Assessing and managing fever in children

The febrile infant or child remains one of the most common clinical problems that presents to family doctors.

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A careful history, a detailed physical examination and appropriate investigation of children and infants with fever will often reveal the cause and allow appropriate treatment. The most common cause of fever is an infective process but sometimes, despite a thorough approach, a focus of infection is not identified.

What is fever?

Defining fever in children is complex but most would agree that a rectal (core) temperature above 38°C constitutes a significant fever. The average oral body temperature in children is around 36.4 to 36.8°C with a diurnal fluctuation from about 36.2°C in the morning to a high of about 37.5°C in the evening. A baby's temperature falls by about 0.8°C during sleep and rises before waking. Mild elevations in temperature may be caused by hot weather, a hot bath, exercise or feeding. These factors should be borne in mind when assessing temperature in children.

Oral temperatures are generally unreliable in children under 5 years of age unless the child can keep the thermometer under the tongue with his or her mouth closed; hence, axillary temperatures, which approximate oral temperatures (being about 0.5°C lower) are useful in infants. Oral temperatures are 0.5 to 1.0°C below rectal temperatures. Aural thermometers tend to be expensive, and abundant ear wax and inflamed tympanic membranes may produce false readings.

In this article, unless otherwise stated, oral temperatures are given.

What causes fever?

There are three pathophysiological mechanisms for fever:

- raising of the brain's hypothalamic set-point – most often as a result of infection, malignancy or connective tissue disease
- heat production exceeding heat elimination ability – e.g. excessive environmental temperatures, malignant hyperthermia
- defective heat loss – e.g. in heat stroke, ectodermal dysplasia.

In infections, toxins and mediators act on the immune system to increase the release and activity of white blood cells, interleukins, phospholipids,

IN SUMMARY

- **All febrile infants aged less than 3 months should be referred to hospital for admission, investigation and management.**
- **In febrile older babies and children, first assess for reduced alertness and activity, breathing difficulty, circulatory impairment and dehydration.**
- **Generally, nontoxic febrile children aged over 3 months may be managed as outpatients in general practice.**
- **Fever less than 40°C does not routinely need antipyretic treatment unless the child appears uncomfortable.**
- **Paracetamol can be given to children over 1 month of age; care must be given to explain dose clearly when prescribing because available liquid preparations vary in concentration.**
- **Ibuprofen may be given to otherwise well children aged 6 months or over.**

Table 1. Potentially fatal acute febrile illnesses in children

Acute bacterial meningitis
Septicaemia – e.g. meningococcaemia, other bacteraemia
Toxic shock syndrome
Acute viral encephalitis
Acute appendicitis
Severe pneumonia
Severe gastroenteritis
Viral myocarditis
Kawasaki disease
Epiglottitis (seen less frequently now due to the *Haemophilus influenzae* type b vaccination program)

arachidonic acid, prostaglandins and other substances. Prostaglandins increase the temperature set point of the hypothalamus.

Assessing the febrile child

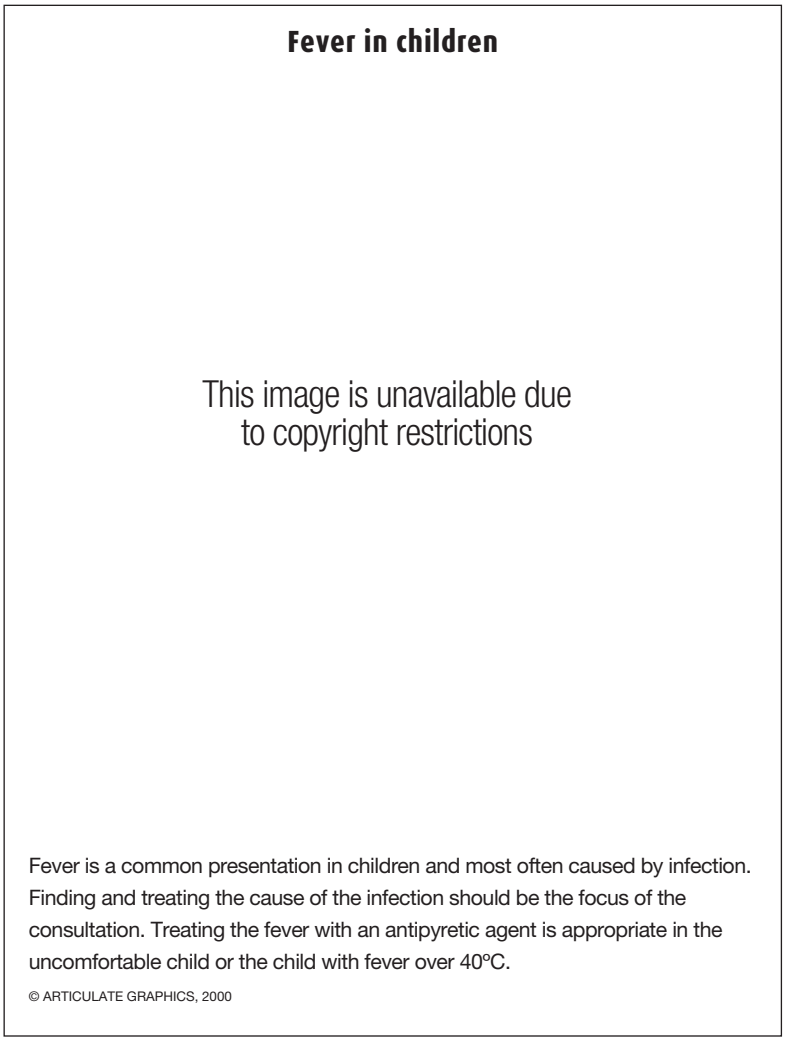
The differential diagnoses of the child with acute fever include benign viral upper respiratory tract infections and potentially fatal conditions, such as a bacterial meningitis or meningococcaemia (Table 1). Distinguishing between these conditions is aided by experience and a systematic approach.

