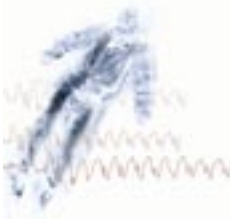
Febrile seizures



BACKGROUND Febrile convulsions, or febrile seizures, are frequently encountered in paediatrics, and despite often being self limiting, these seizures strike fear in the hearts of patients' carers.

OBJECTIVE This article reviews the assessment and management of febrile seizures in children.

DISCUSSION The initial assessment of a child who convulses with fever should be directed at finding a cause for the fever, rather than the seizure itself, once the seizure has abated. A lumbar puncture should be performed if there is clinical suspicion of meningitis. Electroencephalograms and neuroimaging studies are not routinely indicated. Overall, febrile seizures carry a good prognosis, although one-third of children have recurrent attacks. Febrile seizures are genetic in origin. The risk of later epilepsy is small but increased if the child has a complex febrile seizure, neurological deficit, or a family history of epilepsy. Carers should be counselled in the management of seizures. The effectiveness of prophylactic treatment with medication remains controversial.

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Febrile convulsions, or febrile seizures (FS), are defined as seizures in children 6 months to 5 years of age, accompanied by fever, but without evidence of underlying central nervous system (CNS) infection.[1,2] The peak occurrence of FS is 18 months.[3,4] By definition, FS are excluded in children with seizures due to a CNS infection, a previous afebrile seizure, or an underlying CNS abnormality.[5]

Febrile seizures are the most common seizures in children, occurring in 2–5% of caucasian children, and 8% of Japanese children.[1,3,5–7] Often the carer, faced with their first FS, believes the child is dying and that the seizure lasted longer than the typical duration of 1–2 minutes. For this reason, it is imperative that FS are diagnosed and managed appropriately, with proper parental counselling.

Febrile seizures have a complex genetic aetiology, ie. they have a polygenic basis with or without an environmental contribution.[8,9] Genes for FS have been identified in rare large families where seizure disorders follow an autosomal dominant inheritance pattern and many members have FS or epilepsies.[10,11]

Febrile seizures can be a prelude to both generalised and focal epilepsy syndromes but are only seen in a minority of people with epilepsy overall. They are classified as:

- simple – consists of a generalised convulsive seizure without focal features, lasting less than 15 minutes, and not recurring within 24 hours[1,4,12] (accounts for two-thirds of FS),[4,13] and
- complex – has one of the following features: prolonged duration (lasting 15 minutes or more), focal features, or seizure recurrence within a 24 hour period or within the same febrile illness.[1,4,12,13]

Diagnosis

The diagnosis of a FS is a clinical one. Not all events with fever are febrile seizures. Differential diagnoses include rigors, 'febrile delirium' – an acute and transient confusional state associated with high fever, and 'febrile syncope', also known as neurocardiogenic or febrile syncope, or 'breath holding' attacks.[14,15] The latter can sometimes lead to reflex anoxic seizures if cardiac output is reduced significantly. After initial acute resuscitation and control of the seizure (*Figure 1*), the emphasis during the assessment should be directed at finding the underlying cause of the fever (*Figure 2*). In particular, the possibility of meningitis or encephalitis should always be kept in mind, as both are associated with considerable morbidity and mortality. It

is also imperative to consider other causes of seizures, besides a fever, such as an electrolyte imbalance. The differential diagnosis of a child that convulses with fever is shown in *Table 1*.[16] It should also be noted however, that a child with epilepsy is more likely to have a seizure if febrile.

The physical examination in a child with a simple FS should reveal a lack of focal neurological deficits, and demonstrate a fever, generally above 38˚C, although the fever may not be evident until after the seizure.[3,12,17] There should be careful examination for a cause of the fever such as otitis media or pharyngitis. Complex FS may also be associated with transient unilateral paresis (Todd's paresis) following the seizure.[16]

In a child with seizures and a fever, the frequency of bacterial meningitis is low, but nevertheless significant, with studies showing up to 7% of children having bacterial meningitis; the likelihood increasing with longer seizure duration.[18] The likelihood of meningitis is low in the absence of petechiae, coma, and nuchal rigidity, and most children with meningitis who present with fever and seizures have an altered conscious state, signs of increased intracranial pressure, or signs of meningism.[18,19] However, it should be remembered that meningeal signs can be absent in infants and young children with meningitis.[18]

