OBSERVATIONS

The Effect of the Menstrual Cycle on Glucose Control in Women With Type 1 Diabetes Evaluated Using a Continuous Glucose Monitoring System

Information on the factors that affect glycemia is pivotal in the treatment of diabetes, including insulin sensitivity in different physiological processes (1–4). The current study evaluated the effect of the menstrual cycle on glucose control in six patients with type 1 diabetes, with a median age 23 years and regular menstrual cycles, not in use of hormonal contraception, not pregnant or breastfeeding, with normal thyroid function, and recent glycated hemoglobin <8% (median 7.4%); four patients were normal weight and two overweight. They were evaluated using a continuous glucose monitoring system over 72 h in the follicular (4th–8th days) and in the luteal phase (18th–22nd days). Reference values were hyperglycemia >180 mg/dL, hypoglycemia <70 mg/dL, postprandial hyperglycemia >180 mg/dL (≤2 h after a meal), and nocturnal hypoglycemia <70 mg/dL. Hormone levels were measured and ultrasonography was performed to identify ovulatory patterns. One patient used an insulin infusion pump, and the others used multiple insulin doses. All the patients counted carbohydrates and corrected their glucose levels whenever necessary. Glucose control ranged from a minimum of 556 to a maximum of 1,146 measurements. Analysis of the percentage of time in which the patient was normoglycemic, hypoglycemic, or hyperglycemic showed that normoglycemia was similar in both phases. Blood glucose level variation in each individual patient showed a reduction in the percentage of hypoglycemia (10.7 vs. 15.8%) and an increase in hyperglycemia (28.5 vs. 22.8%) in the luteal compared with the follicular phase. The number of nocturnal hypoglycemic episodes was similar, with a total duration of 21.9 h in the follicular and 22.8 h in the luteal phase. Median glucose levels after breakfast tended to be higher in the luteal phase (199.3 vs. 163.6 mg/dL). As well, in five patients, the minimum glucose level after breakfast was higher in the luteal phase ($P < 0.046$). The median glucose level for the group in the second phase was higher after lunch (150.3 vs. 110.8 mg/dL, $P < 0.046$) and tended to be higher (178.6 vs. 139.6 mg/dL) before dinner. Analysis of the median glucose levels throughout the day revealed higher glucose levels in the second phase of the cycle at fasting, after breakfast, after lunch, and before dinner. Ovulation occurred on the 14th or 15th days of the cycle in four patients; in the remaining two, ovulation occurred on the 20th day. An increase compatible with the ovulatory cycle was found in mean estradiol levels (126.5 vs. 38.5 mg/mL; $P = 0.028$) and in mean progesterone levels (7.5 vs. 0.5 pg/mL; $P = 0.028$) in the luteal phase compared with the follicular phase.

These results are in agreement with the findings of Goldner et al. (4), who also used continuous glucose monitoring systems to evaluate glucose levels and reported an increase in the frequency of hyperglycemia during the luteal phase. Glucose control seems to differ in the follicular and luteal phases, probably due to a hormonal effect or additionally to the presence of premenstrual symptoms or premenstrual syndrome (5), indicating that in women with type 1 diabetes the two phases of the menstrual cycle should be taken into consideration when planning insulin therapy.

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