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Two types of febrile seizure: anoxic (syncopal) and epileptic mechanisms differentiated by oculocardiac reflex

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Summary and conclusions

The duration of cardiac asystole induced by ocular compression was measured in 100 consecutive children referred for electroencephalographic examination after one or more febrile convulsions (FC). The children were classified into three groups—namely, those with anoxic FCs, those with epileptic FCs, and “others”—according to the appearances of the FC and the electroencephalogram (EEG). In 14 children the description of the FC suggested non-epileptic anoxic cerebral seizures such as are seen after prolonged syncope or breath-holding. In 35 children the FCs were assumed to be epileptic in mechanism on the basis of unilateral (hemiclonic) twitching, known cerebral disease, a family history of epilepsy, or spikes on the EEG. In the 51 “others” the FCs could not be classified. Definitely abnormal asystole (four seconds or over) was induced by ocular compression in half the anoxic group, in 16% of the “others,” but in none of the epileptic group. The differences between the degree of asystole induced in each of the three groups was highly significant ($P=0.005$).

These results support the hypothesis that vagal-mediated cerebral ischaemic anoxia is implicated in the genesis of FCs that resemble anoxic seizures and in a substantial number of those without an obvious epileptic mechanism. The significance, genetics, management, and prognosis of FCs must now be re-examined in this light.

Introduction

Febrile convulsion (FC) is the most common neurological disorder of childhood.¹ It is frightening to witness, and may sometimes lead to lasting brain damage,^{2,3} but exactly what it is and why it affects only certain children are ill understood. It is usually assumed⁴⁻⁶ that FCs are epileptic in mechanism—that is, that they result from excessive hypersynchronous cerebral neuronal discharges⁶—even though epilepsy rarely follows in later life.⁷ An alternative suggestion^{8,9} that the convulsions are primarily anoxic or syncopal—that is, that they are associated with reduced cerebral blood flow and reduced cerebral cortical neuronal activity⁶—has been almost totally ignored.¹⁰ In a recent study¹¹ of reflex anoxic seizures presumed to result from vagal-mediated cardiac arrest after unpleasant stimuli¹² the retrospective incidence of FCs was 14%, four times the expected incidence of 3.4%⁷ ($P<0.002$). Furthermore, the FCs in that study did not appear from the history to differ in character from afebrile reflex anoxic seizures suffered by the same children. I have therefore carried out a study to investigate prospectively a series of children with a history of FCs, first making a clinical judgment on the type of FC—whether anoxic, epileptic, or uncertain—and then using a physiological technique¹¹ that elicits the oculovagal or oculocardiac reflex, which is hypersensitive in syncope,¹³ to differentiate between reflex anoxic and epileptic seizures.

Patients and methods

I studied 100 consecutive children aged under 8 years referred to the electroencephalography department with a history of FCs (defined as any seizure with fever of 38°C or over). There were no exceptions, as those who also had, for example, afebrile seizures or cerebral disease were included. Before the study, in accordance with hospital policy, children who had had FCs and were referred for electroencephalographic examination were mostly atypical or had had recurrences. During the study there was an increased referral

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Although an epileptic mechanism for FCs has been implicitly assumed recently,^{1 4 5 16} this was not always so. McGrealy,⁸ whose findings have been published only in abstract,¹⁷ concluded that most FCs (described in detail⁸) were "fundamentally

anoxic, not epileptic." Gastaut and Gastaut⁹ induced 10 frank anoxic seizures¹⁸ by ocular compression in 44 children with FCs but were unable to induce anoxic seizures in 66 children with symptoms of a cerebral lesion. Gastaut *et al.*,¹⁹ summarising the discussion and conclusions of the 1959 International Colloquium on Cerebral Anoxia and the EEG, said "two-thirds of attacks of unconsciousness in infancy (which are called 'convulsions') are in reality syncope due to cerebral ischaemia brought about by cardio-inhibitory reflexes." More recently, however, Gastaut⁶ proposed that most FCs were epileptic,²⁰ with a familial predisposition. Evidence from the present study suggests that the anoxic mechanism is at least as important as an epileptic one in FCs, particularly since, because of hospital referral policy, epileptic FCs were over-represented in this study.

Numerous trials of antiepileptic drugs are now being carried out throughout the world on children with FCs. It is difficult to see how useful conclusions can be reached unless the investigators attempt to differentiate between anoxic and epileptic FCs and consider the interactions between each of these mechanisms and any preceding neurological abnormality in the child.⁷

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Sampling pure fetal blood by fetoscopy in second trimester of pregnancy

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Summary and conclusions

A technique for fetal blood-sampling in the second trimester of pregnancy (between 16 and 22 weeks' gestation) combining fetoscopy with real-time ultrasound was used in 48 attempts at fetal blood-sampling. Specimens containing fetal red cells with or without amniotic fluid or maternal blood, and adequate for diagnosing haemoglobinopathies, were obtained in 45 of the 48 fetoscopies. Sampling was successful in all 18 patients with a posterior placenta, and in 27 of the 30 with an anterior placenta. In 22 of the last 27 consecutive fetoscopies pure fetal blood was taken; the placenta was anterior in 16 and posterior in six. Out of 17 cases sampled between 18 and 22 weeks' gestation pure fetal blood was obtained in 16. The volume of the samples varied from 50 to 500 μ l.

The ability to obtain pure fetal blood consistently even when the placenta is anterior will increase knowledge of fetal physiology and the scope of prenatal diagnosis.

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Introduction

Fetal red cells have been obtained in the second trimester by placentocentesis¹ and by fetoscopy.² The first technique can be used whatever the placental site, but the anterior placenta has hitherto been regarded as a contraindication to fetoscopy. The specimens obtained by either technique have usually consisted of a mixture of fetal and maternal blood or amniotic fluid, or of all three, with fetoscopy yielding a higher proportion of fetal red cells. Such specimens are adequate for prenatal diagnosis of haemoglobinopathies, but greater reliability in obtaining whole fetal blood, and thus pure fetal serum, would widen the scope of fetal investigation to include biochemical abnormalities that cannot be diagnosed from an analysis of amniotic fluid or fetal red cells.

We found that fetal blood sampling by fetoscopy may be performed when the placenta is anterior, and that samples of pure fetal blood, uncontaminated by maternal blood or amniotic fluid, can be reliably obtained.

Patients and methods

Gestational age is checked by an ultrasound scan and the timing of the fetoscopy planned; for diagnosing a haemoglobinopathy, fetoscopies may be done after 16 weeks' gestation, but better fetal blood samples are obtained after 18 weeks. When it is important to obtain pure fetal blood—for example, in carriers of Duchenne's muscular dystrophy—the procedure should take place at 18-20 weeks. A