Editorial

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Correlations of Glucose Levels in Interstitial Fluid Estimated by Continuous Glucose Monitoring Systems and Venous Plasma

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Continuous glucose monitoring systems (CGMS) are relatively new technology that measures interstitial glucose every 5 minute over a period of 72 hours [1]. Continuous glucose monitoring by CGMS provides accurate data to patients and physicians about blood glucose variability during the measurement period. Two types of CGMS devices, intended for professional and personal use, are available. Professional devices allow physicians to download and analyze data and for use in clinical decision making. Personal devices allow patients to monitor real time glucose data and use such data for self-monitoring and medication adjustments. For this reason, the American Association of Clinical Endocrinologists has recommended the use of personal devices for glucose control and prevention of hypoglycemia in patients with type 1 diabetes [2,3] and pregnancy with diabetes [4,5].

The article, "The correlation and accuracy of glucose levels between interstitial fluid and venous plasma by continuous glucose monitoring system" [6] clearly showed a glucose time lag between blood levels and subcutaneous interstitial levels. Blood and interstitial fluid had different peak times and peak values after meal loading, but the trends of glucose excursion were very similar. In addition, CGMS data showed delayed peaks and lowered peak values compared to venous blood sugar levels after the ingestion of different kinds of food. These lags between the two compartments did not differ by food. The use of CGMS devices, which provide accurate control and monitoring of blood glucose levels, is suitable for use in uncontrolled diabetic patients and to help physicians make decisions regarding treatment modalities.

In the treatment of diabetes, glucose variability, especially postprandial hyperglycemia, is a major risk factor for cardiovascular complications. By using CGMS devices, clinicians can easily access glucose variability in patients. Although patients more easily achieved target HbA1c levels when practicing self monitoring of glucose using the CGMS device than by other methods, systemic reviews comparing the results of CGMS use and intermittent fingertip glucose monitoring do not indicate significantly superior benefits of CGMS. However, they do support the improved detection of asymptomatic nocturnal hypoglycemia [7].

CGMS systems offer many advantages to patients and physicians. However, the sensitivity of glucose sensing decreases over time. After 3 to 5 days, the sensing amplitude of CGMS sensors becomes unreliable. The accuracy of sensors is affected by localized tissue reactions and fibrous encapsulation [8]. For these reasons, patients should calibrate sensing amplitudes through comparisons with fingertip glucose values regularly. Methods of blocking fibrous tissue aggregation and reducing

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tissue reactions, such as corticosteroid sprays or anticancer drug coatings, were used in attempts to address these problems [9,10]. Also, if we placed the sensor in subcutaneous space during continuous monitoring, small glucose diffusion gap from blood level to subcutaneous tissue fluid was another limitation.

Recently, ubiquitous health systems have been introduced to help outpatients to control their blood sugar levels. If patients send their blood glucose profiles to physicians over the internet, their physicians can provide advice to meet their patients' needs. The use of CGMS systems connected to Internet networks has the potential to provide effective, evidence-based support to clinicians in their daily efforts to optimize glycemic control [11].

The closed loop pump is a state of the art technology [12,13]. But major pitfall of this closed loop pump is sensing problems of glucose sensor and limited space of insulin reservoir in transplanted pump. Closed loop pumps are expected to replace open loop pumps and decrease the pain associated with insulin injections. Permanent usable blood glucose sensors and interstitial glucose sensors are also expected to be developed [9,10]. Rapid development of information technology devices and techniques will solve the relevant technological problems, and closed loop systems will be available to patients in the future.

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