MANAGEMENT OF FEBRILE CONVULSION IN CHILDREN

Siba Prosad Paul and colleagues discuss the aetiology, clinical presentation, diagnosis and management of the most common type of seizure in children, and set out best practice for their care.

Abstract

The causes of febrile convulsions are usually benign. Such convulsions are common in children and their long-term consequences are rare. However, other causes of seizures, such as intracranial infections, must be excluded before diagnosis, especially in infants and younger children. Diagnosis is based mainly on history taking, and further investigations into the condition are not generally needed in fully immunised children presenting with simple febrile convulsions.

Treatment involves symptom control and treating the cause of the fever. Nevertheless, febrile convulsions in children can be distressing for parents, who should be supported and kept informed by experienced emergency department (ED) nurses. This article discusses the aetiology, clinical presentation, diagnosis and management of children with febrile convulsion, and best practice for care in EDs. It also includes a reflective case study to highlight the challenges faced by healthcare professionals who manage children who present with febrile convulsion.

Keywords

Children, paediatric, seizures, fever, high temperature, febrile convulsions, epilepsy

Aetiology and pathophysiology

The exact aetiology of febrile convulsion is unknown, but it is considered to be the result of a complex interplay between environmental and genetic factors (Paul et al 2012, Chung 2014). Fever in febrile convulsions is extra-cranial in origin and the high temperature associated with it is a normal physiological response to infection. Mechanisms that could explain the process of such convulsions include the release during fever of cytokines, which cause temporary abnormal electrical activity in the brain (Lux 2010a, NHS Choices 2014).

In the UK, the most common infections associated with febrile convulsion (Paul and Eaton 2013, NHS Choices 2014) are chickenpox, flu,
gastroenteritis, middle ear infections, respiratory tract infections and tonsillitis.

The risk of febrile convulsion is increased by positive family histories, with up to 40% of children having such histories. Between 9% and 22% of children with siblings who have experienced febrile convulsion experience it themselves, and the likelihood that the other twin will experience febrile convulsion is highest among monozygotic twins (Lux 2010a). Almost 50% of children in whom siblings and one parent have experienced febrile convulsion experience it too (Tejani 2015).

Pre-existing neurological conditions, such as cerebral palsy, and iron and zinc deficiencies, are also thought to increase the risk of febrile convulsion (Paul et al 2012, Waqar Rabbani et al 2013).

Research demonstrates that the development of febrile convulsion may be due mainly to polygenetic inheritance (Paul and Chinthapalli 2013, Tejani 2015), although an autosomal dominant pattern of inheritance known as a ‘febrile seizure susceptibility trait’ has been identified in a few families (Tejani 2015). Although the exact molecular mechanisms are yet to be understood fully, underlying mutations in genes encoding sodium channels and the gamma-aminobutyric acid A receptor have been identified in children with febrile convulsions (Tejani 2015).

Clinical presentation

The peak age of onset of febrile convulsion is 18 months, with up to 50% of children having first episodes aged between 12 and 30 months. First presentations of febrile convulsions in children aged over three years are rare (Sadleir and Scheffer 2007, Chung 2014).

Children with febrile convulsion usually have a temperature of more than 38°C. Convulsions can occur at any point during a febrile illness, however, and children may not have a raised temperature at the time of their seizures but may subsequently develop one.

Signs and symptoms can include loss of consciousness, global or focal twitching or jerking of arms and legs, difficulty breathing, foaming at the mouth, pallor or going blue, and eyes rolling back in the head. After a seizure, children are often drowsy and sometimes confused, and can take up to 30 minutes to wake properly (Department of Health Australia 2010).

There are two types of febrile convulsion, with 70% classified as simple and 30% as complex. The characteristics of each are shown in Table 1.

Febrile status epilepticus, a severe form of complex febrile convulsion lasting at least 30 minutes without interim recovery, occurs in 5% of children with febrile convulsion, and is more likely than other forms of complex febrile convulsion to have focal features (Sadleir and Scheffer 2007, Chung 2014, Tejani 2015).

