4). "Perhaps by attempting to relieve parents' concern, physicians may, in fact, be accentuating their anxiety." (5)

Several recent journal articles discuss the benefits and misconceptions of fever. A study in the journal *Clinical Pediatrics* polled Physicians' attitudes toward the diagnosis and management of fever in children 3 months to 2 years of age (5). Although many doctors have an appropriate knowledge of fever in children aged 3 months to 2 years, a significant number still have exaggerated concerns. Below I quote from the discussion of this article. "...there is little uniformity in the teaching and management of the febrile child, which often results in the vigorous and often inappropriate administration of antipyretics by physicians without documented rationale. This attitude exists in the face of good data which suggest that fever is not harmful and may in fact, be beneficial to the host, although contrary opinions still prevail. Furthermore, the benign outcome of typical febrile seizures has now also been well documented."

"It is surprising that a significant number of the physicians in this study still consider febrile seizures a significant danger to the child's health, since there is no evidence to suggest that death or permanent motor disability, deficits in school performance, or significant behavioral differences exist between children with a history of typical febrile convulsions and the rest of the population. It has also not been proven that antipyretics or sponging can decrease or prevent febrile seizures or their recurrence, yet one fifth of physicians indicated that this was the main purpose of antipyretic treatment." (5)

An interesting study published in the *Annals of Tropical Pediatrics* (6) asked parents, medical students and nurses from Saudi Arabia about their understanding of fever. "All the parents and 80-90% of the students, nurses and doctors believed that fever is harmful...As shown, 37.5% of the parents believed that fever caused brain damage, while 42.7% believed that it was a sign of serious disease. It was obvious that the main concern of the medical staff was convulsions. However, none of the medical students and doctors and only 2% of the nurses were concerned about brain damage. When questioned on the usefulness of fever, 86% of the parents, 37.5% of the doctors, 23% of the medical students and 33% of the nurses did not know or believe that fever could be useful."

Consider the following information from the most recent update on fever phobia (7). "In addition to the beneficial effect that fever has on the immune system, it is important to note that the febrile response is a homeostatic process. Many caregivers are unaware of this process and believe that temperatures will continue to rise to potentially lethal levels if left untreated. Caregivers need to know that in the absence of hyperthermic insults, such as dehydration and

closed, hot automobiles, and in neurologically normal children, the body does not allow fever to rise out of control to potentially lethal levels."

What about using drugs to reduce Fever?

The study by Crocetti et al. (7) examined 340 caregivers (responses) whose children were enrolled in 2 Maryland pediatric clinics. The authors found the following, "In addition to excessive fever monitoring and incorrect sponging, we found that many caregivers are dangerously liberal with their use of antipyretics. Compared with 20 years ago, more caregivers gave antipyretics for normal temperatures (<37.8C, <100F) and more caregivers gave these medicines at incorrect dosing intervals. Inappropriate dosing of acetaminophen and ibuprofen places children at undue risk for toxicity." Interestingly, Mayoral et al. (8) reported that 50% of pediatricians who were surveyed said that they advised parents to alternate acetaminophen and ibuprofen using various regimens. Twenty-nine percent of these respondents said that they followed the recommendations of the American Academy of Pediatrics, despite that no such policy exists. This obviously implies that caregivers might be receiving incorrect advice regarding the management of fever along with the suggestion by health care providers implying that fever should be reduced.

Physicians have used various forms of antipyretics since ancient times to lower the temperature of febrile patients. However, it has yet to be determined whether the benefits of antipyretics outweigh the risks. In fact, it is not known if core temperatures encountered during fevers ever reach levels that are intrinsically noxious, or if ever, fever's metabolic expenses exceed its physiologic benefits, or if the benefits of symptomatic relief offered by antipyretics consistently exceed their toxicologic cost (9). Preliminary experimental and clinical observations suggest that antipyretic therapy has the potential to increase the duration and/or severity of certain infections, although the validity of these observations cannot be determined to this point (9).

Are there benefits of Fever?

A recent article from the journal *Infectious Disease Clinics of North America* concludes the following. "Overall we believe there is overwhelming evidence in favor of fever being an adaptive response to infection that has persisted throughout the animal kingdom for hundreds of millions of years. As such, it is probable that the use of antipyretic/anti-inflammatory/analgesic drugs, when they lead to the suppression of fever, results in the increased morbidity and mortality during most infections. The reason that this increased morbidity and mortality may not be readily apparent to most healthcare workers is that we are armed with dozens of host defense responses, with fever being only one of

them. Furthermore, most infections are not life-threatening and subtle changes in morbidity are not easily detected, particularly, in 'experiments' that are not carefully controlled." (10)

Are all fevers beneficial?

Likely not. Early consideration of the febrile infant is important. The greatest risk of serious bacterial infection is in an infant younger than 3 months of age, where 1 in 10 febrile episodes is likely due to a localized infection (e.g. pneumonia, bacteremia) (11). Since young children are less able to localize disease processes, they require special consideration. Factors that indicate high risk for possible serious disease include: low birthweight or prematurity, previous frequent hospitalization, developmental disability, improper nutrition, age < 4 weeks, rapid onset of symptoms, social disadvantage, current antibiotic use, and prolonged illness (11). However, it is important to realize that the vast majority of febrile illnesses in infants and young children are self-limiting viral infections requiring only supportive care and watchful observation (11). Because fever is a non-specific defense response, these responses are highly stereotypical. In other words, infection by a wide range of different organisms will produce similar responses characterized by loss of appetite, lethargy, increased sleep, fever, and synthesis of a wide array of proteins geared for inflammation. This is why it is recommended you consult a health care practitioner to examine the cost-benefit ratio of a specific fever response if there is question.

If fever is overall beneficial then why do we not maintain fever continually even when not infected?

There is a metabolic (energy) cost of fever. Fevers cost considerable energy. It has also been theorized that maintaining a body temperature below optimal temperature for immune defenses may be a mechanism to reduce the "contribution of the immune system to aging." This lower "normal" temperature also would produce less free radicals.

How does a fever kill the "invading microorganisms" inside us?

Most living organisms have had to adapt their structural and biochemical characteristics to a given temperature to function at the lowest possible "thermodynamic" (energy) cost. Invading microorganisms acclimated to a given ambient temperature may encounter unfavorable conditions if the temperature of the host changes rapidly either upward or downwards. The invading microbe is proposed to suffer "thermic shock", which might contribute to reduced growth. Also, our own bodily reactions speed up, which also aid in the defense.

Conclusion

Much confusion exists about the nature and management of fever. This brief piece has answered some common questions that parents have about fever. Although many doctors and fewer parents have appropriate knowledge of fever, a significant number still have exaggerated concerns.

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