- Position child in lateral position to maintain airway and allow drainage of secretions and vomitus
- Clear airway of secretions
- If longer than 5 minutes call ambulance
- Apply oxygen via face mask if child cyanosed
- If seizure lasts more than 10 minutes, administer rectal diazepam (0.5 mg/kg to maximum 10 mg), or if intravenous access in situ, IV diazepam (0.2 mg/kg to maximum 3 mg if <5 years, 5 mg if 5–10 years) **Do not administer IV diazepam rapidly as this may cause respiratory depression; monitor for respiratory depression**
- A parent handout can be downloaded from www.rch.org.au/kidsinfo/factsheets.cfm?doc_id=3722

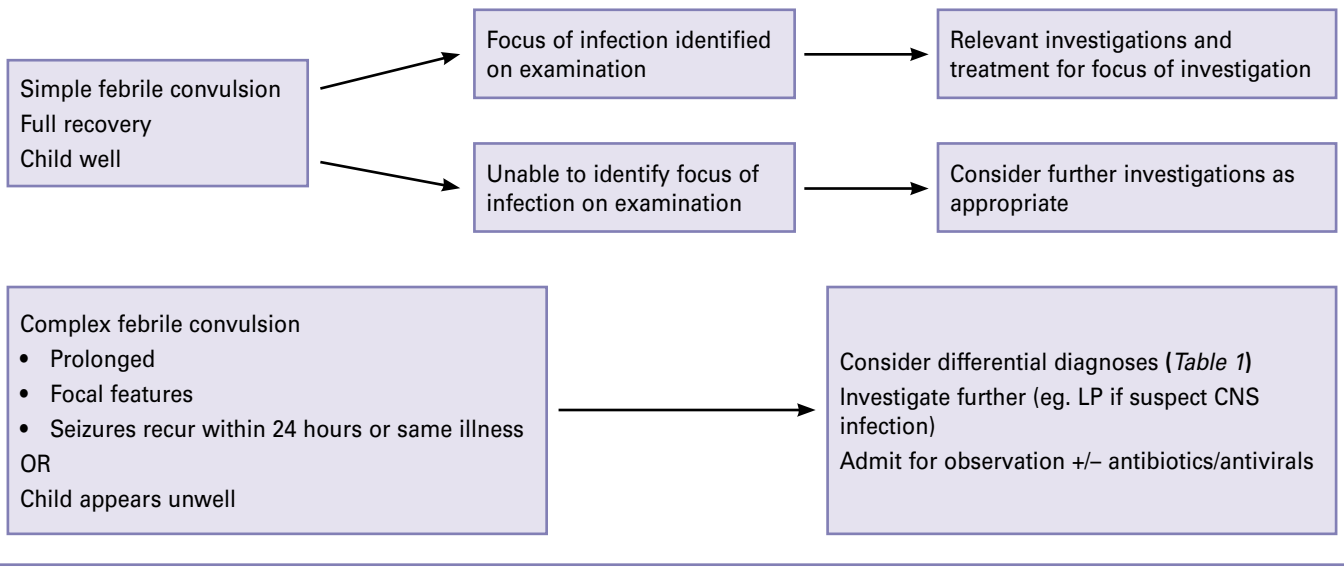
Adapted from: Rectal diazepam – instructions for home use. Children's Epilepsy Centre, Royal Children's Hospital, Melbourne. Available at: www.rch.org.au/clinicalguide

Figure 1. Management of acute seizures

Investigations

Lumbar puncture

The decision to carry out a lumbar puncture (LP) rests on the likelihood of an underlying CNS infection as suggested by the history and physical examination. In general, LP is recommended after the first seizure with fever in a child less than 12 months of age, as clinical signs of meningitis may be poor in this age group.[1] An LP should be considered if there is a history of prior antibiotic treatment in a child with fever and seizures as antibiotics may mask CNS infection. The British Paediatric Association also includes LP in children



Adapted from: Febrile convulsions flowchart. Royal Children's Hospital Clinical Practice Guidelines. Available at: www.rch.org.au/clinicalguide/cpg.cfm

Figure 2. Simple algorithm for febrile convulsions

Table 1. Differential diagnoses of fever and convulsions[16]

Febrile seizures	Simple
	Complex
Central nervous system infection	Meningitis
	Encephalitis
Fever triggering seizures in a child with epilepsy	
Other precipitants of seizures in a child with fever	Systemic illnesses (eg. occult bacteraemia)
	Head trauma
	Intoxication
	Electrolyte imbalance
	Hypoglycaemia

older than 12 months with complex FS, as these are more frequently associated with meningitis than simple FS.[19,20] Conversely, there are recommendations that routine investigation of cerebrospinal fluid is not required in the absence of clinical signs of meningitis such as meningism or features of increased intracranial pressure.[18] In practice, the decision to LP should be tailored to each individual child's presentation.

