Dakota Diabetes Coalition is proud to offer this column on diabetes and related concerns every other Friday.

Dr. Johnson is a family practice doctor in Grand Forks with a special interest in diabetes -- and a special knack for writing. As a member of the Dakota Diabetes Coalition, he has generously made himself available to answer questions through our listserv. If you have comments, or questions for Dr. Johnson to address in future columns, please contact gailhand@q.com

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Sugars 'all over the place?'
How to spot and manage Variabilty

How often do you see patients who say their blood glucose values are "all over the place"? There are several points to be considered in these patients, and a little troubleshooting can go a long way in reducing this variability, which likely reduces the risk of complications, and improves well being. Additionally, a patient's outlook toward their diabetes and sense of well-being can be positively influenced with a little success in solving some of these issues.

We can't really know what is going on with a patient unless we have data. There are 3 data sets we can consider when evaluating a patient with regard to glucose levels. 1) A1C, 2) self blood-glucose monitoring (SBGM), and 3) continuous blood glucose monitoring (CGMS). A1C is **not a good reflection of glucose variability.** This value is much more reflective of glucose average. For example, a patient may have a range of blood glucose values from 40 to 400, and another may have a range of 80-220, but their average, and thus A1C, may be very similar.

Self-blood glucose monitoring can give a provider and patient a lot of information regarding blood glucose variability. First, it's important to have a patient define what they feel is variability ("all over the place").

Sometimes, it just isn't the case.

A type 1 on insulin may show us values done 4 to 6 times daily that range from 60 to 230, but 75% of these values may be between 80-180. This would not be a lot of variability, but in their mind, they may think so, particularly if they are having bothersome lows. We may have a patient, type 2, on metformin, who only checks blood sugars twice a week, and ranges from 100 to 260. We really don't have enough information in this case to make a determination about variability. So, what should we be doing in these cases?

To start, collecting blood glucose levels over a period of a couple of weeks, 4 to 6 times daily can be very useful. These values should **include fasting, pre-meal, 2 hour post-meal, bedtime, and maybe some 3 A.M. values.** Different values can be collected on different days, and including some 'special occasion' or numbers from out of the ordinary routine (such as following unexpected exercise, or large meal) can be beneficial in making treatment decisions. Different patients will have different goals, but for most adults with diabetes these values are appropriate:

Fasting: 70-130
Two hours post-prandial <180
Bedtime and overnight 100-180

Patients need to understand factors that may affect their blood glucose values. Most patients understand what they eat will affect these numbers, but often **activity level** is not necessarily considered. **Illness** can be a cause of variability in blood glucose values as well.

Continuous glucose monitoring done by a clinician familiar with this technology can illuminate day-to-day changes in conditions very well. Typically, three days of continuous data is collected, with values charted as graphic data. This can give a lot of insight to patients, and help the clinician direct therapy.

For all patients with diabetes, variability can often be addressed by reviewing fundamental concepts such as carbohydrate counting and exercise guidelines and patterns. For type 2 patients on oral agents, adding basal insulin can be very helpful. For those already on basal insulin, adding mealtime rapid-acting insulin may go a long way in

reducing variability. Timing insulin with meals can reduce variability in blood glucose values.

<u>For type 1 or type 2 patients using multiple daily injections</u>

A good starting point to figure insulin-to-carbohydrate ratio:

Type 1 -- 1 unit per 15 grams

Type 2 -- 2 units per 15 grams

A good starting point to figuring a correction factor (sensitivity):

Type 1 -- use 1 unit to drop 50 points

Type 2 -- use 1 unit to drop 30 points

Taking exercise into account is almost always useful.

Here's a good rule of thumb to use with exercise: For every 30-minute period of exercise, subtract 15 grams of carbohydrate choice for a single dose of rapid-acting insulin.

An example

Suppose we had a type 2 patient who was taking 2 units of rapid-acting insulin for each 15 grams of carbohydrate intake. The meal to be considered has 60 grams of carbohydrate, so that would make the dose of rapid-acting insulin 8 units. But, this patient has either just completed, or will be undertaking 30 minutes of exercise within the next couple of hours; therefore, we'd subtract 15 grams of carbohydrate from the total to be used for insulin dose calculation. The person is still eating 60 grams of carbohydrate, but only dosing insulin for 45 grams-thus the insulin dose would be 3 units, not 4 units.

Finally, a balance between rapid-acting (bolus) and long-acting (basal) insulin should be targeted. Patients taking a preponderance of either will likely have more variability in their blood glucose values. For most patients an approximate 50/50 split between their total bolus insulin and basal insulin is usually associated with less variability, although there can certainly be individual differences. More active individuals may need less basal, and reviewing blood glucose monitoring values can be worthwhile in finding this balance.

Getting the data and acting on it with a few guidelines can reduce variability in blood glucose values for patients. This can help patients build confidence, and may decrease burnout or a sense of helplessness in managing their diabetes.

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