more classes. A significant increase in risk of endometrial cancer is found for relatedness when all the relatives are taken together but not for each type of relative. The same applies to risk of prostate cancer according to cancer in first degree relatives of the probands. When second degree and more distant relatives are divided into five classes according to whether the proband had first degree relatives with prostate, breast, ovarian, or endometrial cancer or none, the only significant increase in risk was for prostate cancer. When the categories considered were restricted to prostate cancer, breast cancer, and neither, a significantly increased risk of breast cancer was also found.

Body mass has been suggested as a confounding factor. Body mass index has been reported to be a risk factor for breast cancer¹⁴ or prostate cancer.¹⁵ But in Icelandic cohort studies it was not found a significant risk factor for any of the cancer sites considered in this study.^{16,17} For breast cancer, however, both height and weight independently were positive risk factors, as were body surface and lean body mass. General lifestyle factors may affect husband and wife in a similar way. We therefore tested whether the husbands of the probands had an increased risk of prostate cancer when compared with husbands of female relatives. No indication of increased risk in husbands of probands was found.

The results suggest that the familiarity of breast cancer is heterogeneous in that the increase in risk of breast and prostate cancer in relatives of probands is not confined to first degree relatives, as it is among endometrial and ovarian cancer. The power of this study to show an increased risk among second degree relatives is considerably stronger for prostate cancer than for ovarian cancer.

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Epilepsy in the first 10 years of life: findings of the child health and education study

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Abstract

Objectives—To identify children with afebrile seizures in a national cohort, classify the seizures, and document progress in the first 10 years of life.

Design—Population based birth cohort study.

Setting—The child health and education study, which includes 16 004 neonatal survivors (98.5% of infants born in the United Kingdom during one week of April 1970).

Subjects—14 676 children for whom relevant information was available.

Main outcome measures—Responses to parental and general practitioner questionnaires and hospital records at 5 and 10 years after birth.

Results—84 children (42 boys, 42 girls) had had one or more afebrile seizure (incidence 5.7/1000). 63 children (31 boys, 32 girls) had epilepsy (incidence 4.3/1000). 49 of 55 children had a second seizure within a year of the first. The commonest seizure types were tonic-clonic (42) and complex partial (25). A greater proportion of children with complex partial seizures had recurrences. Children who had infantile spasms or a mixed seizure disorder had a poor outcome. All six children who died had symptomatic seizures in the first year, but seizures were not the direct cause of death.

Conclusions—The results of this study are probably representative of seizure patterns in the general population. Outcome after seizures is determined more by the underlying disease than by the seizures themselves.

Introduction

The child health and education study has prospectively followed a cohort of 16 004 neonatal survivors born in one week in April 1970. Detailed clinical information was obtained about children suspected of having seizures. Only a few studies have been large enough to obtain similar data about seizure disorders in childhood.¹⁻⁴ This paper reports on the study children who had had one or more afebrile seizures by 10 years of age.

Subjects and methods

The child health and education study started as the 1970 British births survey.⁵ This survey enrolled 98.5% of the infants born in the United Kingdom in one week in April 1970; 13 135 (82%) of the survivors were assessed at 5 years of age and 14 902 (93%) at 10 years. As part of both assessments the parents were

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asked "Has the child ever had any form of convulsion, seizure or other turn in which consciousness was lost or any part of the body made an abnormal movement?" At the 10 year follow up replies to this question were available for 14 676 children, 1318 of whom had had a suspicious event. Parents' responses were validated by sending a questionnaire to general practitioners at 5 and 10 years: general practitioners returned questionnaires for 92% of the children with suspected seizures and hospital records were obtained for 89% of the children seen in hospital. Hospital records of children who had died after the neonatal period were searched for evidence of afebrile seizures.

Eighty four children had had one or more afebrile seizures. Suspected seizures in the neonatal period (the first four weeks of life) were not included. A total of 398 children had had febrile convulsions, of whom 17 subsequently had afebrile seizures.⁶⁻⁸

In this part of the study children were classified as being developmentally delayed or having learning disabilities on the basis of clinical information in hospital notes and questionnaires and not by using standardised tests.