Diagnosis

When children with febrile convulsion present to EDs, healthcare professionals should take detailed and accurate histories, and make physical examinations, to rule out other diagnoses and to identify the cause of fever. Differential diagnoses of childhood seizures (Sadleir and Scheffer 2007, Paul et al 2012) include:

- Rigors with no loss of consciousness.
- Febrile delirium, an acute and transient confused state associated with fever.
- Febrile syncope.
- Breath-holding attacks, in which children transiently lose consciousness due to voluntarily holding their breath.
- Reflex anoxic seizures, in which painful events or shock causes children suddenly to become limp. Such children may have low-grade pyrexia.
- Evolving epilepsy syndrome.
- Central nervous system (CNS) infections, such as meningitis and encephalitis.

Histories are likely to come from children’s parents or guardians, and healthcare professionals should be careful to gather information on (Chung 2014):

- The nature of the convulsion, for example whether it is generalised or focal, and its duration.
- The duration of the post-ictal phase.
- Recent illnesses or fever.
- Recent antibiotic use.
- Other symptoms, such as breathing difficulties and diarrhoea.
- Immunisation status.
- Histories of febrile convulsions or previously diagnosed neurological conditions.
- Family histories of febrile convulsions, epilepsy or sudden death.
- Use of antipyretics.
- Use of rescue anticonvulsants, such as diazepam and midazolam, to terminate seizure. This question may be asked of paramedic staff rather than parents or guardians.

Examinations should include full neurological assessments and healthcare professionals should look for signs of meningeal irritation, such as neck stiffness (Chung 2014). It is therefore vital that they can recognise the signs and symptoms of CNS infections, which can be subtle in infants and young children (Paul and Chinthapalli 2013).
The seriousness of illness in children should not be assessed solely on the height of their temperatures, and healthcare professionals should also record each child's respiratory rate, oxygen saturation, central capillary refill time, heart rate, blood pressure, blood glucose level and paediatric early warning score (PEWS) (Royal College of Nursing 2013).

Clinicians should remember that children who present during or immediately after febrile convulsions will have a high PEWS and should be reviewed urgently by a medical professional or advanced emergency nurse practitioner. A high PEWS is likely to persist for a short period of time due to pyrexia and associated tachycardia and tachypnoea, and ED nurses should continue to monitor the child concerned until his or her transfer because a further increase in PEWS should trigger a reassessment of the child’s condition.

Investigations should also be carried out in children who show signs and symptoms of serious illness or intracranial infection, such as meningitis or pneumonia. Investigations are rarely necessary in children who are aged over one year, are fully immunised, have a clear focus of infection and have had simple febrile convulsions (Oluwabusi and Sood 2012). However, further investigations should usually be carried out in children who are less than one year old, who are presenting with complex febrile convulsions for the first time or who may have symptoms that suggest CNS infections (National Institute for Health and Care Excellence (NICE) 2013a).

In such cases, healthcare professionals can request full septic screens including:

- Full blood count and tests of C-reactive protein, calcium, glucose, magnesium, urea and electrolytes, and, if bacterial sepsis is suspected, blood culture.
- Urine dipstick and culture tests.
- Chest X-rays.
- Stool culture tests.
- Lumbar puncture. However, because raised intracranial pressure is difficult to assess in the post-ictal period, this test should not be undertaken immediately after a febrile convulsion. In children with complex or recurrent febrile convulsion, or those with neurological abnormalities, magnetic resonance imaging, computed tomography, electroencephalography (EEG) or a combination of these can be considered to rule out underlying or evolving neurological problems. EEG is usually undertaken at least 48 hours after the febrile convulsion to prevent post-ictal electrical activities being misinterpreted as abnormal seizure activities (Paul et al 2012, Shah et al 2014).

In children who have had recurrent episodes of febrile convulsion and with clearly identified sources of infection, repeat investigations are not required. However, it is important that healthcare professionals determine the source of children’s infections and ensure that they are managed appropriately (Paul and Chinthapalli 2013).

A case study involving a young child with febrile convulsion is shown on page 22.

### Management

The first healthcare professionals to see children with febrile convulsion are often emergency nurses, who therefore have an important role to play in managing the children’s condition. Most such children present to EDs after their episodes of convulsion are over, but a small number present while still convulsing and must be stabilised following the ABCDE approach. This is generally done in a resuscitation room (Paul and Chinthapalli 2013).

Witnessing convulsing children is distressing for their parents. Such children appear pale,
Case study

A paediatric medical team was ‘crash bleeped’ to attend resuscitation urgently after a three-year-old boy was rushed with his parents by ambulance to the emergency department (ED).

