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Febrile Seizures in Children: A Comprehensive Overview

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Abstract

Febrile seizures, a neurological disorder marked by neuronal hyper-excitability, are frequently seen in children aged 3 months to 5 years. They are brought on by an elevated core body temperature during a fever that was brought on by an underlying systemic infection. These infections trigger an inflammatory response in the immune system, which leads to macrophages releasing cytokines. There are two categories for febrile seizures: simple and complex. Given the multifactorial inheritance of febrile seizures, it is likely that both environmental and genetic variables play a role in their occurrence. Risk factors for initial Febrile seizures are a developmental delay and a condition with a family history. The following are risk factors for recurrent febrile seizures: a family history, age under 18 months at seizure onset, fever duration, and highest temperature. The development of epilepsy later is at risk due to complicated Febrile Seizures and neurodevelopmental abnormalities. When examining children following a straightforward Febrile Seizure, clinicians should focus on determining the aetiology of the child's fever. There is a need for a different, more accessible treatment with fewer negative side effects because the current therapies for febrile seizures have health-harming side effects. This is especially important in low-income areas where febrile seizures are becoming a bigger problem due to other underlying socioeconomic factors.

Keywords: Febrile seizure, fever, Temporal lobe epilepsy, neuroinflammation, treatments, convulsions

INTRODUCTION

Children between the ages of 6 months and 5 are usually affected by febrile seizures (FS), which are "provoked" epileptic seizures that begin during a feverish event or episode (>38.0°C/100.4°F) that happens without a central nervous system illness. FS typically reach their highest frequency during the second year of a child's life. The immune system responds to a peripheral infection by causing an inflammatory reaction, which raises the body's core temperature and causes a fever. Convulsions are caused by increased neuronal excitability brought on by the temperature rise. The primary risk factors for FS include viral infections, a family history of seizures, developmental delays, low levels of zinc and iron in the blood, maternal smoking, and stress. Most FS resolve on their own without causing lasting harm. While typically harmless for children, they can be very distressing for parents, so it's important to handle the situation with care. Children who experience prolonged FS have a higher risk of developing temporal epilepsy later. Temporal lobe epilepsy (TLE), which is frequently challenging to manage, is linked to hippocampal damage and typically manifests in teenagers or young adults, some of whom had experienced prolonged FS as young children. To create more effective preventative measures, researchers are attempting to determine which kids are at risk of developing TLE [1].

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RISK FACTORS & ETIOLOGY

1. *Gender:* Male gender.
2. *Antenatal factors:* The incidence of febrile convulsions in the offspring has been linked to

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maternal illness, parental subfertility, and prenatal mother alcohol consumption and cigarette smoking.

3. *Perinatal factors:* Abnormal pregnancies or birth histories increase the risk of both difficult initial febrile convulsions and general febrile convulsions.
4. *Genetic Factor:* family history of febrile convulsions.
5. *Precipitating factors:* Shigella and pneumococcal bacteremia, urinary tract infections, and febrile convulsions can all be linked to bacterial infections. There is higher risk of FS on the day of DPT vaccination and 8–14 days following MMR vaccination, which is ostensibly unrelated to long-term negative effects, low levels of blood sugar, sodium, or calcium, microcytic hypochromic anaemia, as well as deficits in zinc and iron. Adenovirus, respiratory syncytial virus, parainfluenza, influenza, human herpesvirus, and severe acute respiratory syndrome coronavirus (SARS-CoV-2) are the viruses most linked to FS. Feverish seizures may be made more likely by the inflammatory state that viral infections can cause [2].
6. The exact causes of FS are unknown.

EPIDEMIOLOGY AND CLINICAL FEATURES

Around 50% of children with FS experience their first episode between 12 and 30 months of age, while only 6–15% of children have their initial seizure after the age of four. Although seizures can occur at any point during a febrile illness and some children may develop a fever after the seizure, FS typically happens when the child's body temperature exceeds 38°C. Common symptoms of FS include loss of consciousness, difficulty breathing, pallor or a bluish tint to the skin, foaming at the mouth, eyes rolling back, a fixed stare, and either localized or generalized twitching and jerking of the limbs. After the seizure, children may appear agitated, disoriented, or drowsy, but they generally recover fully within 30 minutes [3].

Classification

FS can be classified into two main types: simple FS, which makes up about 70% of all cases and usually does not lead to long-term neurodevelopmental consequences, and complex FS. Depending on the duration, recurrence, and existence of focal indications within a single infectious episode, the condition is classified as "complex" or "simple." repetition in a single contagious incident. In children less than 12 months, the prevalence of FS can reach 45%, with about 20–35% of cases being categorised as complex (Table 1).

A prolonged FS (more than 5 minutes) may eventually lead to febrile status epileptics (FSE). FSE was previously defined as at least 30 minutes of continuous seizure activity or 30 minutes of recurring seizures with no full recovery of consciousness in between. FSE is responsible for 25–52% of all paediatric status epilepticus cases, yet it only makes up a tiny percentage of FS [4, 5].

Table 1. Characteristics of simple and complex febrile seizure.