The box shows the definitions of seizures and epilepsy. Classification of afebrile seizures was based on the proposals of the International League Against Epilepsy, revised in 1981.⁹ We differed from these proposals in retaining "infantile spasms" and also in having a category of "mixed seizures" for children with more than one seizure type.

Proportions were compared by the χ^2 test with Yates's correction. Fisher's exact test was used for numbers less than five.

Results

MANAGEMENT OF CHILDREN WITH SEIZURES

Eighty four children had had afebrile seizures, of whom 78 had attended hospital outpatients and 58 had been admitted to hospital. Thirty four children had had skull radiography, 30 lumbar puncture, six computed tomography, and 60 electroencephalography. Results of electroencephalography were available for 58 children and were normal in 19. Twenty eight of 42 children (67%) with tonic-clonic seizures and 20 of 25 children (80%) with complex partial seizures had had electroencephalography. Anticonvulsants had been prescribed for more than a month for six of 21 children (29%) who had had only one seizure and 59 of 62 children (95%) who had recurrent seizures.

INCIDENCE OF AFEBRILE SEIZURES AND EPILEPSY

By the age of 10 years 84 children (42 boys, 42 girls) had had one or more afebrile seizures. Data were available for 14 676 children, giving an incidence of 5.7/1000. First seizures occurred at a median age of 3 years (range 5 weeks—9 years 3 months). Excluding the neonatal period, 23 seizures occurred in the first

TABLE I—Number of children with different seizure types

	≥ 1 Afebrile seizures	Epilepsy
Tonic-clonic	42	24
Complex partial*	25	22
Mixed	9	9
Infantile spasms	3	3
Atypical absence	2	2
Absence	1	1
Myoclonic	1	1
Simple partial secondarily generalised	1	1
Total	84	63

*All except four of the children with complex partial seizures had secondarily generalised attacks at some time.

Definitions

Afebrile seizure—"A paroxysmal disturbance of consciousness, sensation or movement, primarily cerebral in origin, unassociated with acute febrile episodes." We studied all children who had one or more afebrile seizures and used the term epilepsy for those with more than one afebrile seizure episode. Recurrent seizures during one 24 hour period were counted as a single episode

Status epilepticus—A seizure or series of seizures lasting more than 30 minutes

Remission of seizure—2 or more years free of seizures before the 10 year follow up, whether or not anticonvulsant drugs were still prescribed

Active epilepsy—Afebrile seizures in the two years before the 10 year follow up in a child with epilepsy

Idiopathic seizures—Those for which there was no underlying diagnosis or history of neurological insult that could be considered a predisposing cause

Symptomatic seizures—Those that were not idiopathic.

TABLE II—Comparison of outcome in children with onset of seizures in the first year of life and those with later onset

	No (%) with onset in first year (n=23)	No (%) with onset after first year (n=61)	p Value for difference between groups (χ^2 value)
Symptomatic	16 (70)	8 (13)	<0.0001 (23.4)
Developmental delay or learning disability	12/21 (57)*	13 (21)	<0.01 (7.8)
Status epilepticus	4 (17)	14 (23)	NS
Recurrence (epilepsy)	17/21 (81)*	46 (75)	NS
Remission after epilepsy	5/13 (38)†	17/46 (37)	NS

*Excludes two children who died aged <1 year.

†Excludes six children who died as remission was defined as being seizure free at 10 years of age.

TABLE III—Comparison of children with symptomatic and idiopathic seizures

	No (%) with symptomatic seizures (n=24)	No (%) with idiopathic seizures (n=60)	p Value for difference between groups (χ^2 value)
Developmental delay or learning disability	16/22 (73)†	9 (15)	<0.0001 (22.7)
Onset <1 year	16 (67)	7 (12)	<0.0001 (23.4)
Status epilepticus	8 (33)	10 (17)	NS
Recurrence (epilepsy)	19/22 (86)†	44 (73)	NS
Remission after epilepsy	3/15 (20)‡	19/44 (43)	NS

*Symptomatic seizures were due to cerebral palsy (four children) encephalitis (three), Rett syndrome (two), tuberous sclerosis (two), head injury (two), plus single cases of birth asphyxia, cerebral oedema and sepsis, collagenosis, hypernatraemic dehydration, hyperpyrexia (hot bath when febrile), intracranial haemorrhage, Leigh's encephalopathy, meningitis (*Salmonella typhimurium*), postoperative complications (Ramstedt), shunt for hydrocephalus, and Sturge-Weber syndrome.

