HOME MONITORING OF DIABETIC PATIENTS

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Recent emphasis has been placed on finding better monitoring methods. Performance of in-hospital blood glucose curves has long been the gold standard for assessing diabetic control, but they are certainly not perfect. Blood glucose curves can be affected by the stress of hospitalization and deviation from normal routine and vary significantly from day to day. One study recently assessed day-to-day variability of serial blood glucose concentration curves in diabetic dogs.1 Due to the variation, predicting the timing of a diabetic’s nadir on the basis of previous serial blood glucose curves and obtaining a single sample at that time is unlikely to give a reliable result,1 i.e. spot checking does not provide helpful information.

In order to avoid some of the problems associated with in-hospital curves, performance of glucose curves at home has taken on new importance. For home glucose curves, it is not necessary for venous blood to be collected. Capillary blood is suitable,2 and the ear is the best site for blood collection. Two types of lancing device are available. If using conventional automatic devices designed for pricking human fingertips, a device with a variable needle depth should be chosen. The appropriate depth for each patient can then be used.3 Warming of the ear with a hair dryer or a warm, wet washcloth enclosed within a plastic bag may be necessary but not well tolerated, and it may take up to 2 minutes to obtain an adequate sample.3 A device which creates a vacuum after lancing the skin (e.g. Microlet Vaculance, Bayer) does not require warming of the ear and generates an adequate drop of blood within approximately 30 seconds,3 but mastery may be a bit difficult and require repeated instruction.3 Glucometers that require minimal amounts of blood as well as those that “sip” the blood into the strip are desirable.

Continuous monitoring of glucose concentrations has also received attention of late.4,5 The CGMS (Continuous glucose monitoring system, Minimed) is a device that can be strapless onto a patient and a small needle inserted into subcutaneous tissue. Interstitial glucose concentrations are sampled every 5 minutes for up to 72 hrs. Using such a device gives many more data points for evaluation and avoids the stress of multiple venipunctures or catheterization. Indeed, the device could potentially be worn by a patient at home.

The device has been assessed in normal and diabetic dogs and cats. Interstitial and serum glucose concentrations were highly correlated overall.4,5 The working range of the CGMS is approximately 40-400 mg/dL, i.e. blood glucose concentrations outside the range can not be measured. In certain cases, post-prandial increases in serum blood glucose concentration were not detected in the interstitial fluid.5 Some variation existed between patients and the differences between serum and interstitial glucose concentrations were more marked in some patients than others. The greatest discrepancies occurred at higher glucose concentrations.5 No irritation resulted from sensor placement.

To examine the clinical implications of using the CGMS, two clinicians independently reviewed the separate CGMS traces and glucometer-generated blood glucose curves in 10 diabetic dogs and made recommendations regarding the insulin dose and frequency. The same change of insulin dose was recommended 5 of 10 times by clinician A and 7 of 10 times by clinician B. The same adjustment of frequency of insulin administration was recommended 6 of 10 times by clinician A and 8 of 10 times by clinician B. This suggests that the data generated by the CGMS is useful for clinical management of insulin therapy, at least in diabetic dogs.5 In the cases where a different recommendation was made, it was not determined which was the better – the one based on glucometer data or the one based on CGMS data.

Measurement of urine glucose concentration at home can aid in monitoring. First, urine glucose levels can be determined as needed to aid in assessment of glycemic control, especially when other data are conflicting. Consistently negative readings on urine glucose may indicate that insulin dosages are either adequate or excessive. A serial glucose curve will differentiate between adequate insulin therapy and use of excessive doses that could result in hypoglycemic shock. Uniformly high urine glucose readings coupled with unresolved clinical signs indicate that the insulin dose may be inappropriate.5 Negative urine glucose concentrations in the afternoon, followed by high urine glucose readings (4+) the following morning may be indicative of the Somogyi phenomenon (hypoglycemia-induced hyperglycemia); however, documentation of the Somogyi phenomenon requires serial blood glucose monitoring. Second, urine glucose concentrations can be determined regularly (at least weekly) to help in the assessment of ongoing control. Urine glucose should be measured once or twice weekly. Changes in urine glucose levels may alert the owner and clinician to loss of glycemic control and a need for reevaluation. If urine can not be collected, then, for cats, use of Glucotest™ (Purina) may help. This is a product that is sprinkled in a litter box and changes color proportionate to the urinary glucose concentration.

Recently, home monitoring of clinical signs alone has been advocated as an accurate method of diabetic assessment.7 In one study of 53 dogs, control was judged to be good or bad based on clinical signs, physical examination findings and body weight. Then, the clinical determination of good or poor control was compared with fasting blood glucose, serial blood glucose curve and serum fructosamine and GHb concentrations. Although all parameters of glucose control were significantly lower in dogs with good control, considerable overlap existed between the 2 groups for all. All blood glucose measurements, fructosamine and GHb were consistent with good glycemic control in 60% of dogs judged to have good clinical control or with poor control in only 39% of judged to have poor clinical control dogs. The initial fasting blood glucose was 100-300 mg/dl in 80% of dogs with good clinical control and in 21% of dogs with poor clinical control. The study’s authors concluded that history, physical examination and body weight are sufficient for initial assessment of glycemic control and a glucose curve may not be necessary in a dog with apparent good clinical control when the initial morning blood glucose is 100-300 mg/dl.7

Certainly, the importance of home monitoring of clinical signs cannot be over-emphasized. However, this author has some concerns with study methodology and conclusions and believes that glucose curves should be performed periodically in all diabetic patients (for aggressive animals or those who experience stress hyperglycemia in the hospital, the curves are most appropriately performed at home).

References available from author upon request.