REFRESHER COURSE FOR GENERAL PRACTITIONERS

CONVULSIONS IN CHILDHOOD

BY

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In discussing fits in childhood the first point to make quite clear is that on many occasions they have not the same serious significance as in adults. The central nervous system of some infants and older children is more unstable than that of others, so that unusual brain stimuli easily evoke convulsions which under similar circumstances would never appear at a more mature stage.

Symptomatic Fits

One large group can be labelled "symptomatic." These cases should be recognized as early as possible so that a series of fearsome investigations and gloomy prognostications can be avoided. A history of some infection or febrile disturbance each time the convulsions arise is suggestive, and in doubtful cases help can be obtained from an electroencephalographic tracing. For a few days a sedative should be prescribed to cover any possible recurrence during the fever, and instructions given that the drug can be repeated as a prophylactic measure in the event of another acute infection. Symptomatic fits are particularly apt to occur in infancy, and again towards puberty.

Apart from this important group, which must always be excluded first, fits in children can be classified into the following aetiological categories: traumatic, metabolic, hypertensive and toxic encephalopathy, degenerative, cases due to infection of the central nervous system or to raised intracranial pressure, and epileptic.

Vascular Damage

Traumatic fits are mostly encountered in the neonatal period. They are associated with oedema of the brain or frank cerebral haemorrhage, due either to a stormy labour at full term or to the hazards of birth in a premature delivery. The clinical picture is characteristic: breathing is shallow or irregular; the baby is restless, "jumpy," or hypertonic; the fontanelle is tense; and the colour is poor or definitely cyanosed (asphyxia neonatorum). The main requirements are an atmosphere of 50% oxygen and sedation with chloral hydrate orally in $\frac{1}{4}$ -gr. (32-mg.) doses at four-hourly intervals, or with sodium phenobarbitone, $\frac{1}{4}$ gr. (8 mg.) eight-hourly intramuscularly. Lumbar puncture may reveal fresh or altered blood, but, since its discovery will hardly influence treatment at this stage, there is much to be said against carrying out this procedure. It is far wiser to disturb the infant as little as possible in the hope that any haemorrhage is slight and will cease spontaneously. A major tentorial tear will probably prove fatal whatever steps are taken.

Vascular accidents due to birth trauma sometimes have delayed symptoms. A *subdural haematoma*, for instance, may take some months to produce signs of a space-occupying lesion; it is discussed in fuller detail below.

Vascular occlusion, usually arterial, either by embolism or by thrombosis, may cause degeneration and atrophy of quite large areas of cerebral tissue, usually after an appreciable interval. As a result an apparently normal infant will suddenly develop a series of fits and serious mental deterioration at the age of 3 to 4 months, often associated with hemiparesis. Quite a number of these children survive and grow up with gross mental retardation. Some of them finally enter an institution, where years later necropsy may reveal a shrunken, "walnut" brain on one side. In some cases of infantile hemiplegia the intelligence is less impaired,

but the fits increase in number and severity, and are not controlled by the usual sedatives. Recently hemispherectomy of the affected side of the brain has been attempted for this condition and successful results have been reported.

Sinus thrombosis is also best considered under this heading. It may be purely infective, as in the case of lateral sinus thrombosis, rare these days, associated with otitis media and mastoiditis. Ascending cortical thrombosis can arise from the same source, but it occurs more often in adults than in children. The sagittal sinus may also become thrombosed as a terminal event in a dehydrated marasmic infant who has suffered from a prolonged and intractable bout of diarrhoea. These vascular lesions can all lead to fits.

Metabolic Convulsions

Various metabolic disturbances can produce convulsions. A good example is *hypoglycaemia* in diabetes mellitus, when the amount of insulin is excessive or a child on an adequate maintenance dose refuses food during an acute illness. Protection can then be afforded with sweetened fruit drinks, which the child can usually be persuaded to take. *Hypocalcaemia* with tetany, laryngismus stridulus, and fits (spasmodophilia) was a not uncommon complication of rickets in the past, but is hardly ever seen now, since the associated vitamin deficiency has practically disappeared in this country.

Very severe degrees of *alkalosis* can cause convulsions, but there are few clinical conditions which can lead to this, with the possible exception of prolonged vomiting or post-operative gastric drainage. If for any reason alkalis are also being given, particularly when there is dehydration and impaired renal function, the danger is greater.

