REVIEW ARTICLE

Clinical Features and Management of Febrile Seizures in Pediatrics

Maail Khan Mangal[1], Mohammad Hanif Ahmadzai[1], Khoshal Gul Mohammad[2]

Abstract

A febrile seizure (FS) may be defined as an event in infancy or childhood, mostly occurring between six months and five years of age. It is accompanied by fever but without signs of intracranial infection. These are not regarded as a type of epilepsy. Moreover, they are an age-dependent phenomenon that occurs in about 2 to 4% of children. FS can lead to extreme fear in parents, even if they are generally harmless for children, making it important to manage parental anxiety carefully. This review focuses on the management of FS in the pediatric age. Most children with FS have high rate of prediction while few develop long-term health issues as shown by an analysis of the literature. Its diagnosis is clinical. Intracranial infections are important to exclude, particularly after a complex FS. Symptom control and treating the cause of the fever are elements of its management. It is crucial to improve the knowledge of paediatricians and neurologists on FS management due to the improper use of diagnostic tests and treatments and to standardize the diagnostic and therapeutic work-up.

Keywords: Febrile seizure, Paediatrics, Epilepsy, Intracranial infection, C-reactive protein.

Journal of Applied Pharmaceutical Sciences and Research, (2023); DOI: 10.31069/japsr.v6i1.01

Introduction

Febrile seizures (FS) are seizures or convulsions that are triggered by fever and occur in children between six months and five years of age without indication of intracranial infection or known cause.[1, 2] Febrile seizures are not regarded as a kind of epilepsy characterized by repeated nonfebrile seizures.[2, 3]Generally recognised criteria for febrile seizures include:[4, 5, 6]]

- A seizure brought on by a high temperature of more than 38°C.
- A young child, less than five years old, who is older than six months.
- Absence of inflammation or infection in the central nervous system.
- Absence of acute systemic metabolic imbalance that might cause convulsions.
- No history of previous afebrile seizures.

Their frequency is about 3–4% in white children, 6–9% in Japanese children, and 5–10% in Indian children.[7] Simple febrile seizures represent the majority of febrile seizures that last less than 15 minutes and do not reoccur during 24 hours. Although some studies have found a possible link between environmental and genetic factors and FS, the exact causes are still unknown.[8] Generally, fever is caused due to infection, and the release of elevated levels of cytokines during a fever may modify normal brain activity, triggering seizures.[8] The risk factors for FS, as proved by earlier studies, include male gender, a family history of FS, a high peak body temperature, specific underlying causes of the fever, prenatal and natal complications, low serum calcium, sodium or blood sugar, microcytic hypochromic anemia, and iron and zinc deficiencies.[9, 10] Even though some families have been found to have an autosomal dominant inheritance pattern of a specific "febrile seizure susceptibility trait," some studies have shown that FS are associated with a polygenetic inheritance. And last, the development of FS may be influenced by mutations in the genes encoding for sodium channels and the -aminobutyric acid A receptor.[11] Chickenpox, influenza, middle ear infections, upper and lower airway infections (including tonsillitis, pneumonia, bronchitis, and sinusitis), tooth infections, and gastroenteritis (particularly those brought on by rotavirus) are the most common diseases linked to FS in children.[8, 12]

[1]Department of Internal Medicine, Medical Faculty Paktia University, Paktia, Afghanistan

[2]Department of General Surgery, Medical Faculty Paktia University, Paktia, Afghanistan

Corresponding Author: Maail Khan Mangal, Department of Internal Medicine, Medical Faculty Paktia University, Paktia, Afghanistan, Email: mangalmaailkhan@gmail.com

How to cite this article: Mangal M K, Ahmadzai M H, Mohammad K G. Clinical Features and Management of Febrile Seizures in Pediatrics. Journal of Applied Pharmaceutical Sciences and Research. 2023; 6(1):1-4