The boy’s parents said that, while at home about five hours earlier, he had become febrile. His parents had given him paracetamol, but he had suddenly become ‘floppy’ and unresponsive. Worried that their son had sustained brain damage due to high fever or was about to die, the parents had called for an ambulance. On the way to the ED, the right side of the boy’s body had begun to twitch and the twitching progressed to a generalised tonic-clonic seizure.

On arriving at the ED, the parents were extremely distressed and, while the team stabilised the boy, made initial observations and administered medications, his parents were supported by a senior ED staff nurse.

The family is of an Indian ethnic background. History taking from the parents revealed that there was no family history of epilepsy, although the boy’s mother reported that she had experienced recurrent febrile convulsion early in her life and had been treated with sodium valproate till her sixth birthday.

Initial observations showed that the boy had a temperature of 39.3°C, a pulse rate of 166 beats per minute, respiratory rate of 36 breaths per minute, oxygen saturations of 91% in air and a central capillary refill time of two seconds. His bedside blood glucose level was 9.3mmol/L.

The boy was administered high-flow oxygen through a face mask. An intravenous (IV) cannula was inserted and the boy was administered a dose of IV lorazepam 0.1mg/kg.

After 12 minutes, the boy’s seizure terminated but he remained unresponsive and with a low Glasgow Coma Scale score, of 10/15. He remained unresponsive for a further 90 minutes.

During this period, laboratory results showed he had a C-reactive protein level of 27 mg/L and a white cell count of 14.8x10^9/L, but no electrolyte abnormalities were detected.

On waking, the boy was confused and distressed, and struggled to recognise his parents for another 25 minutes. Clinical examination revealed he had bilateral inflamed tympanic membranes and right-sided inflamed enlarged tonsils.

The boy was given a provisional diagnosis of complex febrile convulsion and was put under neurological observation. The possibility that he had contracted another serious infection, such as meningitis or encephalitis, was considered and documented. Because there had been a prolonged period of unresponsiveness before and after his seizure, he was administered IV ceftriaxone and acyclovir in case of intracranial bacterial and herpes infections.

Over the next 36 hours, the boy’s fever settled and he recovered completely. His detailed neurological assessment produced normal results. The team discussed with the boy’s parents whether he should undergo lumbar puncture but, in light of the parents’ reluctance and the fact that the likelihood that he had contracted an intracranial infection was considered minimal, it was decided not to carry out the procedure.

At 72 hours after admission, the boy’s blood culture was reported to be negative and IV medicines were discontinued. He was put on a ten-day course of oral co-amoxiclav and his discharge home was arranged.

At his discharge, his parents were given an information leaflet on febrile convulsion. A children’s nurse explained to them that, in view of the boy’s complex febrile convulsion and family history, he was at a high risk of further febrile convulsions and gave them advice about the use of antipyretics at home.

Two weeks later, the boy and his parents returned for an electroencephalogram, which was subsequently reported to be normal. After consulting a neurologist while on holiday, his parents also organised a magnetic resonance imaging scan of his brain, which was also reported as normal.

The boy was discharged from the follow-up paediatric clinic a year later, when the parents decided to move the family to India. A summary of the boy’s medical condition, including the investigations performed and plan of management, was given to them. The boy was reported to be developing normally and doing well at school.
cannot communicate, and can be frothing from the mouth and actively fitting. Parents often think their children are going to die because they can appear lifeless during episodes. Baumer et al (1981) interviewed 36 parents who had witnessed their children's first febrile convulsions and reported that most thought that their children were dying or were likely to die. It is therefore vital that parents are adequately reassured and that their concerns are addressed. It should be acknowledged and explained that the experience can be frightening, but they should be reassured that their children will live.

If parents want to witness the resuscitation of their children, appropriately trained healthcare professionals should support them (Perry 2009). The benefits of allowing parents to be present (Maxton 2008, Keller 2011) include:

- Giving them a sense of continual involvement in their children's care.
- Giving children a sense of reassurance and safety when they start to wake up and can see their parents are present.
- Helping parents to understand that their children have received the best possible care, and satisfying them that the healthcare professionals have done everything they can to make their children better.
- Improving relationships between families and healthcare professionals.

