Glycemic Variability Is Associated With Quality of Life and Treatment Satisfaction in Patients With Type 1 Diabetes

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Patients with type 1 diabetes have greater glycemic variability than that in patients with type 2 diabetes. However, neither glucose variability nor hypoglycemia is detected precisely by HbA_{1c}. This study investigated whether glycemic variability assessed by continuous glucose monitoring influences quality of life (QOL) and treatment satisfaction in patients with type 1 diabetes.

The study was conducted in Kyoto University Hospital between September 2011 and June 2012. The study protocol was approved by the institutional review board (UMIN Clinical Trials Registry UMIN000005833). Twenty-eight patients with type 1 diabetes aged ≥18 years were included in analyses (age, 45.9 ± 14.5 [mean ± SD] years; diabetes duration, 15.0 ± 8.2 years; 57% female; 21% using insulin pump; HbA_{1c}, 8.1 ± 1.2% [64.5 ± 13.0 mmol/mol]). Glycemic variability in everyday life was assessed for a 72-h period using the CGMS System Gold continuous glucose monitoring system (Medtronic, Northridge, CA), and mean absolute glucose (MAG) change was calculated as a glycemic variability measure. This is a summation of all absolute changes in glucose divided by the time over which the measurements were taken (1). QOL and treatment satisfaction were evaluated by the diabetes quality-of-life measure (DQOL) and the Diabetes Treatment Satisfaction Questionnaire (DTSQ) (available from www.healthpsychologyresearch.com) (2–4). We divided the participants into two groups by HbA_{1c} level—<8% (64.0 mmol/mol), good/fair-control group (n = 14); ≥8% (64.0 mmol/mol),

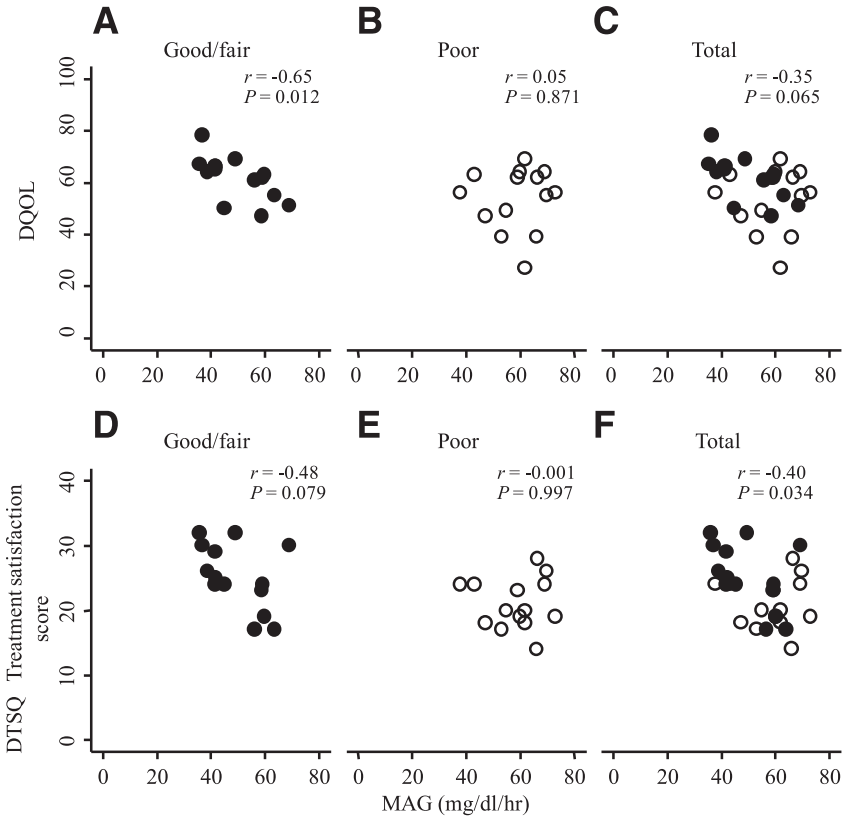

Figure 1—Correlation between glycemic variability and DQOL (*A*–*C*) and DTSQ (*D*–*F*).

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poor-control group ($n = 14$)—considering HbA_{1c} as a potential intermediate variable between glycemic variability and patient-reported outcomes (5). Potential confounding factors were use of carbohydrate-counting with insulin adjustment, age, sex, diabetes duration, and use of insulin pump and the Clarke hypoglycemic score.

Glycemic variability correlated negatively with DQOL in the good/fair-control group ($r = -0.65$, $P = 0.01$), whereas there was no correlation in the poor-control group ($r = 0.05$, $P = 0.87$) (Fig. 1). Glycemic variability correlated negatively with DTSQ across all patients ($r = 0.40$, $P = 0.03$). No significant confounding effect was identified by stepwise selection.

Our study identifies the important association of glycemic variability with diabetes-related QOL and treatment satisfaction in patients with type 1 diabetes. Interestingly, the association between glycemic variability and diabetes-related QOL, which measures satisfaction, impact, social worries, and diabetes worries, was limited to the group with good/fair glycemic control, indicating that the contribution of glycemic variability to QOL is emphasized by better glycemic control. On the other hand, the insignificant association in the poor-control group may imply other important predictors of QOL in patients with poorer glycemic control. The strong points of this study include use of a relatively new indicator, MAG change. It differs from standard deviation, a measure of how spread out data values are around the mean, in that it represents not only dispersion but also the rate of change of blood glucose. Although the limitations of our study include small sample size and exclusion of 12 of 40 participants whose continuous glucose monitoring data were less than 48 h because of disconnection of the sensor, calibration errors, or out-of-range data, this is the first report about the important association between glycemic variability and patient-reported outcomes in type 1 diabetes.

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Duality of Interest. No potential conflicts of interest relevant to this article were reported.

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