Source of support: Nil

Conflict of interest: None

Received: 6/01/2023; **Accepted**: 2/03/2023; **Published:** 15/06/2023

Epidemiology and clinical features

The most prevalent neurologic condition affecting newborns

and young children is febrile seizures. With a peak incidence between 12 and 18 months, they affect 2 to 4% of children under the age of five. There have been reports of a higher occurrence in a few places, like the Japan Mariana Islands. With an estimated male-to-female ratio of 1.6:1, there is a minor male predominance[13] All ethnic groups may have FS in their children, but some have a higher incidence than others, including Guamanians (14%), Japanese (6–9%), and Indians (5–10%).[14, 15] Although children may experience seizures at any point while suffering from a febrile disease, and may not experience a fever until after their seizure. FS typically occur when the child's temperature is higher than 38oC. Besides age, the most frequent risk factors are a high temperature, a viral infection, a recent vaccination, and a family history of febrile seizures. Loss of consciousness, trouble breathing, pallor or turning blue, foaming at the mouth, eyes rolling to the back of the head, a fixed gaze, generalized or focused twitching, and jerking of the limbs and legs are typical signs and symptoms of FS. Children who have had a seizure may be agitated, disoriented, or sleepy afterward, but they will fully recover in about 30 minutes.[15-18] Based on clinical characteristics, febrile seizures are further classified into simple or complex. [19] The most frequent type of febrile seizures, simple febrile seizures are characterized by generalized seizures that last less than 15 minutes and do not recur within a 24 hours period. A cut-off of 10 minutes has been suggested as a more suitable criterion for differentiating between simple and complex fever seizures because the majority of simple febrile seizures last less than five minutes. [20] Complex febrile seizures are characterized by episodes that start focally, persist longer than 15 minutes, or happen more than once in a 24 hours period. [21]

Febrile status epilepticus: Some patients arrive in febrile status epilepticus (FSE), which is characterized by ongoing or sporadic seizures without neurologic improvement. Before 2015, continuous seizures lasting five minutes or longer were included in the definition of FSE, which had historically only applied to seizures lasting 30 minutes or longer.[22] The actual seizure length is underestimated in the emergency room in up to one-third of FSE episodes.[23] The appearance of closed eyes and a deep breath are significant clinical indicators that a seizure has concluded. Even if the convulsive motor activity has ended, children with eyes that remain open and affixed in an abnormal position may be having a continuing focal seizure.

Diagnosis

In order to rule out secondary causes of convulsions in a child with FS who presents to the Emergency Department (ED), it is crucial above all to take a thorough and accurate history and conduct a detailed clinical evaluation, including a neurologic examination. [14, 15, 18, 24] The differential diagnosis of a febrile seizure includes nonepileptic occurrences or movements, seizures that are induced by an infection of the central nervous system (CNS), such as meningitis or encephalitis, and rare inherited epilepsy types where fever-related seizures are more frequent. In general, a history is taken from the parents or carers and should detail the nature and severity of the convulsions, the presence and time of the post-ictal phase, recent fevers or infectious diseases, the use of antibiotic therapy recently, any additional symptoms that may be present, immunization and vaccination history, a history of prior episodes of FS or a diagnosis of epilepsy, other neurologic conditions and diseases, and any family history of FS, epilepsy, or neurologic diseases, the use of antipyretics, and the need for rescue anticonvulsants to interrupt seizures, such as diazepam or midazolam. [25] Identifying the infection that is causing the fever should be the main goal of the clinical assessment. If the child is still convulsing, emergency stabilization is required using the ABCDE strategy (airway, breathing, circulation, disability, and exposure/examination, in addition to a blood glucose check) [26, 27] and the seizure should be ceased as soon as possible using antiepileptic medications and mentioned in the management heading.

Vital indicators should be monitored after stabilization, including temperature, heart and breathing rates, capillary refill time, and blood glucose.[17-18] It is important to rule out brain infections as soon as possible in young infants because their signs and symptoms, such as meningitis or encephalitis, can be quite mild. [25-28] Paediatric patients seldom get brain abscesses, which affect children under the age of 15 in 25% of cases and peak between the ages of 4 and 7 years old. 25 to 50% of individuals have seizures, focal neurologic abnormalities, and altered mental status, however, symptoms may not always be noticeable. The initial diagnostic technique of choice is brain magnetic resonance imaging (MRI). Surgery to drain the abscess and antibiotic treatments make up the course of treatment. Streptococci, staphylococci, and enteric bacteria are the most common culprits in brain abscesses, but over the past ten years, methicillin-resistant Staphylococcus aureus (MRSA) has become a bigger cause for concern.[29] A general physical and neurological examination should focus on the patient's vital signs, level of awareness, meningismus, a tight or enlarged fontanelle, and any focused variations in muscle tone, strength, or spontaneousmovement. A different etiology, such as meningitis or an