†Excludes two children who died aged <1 year.

‡Excludes six children who died as remission was defined as being seizure free at 10 years of age.

year (1.6/1000/year), 12 in the second year (0.8/1000/year), and 11 in the third year (0.7/1000/year). After that the rate became fairly constant at about six per year (0.4/1000/year).

Sixty three children (31 boys, 32 girls) had a history of epilepsy—that is, recurrent afebrile seizures—an incidence of 4.3/1000. Twenty two of these children had been free of seizures for two years before the 10 year follow up, leaving 41 (2.8/1000) with active epilepsy.

Of the 14 278 in the cohort who had had no febrile convulsions, 53 (3.7/1000) developed epilepsy. Seventeen children had had febrile seizures at some time before their afebrile seizures.⁸ Eighteen children had had one or more episodes of afebrile status epilepticus.

DISTRIBUTION OF SEIZURE TYPES

The commonest seizure types were tonic-clonic and

complex partial (table I). All but four of the children with complex partial seizures had attacks that were secondarily generalised at some time. All children who had infantile spasms subsequently developed a mixed seizure disorder. Only one child had classic absence seizures (petit mal). Seven children had atypical absence seizures, five of whom also had other types of seizure: one had infantile spasms first and the other four had "mixed" seizures.

INTERVAL BETWEEN FIRST AND SECOND SEIZURE

Sixty three (75%) of the 84 children with seizures had recurrent seizures (epilepsy). The timing of recurrence was known for 55. Twenty eight children had the second seizure within a month, 49 within a year, 51 within two years, and 54 within three years.

Seizures started after the age of 7 years in only 14 children (seven complex partial, five tonic-clonic, and two atypical absence) and six children had had a recurrence before age 10 years. Overall recurrence rates are therefore unlikely to have been distorted by short follow up in those presenting after 7 years of age.

FACTORS ASSOCIATED WITH SEIZURE RECURRENCE

Family history of epilepsy was known for 41 of the 44 children with idiopathic recurrent seizures (epilepsy) and 15 of 16 children with idiopathic single seizures. A greater proportion of children with recurrences (13/41,

TABLE IV—Children with clinical evidence of developmental delay or learning disability compared with other children with seizures. (Two children who died aged 10 months were excluded)

	No (%) with developmental delay (n=25)	No (%) with normal development (n=57)	p Value for difference between groups (χ ² value)
Symptomatic	16 (64)	6 (11)	<0.0001 (22.7)
Onset <1 year	12 (48)	9 (16)	<0.01 (7.8)
Status epilepticus	8 (32)	9 (16)	NS
Recurrence (epilepsy)	24 (96)	39 (68)	<0.05 (5.96)
Remission after epilepsy	5/20 (20)†	17/39 (44)	NS

†Excludes four children who died as remission was defined as being seizure free at 10 years of age.

TABLE V—Comparison between children with tonic-clonic and complex partial seizures

	No (%) with tonic-clonic seizures (n=39)*	No (%) with complex partial seizures (n=25)	p Value for difference between groups (χ ² value)
Male	16 (41)	15 (60)	NS
First degree relative with idiopathic seizures†	8/30 (27)	6/21 (29)	NS
Previous febrile convulsion	10 (26)	6 (24)	NS
Symptomatic	7 (18)	3 (12)	NS
Developmental delay or learning disability	9 (23)	3 (12)	NS
Status epilepticus	2 (5)	3 (12)	NS
Recurrence (epilepsy)	23 (59)	22 (88)	<0.05 (4.8)
Remission after epilepsy	14/23 (61)	7/22 (32)	NS

*Excludes the three children with tonic-clonic seizures who died.

