# Epilepsy in children and adolescents with type 1 diabetes

Edith Schober and Reinhard Holl

Seizures provoked by hypoglycaemia are relatively frequent in people with type 1 diabetes. Each year, up to 15% of children with type 1 diabetes experience a severe hypoglycaemic episode, or 'hypo', with seizures – often as a result of administering too much insulin. But seizures also can occur during diabetic ketoacidosis - when not enough insulin has been taken. These acute complications often constitute an obstacle to diagnosis of epilepsy in people, especially children and adolescents, with diabetes. The authors of this article look at some of the links between epilepsy and type 1 diabetes and report on a number of interesting findings from their recent study involving a large number of European children with type 1 diabetes.

Epilepsy is a common chronic neurological condition, which affects the nervous system. Also referred to as a 'seizure disorder', epilepsy involves sporadic electrical storms in the brain, which cause sudden mild loss of attention or staring, and/or violent muscle contractions and loss of consciousness. known as grand mal seizures. There are several types of epilepsy, each with different causes, symptoms and treatments. Idiopathic generalized epilepsy is a group of disorders that tends to manifest itself in young people between early childhood and adolescence but which can develop in later life. The prevalence of idiopathic generalized epilepsy varies according to age. A peak prevalence of 1.1% occurs in adults over 50 years of age; in children and adolescents, the prevalence of epilepsy ranges between 0.2% and 0.4%.1

There is a recognized association between diabetes and idiopathic generalized epilepsy. In a UK study, a group of adults with epilepsy were found to have a four-fold higher prevalence of type 1 diabetes compared to the general population.<sup>2</sup> In that group, diagnosis of diabetes had preceded the onset of epilepsy by several years.

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Recent studies in children have showed conflicting results. An Italian centre reported a higher prevalence of epilepsy in adolescents with diabetes compared to young people without diabetes. Again, diabetes had been diagnosed in these young people on average 2.8 years before epilepsy.<sup>3</sup> On the other hand, an Australian study found no increase in risk for epilepsy in children and adolescents with diabetes.<sup>4</sup>

In many cases, epilepsy-related seizures in children may be mistaken for the symptoms of hypoglycaemia. Consequently, the diagnosis of epilepsy in children with diabetes is often delayed or underestimated. Generally, a diagnosis of epilepsy is based on at least two unprovoked seizures – not resulting from an external cause, such as injury or consumption of



prescribed medications or other drugs – in a person with normal blood glucose levels (above 3.9 mmol/l) and with an interval greater than 24 hours between the seizures. Although monitoring blood glucose is recommended when seizures or loss of consciousness occur in a child with diabetes, parents might not carry out a glucose test in such a frightening situation.

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We had the opportunity to analyze the association between diabetes and epilepsy in a large group (45,847) of young people with type 1 diabetes aged between 0.1 and 20 years from Germany and Austria as part of the DPV initiative.<sup>5</sup> We found a significantly higher frequency of epileptic seizures in children and adolescents with diabetes than expected: twice as high as in children without diabetes. There was no difference between boys and girls.

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## Some interesting findings

It was interesting to note that the children with both diabetes and epilepsy were younger at onset of diabetes than the children with diabetes alone. The reason for the increased frequency of epilepsy in children with type 1 diabetes is unknown and deserves further investigation. However, previous studies have shown that both severe hypoglycaemia and ketoacidosis can lead to abnormalities in an electroencephalogram (test to detect problems in the electrical activity of the brain) in children with diabetes.

Given the risk of acute complications posed by both diseases, parents of children with epilepsy and diabetes might be expected to prevent convulsions in their child by attempting to avert hypoglycaemia using less insulin – with the consequence of higher overall blood glucose levels. However, among the children with both diseases, HbA<sub>1c</sub> levels and insulin dosage-to-body weight ratios were similar to those in the children without epilepsy and we saw no difference in the type of treatment – pump or injections.

An interesting and unexplained result of our study was a significantly increased risk for diabetic ketoacidosis in children and adolescents with type 1 diabetes and epilepsy. They appear to be at twice the risk compared to children with type 1 diabetes alone. The causes of this association are unclear. It could it be that people with repeated episodes of ketoacidosis are more prone to epilepsy.

### Education to prevent complications

Close observation by parents of a child with diabetes and epilepsy could enable them to anticipate the symptoms of metabolic disturbances, allowing earlier diagnosis of (still mild) ketoacidosis. In reality, however, we found that rates of mild as well as severe ketoacidosis were higher in the children with both diseases. Children, their families and their healthcare providers need to be aware of this increased risk and should receive adequate and appropriate education to be able to detect and prevent ketoacidosis.

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