Table 1: The warning signs and symptoms that a child is having febrile seizures (FS)

1.	The child displays complicated FS.
2.	A positive Kernig's sign, a positive Brudzinski sign, or neck stiffness are all meningeal indications that have been noted.
3.	Altered state of awareness for more than an hour after the FS was interrupted.
4.	The development of non-blanching rashes in a sick kid
5.	Anterior fontanelle enlargement
6.	Tachycardia that is out of proportion to body temperature or that continues even after body temperature has returned to normal.
7.	Signs of moderate to severe respiratory distress include tachypnea, grunting, low oxygen saturation (less than 92% on air), and chest wall recessions.

Table 2: Common medicinal treatment regimen for the management of FS

Name	Dosage	Administration Route	Freq uency	MaximumDosage	When Used
Paracetamol	15 mg/kg	Oral, rectal or intravenous (IV) during resusc itation	Every four to six hours	Five within 24 h	For pyrexia inchildren with FS
Ibuprofen	5–10 mg/kg	Oral	Every six to eight hours	Four within 24 h	For pyrexia in children with FS unless they are dehydrated
Lorazepam	0.1 mg/kg	IV	A Second dose may be given ten minutes after the first	Only two doses are to be used	For an actively convulsing child whose seizures have lasted more than five minutes

underlying structural defect, should be considered if any of these symptoms are present. According to the length and kind of seizure, post-ictal sleepiness normally resolves within 5 to 10 minutes in children who have febrile seizures. Beyond this point, encephalopathy should raise concerns about possible CNS infection or severe systemic infection. Further testing should be considered in infants and young children with a first episode of complex FS or symptoms that point to an intracranial infection.[12] This testing should include labs like a full blood count, C-reactive protein, urea, calcium, magnesium, glucose, electrolyte levels, and blood cultures if bacterial sepsis is suspected. It should also include urine dipstick and culture tests, chest X-rays, stool culture tests, and a lumbar puncture (this test should not be performed shortly after FS since in the post-ictal phase, it is difficult to notice a higher intracranial pressure). In order to rule out the presence of neurologic disorders, children with a history of complex or recurrent FS or who come with neurological abnormalities may be subjected to electroencephalography (EEG), computed tomography (CT), magnetic resonance imaging (MRI), or a combination of these. An EEG is not advised after an FS in a healthy child with a clear source of infection. If an EEG is conducted, it should be performed at least 48 hours after the FS to prevent confusing post-ictal electrical activity with aberrant activity.

Management

A child with a simple FS who is in good clinical condition and whose infection source is obvious shouldn't need to be hospitalized. Following a period of monitoring in the ED, preferably six hours following the occurrence, the kid can be released. Most FS episodes are brief and self-terminating, necessitating no long-term antiepileptic medication therapy. [30]

Antiepileptic medications should be administered to a kid who is still convulsing when brought to the ED if the seizure lasts more than five minutes, is febrile, or is recurrent. Recognizing red flags is crucial when assessing a kid with FS since they help determine whether additional care is necessary. Finding the signs and symptoms that indicate the likelihood of a serious disease is made easier by the National Institute for Health and Care Excellence (NICE) traffic-light system. [18] When a child exhibits red flag signs and symptoms, a complex FS occurs, residual neurological findings (such as Todd's paresis) are present, a serious infection is suspected but the source of the infection cannot be determined, If the child is younger than 18 months, there is a risk of seizure recurrence, and the parents or carers are unable to provide regular monitoring soon after the FS, hospitalization for observation is required. [12, 18] Some warning signs and symptoms that require serious attention are mentioned below in Table 1.