†Family history not available for two children with idiopathic tonic-clonic seizures and one with complex partial seizures.

TABLE VI—Details of disease in children with seizures who died in the first 10 years of life

Seizure type	Age at first seizure	Underlying or predisposing cause	Age at death	Cause of death
Mixed	6 Weeks	Salmonella meningitis	3 Years 4 months	Collapse
Mixed	2 Months	Birth asphyxia	1 Year 2 months	hydrocephalus
Mixed	6 Months	Leigh's encephalopathy	3 Years 4 months	Gastroenteritis and shock
Tonic-clonic	7 Months	Encephalitis	5 Years 11 months	Progression of disease
Tonic-clonic	10 Months	Subarachnoid haemorrhage	10 Months	Bronchopneumonia
Tonic-clonic	10 Months	Pneumonia and cerebral oedema	10 Months	Subarachnoid haemorrhage
				Pneumonia and cerebral oedema

32%) than children with single afebrile seizures (2/15, 13%) had a first degree relative with epilepsy, but this did not reach significance. Sex did not affect recurrence rate: 76% (22/29) of girls with idiopathic seizures had a recurrence compared with 71% (22/31) of boys.

All the children who had seizures other than tonic-clonic and complex partial developed epilepsy. No significant increase was found in the proportion of children with recurrent seizures among those with onset in the first year of life (table II) or those with symptomatic seizures (table III). A greater proportion of children with developmental delay or learning disability (table IV) and complex partial seizures (table V) developed epilepsy compared with other children with seizures.

ONSET OF SEIZURES IN FIRST YEAR OF LIFE

Excluding the neonatal period, 23 children (13 boys, 10 girls) had their first seizure in the first year of life. Eleven children had tonic-clonic seizures, two complex partial seizures, and one myoclonic seizures; six children had a mixed seizure disorder and three children presented with infantile spasms but later developed a mixed seizure disorder.

Outcome depended on seizure type. The three children who presented with infantile spasms and the six with a mixed seizure disorder had a poor outcome. All had evidence of developmental delay, three of the children with mixed seizures died, and none of the six survivors were in remission at 10 years of age. Of the 11 children who presented with tonic-clonic seizures, three died (two immediately of the underlying cause). Of the remaining eight children with tonic-clonic seizures, only one showed evidence of developmental delay and seven had been free of seizures for two years by age 10.

A greater proportion of children who had onset of seizure in the first year rather than later had symptomatic seizures and a greater proportion of the survivors showed evidence of developmental delay or learning disability, but there was no increase in the proportion who had status epilepticus, developed epilepsy, or went into remission (table II).

DEATHS

Six children died in the first 10 years of life—7.8% of the children with afebrile seizures (table VI). All deaths occurred in children with symptomatic seizures that started in the first year of life. Two children presented with seizures and died almost immediately; the others died after an interval. The deaths were due to the underlying disease rather than to the seizures.

CHILDREN WITH SYMPTOMATIC SEIZURES

In 24 of the 84 children (29%) a likely cause for the epilepsy was evident. Thirteen children had acute cerebral damage (with seizures during the acute event in 10) and 11 had a predisposing clinical condition (table III). Table III compares the children with symptomatic seizures with those with idiopathic seizures. All the deaths were in symptomatic children, of whom a significantly greater proportion had onset of seizures in the first year and showed later developmental delay or learning disability. After excluding the children who died, there was no significant difference in the proportion who had status epilepticus or developed epilepsy in the two groups. A smaller proportion of children with symptomatic epilepsy were in remission at 10 years, but this was not significant.

CHILDREN WITH DEVELOPMENTAL DELAY OR LEARNING DISABILITY

A greater proportion of children with developmental delay or learning disability had symptomatic seizures, had onset of seizure in the first year, and developed

epilepsy compared with children with normal development (table IV). Although fewer children with developmental delay were in remission at 10 years this did not reach significance.

