Could Blood Ketone Monitoring Be A Tool for Managing Gestational Diabetes Mellitus?

Nutritional management of gestational diabetes mellitus (GDM) is based on guidelines from diabetology societies (1). Ketonuria is often monitored, but clear management guidelines have not been established. Home-based methods of measuring ketonemia are available. We believe that it is important to evaluate the utility of this tool in GDM.

We measured ketonemia in a control population of pregnant women and a GDM population. Pregnant women were systematically screened for GDM between the 24th and 28th weeks (75-g oral glucose tolerance test [OGTT], World Health Organization guidelines). A total of 56 women (29.98 ± 4.86 years of age, prepregnancy BMI 23.14 ± 6.26 kg/m², weight gain 14.49 ± 4.93 kg) with a normal OGTT and 49 women (31.35 ± 5.39 years, prepregnancy BMI 25.96 ± 5.91 kg/m², weight gain 9.25 ± 5.52 kg) with GDM were included.

Each subject was monitored in accordance with the appropriate guidelines; in addition, the control subjects performed glycemia and ketonemia self-monitoring three times a day (upon waking and before the midday and evening meals). GDM women were also asked to measure their postprandial glycemia. All subjects measured their fasting ketonuria.

Glycemia measurement was performed using test strips and a meter (Abbott), and capillary blood ketonemia measurement was performed using Optium β-Ketone test strips and the same meter. The replicate analysis resulted in CVs of 3.3%. The study protocol was approved by an ethics committee.

The two groups did not differ in terms of age, but BMI and weight gain were higher in the GDM than in the control group (P < 0.01). The mean ketonemia was lower in the control than in the GDM group (0.01 ± 0.10 vs. 0.04 ± 0.009 mmol/l, P < 0.001). Fasting ketonemia did not differ between the control and GDM groups (0.01 ± 0.11 vs. 0.01 ± 0.06 mmol/l, respectively). Ketonemia values measured before the midday and the evening meal were lower for control than for GDM patients (midday 0.01 ± 0.08 vs. 0.05 ± 0.11 mmol/l, P = 0.002; evening 0.02 ± 0.09 vs. 0.05 ± 0.10 mmol/l, P = 0.005).

A ketonemic episode was defined as the unbroken period during which each day is a part of a sliding 7-day interval containing ≥25% of height value. Of the control subjects, 6 (12%) experienced at least one ketonemic episode (average length 10.5 days) versus 23 (47%) in the GDM group (average length 13.8 days) (a total of 37 episodes).

For women with GDM, we are not currently in a position to conclude whether their ketonemia levels have clinical significance in terms of the pregnancy outcome or the health of the child. Ketonemia values differ from those recorded in control subjects, and this difference is not irrelevant. A study needs to be performed to be certain that higher ketonemia has a detrimental prognostic significance for fetal development.

Reports from the literature have focused exclusively on ketonuria. A negative correlation between ketonuria and intellectual quotient in children born to diabetic mothers has been reported (3,4). A relationship between high fasting ketonemia during the last trimester and delayed educational development has been suggested (5).

References


Blood Pressure Measurement in Diabetes Clinic

Are we paying enough attention?

The American Diabetes Association statement (1), “Care of Children and Adolescents With Type 1 Diabetes,” outlines recommendations for management of hypertension in children with type 1 diabetes. Hypertension in children can be missed if appropriate norms are not used, and, as the authors state, “clinicians who care for children with diabetes often pay little or no attention to blood pressure.” Here, we report results of a retrospective chart review of serial clinic
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blood pressure measurements among 217 youth with type 1 diabetes for ≥5 years. Hypertension was defined as systolic and/or diastolic blood pressure >95th percentile for age, sex, and height at three consecutive clinic visits (2). Blood pressure was taken at each outpatient visit using an automated blood pressure device by trained medical assistants.