Simple Febrile Convulsions	Atypical Febrile Seizures
Seizures often last less than 15 minutes, happen within 24 hours of the fever starting, and occur just once during a feverish episode. Seizures are widespread. The postictal neurological impairment is absent.	For instance, only one side of the body is involved in focal features. The duration of seizures exceeds 10 minutes. Within 24 hours, two or more seizures take place. After an hour, no full recovery is shown. Post-ictal neurologic effects exist. Following the seizure, there is a brief period of paralysis known as Todd's paralysis. Febrile SE appears Anticonvulsant medications could be necessary to stop the seizure.

Diagnosis

All children do not usually require investigations following a FS.

Basic FS typically do not need radiography or laboratory testing; instead, they should only be used to determine the cause of fever as determined by physical examination [6].

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The primary objective of the clinical assessment is to identify the infection responsible for the fever. A thorough and detailed history, along with a comprehensive clinical evaluation, including a neurological exam, is necessary to rule out secondary causes of seizures. The assessment should cover several factors, such as the nature and duration of the seizures, the length of the postictal period, any recent fevers or infections, recent antibiotic treatments, related symptoms, vaccination and immunization history, previous occurrences of FS or diagnoses of epilepsy, other neurological conditions, family history of FS, epilepsy, or neurological diseases, the use of antipyretic medications, and whether rescue anticonvulsants (like diazepam or midazolam) were needed to stop the seizures. These details are typically gathered from the child's parents or caregivers [7].

TREATMENT

First Aid for Convulsive Fever

1. Remain composed and avoid panicking.
2. Child should be on the floor to ensure their safety. Anything that they might bump into should be taken away.
3. Keep everything out of your child's mouth.
4. Do not slap or shake your child.
5. Don't take child away.
6. After the seizure has ceased, turn the kid onto their side, which is referred to as the recovery position. Turn their head sideways if they have food in their mouth, and don't try to take it out.
7. Make a note of when the fit began and ended so the doctor knows [8].

Initial Assessment

The child's airway, breathing, and circulation should be stabilised as the top priority in prehospital and urgent care. FS usually resolves on its own before children are admitted to the hospital. To soothe the patient during febrile convulsions, the temperature is quickly lowered using hydrotherapy or antipyretics.

Admission to Hospital

FS that persist for longer than a few minutes, and the kid should be taken to the hospital if the seizures are uncontrollable.

Seizures lasting longer than 5 minutes are unlikely to resolve spontaneously, so the administration of a benzodiazepine is advised to terminate them.

Establishing an IV access is necessary in cases of prolonged FS to provide anticonvulsant medicine and to ensure proper hydration [9].

FS Prophylaxis

Intermittent or continuous prophylaxis are both possible. When there are three or more FS in 6 months, six or more in a year, FS that last longer than 15 minutes, or when pharmacological therapy is needed to manage seizures, intermittent prophylaxis of febrile convulsions is recommended.

The current recommendation is intermittent prophylaxis during fever bouts. Use of a medication that avoids febrile convulsions and rapidly raises drug levels is recommended. An efficient preventative is oral clobazam (0.75–1 mg/kg/day), which is administered for three days during fever bouts. All patients should be prescribed antipyretics, hydrotherapy, and careful temperature monitoring. Care for the home is advised.

In cases when intermittent therapy fails, recurring atypical seizures occur, and parents are unable to rapidly identify the development of fever, continuous prophylactic use of antiepileptic medications is recommended. Phenobarbitone (3–5 mg/kg/day) or sodium valproate (10–20 mg/kg/day) are the only medications that effectively prevent FS. Neither phenytoin nor carbamazepine work. The recommended length of therapy is 1–2 years, or until the child is 5 years old.

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PROGNOSIS

Between 30 and 50 percent of febrile convulsions will recur. Frequent fevers, low temperature at the commencement of the FS, epilepsy or fevers in first-degree relatives, and early age (less than 15 months) are risk factors that can predict the recurrence of both simple and complex FS. Epilepsy is likely to occur in approximately 1%–2% of children with simple febrile convulsions and up to 5% of children with recurrent complex seizures. It is important to reassure the child's parents that the likelihood of developing epilepsy following a simple FS is not appreciably higher than in the general population. Atypical seizures, a consistently abnormal electroencephalogram, poor neurodevelopment in the child, or a family history of epilepsy all increase the child's risk of developing epilepsy. After years of continuous atypical febrile convulsions, complex partial seizures may appear [10].

DISCUSSION

A fit or seizure that happens in children with a high fever between the ages of 6 months and 6 years is known as a febrile convulsion. A brief seizure won't hurt the brain; even a prolonged seizure rarely does. A febrile convulsion is not epilepsy. An ambulance should be called if the fit lasts more than 5 minutes since medication may be required to end it. It can be prevented by reducing body temperature [11].

CONCLUSIONS

The most prevalent kind of seizure in children is FS, which affects 2–5% of kids aged 6 months to 5 years. Fifteen to twenty percent of FS are complex, while the majority are simple. Typically, simple FS are harmless, but children who experience complicated FS may develop epilepsy in the future. Of children who experience a FS, about one-third will experience another one in their early years. Most children tend to outgrow the condition by the age of 6.

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