History

Besides the duration and degree of fever, ask about associated symptoms, such as vomiting, diarrhoea, dysuria, loin pain, cough and rash, which may direct attention to a focus of infection. A child who is well between febrile episodes apart from minor respiratory symptoms and signs most likely has a benign self-limiting viral upper respiratory infection.

The immunisation history and travel history may provide important information (e.g. SARS, typhoid fever). Also ask about exposure to illnesses through family or other contacts (e.g. tuberculosis, hepatitis A) and animal exposure (e.g. cat scratch disease). A past history of serious infections, recurrent bacterial infections, splenectomy or other immune disorders may indicate a propensity to bacterial infection and should be noted. Also, ask about prior antibiotic and antipyretic use (this includes herbal medicines) as these may mask symptoms, affect the interpretation and usefulness of bacterial cultures, and guide treatment.

Fever in children



Fever is a common presentation in children and most often caused by infection. Finding and treating the cause of the infection should be the focus of the consultation. Treating the fever with an antipyretic agent is appropriate in the uncomfortable child or the child with fever over 40°C.

Examination

General well-being

The first, and perhaps the most important, part of the assessment of a febrile child is a careful consideration of the child's general wellbeing. At The Children's Hospital at Westmead, the following ABCD list of warning signs and symptoms are used to help identify the ill or 'toxic' infant or child.[1]

- A – poor Arousal, reduced Alertness, and reduced Activity
- B – Breathing difficulty (grunting, tachypnoea, increased respiratory effort)
- C – Circulatory impairment (mottling,

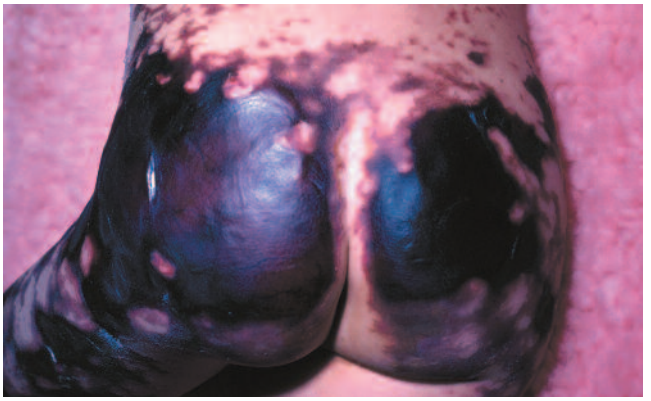


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Figure 1. A purpuric rash in a child with meningoccaemia.

