# Repeat Admissions for Ketoacidosis Seen in Youths

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KEYSTONE, COLO. — If it seems like the same handful of patients in your practice are hospitalized over and over for diabetic ketoacidosis, you're not imagining things, according to Dr. Robert Slover.

A prospective 2002 study of 1,243 Denver-area children and teens with type 1 diabetes followed for an average of 3.2 years showed that 60% of all hospitalizations for diabetic ketoacidosis (DKA) in patients with established diabetes occurred in the 5% of youths who had two or more DKA events.

"In other words, we see the same kids over and over and over again. Unfortunately, that's the pattern across the United States and worldwide. A few patients make up the majority of the problem of DKA in patients with known diabetes,"

**'These children can develop cerebral edema once they are resolving [when] they seem to be doing pretty well.'**

**DR. SLOVER**

Dr. Slover said at a conference on the management of diabetes in youth.

The overall incidence of DKA in the Denver study was eight cases per 100 person-years. Among patients with established diabetes who were aged 7-12 or 13-19, the rate was significantly higher in girls than boys, while in patients younger than 7 years the opposite was true (JAMA 2002;287:2511-8).

In addition to prior DKA episodes and female sex, this study and others have identified other risk factors for DKA in children with established type 1 diabetes. These include lower socioeconomic status, lack of appropriate health insurance, poor metabolic control, eating disorders or other psychiatric conditions, and inappropriate interruption of insulin pump therapy.

DKA is a huge problem. It causes 160,000 admissions to private hospitals annually. The cost of care is in excess of $1 billion per year. Patients younger than 19 years old account for 65% of cases, and DKA is far and away the leading cause of diabetes-related death in children, accounting for 85% of cases.

Cerebral edema is the cause of 69%-80% of DKA-related deaths, said Dr. Slover, a pediatric endocrinologist at the Barbara Davis Center for Childhood Diabetes, Aurora, Colo.

"That figure ought to be 100%," he said, "because the other causes of mortality in children with DKA we really ought to be able to prevent: hypokalemia, hyperkalemia, thrombosis, sepsis, intracranial bleeding, aspiration pneumonia."

Cerebral edema in patients with DKA has a high morbidity and mortality. Overall, 20% of those with cerebral edema die, and another 20% are left with mild to severe neurologic impairment.

A 95-patient study of the timing of onset of cerebral edema in DKA showed that while the peak onset was 3.0-5.9 hours into treatment, there were as many cases with onset at hours 12-15 as during the first 3 hours. In a few cases, onset occurred as late as hours 18-24, according to the study, conducted at the University of Florida, Gainesville (Diabetes Care 2004;27:1541-6).

"That's important to recognize," Dr. Slover stressed. "These children can develop cerebral edema once they are resolving—when their pH is coming up, their blood glucose is looking better, and they seem to be doing pretty well."

Patients with DKA who are at increased risk of cerebral edema include those who have prolonged severe acidosis with an initial pH of less than 7.1, have abnormal baseline mental status, are aged younger than 5 years, have hypernatremia or persistent hyponatremia, or undergo rapid rehydration in excess of about 50 cc/kg in the first 4 hours.

Signs and symptoms of pending cerebral edema include a sudden return of vomiting, worsening level of consciousness, rise in blood pressure, bradycardia, and headache.

Don't send a patient with suspected cerebral edema off for confirmatory CT or MRI, Dr. Slover urged. Instead, treat presumptively. Brain imaging changes are often not apparent early on.

The meeting was sponsored by the Barbara Davis Center for Diabetes, the University of Colorado, and the Children's Diabetes Foundation at Denver. ■