Febrile convulsions: a new look at an old problem[1]

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Febrile convulsions commonly occur in children and may recur in approximately 25% to 50% of patients, but intelligence and learning do not appear to be influenced even after frequent recurrences. The risk of future epilepsy is low in most patients; however, a small group of high-risk children can be identified by prior abnormal neurologic status, atypical seizures, or a family history which reveals a close relative with epilepsy. Chronic phenobarbital prophylaxis can protect patients against recurrent febrile convulsions, but the effects of such treatment on the later development of epilepsy are not known. Most children with febrile convulsions need not be treated with anticonvulsants.

Index term: Convulsions, febrile

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In ancient times, Hippocrates noted that "convulsions occur in children if acute fever be present . . . most readily up to their seventh year. Older children and adults are not equally liable to be seized with convulsions with fever . . . ."[1] These febrile convulsions occur in more than 3% of children less than six years old. Despite the enormous amount of data that has been published, physicians still cannot agree on a definition for the condition, on a proper evaluation technique, on the prognosis, and on effective therapeutic procedures.

Interest in febrile convulsions was renewed in the 1970s. Much information was learned from an analysis of 54,000 children born to mothers registered in the Collaborative Perinatal Study between 1959 and 1966.[2–5] These children underwent a regular schedule of examinations until they

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were seven years old. Patient histories were followed at regular intervals. In a study from the Mayo Clinic,[6] persons who had experienced febrile convulsions were evaluated until they were 20 years old. Further information, especially dealing with the use of phenobarbital for the treatment of febrile convulsions, came from studies performed by the Southern California Permanente Medical Group.[7–10] With more data available, a Consensus Developmental Conference on Febrile Seizures, sponsored by the National Institutes of Health, was held in 1980 and summarized the current state of knowledge and made recommendations regarding diagnosis and treatment.[11]

Definition

Febrile convulsions can be defined as epileptic events occurring during a febrile illness, regardless of the type of seizure or the circumstances. Yet others believe that febrile convulsions can be divided into different types. Much of the early work in this country was influenced by the writing of Livingston[12] who differentiated simple febrile convulsions (SFC) from convulsions with fever. He found that less than 3% of those with SFC would later have afebrile seizures. SFC is diagnosed based on the criteria listed in *Table 1*. The 1980 Consensus Conference defined a febrile seizure simply as an event usually occurring between three months and five years of age and associated with fever, but without evidence of intracranial infection or defined cause. Seizures with fever in children who have suffered a previous afebrile seizure were excluded.

Evaluation

Until 1975, the following laboratory tests were recommended for the evaluation of a child with febrile convulsions: spinal tap; complete blood count; urinalysis; determination of electrolytes, as well as blood-urea-nitrogen, glucose, and calcium levels; radiography of the skull; and electroencephalography. Since then, a number of studies have concluded that children with simple febrile convulsions do not require any of these tests except for examination of the spinal fluid.[13–16] A spinal tap is still recommended when meningitis is suspected or for children less than 18 months old when the classic signs of meningitis are often absent.[17] The value of performing all these tests for patients with atypical febrile convulsions requires further evaluation.

Table 1. Simple febrile convulsions

Age at onset	6 mo to 6 yrs old
Duration	<10 min
Character	Generalized
Fever	102° (not involved with the central nervous system)
Relationship to fever	Within 24 hrs of onset
Antecedent history	No known encephalopathic event
Post-ictal examination	No focal findings
Inter-ictal examination	Normal
Electroencephalogram	Normal
Family history	Often present

Prognosis

After a febrile convulsion, children generally continue to enjoy good health, but are more prone to experience a similar seizure at a later time. The risk of recurrence varies with the age of the child at the time of the initial seizure.[3] Without treatment, febrile convulsions recur in approximately 50% of children whose first seizure occurred before they were one year old and in approximately 25% whose first seizure occurred after they were more than one year old. Eighty-eight per cent of all recurrences take place within 24 months of the first seizure.[3] The number of febrile convulsions, however, does not appear to influence intelligence or learning[4] and does not lead to physical disability.[3]