Encephalopathies

Hypertensive encephalopathy is occasionally encountered in children, with fits as one of the main symptoms. It is one of the rare complications of acute nephritis (Type I); more often it is seen in the terminal stages of chronic nephritis or in congenital abnormalities of the kidney associated with renal rickets. When the condition is reversible, as in acute nephritis, every effort should be made to reduce the cerebral oedema. Magnesium sulphate, 1 to 3 oz. (30 to 90 ml.) of a 50% solution, can be given rectally, or, by intramuscular injection, 0.2 ml. of a 25% solution per kg. of body weight. Hypertonic solutions of glucose (50%) also help if given intravenously, 10 ml., repeated if necessary.

The only metallic poison likely to affect the brain in children is lead. There is usually a history of pica—a curious habit of eating dirt and other unusual substances. Plumbism can result from licking the paint off the side of cots or biting the heads off toy soldiers, as occurred in one of my cases. Eventually the child may go into a state of coma and die. Some recover but are left with fits and some impairment of their intelligence.

Degeneration

Apart from the vascular lesions already mentioned and the toxic effects just described, there are certain other degenerative conditions of the brain, such as amaurotic family idiocy and Schilder's disease, which may be associated with fits. Encephalopathy with resulting demyelination is also a recognized complication of vaccination and of several of the exanthemata.

Infection

Convulsions may also be due to infection of the brain or meninges. Virus encephalitis, encephalo-myelitis, bacterial meningitis, and, rarely, syphilitic pachymeningitis may begin in this way. Examination of the cerebrospinal fluid will assist the diagnosis and there may be other suggestive physical signs in the central nervous system. Lumbar puncture should not be lightly undertaken in the presence of papilloedema, for a brain tumour is then a possibility, with a pressure cone. Sudden release of cerebrospinal fluid may then prove fatal. If, therefore, in doubtful cases this investigation has to be undertaken, very little fluid should be removed and the operator should be prepared to inject sterile normal saline into the thecal canal immediately any alarming effects are noticed.

Localized Intracranial Lesions

Tumours of the brain situated supratentorially may give rise to convulsions as an early manifestation; in fact a Jacksonian epileptic attack may have some localizing value. Since, however, the cerebellum and pons are much more likely to become involved in children, fits are not often the presenting sign. The commonest site for *abscesses* is either the cerebellum or the temporal lobe, by direct extension from an infected ear or mastoid. Fits are therefore not a common feature, but they may result from pyaemic abscesses, which can develop anywhere in the brain. A more likely cause of fits from a localized lesion is a *subdural haematoma*. Its development from birth trauma has already been mentioned and also the delay before its presence is suspected. This is because it takes time for the haemorrhage to become fibrinized into a cystic tumour which absorbs fluid, gradually increases in size, and encroaches on neighbouring structures. The clinical picture then is that of progressive hydrocephalus with separation of the sutures and, in all probability, fits. Surgical removal of the cyst is followed by complete recovery. A blow on the head, seemingly insignificant at the time, may bring about the same sequence of events. Gross hydrocephalus from other causes may also produce convulsions, and for this reason fits usually occur in a rare protozoal infection—toxoplasmosis.

Epilepsy

This forms the largest group in any paediatric practice, and, although much can be done to control such fits, these cases are always likely to recur. Heredity plays a considerable part, but it is also possible for fits in one generation to be followed by migraine in the next and vice versa. Some indication of the outlook in epilepsy may be gathered from what occurred in a parent or elder brother or sister who suffered from similar trouble in childhood. If the disorder disappeared as they grew older, there is a reasonable prospect of the same happening in the child now brought for advice. Adie singled out a group of patients who suffered from innumerable attacks which were uninfluenced by any form of treatment. They appeared to be familial and tended to clear up at puberty (pyknolepsy).

Petit Mal.—This type of epilepsy is too well known to need detailed description. Difficulty in diagnosis may arise at first, since the lapse of consciousness may be so very brief as to pass unrecognized. The child may merely change colour momentarily or cease what he is doing and not resume where he left off. Two of my patients are particularly good examples of this. One boy was undressing to retire for the night, when he suddenly stopped and proceeded to re-dress himself and walk downstairs, thinking it was time to get up. The other, a young girl, set forth to fetch some milk from the local dairy. On her way she had her first "turn," with a brief gap in her train of thought. She never completed her errand and came home with an empty can. Parents sometimes bring their child because of "day-dreaming," which takes the form of a vacant stare into the distance for a few moments. Occasionally other epileptic equivalents are seen which make children behave

