FEBRILE CONVULSION: ANOTHER LOOK AT AN OLD SUBJECT

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Abstract:
Febrile convulsion (FC), an occurrence frequently encountered in everyday practice, is discussed in this article with a review of corresponding literature.
Taking into account the extent of debate on the topic, from FC being considered a kind of epileptic seizure to its being viewed as a non-epileptic phenomenon, our aim is not to be judgmental regarding its nature in the present writing. Two distinct groups of children, who convulse with fever are described; one, the group whose neurological status is suboptimal and the other children who one who enjoy good health.
In this review, the clinical aspects of management of fever, a forerunner of a seizure are emphasized. The other important aspect of handling a case of febrile convulsion consists of controlling the seizure, which should be done without any delay when it occurs.
Nowadays, the drugs of choice are diazepines, used via the rectal, buccal or intranasal routes. The most important area of investigation is lumbar puncture in a child who has had a febrile convulsion, which will be discussed at the end.

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INTRODUCTION

Childhood seizure is commonly associated with fever; in some otherwise normal children between the ages of 6 months to 6 years. Convulsions have long been known to occur with fever due to non intracranial infection, with occasional cases occurring at younger and older ages. Such attacks are described as febrile convulsion (FC).(1) Their mean incidence in six large populations was 29/1000 children aged under 5 years.(2) This figure of about 3% may be an underestimate since surveys, e.g. Miller et al 1960, Costeff 1965, have shown that many childhood seizures never even come to medical attention.(3-4) In a third to a half of cases, FC occurs in close relatives, especially siblings and sometimes in a parent or grandparent. The tendency to convulse with fever usually ceases by the age of 5 or 6 years.(1) In the past, there was considerable controversy regarding the prognostic significance of convulsion occurring in association with elevated temperature (febrile convulsion) in young children and also regarding the relation between such convulsions and epilepsy.

In 1921, Husler stated that febrile convulsion bears no relation to epilepsy. Then in 1934, Lederer reported thirty patients with epilepsy whose first convulsion had occurred during a febrile illness in infancy or childhood.(5) He classified the febrile convulsion as a form of epilepsy. (5)Faxen in 1935 and Herlitz in 1941 reported a favorable prognosis of children with febrile convulsion..(6) In 1946 Buchanan stated that 15 to 26 per cent of children who have attacks in childhood associated with fever have spontaneous attacks later in life.(5)

M.A Lennox in 1947, noted that " febrile convulsions differ as a disease from epilepsy only with respect to severity, but there is no real difference in kind ".(6) In 1949 Bridge stated that " there is no good reason for considering febrile convulsion as a clinical entity distinct from epilepsy. In reality, both belong in a single group, best described with the name of convulsive disorder. The difference is not of a fundamental nature but only of type and degree ".(7)

Considering the above-mentioned opinions, in recent decades the subject of FCs, their relationship to epilepsy (i.e. recurrent unprovoked, non febrile seizures) and their -neurological and developmental prognosis has, in the recent past, attracted much attention and provoked hot debate. Epidemiological and clinical studies, such as those of Nelson and Ellenberg(1978), Verity et al(1985), Wallace(1988) have contributed much towards clarifying these issues.(1) There is mounting evidence to suggest two distinct populations of children vulnerable to FC: One conforms to the classical concept of benign epilepsy, often with a positive family history for these children and a relatively good prognosis. In the second group, with previous neurodevelopmental abnormalities and usually no family history of FC, the first febrile seizure is the foremost acute indication that all is not well with the child's nervous system, and the outlook for subsequent epilepsy and persisting neurodevelopmental problems is poor. Some clinical and neuropathological studies, like that of Ounsted et al, 1966(1)suggest a relationship between FC and the later development of temporal lobe epilepsy or complex partial seizures. Falconer and Taylor in1968,and again Falconer in1971,have shown the importance of mesial temporal sclerosis in such cases.(8-9)

Differential diagnosis:

The clinical features of FC, with fever, clonic movements, cyanosis and frequent respiratory arrest, usually distinguish it from other similar episodes such as rigors, breath holding spells, reflex anoxic seizures, syncope, benign paroxysmal vertigo, tetany or temper tantrums.(1)

Prevalence:

The overall prevalence in reported series lies between 1.5 and 4.2% but varies greatly with certain factors such as a family history of seizures and the infection involved.(1) Thus children of parents who themselves had FC run an overall 4.4 times greater risk than for the general population, the risk being greatest (8 times) for the sons of female probands.(10)

When siblings have FC, the risk is 3.5 times greater than for the general population.