In the acute phase, therapy focuses on figuring out the underlying cause of the fever and treating its symptoms. Encourage the child to drink to ensure that they are getting enough fluids, as well as may give them paracetamol or ibuprofen to ease their discomfort from the infection.[25,18] Due to the minimal therapeutic benefit, increased risk of drug administration errors and overdoses, and misleading message to parents, NICE does not advise taking paracetamol and ibuprofen together.[18, 31, 32] It is important to let parents and other carers know that the purpose of using antipyretic medications is to ease the discomfort the illness brings, not to lower the risk of FS.[12, 17] Table 2 shows a common medicinal treatment regimen for the management of FS.

Prognosis

Clinicians and parents/caregivers frequently worry about the recurrence of FS, especially regarding the possibility of epilepsy developing. Simple FS has no negative consequences on behavior, academic performance, or neurocognition but may modestly raise the likelihood of developing epilepsy. [33] Children with a history of complicated FS are at an even higher risk of epilepsy. [33] A second episode of FS will occur during a subsequent febrile disease in one-third of children who have already experienced one. In children without risk factors, 4% of febrile seizures will return, whereas in those with those risk factors, 75% of the time.[14, 24]

Conclusion

In pediatric patients, FS are the most typical form of seizure. The prognosis for the majority of kids is excellent and only few of them experience persistent health issues. After an FS, parents and carers are frequently distressed and afraid, so it is important to properly inform them of the generally good prognosis and provide them with guidance on how to handle their child's fever and the acute phase of FS. Few children experience long-term health issues, and the majority have favorable prognosis.