in an odd way. The lapse of consciousness may be just long enough for a child with petit mal to lose his balance and drop forward from a sitting posture. Recovery is almost instantaneous, and when the fits are often repeated they resemble the obeisances of an old Indian servant, and hence have been called "salaam convulsions." For the most part, however, petit mal is easy to recognize, the short seizures becoming more and more frequent until a bad case may develop as many as 50 a day. The differential diagnosis is not difficult. At times asphyxial attacks as a result of breath-holding have been mistaken for minor epilepsy, but the fact that they occur only when the child is thwarted and in a temper tantrum is enough to give the case away. The remedy, a douche of cold water, is both simple and effective. A Stokes-Adams syndrome is exceptional in childhood, although rare examples have appeared in congenital heart-block. Sudden cerebral anaemia is more likely to occur in the severest forms of Fallot's tetralogy, with an asphyxial "black-out" on the slightest exertion.

Grand Mal.—Petit mal can continue for some years, but after a time it generally becomes interspersed by major attacks. The reverse is not seen; if children begin with major epilepsy, this is the type of fit which will be repeated. It has the same characteristics as in adults, sometimes with incontinence of urine at the time, and often with vomiting, headache, and drowsiness afterwards. Auras are not likely to occur or are not recognized as such. Temporary paralysis of a limb, or a unilateral extensor plantar response, persisting for some days after a severe and prolonged fit, is not uncommon (Todd's paralysis). Outside influences, such as an accidental knock or a fever, can also sometimes precipitate an attack. There may then be difficulty in distinguishing true epilepsy from a symptomatic fit, and the diagnosis will depend on whether other attacks have occurred spontaneously. Help will also be gained from an electroencephalogram, which in idiopathic epilepsy will show characteristic waves. Occasionally, epilepsy will begin in a Jacksonian manner, although later it will take on the more usual form.

Status epilepticus, in which one fit succeeds another for one or two days on end, is a most dangerous condition. Every step should be taken to terminate it, otherwise the child may succumb through sheer exhaustion and with a high temperature. In some cases there is irretrievable damage to the brain.

Treatment of Epilepsy

Many drugs have been tried in idiopathic epilepsy. Bromides have largely passed into disuse and their place has been taken by phenobarbitone, which is particularly useful in grand mal, but less effective in petit mal. For infants $\frac{1}{8}$ to $\frac{1}{4}$ gr. (8 to 16 mg.) can be given twice a day as a maintenance dose; older children can take up to 1 to 3 gr. (65 to 200 mg.) a day according to age. Toxic signs will appear as ataxia, a rash, depression, and, occasionally, such excitability that the child will become difficult to control. Methylphenobarbitone has been claimed to be less toxic and so can be given in a dosage which is 50% to 100% greater. Phenobarbitone often fails in petit mal and then it is worth changing to phenytoin, $\frac{1}{4}$ to 3 gr. (50 to 200 mg.) daily up to 6 years of age; 3 to 4½ gr. (200 to 300 mg.) over 6 years.

Troxidone and "paradione," a less toxic compound, have been recommended as specially useful in petit mal, but they can have alarming side-effects, and patients on these drugs should remain under careful medical supervision and have blood counts carried out fortnightly at first, and then at monthly intervals. Leucopenia with agranulocytosis, albuminuria leading occasionally to Type II nephritis, rashes, and digestive upsets are the chief complications. It is advisable to combine troxidone with phenytoin, as otherwise there is danger of the treatment provoking an attack of grand mal. The dose of troxidone is 0.3 g. daily in three divided doses up to 2 years of age; 0.6 g. daily from 2 to 6 years; and 0.9 g. over 6 years. My experience with this drug has not

been very encouraging. "Mysoline" has undergone quite recent trials with reported good results in major epilepsy. A suitable dose would range between 0.25 and 0.75 g. daily, but the treatment is still in the experimental stage, and the optimum dose for children has not yet been established.

It is obvious from this account that of the two types of epilepsy petit mal is the most difficult to control, and sometimes the older forms of treatment are still found to be effective. Tincture of belladonna, 10 minims (0.6 ml.), combined with sodium borate, 6 gr. (400 mg.), three times a day for a child of about 6 years, is worth trying, and when everything else fails a ketogenic diet may save the situation. This is made up with an adequate amount of protein and with the proportion of fat to carbohydrate and protein in the ratio of 3 to 1, the total calorie value being 50 to 60 per kg. per day, depending on whether the child is under or over 5 years of age. Obviously with the present rationing in this country it is not easy to maintain this diet out of hospital, but special permits can be obtained at the local food office.