Healthcare professionals should also give parents verbal and written advice about caring for their children after febrile convulsions. This advice should be based on (NICE 2013b):

- Safe use of antipyretics.
- Maintaining hydration, and identifying signs and symptoms of dehydration.
- Identifying non-blanching rash.
- Checking children at night.
- Seeking further help if children have further seizures, if fevers last for more than five days or if the children's conditions deteriorate.

Resuscitation is also stressful for the staff supporting the parents, especially if there is uncertainty about when convulsing children will respond to medication. Some children who have been given intravenous (IV) lorazepam respond immediately, for example, while others also need IV phenytoin or rapid sequence induction by an anaesthetist before responding. There is a risk in such cases that the information staff provide to patients will distress them further and staff need to judge what information to share on a case-by-case basis.

Febrile convulsions are usually self-limiting but, when they have lasted for more than five minutes, anticonvulsant medication, such as per rectal diazepam or buccal midazolam, may be needed to stop them (Chung 2014). A list of medicines commonly used in children presenting with febrile convulsion is shown in Table 2, page 24.

Children with simple febrile convulsions, a clear focus of infection and who appear well do not require admission and can be discharged after a period of observation in the ED or a short-stay ward, preferably six hours after the episode (Shah et al 2014). However, admission for observation is recommended (NICE 2013b) if:

- The child is under 18 months of age.
- The child is ill.
- There has been a prolonged or complex febrile convulsion.
- There is a risk of recurrence.
- Meningitis or encephalitis is suspected.
- There is no clear source of infection.
- The child shows developmental delay or neurological abnormalities.
- The parents cannot cope or clinicians think the parents cannot provide regular monitoring immediately after the child's febrile convulsion, or there are other child-safeguarding concerns.

Treatment should be directed at treating the source of infection and management of symptoms. If bacterial infection is suspected, antibiotics may be considered. Children should also be encouraged to drink fluids to keep hydrated.

Parents and healthcare professionals often assume that a raised temperature means an increased risk of febrile convulsion, which often leads to overuse of antipyretics (Banks et al 2013). However, research suggests that, although antipyretics reduce body temperature, they do not reduce febrile convulsion recurrence rates (Strengell et al 2009, Lux 2010b, Banks et al 2013, Chung 2014). Antipyretics should be administered only to reduce discomfort, therefore, and to increase the likelihood of drinking and thereby maintain hydration (Banks et al 2013, Wragg et al 2014).

Paracetamol and ibuprofen can be administered, unless they are contraindicated, although NICE (2013b) recommends using only one because the clinical benefit of using them together is small and there is no evidence that the combination is more effective than a single antipyretic agent in reducing distress. Administering combinations of antipyretics is common practice in hospitals but provides no added benefit, increases the risk of drug administration errors and overdoses, and gives an incorrect message to parents (Banks et al 2013, NICE 2013b, Wragg et al 2014).
Children with fever should not be under- or over-dressed, and infants’ heads should be left uncovered (NICE 2013b). The temperature of the room can be reduced, but it is not advisable to blow air from a fan directly towards children or to give them a sponge bath as these techniques can lead to peripheral vasoconstriction, and raise body temperature even further through shivering (NICE 2013b).

Long-term anticonvulsant medication is not usually prescribed as prophylaxis for febrile convulsions because trials have shown they do not reduce the chance of developing epilepsy and their potential side effects outweigh their potential benefits (Strengell et al 2009, Lux 2010a, Paul and Chinthapalli 2013, Shah et al 2014). In specific circumstances, however, the benefits can outweigh the risks and children are prescribed benzodiazepines, such as rectal diazepam or buccal midazolam, for use at home as a ‘rescue therapy’ to stop a seizure (Chung 2014). Benzodiazepines to be administered by parents at home can be prescribed for children who have frequent febrile convulsions in short periods or convulsions that last more than 15 minutes, as long as anticonvulsants have been required previously to stop seizures, or the children and their families live in geographically isolated areas where they cannot receive immediate medical assistance (Sadleir and Scheffer 2007, Lux 2010a, Paul and Chinthapalli 2013).

Prognosis

Healthcare professionals and parents are usually most concerned about the risk of seizure recurrence of febrile convulsions and the risk of epilepsy. For most children, however, febrile convulsions have no long-term consequences, and do not affect behaviour, learning or intelligence (Chung 2014). It is important to emphasise that febrile convulsions are not epileptic in origin and children who have simple febrile convulsions are at no greater risk of developing epilepsy than other children (Mewasingh 2010).