References

1. Paul, S.P.; Eaton, M. At a glance: Febrile convulsion in children. J. Fam. Health Care 2013, 23, 34–37. [PubMed]
2. Millichap JG. The definition of febrile seizures. In: Febrile Seizures, Nelson KB, Ellenberg JH (Eds), Raven Press, New York 1981.
3. Berg AT, Berkovic SF, Brodie MJ, et al. Revised terminology and concepts for organization of seizures and epilepsies: report of the ILAE Commission on Classification and Terminology, 2005-2009. Epilepsia 2010; 51:676.
4. Subcommittee on Febrile Seizures, American Academy of Pediatrics. Neurodiagnostic evaluation of the child with a simple febrile seizure. Pediatrics 2011; 127:389.
5. Natsume J, Hamano SI, Iyoda K, et al. New guidelines for management of febrile seizures in Japan. Brain Dev 2017; 39:2.
6. Wilmshurst JM, Gaillard WD, Vinayan KP, et al. Summary of recommendations for the management of infantile seizures: Task Force Report for the ILAE Commission of Pediatrics. Epilepsia 2015; 56:1185.
7. Mewasingh, L.D. Febrile Seizures: Clinical Evidence. 2010. Available online: www.tinyurl.com/nketvst (accessed on 11 April 2017).
8. NHS Choices. Febrile Seizures—Causes. 2014. Available online: www.nhs.uk/Conditions/Febrileconvulsions/Pages/Causes.aspx (accessed on 11 April 2017).
9. Indar Kumar, S.; Jitender, S.; Lesa, D. Evaluation of Risk Factors associated with First Episode Febrile Seizures. J. Clin. Diagn. Res. 2016, 10, 10–13.
10. Waqar Rabbani, M.; Ali, I.; Zahid Latif, H. Serum zinc level in children presenting with febrile seizures. Pak. J. Med. Sci. 2013, 29, 1008–1011. [PubMed]
11. Tejani, N.R. Febrile Seizures. 2015. Available online: https://emedicine.medscape.com/article/801500overview (accessed on 11 October 2018).
12. National Institute for Health and Care Excellence. Clinical Knowledge Summaries: Febrile Seizures; NICE: London, UK, 2013.
13. Guedj, R.; Chappui, H.; Titomanlio, L. Risk of Bacterial Meningitis in Children of 6 to 11 Months of Age with a First Simple Febrile Seizure: A Retrospective, Cross-sectional, Observational Study. Off. J. Soc. Acad. Emerg. Med. 2015, 22, 1290–1297. [CrossRef] [PubMed]
14. Waruiru, C.; Appleton, R. Febrile Seizures: An update. Arch. Dis. Child. 2004, 89, 751–756. [CrossRef] [PubMed]
15. Paul, S.P.; Blaikley, S.; Chinthapalli, R. Clinical update: Febrile convulsion in childhood. Community Practitioner. 2012, 85, 36–38. [PubMed]
16. Department of Health Australia. Emergency Department Factsheets: Febrile Convulsions in Children. 2010. Available online: https://search.proquest.com/openview/3e1d51ff3d832faf730300c4baf03f56/1?pqorigsite=gscholar&cbl=2042236 (accessed on 11 October 2018).
17. Royal College of Nursing. Caring for Children with Fever. RCN Good Practice Guidance for Nurses Working with Infants, Children, and Young People; RCN: London, UK, 2013.
18. National Institute for Health and Care Excellence. Feverish Illness in Children: Assessment and Initial Management in Children Younger Than 5 Years ofAge; Clinical Guideline No 160; Nice: London, UK, 2013.
19. Myers, K.A.; Scheffer, I.E.; Berkovic, S.F.; ILAE Genetics Commission. Genetic literacy series: Genetic epilepsy with febrile seizures plus. Epileptic Disord. 2018, 20, 232–238. [PubMed]
20. Deng, H.; Zheng, W.; Song, Z. The genetics and molecular biology of fever-associated seizures or epilepsy. Expert Rev. Mol. Med. 2010, 20, e3. [CrossRef] [PubMed]
21. Zhang, Y.H.; Burgess, R.; Malone, J.P.; Glubb, G.C.; Helbig, K.L.; Vadlamudi, L.; Kivity, S.; Afawi, Z.; Bleasel, A.; Grattan-Smith, P.; et al. Genetic epilepsy with febrile seizures plus: Refining the spectrum. Neurology 2017, 89, 1210–1219. [CrossRef] [PubMed]
22. Trinka E, Cock H, Hesdorffer D, et al. A definition and classification of status epilepticus--Report of the ILAE Task Force on Classification of Status Epilepticus. Epilepsia 2015; 56:1515.
23. Shinnar S, Hesdorffer DC, Nordli DR Jr, et al. Phenomenology of prolonged febrile seizures: results of the FEBSTAT study. Neurology 2008; 71:170.
24. Sadleir, L.G.; Scheffer, I.E. Febrile Seizures. Br. Med. J. 2007, 334, 307–311. [CrossRef] [PubMed] 22. Paul, S.P.; Chinthapalli, R. Rational approach to management of febrile seizures. Indian J. Pediatr. 2013, 80, 149–150. [CrossRef] [PubMed]
25. Paul, S.P.; Chinthapalli, R. Rational approach to management of febrile seizures. Indian J. Pediatr. 2013, 80, 149–150. [CrossRef] [PubMed]
26. Lux, A. Antipyretic drugs do not reduce recurrences of febrile seizures in children with previous febrile seizure. Evid. Based Med. 2010, 15, 15–16. [CrossRef] [PubMed]
27. Paul, S.P.; Rogers, E.; Wilkinson, R.; Paul, B. Management of febrile convulsion in children. Emerg. Nurse 2015, 23, 18–25. [CrossRef] [PubMed]
28. Oluwabusi, T.; Sood, S.K. Update on the management of simple febrile seizures: Emphasis on minimal intervention. Curr. Opin. Pediatr. 2012, 24, 259–265. [CrossRef] [PubMed]
29. Anand, A.; Salas, A.; Mahl, E. Cerebral Abscess Presenting as a Complex Febrile Seizure. Pediatr. Emerg. Care 2015, 31, 499–502. [CrossRef] [PubMed]
30. Shah, P.; James, S.; Elayaraia, S. EEG for children with complex febrile seizures. Cochrane Database Syst. Rev. 2017, 10, CD009196. [CrossRef] [PubMed].
31. Banks, T.; Wall, M.; Paul, S.P. Managing fever in children with a single antipyretic. Nurs. Times 2013, 109, 24–25. [PubMed].
32. Wragg, E.; Francis, J.; Amblium, J. Managing pediatric patients with pyrexia. Emerg. Nurse 2014, 22, 20–23. [CrossRef] [PubMed]
33. Chung, S. Febrile seizures. Korean J. Pediatr. 2014, 57, 384–395. [CrossRef] [PubMed]