The urgency of treating status epilepticus energetically should again be emphasized. Chloroform and rectal thiopentone (1 g. per 25 kg. of body weight, diluted to a 2½% solution with water) are only temporary measures. Intramuscular injections of paraldehyde, 1 to 6 ml., according to age, is certainly the most effective and may have to be repeated if the fits recur.

Vasovagal Attacks and the Periodic Syndrome

There remain two other disorders which have not so far been considered. Girls, particularly when they are approaching puberty, are sometimes brought to the doctor with a history of fainting. Some strain such as early morning devotions on an empty stomach may be found responsible, and in others it is an inadequately functioning vasomotor system with sudden changes of position which is at fault. In any case the nature of the attacks, the colour of the patient, and the absence of any immediate sequelae are enough to differentiate them from true convulsions. Much more difficult to determine are the short lapses of consciousness which sometimes occur in migraine, cyclical vomiting, and the rest of that syndrome, but these black-outs cease as the child grows up and never develop into true epilepsy. They are nevertheless largely prevented by phenobarbitone.

In conclusion it can be said that fits in children are a common event and have a distinctly varied origin. Many of them are merely an expression of some temporary disorder; others are of a more serious and permanent nature. Among the latter, heredity plays an important part which is not unknown to the laity as well as to the medical profession:

Year by year in pious patience
Vengeful Mrs. Boffin sits
Waiting for the Sleary babies
To develop Sleary's fits.

—RUDYARD KIPLING.

Next Refresher Course Article.—"Recurrent Boils," by Dr. S. T. Anning.

Some details of the scheme to establish medical hostels for industrial workers with rheumatism are given in the fifth annual report of the British Rheumatic Association. The first hostel was established last year at Northwood, in Middlesex, and when funds become available others are planned for Scotland, the industrial North, and the Midlands. Their object is to cut out long delays in waiting for hospital beds. Hostels will be sited near the rheumatic unit of a general hospital so that patients can start treatment at once. The hostels will be managed by the newly formed B.R.A. Homes Ltd., a housing society with charitable status. It is estimated that among miners alone absenteeism caused by rheumatism costs the country £15m. a year.

BEAM THERAPY GIFT TO CANCER CAMPAIGN

Presiding at a special meeting of the British Empire Cancer Campaign at the House of Lords on March 10, H.R.H. the Duke of Gloucester announced a generous gift to the Campaign of a cobalt-60 beam therapy unit. He said that the presence of considerable deposits of cobalt in Canada had led to large-scale experiments there on artificial radioactivity, and a few cobalt units for research into the treatment of cancer had been constructed in the Dominion. A unit had now been built incorporating all the improvements found desirable from experience with the earlier models, and it was this unit which had been presented to the Campaign. Sir Stanford Cade and Professor B. W. Windeyer, who visited Canada recently, had discussed the matter with their Canadian colleagues, and the financial difficulty had been removed by the action of one of Canada's outstanding philanthropists, Mr. McConnell, of Montreal, who had offered to pay for the entire unit himself at a cost of over £25,000.

His Royal Highness added that the unit was due to arrive in this country in August and would be installed at Mount Vernon Hospital, Northwood, after being first exhibited at

A Canadian artist's impression of the cobalt rotational beam therapy unit. (By courtesy of the British Empire Cancer Campaign.)

the seventh International Congress of Radiology at Copenhagen in July. The Campaign had arranged for a prominent physicist, who would be one of those working with the unit when it was installed, to go to Canada next month to gain first-hand knowledge of its operation.

Lord Horder, Chairman of the Campaign, in expressing appreciation of the gift, said that this new apparatus made him feel how far they had travelled in radiophysics in the last 25 years. It also brought home the complexity and difficulty of this subject, the enormously increased cost of the armamentarium, and the demand which its effective operation made upon highly trained personnel.

The Minister of Health, Mr. Iain Macleod, said that this was the most massive weapon ever made in this field. He expressed thanks to all concerned, in particular to Mr. McConnell for his magnificent financial contribution, to Mr. Paul Martin, Minister of National Health and Welfare in Canada, for his co-operation, and to the British Empire Cancer Campaign for undertaking the care and operation of this unit. It was altogether a fine chapter in voluntary effort.

Cobalt in Radiotherapy

Sir Stanford Cade and Professor Windeyer then gave a brief exposition of the place of cobalt in radiotherapy. Cobalt-60, a radioactive isotope, said Sir Stanford Cade, was at present the most suitable substitute for x rays and