In addition to concern regarding the possible injurious effects of single or recurrent febrile convulsions, the possible role of such seizures in causing future afebrile seizures (epilepsy) has also been examined. The Collaborative Perinatal Study found that the risk of subsequent epilepsy was not influenced by the number of febrile convulsions, the age of onset, or the race and sex of the patient.[3] *Table 2* lists significant risk factors that will identify children most likely to become afflicted by epilepsy. Ninety-four per cent of children experiencing febrile convulsions possessed none or one of these risk factors, and epilepsy developed in only 1% to 2% of these patients in later life. Of the 6% with two or more risk factors,

Table 2. High-risk factors associated with increased risk of subsequent epilepsy

Abnormal neurologic or developmental status prior to febrile convulsion
Complex seizure
Longer than 15 min in duration
More than one seizure in 24 hrs
Focal seizure
History of afebrile seizures in parent or sibling

epilepsy developed in 10% by the time they were seven years old.[3]

Annengers et al[6] reviewed the medical histories of residents of Rochester, Minnesota, who had experienced febrile convulsions as children. Their study further confirmed that persons with a prior neurologic disorder or with febrile seizures that were exceptional or prolonged were much more likely to experience epileptic seizures. In addition, the risk of future epilepsy continued past the seventh year of life. After 20 years, this risk was 2.5% for those with neither risk factor and 17% for those with both risk factors (*Table 3*).

Table 3. Risk of future epilepsy

	Low-risk group (%)	High-risk group (%)
Collaborative Study[2]*	1–2	10
Rochester, Minnesota [5]†	2.5	17

* Patients were not more than seven years old.
† Patients were not more than 20 years old.

Treatment

Three modes of therapy are possible: none, intermittent, or continuous. The question regarding which mode to use has generated considerable controversy, and rapid shifts in treatment patterns have occurred. In 1975, a survey of pediatricians revealed that most physicians used intermittent phenobarbital therapy.[18] More recent knowledge about the pharmacokinetics of phenobarbital has shown the uselessness of this technique. If a standard dosage of 5 mg/kg/day is maintained, more than a week will elapse before a stable therapeutic level will be established. By then, the fever will have abated anyway. On the other hand, starting therapy with 15 mg/kg will provide an adequate level of therapy within 90 minutes,[19] but such a dose will produce marked, although transient, symptoms each time a febrile illness occurs. The possible value of rectal diazepam is now being investigated.

The ability of phenobarbital to markedly decrease the frequency of recurrent febrile seizures has been established.[7,20] Nevertheless, other studies have shown that 40% of the treated children become irritable, hyperactive, or experience disturbed sleep patterns.[8,21] The possibility that learning abilities are also adversely affected is still unproved.[10] One alternative drug, valproic acid, is effective, but the risk of hepatotoxicity must be considered.[22] Mephobarbital has the same side effects as phenobarbital. Phenytoin and carbamazepine have not proved to be effective.[23,24]

The Consensus Development Conference on Febrile Seizures attempted to make the best possible recommendations based on current knowledge. The panel recommended using continuous anticonvulsant prophylaxis only in the light of any known high-risk factors. On this basis, only a small percentage of children require treatment, but most practitioners would add those patients with families that strongly wish to prevent further febrile seizures even after being informed of the advantages and disadvantages of the treatment. The ability of continuous therapy to prevent subsequent afebrile seizures (epilepsy) has not been proved. Daily therapy usually continues for at least two years or one year after the last seizure, whichever is the longer period of time.

Conclusion

Much remains to be learned about febrile convulsions. The reasons why some children experience seizures with a fever while others do not remain unclear. The impact of such convulsions on future learning and behavior requires further exploration. For those who have had febrile convulsions, the effect of anticonvulsant treatment on the likelihood that epilepsy may develop later must be determined conclusively. If anticonvulsants are to be used, safe and effective short-term agents must be identified. Finally, the impact of long-term anticonvulsants must be determined.

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