Real-Time Blood Ketone Monitoring Lauded

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KEYSTONE, COLO. — A unique handheld device for real-time monitoring of blood beta-hydroxybutyrate provides a significant advance over traditional urine ketone testing in the early diagnosis and management of diabetic ketoacidosis, an emergency department physician reported.

Randomized trials demonstrate that type 1 diabetic patients equipped with the handheld device have fewer trips to the emergency department (ED) and fewer hospitalizations for diabetic ketoacidosis (DKA) than those testing for ketonuria with urine dipsticks. Several other studies suggest bedside monitoring of blood beta-hydroxybutyrate (beta-OHB) shortens the duration of DKA hospitalizations.

Moreover, four separate studies indicate the rapid blood test is superior to urine ketones for use in the ED in making an immediate distinction between DKA and hyperglycemia, perhaps accompanied by gastroenteritis, Dr. Arleta Rewers said at a conference on the management of diabetes in youth.

The handheld device is marketed by Abbott/MediSense as the Precision Xtra in the United States and as the Optimum Xceed in Europe and elsewhere. Patients can purchase the device, which measures both blood glucose and ketones, in addition to the separate types of test strips.

Urine ketone testing has many shortcomings. Urine may have been in the bladder for hours, so test strip results don't reflect how the patient is doing now. The test strips are messy, have a short shelf life, and provide qualitative rather than quantitative results. In addition, urine testing doesn't detect beta-OHB, the most important ketone body. And dehydrated patients may not even be able to urinate, she noted at the conference sponsored by the Barbara Davis Center for Childhood Diabetes, the University of Colorado, and the Children's Diabetes Foundation at Denver.

The key to keeping patients out of the hospital is early detection and treatment of mild DKA to prevent its progression. Dr. Rewers therefore advises diabetic patients to check their blood beta-OHB whenever their blood glucose exceeds 300 mg/dL, when they have an infection or illness or unusual symptoms, or if they realize they've missed an insulin injection or bolus.

A blood beta-OHB level below 0.6 mmol/L is considered normal. A reading of 0.6-1.0 mmol/L warrants taking an extra dose of insulin along with fluids. A reading in the 1.0- to 1.5-mmol/L range calls for an extra dose of insulin, fluids, and a repeat measurement in 1 hour; if there's no improvement, it's time to call the physician. A reading of 1.5-3.0 mmol/L necessitates an urgent call to the physician. And a level above 3.0 mmol/L in a patient who feels sick indicates significant DKA requiring a trip to the ED, said Dr. Rewers who is with Children's Hospital, Denver.

She noted that investigators at Boston's Joslin Diabetes Center showed in a randomized trial involving 123 diabetic patients up to age 22 years that those assigned to monitor their blood beta-OHB on sick days had half as many ED visits and hospitalizations, compared with those testing for ketonuria during 6 months of prospective follow-up (Diabet. Med. 2006;23:278-84).

Several other studies have demonstrated that rapid blood testing has an 80% sensitivity and 83% negative predictive value in detecting ketosis, compared with a 63% sensitivity and 72% negative predictive value for urine ketone testing.

The gist of four ED studies conducted in more than 400 children and adults with new-onset or known diabetes was that a beta-OHB cutoff of 2.0-3.0 mmol/L provided the best combination of sensitivity and specificity for diagnosing DKA, according to Dr. Rewers. Values above those thresholds had 100% sensitivity, 85%-88% specificity, and an all-important 100% negative predictive value for DKA.

Dr. Rewers and coworkers showed in a 68-patient study that real-time blood beta-OHB measurements obtained at bedside are generally as accurate as values obtained in a reference laboratory (Diabet. Technol. Ther. 2006;8:671-6).

Dr. Rewers disclosed she has received research grants from Abbott Diabetes Care but had no further financial conflicts of interest. ■