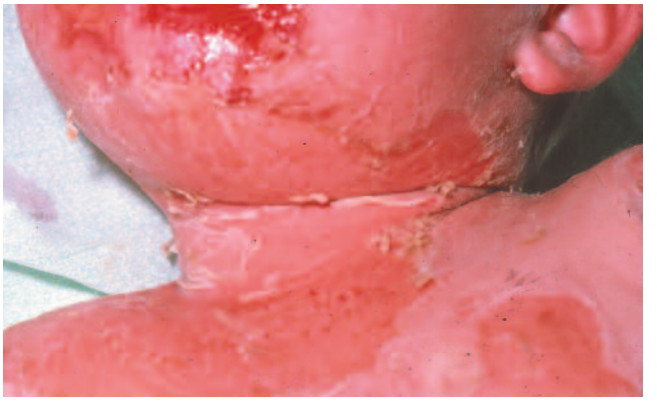

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Figure 2. Staphylococcal scalded skin syndrome.

tachycardia, decreased capillary return, hypotension) and Colour (pallor)
- D – Decreased Drinking (less than half the usual amount in the past 24 hours) and Decreased output (fewer than four wet nappies in 24 hours).

The absence of the above features does not exclude serious illness. Generally, the more the above features are present the greater the likelihood of serious illness. Sinister signs include apnoea, convulsions, cyanosis and petechial rash.

Assessment of febrile babies aged below 3 months of age is tricky and signs may be subtle. Erring on the side of caution with hospital referral and admission is advised.

Temperature and bacteraemia

High fever (above 40°C) is associated with an increased chance of bacteraemia. However, often a child with a viral illness may have a high fever – in this instance the illness will be unresponsive to antibiotics and the child will be clinically well between febrile episodes.

Children with bacteraemia may present with fever associated with vomiting, diarrhoea and prostration. A primary focus of infection may not be obvious, particularly in children aged under 3 years and in the case of urinary tract infection. Blood cultures are necessary to confirm bacteraemia.

Rash

In children, it is common for rash to accompany fever. Often the rash is nonspecific; however, fever with rash should always raise the suspicion of meningococcal infection. The rash of meningococcaemia may begin with one or two petechial spots that progress to a generalised haemorrhagic purpuric rash (Figure 1). However, the rash may be atypical and is not always purpuric. It may consist of discrete salmon-pink macules, which resolve after 12 to 48 hours, with the classic purpuric rash appearing later, over the course of a few hours.

Other clinical syndromes recognisable from a characteristic rash and clinical features include erythema infectiosum ('slapped cheek disease'), measles, staphylococcal scalded skin syndrome (Figure 2) and Kawasaki disease (see box on page 22).

Focus of infection

Clinical examination may reveal a focus of infection. An inflamed tympanic membrane suggests otitis media, tachypnoea and cough (with or without chest signs) – pneumonia, a limp – septic arthritis or osteomyelitis, a bulging fontanelle – meningitis, and abdominal guarding or tenderness – peritonitis or appendicitis.

Finding no focus on examination does not exclude infection. Urinary tract infections, in particular, may present with fever alone, and account for 1 to 4% of fevers in children.

Investigations

Laboratory evaluation can help to identify the child at risk of bacteraemia and to diagnose infections that are not apparent on examination. The well child with mild fever (less than 39°C) and an obvious upper respiratory tract infection may not require any laboratory tests.

Laboratory evaluation should be undertaken if a child:
- has no obvious focus of infection but looks unwell
- has a persistently high fever
- has localising signs
- is aged less than 3 months.

Initial investigation for sepsis should include a full blood count with a differential white cell count, blood cultures, urine microscopy and culture, chest x-ray and, where indicated, a lumbar puncture (cerebrospinal fluid should be examined for cells [particularly leucocytes], protein and glucose, and microscopy and culture should be performed). There should be a high index of suspicion for meningitis in a febrile child aged less than 2 years because the classic signs of meningitis, including neck stiffness, may be absent.

As a general rule, all children less than 3 months of age need a septic work up (as above) whether or not localising

signs are present. Bacteraemia is especially difficult to detect in very young children, who may deteriorate rapidly.

Treating the cause

The presence of bacterial infection warrants antibiotic treatment aimed at the most common bacterial aetiologies. Suspected bacteraemia on either clinical grounds (e.g. high fever, 'toxic' child, prostration) or laboratory grounds (a white cell blood count of 15 x10^9/L or more) should be treated empirically; blood cultures are mandatory and hospital admission is needed. Bacteraemia should be suspected in all unwell neonates with fever.

When the cause is not clear

Sometimes no source of infection will be apparent from examination and investigation; about 5 to 10% of these cases will have occult infection. *Streptococcus pneumoniae* is the most common pathogen causing occult bacteraemia; other pathogens include *Haemophilus influenzae* type b (Hib), now rare due to the Hib immunisation program, *Neisseria meningitidis* and salmonella species. In children younger than 3 months of age, *Escherichia coli* and *Staphylococcus aureus* should also be considered and in neonates, *Listeria monocytogenes* and group B streptococcus.