Particular infections carry varying risks for FC; most associated febrile illnesses are viral upper respiratory tract infections. The viruses involved are usually those prevalent in the community at the time, which often remain undetected. Roseola infantum (exantum subitum) is often associated with FC, and measles, less frequently so. Shigellosis is often complicated by FC, especially under the age of 5 years. The prevalence of seizures with bacterial meningitis is also higher in younger children; this decreased during antibiotic era, at present ranging between 13 and 27%.(1)

Lee and Verrier-Jones (1991) have stressed the importance of urinary tract infection in triggering FC, a point that may be overlooked, unless the urine is examined.(11)

The mechanism and pathology:

The mechanism of and pathology basis for febrile convulsion have not yet been clearly established. Penfield and Erikson believe that the immature condition of the brain, lack of myelin, the difference in cellular permeability, water content and electrical activity of the child's brain, are some of the reasons that children are more susceptible to febrile convulsions than adults.(12) These researchers are also of the opinion that immature brain of the infant is lacking in inhibitory mechanisms. Much has been written concerning the relationship of the height and rapidity of rise of body temperature to the "causation" of febrile convulsion in infants and young children. Millichap investigated body temperature in a group of children with febrile seizures and concluded that "in individual patients and in the group as whole,

the height of the body temperature appeared to be an important factor in the occurrence of the febrile seizures".(5)
Wegman as a result of his experimental study of kittens, arrived at the conclusion that the rapid rate of rise of temperature was more significant in causing his kittens to convulse than was the height of the body temperature.(13) Friderichsen and Melchior studied temperature in 1507 febrile children, 171 of them with febrile convulsion and reported that their findings could not entirely confirm Wegman's animal experiments.(14)

Age of onset:
Maximum susceptibility of children to FC is between 6 months and 3 years, being highest in the second year.(1) About 60% of affected children have their first attack under 2 years of age, and 20% each for children between 2 and 3 years and after 3 years of age.(15) The age at onset is also affected by sex. In a series of 134 patients, Wallace found that 62% of girls and 44% of boys had their first FC less than 20 months of age.(15)

Complex febrile seizures:
These seizures defined as prolonged and repeated within the same illness or with unilateral or focal features, are associated with a younger age of onset than are simple seizures.(1)

Previous neurodevelopmental status and its implication:

The pre and perinatal histories of children with FC show a significantly increased incidence of mothers with chronic illness and, with male children, of subfertile mothers. Wallace stressed the critical importance of prior neurodevelopmental status, with "neurological sub optimality "determining the long term outcome of children with FC. Prior neurodevelopmental abnormalities have implications not only for children with FC but also for their siblings .(10)Those recognized as previously abnormal may have their seizures at younger ages and are at increased risk of having unilateral and recurrent attacks, later epilepsy, continuing intellectual deficits and EEG abnormalities; their siblings have a significantly reduced risk for FC, but an increased risk for epilepsy.

Management of the acute attack:
Most children are febrile for some hours before their seizure. Millichap (1959) showed that in both children and animals the height of the body temperature is the major determinant of seizure with hyperthermia, rather than the rapidity of rise in temperature .(16)

Advice to parents:
Much can and should be done by parents or other "care takers" of children with FC to prevent or shorten attacks; This involves the doctor in his role as a teacher.(1) Much ignorance prevails in the general public about FC (and other seizures) and in most parents, when faced with a first convulsion in their child; they make the worst mistake of covering him with blanket, closing the window and raising the already rocketing temperature. Parents need to be educated on how to reduce the body temperature by stripping the child, tepid sponging, fanning, opening windows and the use of antipyretic. (1)

Treatment of Status Epilepticus:
Since FC is the most common cause of status epilepticus in young children, it is appropriate to discuss the medical management of this condition at this point. The acute problem of stopping the convulsion associated with fever when it continues and medical help has been summoned, usually falls to the family doctor, who must comprehend the seriousness of a prolonged seizure and be able to give emergency treatment; advice to send the child to hospital without trying to stop the attack is dangerous and illogical, since often half an hour or more often passes between the start of the seizure and the doctor's arrival. Various injectable agents are available and the choice depends on the situation and the doctor's experience.
In the ideal situation, i.e. in hospital or a well equipped and staffed doctor's office, diazepam, administered intravenously, is the drug of choice: injection into the vein of a convulsing infant calls for skill, which not all doctors possess. Given as a single IV bolus, the dose is 0.2-0.3 mg/kg body weight. An alternative formula, for use when the exact weight is unknown is 1 mg per year of age plus 1 additional mg (so that a 2 year old child would require 2+1 =3 mg).(1)
Respiratory depression and cardio respiratory arrest may occur, and resuscitation may sometimes be needed; the

risk is higher when the child has already received barbiturates.