One third of children who have one febrile convulsion will have a second during a later febrile illness. Healthcare professionals should be aware of the risk factors for recurrence, therefore, because they may need to counsel the children’s parents accordingly and some children may need ‘rescue’ anticonvulsants. Risk factors for recurrence of febrile convulsions (Waruiru and Appleton 2004, Sadleir and Scheffer 2007, Mewasingh 2010, Chung 2014) include:

- A strong family history of febrile convulsion.
- Onset of first episode before 18 months of age.
- Less than one hour of fever before onset of first convulsion.
- Body temperature of less than 38°C at the onset of febrile convulsion.

Table 2 Medicines commonly used for children with febrile convulsion who present to emergency departments

<table>
<thead>
<tr>
<th>Name</th>
<th>Dosage</th>
<th>Administration route</th>
<th>Frequency</th>
<th>Maximum dosage</th>
<th>When used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td>15mg/kg</td>
<td>Oral or rectal, or intravenous (IV)</td>
<td>Between four and six hourly</td>
<td>Four within 24 hours</td>
<td>For pyrexia in children with febrile convulsion (FC)</td>
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<tr>
<td></td>
<td></td>
<td>or intravenous (IV) during resuscitation</td>
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<tr>
<td>Ibuprofen</td>
<td>5mg/kg</td>
<td>Oral</td>
<td>Between six and eight hourly</td>
<td>Three within 24 hours</td>
<td>For pyrexia in children with FC unless they are dehydrated</td>
</tr>
<tr>
<td>Diazepam</td>
<td>0.25mg/kg</td>
<td>IV or intraosseous</td>
<td>Second dose ten minutes after the first</td>
<td>Only two doses of benzodiazepines are to be used irrespective of the agents and whether they are administered singly or in combination</td>
<td>For an actively convulsing child whose seizure have lasted more than five minutes</td>
</tr>
<tr>
<td></td>
<td>0.5mg/kg</td>
<td>Rectal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lorazepam</td>
<td>0.1mg/kg</td>
<td>IV</td>
<td></td>
<td></td>
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<tr>
<td>Midazolam</td>
<td>0.15-0.2mg/kg</td>
<td>IV</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>0.5mg/kg</td>
<td>Buccal</td>
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<tr>
<td>0.9% sodium chloride solution</td>
<td>20ml/kg</td>
<td>IV</td>
<td>During resuscitation</td>
<td>More than two doses are rarely required</td>
<td>In children with shock, for example during febrile illness due to gastroenteritis</td>
</tr>
</tbody>
</table>

Febrile convulsion will recur in 4% of children for whom no risk factor applies but in 75% of those for whom all four apply (Waruiru and Appleton 2004, Sadleir and Scheffer 2007). It is important that healthcare professionals provide a realistic view of the chances of recurrence depending on the relevance of these risk factors so that parents are fully informed and can act appropriately.

### Summary
Febrile convulsion is the most common type of childhood seizure and most children with the condition have good prognoses, with few going on to develop long-term health problems. The diagnosis is clinical and it is important to exclude serious intracranial infections, especially after a complex febrile convulsion. Management involves symptom control and treating the cause of the fever.

Healthcare professionals need to support parents, who are likely to be distressed and frightened after convulsions have occurred. It is essential that they provide guidance on, and dispel myths about, fever management.

### Implications for practice
Healthcare professionals can:
- Raise suspicion of any serious pathology such as intracranial infection.
- Provide urgent clinical care for convulsing children.
- Provide care for children, including monitoring their temperature and other parameters, and make them as comfortable as possible.
- Instigate investigations and ensure children’s airways are safe if they are being moved to other parts of a hospital, such as the radiology department for computed tomography scans, when they may not have regained consciousness fully.
- Reassure parents and advise them verbally and in information leaflets before discharge, on, for example, the use of single antipyretics, fluid management and what to do if their children have further convulsions.
- Identify children who have missed immunisations and encourage parents to ensure they are immunised.
- Address parental concerns if febrile convulsions have occurred after vaccinations because they may be reluctant to immunise their children again.

### References

**Advanced Life Support Group (2011)**  


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Emergency Department Factsheets: Febrile Convulsions In Children. tinyurl.com/pma6fikq (Last accessed: April 17 2015.)


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**Conflict of interest**  
None declared