All febrile infants aged below 3 months and all toxic or unwell children aged up to 6 months should be referred to hospital for admission, investigation and empirical antibiotic treatment. GPs may monitor the well-looking febrile child aged over 3 months whose parents can be relied on to return for review.

Empirical antibiotic treatment of the febrile child with no obvious source of infection remains controversial. Empirical parenteral antibiotics are favoured by some to reduce the possibility of meningitis and other serious consequence of untreated occult bacteraemia. Others discourage antibiotic use because of cost, potential for adverse reactions and contribution to increasing antibiotic resistance. An empirical parenteral antibiotic used for bacteraemia in some hospital outpatients is an intramuscular dose of ceftriaxone 50 mg/kg (to a maximum of 1 g), followed by a course of oral antibiotics and outpatient follow up.

Treating the symptom

Fever is a symptom, not a disease; it is the body's normal response to infections and possibly plays a part in fighting them, and this constitutes the major argument against routinely treating fever. Arguments for treatment include decreasing discomfort, preventing brain

damage and preventing febrile convulsions. However, there is no evidence to show that antipyretic treatment prevents febrile convulsions. Only 4% of children experience febrile convulsions – these tend to occur early, when the temperature is rising quickly. Lowering an established temperature is unlikely to prevent a febrile convulsion.

The decision of whether to treat fever warrants consideration of the fever's role in host defence as well as associated discomfort and risk of brain damage. It seems reasonable to treat temperatures over 40ºC and fevers in children who appear uncomfortable.

It is more important to treat the cause of the fever than the fever itself. Ongoing evaluation for the underlying cause is essential both before and after fever has been treated, particularly in the unwell child whose diagnosis is not yet established.

Sponging

A 2003 Cochrane review concluded that a few small studies had shown tepid sponging to reduce fever in children.[2] Of note, the children in some of these studies had also received an antipyretic drug.

Sponging with cold water produces heat from shivering. Parents should be advised to use lukewarm water preceded by a dose of oral antipyretic, when trying to lower a child's temperature.

Paracetamol

The antipyretic effect of paracetamol is dose-related. The recommended dosage is 15 mg/kg every four to six hours to a maximum of 60 mg/kg/day (Table 2). No child (or adult) should receive more than 4 g per day. An initial dose of 20 mg/kg may achieve a more rapid onset of effect and a one-off dose of 30 mg/kg at bedtime may enable more rest for the entire

Table 2. Antipyretic agents: dosage chart

Preparation	Dosage instructions
Paracetamol (oral)	
Children 1 month to 12 years	15 mg/kg, four- to six- hourly (up to 60 mg/kg/day to a maximum of 2 g/day)
Adults and children over 12 years	500 mg to 1 g, four- to six- hourly (maximum 4 g/day)
Paracetamol (suppository)	
Children 6 months to 12 years	20 mg/kg, four- to six- hourly (maximum 1 g/day)
Adults and children over 12 years	500 mg to 1 g, four- to six- hourly (maximum 4 g/day)
Ibuprofen (oral)	
Children 6 months to 12 years	5 to 10 mg/kg, six- hourly (up to 40 mg/kg/day to a maximum of 1.2 g/day)
Adults and children over 12 years	200 to 800 mg/, six-hourly (maximum 1.2 g/day)

Kawasaki disease – a cause of fever in young children

Kawasaki disease is a multisystem vasculitis that occurs in young children (aged less than 5 years). Affected children present with fever, red eyes, strawberry tongue and cracked lips as well as a characteristic polymorphous rash, and erythema of the palms and soles. Later, skin desquamation, especially of the hands, occurs.

Although an uncommon disease, early detection is important because treatment with immunoglobulin can prevent the serious complications of the disease, which include coronary artery and cardiac disease.

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Figure A. Skin desquamation is generally seen later in the course of Kawasaki disease.

Figure B. Cracked lips in an infant with Kawasaki disease.

family from its prolonged action. It is important to emphasise to parents that this dose must not be repeated.

Paracetamol should not be given for more than 48 hours without review. At review, one may consider monitoring liver transaminase and INR. Increased risk for hepatotoxicity may occur with concurrent barbiturate, carbemazepine and phenytoin use. The major adverse effect is hepatic necrosis with overdose.

In Australia, liquid paracetamol is sold in different strengths for children. Dosages, therefore, must not be expressed using millilitres per dose because of the potential for confusion with the differing concentrations. Specific instructions on the preparations, dosage and volume should be written and given to the parents to avoid errors. Some preparations may contain alcohol (7 to 12%); all suspensions should be shaken before use.