Rectal diazepam is being used increasingly to control childhood status epilepticus; while suppositories are unsatisfactory, direct instillation of diazepam into the rectum gives adequate absorption of the drug and clinically effective blood levels within a few minutes.(17) Encouraging results were obtained by Kundsen (1979) in a prospective study of 44 children, the drug being effective in 80% of cases .(18) In 10% the rectal approach failed, whereas IV diazepam gave immediate results. Another 10% proved resistant to diazepam by either route. (18)

The therapeutic effect depended on the duration of convulsion before treatment was begun. Early treatment (duration of convulsion 15 minutes or less) was effective in 96% of cases and late treatment (convulsion duration over 15 minutes) in only 57%.

Presently, rectal diazepam, in convenient disposable plastic tubes of 5 and 10 mg, is available and has proven effective and popular with parents. (1) Encouraging reports of the value of lorazepam in the treatment of status epilepticus are now appearing. Appleton et al, 1995, compared the effect of lorazepam and diazepam, intravenously and rectally, in 102 children in a prospective, open, odd and even date, trial.(19)

The rectal route was used when venous access was not possible; the doses (diazepam: 0.3-0.4 mg/kg, lorazepam: 0.05 - 0.1 mg/kg) were the same by either route. A second similar dose of the same drug was given if convulsions continued 7-8 minutes after the first dose. Fits were controlled in 76% of patients given a single dose of lorazepam and in 51% of those given diazepam. Respiratory depression occurred in 3% with lorazepam and 15% with diazepam.

Nowadays, a parent can give emergency treatment of FC, i.e. "abortive therapy" at home if he/ she is emotionally and intellectually capable of the task, i.e. use of rectal diazepam, as described previously.

Also midazolam administered via the nasal or buccal route are currently available options for rapid termination of prolonged seizure or acute repetitive seizure, at home or school. Buccal midazolam appears to be as effective as rectal diazepam in reducing seizure time. In one study, Intranasal midazolam was found to be more effective than rectal diazepam in terminating status epilepticus in children. In the diazepam group, the seizure of 60% of patients stopped at 10 minutes, whereas , 87% of the seizures stopped in the intranazal midazolam group at 10 minutes.(21)

IV Phenobarbital and phenytoin are sometimes used to treat status epilepticus with an initial dose of 5mg/kg of body weight. Phenobarbital carries a risk of depressing respiration and blood pressure and should ideally be used after intubations; it has a long-half life and can be continued with advantage as prophylactic therapy, unlike phenytoin. IM injection of these drugs is considered ineffective because of slow absorption. Sodium valproate using the rectal route was found to be effective by Snead & Miles (1985) in intractable childhood status epilepticus, with a loading dose of 20mg/kg.(20)

Supportive measures:

If FC leads to status epilepticus, it should be treated in an intensive care unit with monitoring equipment and special nursing care. Attention to general supportive measures is essential, above all the maintenance of clear airways and adequate respiration, with the child being safest in the semiprone position. Oxygen should be readily available and given freely. If there is known or suspected cerebral edema (which can develop rapidly in status epilepticus), IV mannitol (0.5-1.5g/kg over 10-30 minutes, repeated 8 hourly if necessary) may be helpful and fluid intake should be restricted. IV dexamethasone is slower acting; it may be given in a 2-4 mg dose followed by 1-2 mg 6 hourly .(1) Hypoglycemia may occur as a result of the excessive neuronal workload and should be corrected when present.

Investigation in the acute stage:

Lumbar puncture (LP); Although bacterial meningitis accounts at most for 4% of febrile seizures, there must be a high index of suspicion and a readiness to rule it out. Addy (1985) analyzed the results of 1191 routine LPs after first FCs in five different series. Five cases of meningitis were detected. (1 bacterial and 4 aseptic) .(22) However data available clearly demonstrate that lumbar puncture following a febrile convulsion is unnecessary and unjustified in an infant without signs of meningitis. In an apparently healthy child whose condition subsequently deteriorates, a previous normal LP does not rule out bacterial meningitis. Observation and regular

review by nursing and medical staff within the first few hours after convulsion, with an emphasis on examination for signs of meningitis are more likely to detect children with bacterial meningitis and obviate the need for a painful and invasive procedure.(23)

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