Problems of Childhood

Febrile fits

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British Medical Journal, 1976, 1, 333-334

It is more constructive to think of febrile fits as convulsions during feverish illness than as episodes caused by fever alone. Predisposing factors may then be considered.

Predisposing factors

Probably 3% of all children have a convulsion when febrile, and 11% of those who are feverish when aged from 6 months to 5 years develop convulsions. These are commoner in boys than girls. Even when there is no fit viral rather than bacterial infections cause disturbances of cerebral electrical activity, and both direct and indirect evidence suggest that the precipitating event for a convulsion is commonly a viral illness.

Age—Certain factors appear important in determining whether or not a child develops convulsions. These may have a considerable influence on the eventual outcome. Age appears critical. Over 90% of convulsions with fever occur in children from 6 months to 3 years, with about 2% presenting in younger and 6% in older children. Girls tend to have fits earlier than boys. The younger the age at which it occurs the greater is the likelihood that the fit will be complicated—that is prolonged, repeated within the same illness, or unilateral—and the greater the risk of subsequent attacks.

Inheritance of the convulsion trait is thought to be dominant. Expression is incomplete since fever at the critical age is a necessary precipitating event. Although boys with a family history positive for convulsive disorders have a significantly increased risk of subsequent convulsions with fever, they have a reduced chance of the initial fit being complicated and their long-term outlook is generally favourable. The influence of positive family history on girls is less obvious. In both sexes, where there is both a family history of convulsive disorders and an abnormal perinatal event, there is a significantly increased likelihood that the initial convulsion will be complicated.

Neurological history—Although a convulsion is essentially an acute cerebral disturbance, surprisingly few studies of clinical neurological findings exist. All reports on unselected groups of patients, however, include a much higher than expected percentage of children who were neurologically abnormal before their first fit. When minor deviations from normal development have been sought, there is evidence for suboptimal or uneven progress before the first fit in at least a third of children who develop convulsions when febrile. Girls who show neurological abnormality before their first fit run a greater risk that this first attack will be complicated. Neurological examination many years after the initial convulsion has shown that

minor changes can be found in over half the children. Moderate disability, which is mainly hemiplegic or dyspraxic, occurs in about 15%, with boys being affected more often than girls.

Initial fit

The characteristics, in particular the duration, of the initial fit may be crucial in determining the outlook for subsequent mental development and for later epilepsy. Children who have a fit lasting over 30 minutes or whose first attack is repeated within the same illness run a considerable risk of convulsions recurring with fever. If such an attack presents before the age of 1 year later mental retardation is common. Prolonged, unilateral fits before the age of 3 predispose to temporal lobe epilepsy. The H₁ (Sommer) sector of the hippocampus is particularly vulnerable to the effects of a prolonged convulsion at this age and mesial temporal sclerosis with subsequent psychomotor seizures may result. Experimental evidence suggests that fever increases the vulnerability of this area of the temporal lobe.

Hence the convulsions must be controlled as soon as possible and the temperature reduced as effectively as practicable. Control of the convulsion is almost certain if intravenous diazepam (Valium), 0.2 mg/kg body weight, is given. (Most children of the age when convulsions with fever occur weigh from 9 to 12 kg). If intravenous injection is impracticable diazepam is almost as effective if given intramuscularly or rectally in similar doses. Alternatively, intramuscular paraldehyde, 0.1 ml/kg body weight, or sodium amytal, 5-7 mg/kg body weight may be used. Reduction of any rise in temperature by tepid sponging and the use of an electric fan are recommended. When the child can swallow antipyretics such as acetylsalicylic acid, 75 mg, paracetamol, 120 mg, may be used every four to six hours to supplement external cooling. The cause of the fever also requires diagnosis and appropriate treatment if possible. A convulsion with fever which lasts over 30 minutes may jeopardise the child's intellectual and neurological future and must be regarded as an acute medical emergency.

Whether or not the child should automatically be admitted to hospital is a vexed question. Undoubtedly those in whom there is any suspicion of meningitis or encephalitis require admission. Nor should there be hesitation when the convulsion is prolonged, unilateral, or repeated. All these circumstances require full neurological and biochemical investigation, including examination of the cerebrospinal fluid, and electroencephalography. More doubt exists when one short generalised convulsion has occurred. There are many points in favour of sending even these children to hospital. Those under 1 year may have meningeal infection without the customary stiff neck, particularly if they are examined in the hypotonic period which often follows a fit. Rapid recovery from a short fit does not preclude a second within a few hours. The child commonly develops convulsions at the beginning of an illness and when there is a sharp rise in temperature. The latter is not easy to predict and is more readily monitored and prevented in hospital than at home. A convulsion is very frightening for the parents:

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their child's fit is often the first attack they have ever witnessed; cyanosis, pallor, and apnoea, and the ineffectiveness of their efforts to stop the convulsion combine to make parents fear that the child has died. Their anxiety may be enough to warrant admission to hospital until after the acute illness has passed.