Laboratory tests

Laboratory studies such as blood tests are generally unhelpful in the management of a child with FS, except when assessing for complications of the underlying intercurrent illness (eg. electrolyte abnormalities associated with dehydration secondary to infectious gastroenteritis). Laboratory studies should be directed at finding the source of the fever (eg. urine culture), which is especially important if no focus is apparent on physical examination. Other laboratory studies performed for afebrile convulsions (calcium, phosphorus, magnesium, glucose) are generally unnecessary in simple FS.[16]

Electroencephalograms

An electroencephalogram (EEG) is not indicated for simple FS.[1] The rate of postictal EEG abnormalities in children with complex FS is low,[21] and studies that have shown an EEG abnormality have been unable to translate this into a long term predictor for future FS and afebrile seizures.[21–26]

Neuroimaging

In a child with a simple FS, without clinical features suggestive of intracranial pathology, there is no indication for neuroimaging such as computerised tomography (CT) or magnetic resonance imaging (MRI) brain studies.[1,12] Concerns about the long term effects of radiation suggests the clinician should think carefully before ordering a CT scan.[27]

Recurrence risks for FS and epilepsy

Following the first FS, many carers' concerns turn to the consequences of a FS. With the exception of the risk of recurrent FS, minimal short term sequelae have been identified.[24] Death from a simple FS is extremely rare, except where pre-existing abnormalities exist.[29] Overall, the recurrence rate of FS is between 30–40%, with the rate climbing as the number of risk factors increase.[12,28,29] The most consistent risk factors associated with FS recurrence are:

- onset less than 18 months of age, and
- a family history of FS (first or second degree relative).[3,26,28–33]

Other risk factors include:

- developmental delay
- lower level of fever, and
- brief duration between fever onset and FS.[30,32]

The overall risk of later epilepsy is 2–7%, however this is 10 times higher than the general population risk.[28,34] The risk of epilepsy is increased if the child had a complex FS, a focal neurological deficit, or if there is a family history of epilepsy.[35]

Management

The main emphasis in managing FS should be on basic first aid seizure management (*Figure 1*) and careful counselling of the child's carers. Parents whose child experiences a FS often have inadequate knowledge, heightened concerns, and inadequate first aid management skills.[36]

Rectal diazepam is effective in the acute management of seizures and is indicated for prolonged attacks, lasting more than 10 minutes, when acute medical care is not accessible. A useful website link addressing this further is www.rch.org.au/cep/treatments/index.cfm?doc_id=3243. Diazepam is now available in a 5 mg/5mL single dose tube formulation which allows more straightforward delivery into the rectum than the liquid formulation. While the nasal or buccal administration routes used for midazolam are more socially acceptable, midazolam use is not yet commonplace.[37,38] Indeed, neither diazepam nor midazolam have an official indication for use in this setting.

Status epilepticus occurs when a seizure lasts 30 minutes or more, or if there are recurrent seizures for at least 30 minutes without regaining full consciousness between ictal events.[2] The immediate mortality and morbidity of febrile status epilepticus (FSE) is low, and patients who have FSE are more likely to have focal seizures or harbour pre-existing neurological abnormalities.[13]

Is there a place for treatment or prophylaxis of FS? The options are ongoing prophylaxis with anti-epileptic drugs (AED), interval antipyretic treatment of febrile episodes, and intermittent AED prophylaxis. Unfortunately, there is no clear consensus regarding these questions.

Several studies have demonstrated that valproate and phenobarbitone reduced the recurrence of FS compared with placebo,[39,40] however the significant adverse effects associated with both drugs (drowsiness and aggression with phenobarbitone, and the rare risk of hepatotoxicity with valproate) limit their practical use. Phenobarbitone should not be used for FS.[8,39] Carbamazepine and phenytoin have been found to be ineffective in short and long term management.[41]

Antipyretic medications such as paracetamol are commonly administered at the onset of a fever. However, there is no evidence that antipyretics prevent further FS alone or in combination with low dose diazepam.[42,43]

It is controversial whether intermittent benzodiazepine administration alone is effective. Numerous studies have found no efficacy in the use of intermittent diazepam prophylaxis (rectal and oral).[39,41,42] However, on closer inspection, these studies either used ineffective doses, or had other flaws.[8,44] In contrast, other studies of intermittent clobazam or diazepam therapy in FS have shown to be effective.[45–47] The decision on whether to use intermittent benzodiazepine prophylaxis needs to be based on the balance between risks and benefits, the frequency of FS, access to medical treatment, and the carer's ability and wishes.[4]

Conclusion

As FS are commonly encountered in paediatrics, the medical practitioner should be comfortable assessing a child who convulses with fever. The clinician should focus on acute seizure management, finding a cause for the fever, and the appropriate counselling of the child's carers.

Conflict of interest: none declared.

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