INFECTIONS AS A SOURCE OF RECURRENT EPILEPTIFORM SEIZURES IN CHILDREN.

BY

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In the past few years we have observed a series of cases with major convulsions of epileptiform character, preceded or accompanied by a fever and an infection. The urine contained acetone in all the cases tested.

A series of twelve such cases has been analysed with the object of ascertaining (1) whether these cases are true epilepsy or whether they usher in epilepsy, and (2) what is the causation, prognosis and best treatment.

The usual history obtained from the mother was that an apparently healthy child had had a series of fits at intervals varying from a few weeks to many months, in each case accompanied by fever. Each series of convulsions lasted from a few minutes to even twelve hours, the child being in some instances in a status epilepticus. During the intervals between the feverish attacks the child was quite normal, and on examination no mental or physical abnormalities could be detected.

The sex incidence showed 8 females and 4 males. Regarding the age incidence, it will be seen from the accompanying table that in 9 of the 12 cases the convulsions commenced under the age of $2\frac{1}{2}$ years, that is, during the period of the first dentition.

The average period over which these recurrent fits were observed was 2 years. In 3 cases there were 3 fits only, in 2 cases there were 8 fits. In the 12 cases there were 63 fits, an average of 5.25 fits per patient, with an average of $4\frac{1}{2}$ months between attacks.

The commonest cause of the convulsions appeared to be a tonsillar or naso-pharyngeal infection, which occurred in 10 of the 12 cases. At times it was described as a feverish or bilious cold, and vomiting was a very pronounced feature of many of the attacks. Reviewing the diet, in 50% of the cases the children were being grossly overfed on fats in the form of milk, cream, butter and eggs.

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CASES OF RECURRENT EPILEPTIFORM CONVULSIONS.

Case	Age	Sex	Age at onset	Period of fits	Number of fits	Average interval	Septic foci	Diet	Remarks
No.	Yrs.		Yrs.	Yrs.					
1	5½	M.	1½	3½	7	6 months	T. & A.	Ketogenic	Bilious attacks often.
2	5¼	M.	1	3¼	6	7 "	T. & A.	"	
3	5½	F.	3½	1½	5	4 "	—	—	
4	3½	F.	2½	1	8	6 weeks	T. & A.	—	T. & A. ½ ago. No fits since.
5	8½	F.	8½	½	3	3 months	—	Ketogenic	
6	2½	F.	1½	½	5	1 "	T. & A.	—	
7	3½	F.	1½	1	3	4 "	T. & A.	Ketogenic	Diet changed ½ ago. No fits since.
8	3½	M.	2½	½	8	1 "	T. & A.	"	
9	4¾	M.	1	2	3	8 "	T. & A.	—	
10	6½	F.	4½	½	6	1 "	T. & A.	—	T. & A. 1 yr. ago. No fits since.
11	3½	F.	1½	1½	4	6 "	T. & A.	Ketogenic	Diet changed ½ ago. No fits since.
12	4½	F.	1½	2½	5	7 "	T. & A.	—	

DISCUSSION.

Type of attack. Is this epilepsy? In favour of such a diagnosis is the fact that the attacks are recurrent and of a typical epileptiform character. Against true idiopathic epilepsy one notes that the children remain mentally and physically normal. In addition each attack is accompanied by fever, and, on the whole, the attacks are well spaced, an average of 4½ months intervening. In true epilepsy an attack is accompanied by very little general upset and the child is about again quite quickly. Fever is exceptional; in fact, with fever and acetone production, as in broncho-pneumonia and measles, true epilepsy seems to cease. The institution of ketogenic diet therapy^{1,5} has been shown to give good results, epileptic seizures disappearing completely in 33% of children treated. As in the diabetic, so in the epileptic, an abnormal diet establishes the optimum condition of general well-being. In the present series of cases the state of the blood appears to be the direct antithesis of that of the epileptic.

Do such recurrent attacks as are here described lead to epilepsy? Consideration of this aspect of the question is of prime importance if it is true that one-eighth of all cases of epilepsy commence during the first three years of life, and 28% of cases of infantile convulsions merge directly into epilepsy in later childhood². From our experience we do not consider these cases become epileptics.

Causation. The period of onset, that of the first dentition, is also the period at which tetany and spasmophilia are most common. This possibility as an ætiological factor can be set aside as further convulsions have occurred in all cases at an age well beyond that at which rickets could play an exciting part.

Whether the deciding factor in each case is the presence or absence of acetone bodies in the blood or cerebro-spinal fluid is of the greatest importance. Certainly accompanying almost every febrile disturbance there is a greater or less degree of acetone excreted in the urine, and in all those cases in which the child's urine could be tested during an attack, the presence of acetone was detected. In several instances a fair degree of acetonuria was present during the intervals between fits also. We think it possible that during the actual attack the cerebro-spinal fluid contains a high concentration of acetone.

Evidence in favour of the suggestion that acetone, or some accompanying chemical product, is the exciting cause of the convulsions is furnished both experimentally and clinically. Parsons²³, working experimentally in the Children's Clinic at the Massachusetts General Hospital has shown that in rabbits acetone causes unconsciousness, complete anæsthesia, and in large doses death; the symptoms can be alleviated and death averted by the intravenous injection of glucose solution. Morris and Graham⁴ of Glasgow have shown that acetone, injected intravenously into rabbits in doses above 0.8 c.cm. per kgrm. of body weight caused them to become stuporous and to lie unconscious for a short period. With very large doses convulsions of a clonic type were observed. Clinically, infections in children on an anti-ketogenic diet produce much less disturbance or elevation of temperature than in those on a ketogenic diet, and the former have also less acetone production. In addition the following case is of interest :—

P.H., aged 3, has had 3 fits at yearly intervals, in each case accompanied by fever. In this third attack she had been unconscious for 4 hours. Lumbar puncture by one of us (D.P.) revealed a clear fluid under pressure, which gave a marked reaction to Rothera's test, showing much acetone to be present. The cerebro-spinal fluid was in other respects perfectly normal.

Such data, both experimental and clinical, cannot fail to impress the observer with the possibility that the acetone bodies produced by mild infections in childhood may be predisposing or exciting factors in the ætiology of these convulsive seizures.

Prognosis and treatment. In our experience the prognosis in these cases depends upon the possibility of, or the success in, removing the causes of the febrile disturbance. In all the cases we have observed the children have remained in a perfectly normal state, both mentally and physically, and in some cases a change of diet or removal of some septic focus has led to a total disappearance of the fits. Great care should be taken to attend to carious teeth, infected tonsils or sinuses, and to place the child in proper surroundings in the country or at the seaside. At the same time a diet should be instituted which is well-balanced and anti-ketogenic, that is, does not contain a high ratio of fat to carbohydrate. We would suggest that the milk should be reduced in quantity and skimmed, and the eggs should be kept down to three

in a week or less. No extra cream should be given and butter allowed in moderate amounts only. At the same time a liberal supply of carbohydrate is to be advised. Such a régime in several of our cases appeared to be eminently satisfactory, but it must always be remembered that there is a tendency for the fits to recur with any chance infection, and the prognosis must accordingly be guarded.

The prognosis as regards mentality is good, in contra-distinction to that in true idiopathic epilepsy.

CONCLUSIONS.

1. Major convulsions of an epileptiform character may accompany infections with acetone production both experimentally and clinically.

2. Such children neither show nor develop any physical or mental abnormality.

3. There is a tendency for such seizures to recur.

4. Removal of all possible septic foci and the institution of a well-balanced, anti-ketogenic diet, play a major role in the successful treatment of these cases.

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