CHILDREN WITH TONIC-CLONIC AND COMPLEX PARTIAL SEIZURES

The median age of onset of seizures was 2 years 2 months (range 5 weeks-9 years 3 months) in the tonic-clonic group and 4 years 8 months (5 months-8 years 5 months) in the complex partial group. Table V compares the two groups. A significantly greater proportion of the complex partial group developed epilepsy (recurrent seizures), even though the median age of onset was later. No significant differences existed between the groups in sex distribution, family history of epilepsy, proportion that had previous febrile convulsions, or in proportions that had symptomatic epilepsy, had developmental delay or learning disability, or that were in remission at age 10 years.

Discussion

The incidence of epilepsy in the first 10 years of life in our study was 4.3/1000. The rate of epilepsy in the national child development study, one of the two other large British cohort studies, was 4.1/1000 by 11 years.³ That study also found little difference in prevalence according to sex. Nelson and Ellenberg reported a rate of epilepsy of 5/1000 by age 7 years among American children who had not had febrile seizures; in our study the equivalent rate was 3.7/1000 by age 10. Most studies of relatively unselected populations report a prevalence of chronic epilepsy between 4 and 10/1000.¹¹

SEIZURE RECURRENCE

Reported rates of recurrence after a single fit vary between 27% and 82%.¹² Chadwick's review¹³ drew attention to the national general practitioner study of epilepsy,¹⁴ which found a rate of recurrence of 78% at 3 years, including first seizures that were identified retrospectively. This rate is similar to ours, probably because the method was similar. In contrast the hospital based study by Hauser *et al* found a recurrence rate at 3 years of only 29%.¹⁵ Variation may be due partly to population selection and partly to delay in referral after the first seizure—if some patients have a second seizure before they can be enrolled those that are enrolled are less likely to have a recurrence. Hospital based studies therefore usually give lower recurrence rates than community based studies.

We found that the rate of recurrence was increased in children with developmental delay or learning disability and in children with complex partial seizures. These two results just attained statistical significance ($p < 0.05$). Because of the number of χ^2 tests performed at least one of the two results may have been significant on a purely random basis. However, Berg and Shinnar reported similar findings in their meta-analysis of previous studies.¹⁶

DISTRIBUTION OF SEIZURE TYPES

In their general practice based study Goodridge and Shorvon^{17,18} used the same classification as we did, and our results agree quite well even though the age range studied was different. The same proportion of electroencephalograms appeared normal in both studies. The proportions of children with mixed seizure disorder, simple partial seizures with secondary generalisation, and classic absence seizures were also similar in both studies. Ross *et al* found only one child with "petit mal" in the British 1958 cohort. Brief "blank spells" in childhood are probably brief complex partial seizures

or atypical absence seizures (sometimes part of a mixed seizure disorder).

The clinical information available in our study (recorded in the 1970s) was not sufficiently specific for us to diagnose benign partial epilepsy.

OUTCOME AFTER SEIZURES

Chevrie and Aicardi studied outcome after seizures in the first year of life in 293 infants and reported a generally poor prognosis, outcome being worse in symptomatic than cryptogenic cases.^{19,20} Cavazutti *et al* reported similar findings.²¹ We found that all the deaths occurred in children who had developed afebrile symptomatic seizures in the first year. We also found that children who had infantile spasms or a mixed seizure disorder in the first year were more likely to have persistent seizures whereas the outcome for children who presented with tonic-clonic seizures in the first year was relatively good.

A greater proportion of children with symptomatic seizures presented in the first year and showed evidence of developmental delay or learning disability. Many other studies have reported similar findings. We looked for "avoidable" epilepsy in this group, but there were only five cases in which the seizures might have been prevented (two head injuries, one birth asphyxia, one child put in a hot bath during a febrile convulsion, one postoperative electrolyte imbalance).