Subsequent fits with fever

Convulsions recur with subsequent feverish illnesses in nearly half the children. In addition to young age of onset, variously stated as less than 19 months or younger, and initial fits which are unilateral, prolonged, or repeated within the same illness, other factors significantly correlated with recurrence of convulsions with fever are a positive family history of convulsive disorders and persisting clinical neurological abnormality. Electroencephalographs performed immediately after the convulsion usually reflect either postictal or infective states and help little in long-term prognosis. They may, however, help in localising a lesion if the fit is associated with underlying structural change, and, in the event of herpes simplex encephalitis presenting with fever and fits, can direct attention to a suitable area for brain biopsy. Although status epilepticus occurs most commonly with the child's first convulsion, the more convulsions suffered the more likely is one of these to be prolonged. Recurrence of convulsions with fever is associated with an increased risk of the later development of grand mal or temporal lobe epilepsy. There is also a significant relationship to reduction of the verbal quotient of the Wechsler intelligence scale for children when the test is administered between 8 and 14. So undoubtedly prevention of further convulsions should be an important aim.

PREVENTION METHODS

In attempting to avert subsequent fits it is illogical to give oral phenobarbitone at the onset of fever. Even if double the usual dose is given a therapeutic level is not achieved in the serum until 48 hours later. On the other hand, two trials using continuous barbiturates have shown that they are effective in controlling convulsions in all but a few cases. A Danish study using phenobarbitone 3-4 mg/kg body weight/day found that satisfactory control was achieved provided the serum phenobarbitone level was maintained above 15 mg/l. A further study in which patients with a high risk of subsequent attacks were selected for treatment with either primidone or phenobarbitone also showed a considerable reduction in recurrences. At least one-fifth, however, and probably as many as one-third of children in whom active prevention of convulsions is needed are so irritable and overactive on barbiturates that the drugs have to be stopped. Phenytoin may be given as an alternative, but though severe fits are unlikely, is less effective than phenobarbitone in preventing convulsions when the child is aged under 3.

Parents are often worried that long-term anticonvulsants might impair their child's learning ability. A recent study has shown that barbiturates given for at least one year before the age of 7 do not cause appreciable intellectual changes when the child is tested between 8 and 14. Since a reduction of verbal intelligence has been significantly related to recurrence of convulsions with fever, a strong case is presented for prescribing barbiturates after the first fit in those children in whom another convulsion is likely. Either phenobarbitone, 3-4 mg/kg body weight/day or primidone, 10-20 mg/kg body weight/day should be given in divided doses in cases in which the fits occurred before 19 months old, if the attack was prolonged, repeated, or unilateral, the family history is positive, and signs of neurological abnormality, however trivial, persist. Phenytoin, 4-6 mg/kg body weight/day may help those who cannot tolerate barbiturates. Treatment should be continued until the child has passed the age when convulsions with fever are

likely to occur—that is up to 4½ or 5 years old. In any case, it is advisable to wait two years after the last fit before ending anticonvulsants. Withdrawal of medication should be gradual.

In subsequent illness during the vulnerable age period for convulsions with fever parents are advised to keep their child as cool as possible by tepid sponging, using a fan, and giving antipyretics. Early examination by a doctor is desirable in case specific treatment for infection is indicated. Where the child is receiving long-term anticonvulsants, an extra dose each day is recommended during fever. Parents also appreciate advice on first-aid treatment of a convulsion, such as lying the child on his side away from obstructions; the inadvisability of trying to insert hard objects into the mouth; and calling for medical aid if the convulsion continues for over 15 minutes.

Later epilepsy

Ten to 15% of children whose first fit occurs with a feverish illness will later have attacks when afebrile. There is a significant relationship between perinatal abnormality and later development of grand mal. Grand mal is also commoner when there have been frequent convulsions with fever and when the family history is positive for epilepsy in adulthood. About 6% of the children will have psychomotor attacks. These commonly follow prolonged unilateral fits before the age of 3.

Mental hazards

At an incidence of 9% mental retardation is three times commoner in children who have developed convulsions with fever than in the general population. Many of the retarded children may not have been entirely normal before their first fit, but others appear to become subnormal after either a single prolonged convulsion or repeated convulsive episodes. Although overall intelligence quotients show most children are within the average range of intelligence, examination of sub-test results shows that uneven scoring and reading difficulties are encountered more often than expected.

Further reading

- Lennox-Buchtal, M A, *Febrie Convulsions: A Reappraisal*. Amsterdam, Elsevier Scientific Publishing Company, 1973.
Ouellette, E M, *Paediatric Clinics of North America*, 1974, 21, 467.

What are the risks, if any, of inhaling dust from Vermiculite granules and glass fibre wadding both in the short term at high concentration during installation (when used for roof insulation) and in the long term at low concentration as part of household dust?

There is no firm answer to this question. Regarding expanded vermiculite used in insulation materials, the dust during use is innocuous as it contains only a little free quartz. Similarly, glass-fibre matting should not release fibres small enough to induce changes in the lungs or pleura. Installation (or removal) of insulating material containing vermiculite and glass fibre embedded in a calcium silicate matrix would probably involve the generation of much respirable dust and fibre from the matrix as well as from the glass fibre (especially if the material required cutting), the long-term effects of which are unknown. Stanton and Wrench¹ showed that when applied to the pleura of rats very fine fibrous glass produced a moderately high incidence of mesotheliomas. It is still debatable whether the inhalation of fibrous dusts from the glass fibre or calcium silicate matrix may lead to their depositing unchanged in the pleura. Once installed these materials should not present any long-term household problems; any hazards would be during installation or removal.

¹ Stanton, M F, and Wrench, C, *Journal of the National Cancer Institute*, 1972, 48, 797.