Ibuprofen

Ibuprofen, an NSAID, is generally not recommended in children younger than 6 months of age. In older children, it may be of particular use in cases of paracetamol sensitivity or when paracetamol is ineffective.

At a dose of 5 to 10 mg/kg, ibuprofen lowers temperature more effectively than paracetamol and also has a longer effect. It is considered very safe since the recommended dose would need to be increased 10-fold for toxicity to occur. It is contraindicated in active peptic ulcer disease or gastrointestinal bleeding, and should be used cautiously in patients with dehydration, hypovolaemia, or liver or kidney insufficiency. It may cause anaemia and granulocytopenia, and inhibits platelet aggregation. Ibuprofen should not be given to children with aspirin-induced asthma.

Varicella is a risk factor for group A haemolytic streptococcal infection, and recent reports have indicated that using ibuprofen may increase this risk; hence ibuprofen is not recommended in children with chicken pox.

In Australia, ibuprofen suspension for children is currently only available in a 100 mg/5 mL preparation.

Paracetamol and ibuprofen

There is an increasingly common practice of prescribing paracetamol and ibuprofen alternately or together. No evidence currently exists to show increased efficacy with fever reduction with either of these practices. The use of both medications together in a child could add to parental fever phobia (see section below on 'fever phobia'), confusion with dosages and risk of compounding side effects.

Table 3. Some examples of conditions that produce periodic fever

Condition	Features	Comments
The PFAPA syndrome	Periodic Fever, Aphthous stomatitis, Pharyngitis and Adenitis	No diagnostic test is available; aetiology is unknown Early use of steroids characteristically aborts the attacks
Hyper-IgD syndrome	Fever, vasculitic rash, vomiting, headache, arthritis or arthralgia, diarrhoea, abdominal pain and splenomegaly	The diagnosis is confirmed by marked raised serum IgD levels Often, the serum IgA level is also raised
Familial Mediterranean fever	High fever, abdominal pain, headaches, pleural or abdominal serositis, and arthritis that may last from hours to several days Less commonly, splenomegaly and an erythematous rash around the ankles	A recessively inherited condition occurring chiefly in children aged about 5 years and of Mediterranean descent
Familial Hibernian fever	Prolonged fever, abdominal pain	A very rare condition that is thought to be dominantly inherited
Cyclic neutropenia	Fever, mouth ulcers, lymphadenitis, pharyngitis, and pyogenic infections and neutropenia	Bouts tend to occur every three to four weeks

Aspirin

Aspirin has no place as an antipyretic today. Its associated risk of Reyes syndrome when used in children, and the possibility of severe gastrointestinal bleeding makes it an unsafe antipyretic.

Recurrent febrile episodes

Recurrent fever in children is not uncommon. 'Periodic fever' is a term used to describe recurrent bouts of fever with no apparent infection. Several clinical syndromes, some with no known aetiology, are now recognised, and are described in Table 3.

In older children, recurrent high fevers require the consideration of juvenile chronic arthritis, systemic lupus erythematosus, osteomyelitis, Crohn's Disease, urinary tract infections, tuberculosis and malignancies (e.g. acute lymphoblastic leukaemia).

Fever phobia

Many parents with a febrile child are genuinely anxious. This may stem from misconceptions, or incomplete or inaccurate information about fever and its significance and possible harm. In one study, 80% of parents reported believing that fevers between 40 and 41°C cause brain damage. This belief is not supported by clinical evidence.[3] Doctors may address fever phobia by understanding the genuine concerns of these parents, assessing the child carefully and spending time educating the parents. Rarely, the doctor may need to prescribe an antipyretic to be seen to be doing something.

Parent education

Parents should be advised to avoid bundling a febrile infant or child with too much clothing, and to give the child extra oral fluids. They should be guided on the appropriate use of antipyretics with clear written instructions on dose, frequency, and duration of use. Parents should be informed that if they are concerned, they should seek medical advice again.

Many people acquire information from the internet, but they should be told that this is no substitute for consulting with a healthcare professional due to uncertainty regarding the source of the information and its accuracy and currency. Of particular concern (and in contradiction with research findings) are recommendations on the internet for cold sponging, cold baths or showers, sponging with alcohol, and using aspirin.

Conclusion

The management of fever in children remains a challenge despite the advances in paediatric medicine in the last decade. The evaluation and treatment of the febrile child need to be individualised; careful assessment and ongoing monitoring are essential. Doctors should focus on treating the patient's illness and not the fever alone. MT

DECLARATION OF INTEREST: None.

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