TONIC-CLONIC VERSUS COMPLEX PARTIAL SEIZURES

Prolonged febrile seizures in childhood have been suggested to cause mesial temporal sclerosis and thus lead to later complex partial seizures.^{22,23} We found no difference between the tonic-clonic and complex partial groups in the proportion with a history of febrile convulsions. This supports Rocca *et al*'s opinion that when febrile seizures precede afebrile seizures there is a usually pre-existing liability for the brain to convulse.^{24,25} They suggested that there is a genetic predisposition in the case of generalised seizures and a pre-existing brain lesion in the case of complex partial seizures, but we found no greater proportion with a positive family history in the tonic-clonic group nor an increased proportion of symptomatic seizures in the complex partial group. In this part of the study our numbers were small and our conclusions are tentative.

We found that a greater proportion of children with complex partial seizures had recurrences, as reported by others.^{17,26} Although a larger percentage of children in the tonic-clonic group had a remission this was not significant. Annegers *et al* found that remission was more likely in children with generalised onset rather than complex partial seizures.

DEATHS

Our findings are similar to those of Chevrie and Aicardi, who studied children with onset of seizures in the first year of life and found that 19% of children with symptomatic seizures died compared with 4% with cryptogenic seizures.¹⁹ In contrast Sillanpaa found that none of those who developed seizures in the first year of life died immediately.²⁸

CONCLUSIONS

Although there is understandable concern when epilepsy is diagnosed it should be remembered that it is mainly children with symptomatic seizures who have a poor outcome. Such children were the minority in our study and the children with idiopathic seizures did much better.

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Cost implications of the British Pacing and Electrophysiology Group's recommendations for pacing

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Abstract

Objective—To compare present pacing practice with the recommendations recently published by the British Pacing and Electrophysiology Group and to assess the increase in annual budget required to implement these recommendations in a regional cardiothoracic unit.

Design—Retrospective analysis of pacemaker implantation for 1991 with calculation of the costs required to implement the group's recommendations based on average 1991 costs of the types of pacing generators and electrode leads used.

Setting—Regional cardiothoracic unit for South West Thames Health Authority.

Patients—433 consecutive patients receiving permanent pacemaker generators: 76 (18%) with sinus node disease; 270 (62%) with atrioventricular block; 25 (6%) with both sinus node disease and atrioventricular block; 59 (14%) with chronic atrial fibrillation and atrioventricular block; and 3 (1%) with carotid sinus or malignant vasovagal syndromes.

Results—Only 102 (24%) patients received pacemaker generators recommended by the British Pacing and Electrophysiology Group; however, 355 (82%) patients were older than 65 years, and 264 (61%) were aged 75 or over. The cost of hardware for pacing was £462 885. Using generators as recommended would have cost £810 525 for "optimal" systems (an increase of 75%) and £710 750 for "alternative" systems (an increase of 54%). These increases would have been considerably reduced by limiting the use of sophisticated pacing to younger patients (aged under 75). Further savings could be made by using the least expensive pacing models available.

Conclusions—Implementing these recommenda-

tions should reduce morbidity related to bradyarrhythmia but will lead to major increases in pacing costs. Age and patients' expected activity may be used to select simple pacing systems and thus to contain cost. More research is needed to determine which patient groups will benefit most from complex pacing systems.

Introduction

The British Pacing and Electrophysiology Group has recently published its recommendations for pacemaker prescription for symptomatic bradycardia.¹ Its report discussed three pacing "policies": right ventricular demand (VVI) pacing for everyone (which was deemed inappropriate); the routine use of the most sophisticated system appropriate for the patients' needs (acceptable but costly); and careful prescription along the recommendations of the report. The working party acknowledged that a radical change in practice would be needed in some pacing centres. Additional funding would also be required for more widespread use of dual chamber and rate responsive pacing systems and their follow up. The extent of the additional funding required is unknown but depends on the prevalence of the different electrocardiographic diagnostic groups (as used by the British Pacing and Electrophysiology Group) in the general population. Table I shows the recommended systems.

Many centres, ours included, at present use far more single electrode ventricular (VVI) pacing systems than is suggested by these recommendations. Although the British Pacing and Electrophysiology Group accepted that these systems might suffice for atrioventricular block in the face of terminal disease or conditions that reduce mobility (for example, previous hemiplegia), most centres use these modes predominantly in elderly

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