Sixty (28%) of 217 patients met the study diagnosis of hypertension (mean age 12.7 ± 3.2 years) after 5.7 ± 3.8 years of diabetes. These patients had higher systolic blood pressure z-scores (1.13 vs. 0.49, P = 0.002) and higher BMI z-scores (0.68 vs. 0.30, P = 0.01) at the time of diabetes diagnosis than did patients without hypertension. Only 21 of 60 (35%) had the diagnosis documented in the medical chart, and only 5 of 60 patients (8.3%) had therapy initiated specifically for treatment of hypertension. Spot-urinary albumin-to-creatinine ratios were categorized as normal (<20 μg/mg), high normal (≥20 but <30 μg/mg on two of three measurements), and microalbuminuria (≥30 μg/mg on two of three measurements). Seventeen (9%) of those with available data (n = 190) had microalbuminuria. This complication was more frequently addressed than hypertension, with 14 of 17 (82%) subjects being treated with ACE inhibitors. Patients who met study criteria for hypertension tended to have higher albumin-to-creatinine ratios. Of those patients with available data, 2 of 57 (4%) with elevated blood pressures had high-normal ratios and 8 of 57 (14%) developed microalbuminuria, while 0 of 133 with normal blood pressure had high-normal ratios and 9 of 133 (7%) developed microalbuminuria (P for trend <0.05).

Our analysis is retrospective and relies upon casual blood pressures, which may overestimate the true rate of hypertension. Nonetheless, our data indicate that adolescents with type 1 diabetes may develop blood pressure in the hypertensive range, and as suggested by the recent American Diabetes Association statement, this blood pressure may not be routinely recognized. This represents missed opportunities to confirm hypertension with repeat auscultatory measurement and/or 24-h ambulatory blood pressure monitoring and to intervene with lifestyle modification/pharmacologic therapy, all with the hope of preventing future micro- and macrovascular complications. Routine blood pressure assessment using appropriate age-, sex-, and height-dependent norms is an essential component of every visit to the diabetes clinic.

JAMIE R. WOOD, MD
MARY ANN O’RIORDAN, MS
BETH A. Vogt, MD
MARK R. PALMERT, MD, PHD

From the 1Department of Pediatrics, Case School of Medicine, Rainbow Babies and Children’s Hospital, Cleveland, Ohio, and the 2Department of Genetics, Case School of Medicine, Rainbow Babies and Children’s Hospital, Cleveland, Ohio.

Address correspondence to Jamie R. Wood, MD, Pediatric and Adolescent Unit, Joslin Diabetes Center, One Joslin Place, Boston, MA 02215 E-mail: jamie.wood@joslin.harvard.edu.

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References


COMMENTS AND RESPONSES

Recommendations for Management of Diabetes During Ramadan

Response to Al-Arouj et al.

Al-Arouj et al. (1) have made recommendations for fasting during the holy month of Ramadan for Muslim diabetic patients. The recommendations were drafted by an expert panel of diabetologists from around the globe, and it represents a landmark for practicing clinicians who look after diabetic Muslims. The recommendations were based on expert opinion rather than evidence-based scientific research, which, as the panel pointed out, is lacking in this area. These provisional recommendations await well-designed research aimed specifically at seeing whether fasting is beneficial or harmful to patients with type 1 diabetes.

Type 1 diabetic patients are often advised not to fast by physicians. The nature of type 1 diabetes makes fasting hazardous. Thus, type 1 diabetic patients are put in the category of very high risk in the recommendations. Evidence-based scientific data will definitely help physicians caring for such patients to decide whether to advise patients with type 1 diabetes strongly or half-heartedly about fasting.

Patient education regarding fasting during the holy month of Ramadan is badly needed. Research in this area is also deficient. In a recent study, only 33% of our diabetic patients received general advice on fasting during Ramadan (2). Morbidity related to fasting has been reported to be quite high. The rates of severe hypoglycemia and hyperglycemia were alarmingly high in the Epidemiology of Diabetes and Ramadan study, a population-based large epidemiological study that spanned 13 countries with sizeable Muslim populations (3). Such a high rate of fasting-related morbidity was reported earlier in a small study by Uysal et al. (4).

Education of patients is the cornerstone of safe fasting, which is needed on both an individual and large-scale level, and this is the responsibility of diabetes care team members.

Diabetic patients with established renal disease run substantial risk of complications by fasting and rightly the recommendations put them in the high-risk category. The great majority of those patients have major comorbidities and are taking many drugs, including insulin and sulfonylurea agents, which make them prone to severe hypoglycemia. We feel that these patients need to be singled out more specifically in the guidelines as such groups, even those who receive renal replacement therapy, often insist on fasting (A.A.A.A., unpublished observations). Fasting for prolonged periods, especially in hot climates, may impose negative impacts on renal function from hypovolemia and dehydration. The mainstay of management of those patients is targeted toward arresting the progression of their underlying renal disease, and fasting during Ramadan should not be recommended.

Another group that deserves special consideration is adolescent patients with type 1 diabetes. These patients should not be encouraged to fast, as recurrent severe