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Effect of fever on recurrence rate of febrile convulsions

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SUMMARY We studied 154 children admitted consecutively with their first febrile convulsion to assess the influence of the temperature on the recurrence rate of convulsions. Those with temperatures of 40°C or more were nine times less likely to have subsequent convulsions than those with temperatures of 38-38.9°C.

Factors associated with increased risk of recurrence of febrile convulsions are: the first febrile convulsion occurring before 12 months of age, a history of febrile convulsions in first degree relatives, and the presence of associated complex features of febrile convulsions.¹ Little information is available about factors associated with a reduced risk of recurrences. In a previous retrospective study with a limited number of children² we suggested that a high temperature during the initial febrile convulsions was associated with a decreased incidence of recurrent febrile convulsions. We have expanded the study by including 79 further children prospectively studied since January 1982.

Patients and methods

All children who presented to the paediatric department of this hospital with their first febrile convulsion between January 1980 and February 1986 were included in the study.

The study group comprised 173 children (91 boys and 82 girls). All except four had been born here, so their earlier records were available. Four infants were of low birth weight but had made normal neonatal progress, and the remainder were born at full term with birth weights within the normal range; they had also made uncomplicated postnatal progress.

A febrile convulsion was defined as a generalised convulsion associated with a temperature of more

than 38°C that occurred in a child aged 6 months to 5 years who had no pre-existing evidence of neurological abnormalities. All the children were managed consistently according to a routine protocol aimed at reducing body temperature. Paracetamol (10 mg/kg, every four hours) was prescribed for temperatures of over 38.5°C. The rectal temperature was recorded on admission and then every four hours. Routine investigations included a full blood count and cultures from throat, urine, and stool. Blood culture, chest radiograph, and lumbar puncture were not performed unless there were clinical indications. Antibiotics were used if there was evidence suggesting bacterial infection.

The children were divided into three groups according to the severity of the fever recorded on presentation to hospital. Group 1 had temperatures >40°C, group 2, 39-39.9°C, and group 3, 38-38.9°C.

Fifteen children were lost to follow up. Four children subsequently developed afebrile convulsions and were withdrawn from the study. The remaining 154 children were reviewed at three monthly intervals for a mean of 40 months (range 27 to 96).

Results

The groups were comparable with regard to age, sex, and family history of febrile convulsions.

Bacterial infection occurred in 24 patients (16%), 12 in group 1, 10 in group 2, and two in group 3. These infections were tonsillitis (n=2), shigella enteritis (n=4), salmonella enteritis (n=6), otitis media (n=8), pneumonia (n=2), and urinary tract infections (n=2). Antibiotics were not used to treat salmonella and shigella enteritis.

The recurrence rates of febrile convulsions are shown in the table. None of the 11 children who had their initial febrile convulsions after the age of 30 months had a recurrence. The average number of

Table Recurrence of febrile convulsions in children with temperatures of $\geq 40^{\circ}\text{C}$ (group 1), $39\text{--}39.9^{\circ}\text{C}$ (group 2), and $38\text{--}38.9^{\circ}\text{C}$ (group 3)

Age range (months)	Group	Total No	Male:female ratio	No (%) with recurrent convulsions	p Value
6-18	1	49	26:23	4 (8)	<0.001*
	2	32	15:17	19 (59)	
	3	13	8:5	10 (77)	
19-30	1	22	14:8	4 (18)	<0.01**
	2	21	10:11	5 (24)	
	3	6	1:5	5 (83)	
>30	1	6	4:2	0	
	2	4	3:1	0	
	3	1	0:1	0	
Total		154	81:73	47 (31)	

*Group 1 compared with both group 2 and group 3; **group 1 compared with group 2, and group 2 compared with group 3.

recurrences was 3.0 (range 2-7), and these occurred between one and 22 months after the original episode.

Discussion

Our results suggest that the recurrence rates of febrile convulsions were significantly greater in infants aged 6-18 months in whom the initial febrile convulsions had been associated with a lower temperature. The rate of recurrence was over nine times higher in infants who had the lowest fever, $38\text{--}38.9^{\circ}\text{C}$ (77% compared with 8%) and over seven times higher in infants with temperatures of $39\text{--}39.9^{\circ}\text{C}$ (59% compared with 8%). For infants aged 19-30 months, the recurrence rate was also higher with the lesser degree of fever (table).

It remains unclear why it is rare for a child to develop repeated convulsions during the same febrile illness or subsequently when exposed to similar or higher temperatures. Although the children who were admitted with febrile convulsions usually continued with spikes of fever for a few days, repeated convulsions occurred in only four children (3%). Previous publications³ have reported that 50% of the recurrences occur within six months of the initial convulsion. Our results were similar, 28 out of 47 (60%) having had recurrences within six months. Recurrences within one month were rare (four of 47=9%), and only 10 (21%) had their recurrences within three months, although most of the children (82%) had febrile illnesses during this period.

It is possible that the central nervous system enters a refractory phase after febrile convulsions that protects the patient from a further febrile convulsion, and this phase is longer the higher the temperature at the time of the initial convulsion. The reason for that is not clear. During the past 20 years considerable data have accumulated suggesting that fever is beneficial to the infected host. More studies on fever in specific diseases are necessary to determine if fever alone is beneficial, harmful, or without effect.⁴ In febrile convulsions it is unlikely that the fever itself or the rate of rise of body temperature are the only precipitating factors. There may be an invasion of virus into the central nervous system in a vulnerable child.⁵ Such a virus may trigger antibody response, which protects against reinfection and further febrile convulsion. It is also now well established that fever (by enhancing human host defences) produces various substances that are collectively termed interleukin 1.⁶ Interleukin 1 is known to be pyrogenic and a lymphocyte stimulator. It follows that the amnastic response of the lymphocyte may correlate with the degree of fever and can therefore protect the host from reinfection. In brain tissue the interleukin 1 produced by astrocytes may contribute to such an immunological response within the central nervous system, and play a part in protecting the patient from further convulsions.

Our data suggest that the degree of fever at the time of the initial febrile convulsions might be a useful prognostic indicator of the risk of recurrence of febrile convulsions.

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