

Continuous Glucose Monitoring Holds Potential

BY MIRIAM E. TUCKER
Senior Writer

COLUMBUS, OHIO — Real-time continuous glucose monitoring is likely to become the standard of care for the treatment of type 1 diabetes within the next 5-10 years, but for now it's best to reserve the technology for selected patients, Dr. Irl B. Hirsch said at a meeting on diabetes sponsored by Ohio State University.

Real-time continuous glucose monitors (RT-CGMs) have been on the market only since 2006 and are not yet indicated to replace fingerstick glucose testing. Currently, the main benefits of RT-CGMs are their capability for detecting glucose trends throughout the day and night, and their ability to alert the patient when glucose levels become too high or too low.

The potential for decreasing glucose variability—both the danger of severe hypoglycemia and the damaging oxidative stress that accompanies postprandial glucose surges—is what makes the technology so promising for the future and also valuable for some patients even now in its very early stages, said Dr. Hirsch, professor of medicine and medical director of the diabetes care center at the University of Washington, Seattle.

Still, until the technology and experience with RT-CGMs improve—along with the insurance coverage—they are not for everyone, according to Dr. Hirsch. This was demonstrated in the STAR I (Successful Teens Achieving Readiness for Independence I) study, in which 138 adolescents and adults with poorly controlled type 1 diabetes (hemoglobin A_{1c} of 7.5% or greater) despite 6 months or more of

insulin pump therapy were randomized to one of two groups: One group wore the combined pump/RT-CGM device (the MiniMed Paradigm 722 system) and performed self-monitoring of blood glucose (SMBG) four or more times per day, and the other group performed SMBG while wearing the pump by itself.

At 13 weeks, mean HbA_{1c} levels had dropped significantly and to a nearly identical degree in both groups, from 8.4% to 7.8% in the controls and from 8.5% to 7.7% in the RT-CGM group. There were no further significant drops in either group, and by week 26, both groups had a mean HbA_{1c} of 7.8%, Dr. Hirsch first reported last summer at the American Diabetes Association's annual scientific sessions (FAMILY PRACTICE NEWS, Sept. 1, 2007, p. 15).

Although the findings might seem negative, further analysis revealed that compliance strongly predicted the results among the RT-CGM patients. With "compliance" defined as wearing the sensor 6 days per week (meaning it was possible to be more than 100% compliant) HbA_{1c} levels among the patients with 100% compliance or greater dropped from 8.6% at baseline to 7.7% at 26 weeks. Those with 80%-100% compliance dropped similarly (from 8.4% to 7.7%), as did those with 60%-80% compliance (from 8.2% to 7.5%).

All of those reductions were significant. However, when compliance dropped below 60%, mean HbA_{1c} actually rose slightly, but not significantly (from 9.5% to 9.6%).

"I think we have oversold this technology, which is really in its first generation,"

Dr. Hirsch commented at the OSU meeting. "Patients and providers have to know how to use the technology appropriately, including putting it on the right patient."

For example, it's unlikely that patients with very poor glucose control who are not committed to treatment goals and aren't already performing frequent fingerstick glucose testing will benefit from an RT-CGM.

"If the hemoglobin A_{1c} is high at baseline, the patient may not be using current tools adequately. My personal opinion is that RT-CGM is a better technology for the patient who is closer to target, in order to prevent hypoglycemia. Someone with an A_{1c} above 9%-10% probably doesn't need CGM," he said.

Based on his experience using both the Medtronic and the DexCom Inc. RT-CGM products, Dr. Hirsch offered the following clinical "pearls" for patients' use:

► **The more you look, the better you do.** Patients who wear the sensor but don't look at it often do no better than those who don't wear it at all. "No matter which sensor you're using, you have to look at it over and over to see the trend," he said.

► **Trend trumps "insulin on board."** This is controversial. Insulin pumps that automatically perform bolus calculations will instruct the patient not to take any more insulin if there is already a large amount "on board." However, if the glucose is rapidly rising for longer than 1 hour, Dr. Hirsch recommends that adult patients take at least a small bolus. "If the glucose is going up, you need insulin," he said. For children, however, pediatric endocrinologist Dr. William Tamborlane of Yale University, New Haven, Conn., rec-

ommends waiting at least 2 hours before overriding the bolus calculator.

► **For an upward trend, delay eating or at least reduce carbs.** This is especially true if the glucose is rising faster than 1 mg/dL per minute. And remember Pearl #2: For a correction dose with an upward trend before a meal, more insulin is needed.

► **For a downward trend, fingerstick glucose measurements are critical.** That's because of the lag time with the interstitial fluid that the RT-CGM is sampling. Relying solely on the RT-CGM reading is especially dangerous with significant insulin on board. If the glucose is dropping rapidly, you want to take less insulin or decrease the time between the insulin and the food. Consider a snack at the low end of the target range if the downward trend is at 1-2 mg/dL per minute, and at the high end of the target range if the trend is at or above 2 mg/dL per minute.

"With RT-CGM, we're starting to talk about the velocity of glucose changes. Velocity is a concept we've never talked about before," Dr. Hirsch noted.

► **We have much yet to learn from this new technology.** "What is the potential for use in the hospital? In pregnant patients? Insulin-requiring patients with type 2 diabetes? We're just at the beginning, but one thing is certain right now: If the technology allows some of our patients to live happier lives without hypoglycemia, there's something to be said for that, even if the reimbursers don't agree."

Dr. Hirsch said he has received grants and research support from Medtronic, but has no financial relationship with DexCom. ■

Moderate Exercise Improves Metabolic Syndrome in Adults

BY JOHN R. BELL
Associate Editor

Moderate-intensity exercise that was equivalent to walking about 12 miles over an average of 170 minutes per week significantly improved features of the metabolic syndrome even without dietary modification in a study of 171 overweight adults.

Johanna L. Johnson of Duke University, Durham, N.C., and colleagues analyzed 171 overweight or mildly obese participants (80 men and 91 women) previously enrolled in the Studies of a Targeted Risk Reduction Intervention Through Defined Exercise trial. They reported their findings in the American Journal of Cardiology.

Each person was randomly assigned to 6 months of continued inactivity or one of three 6-month exercise regimens: low amount/moderate intensity (calorically equivalent to walking 12 miles a week at 40%-55% peak oxygen consumption), low amount/vigorous intensity (equal to walking

12 miles a week at 65%-80% peak oxygen consumption), and high amount/vigorous intensity (equal to walking 20 miles a week at 65%-80% peak oxygen consumption). All participants were instructed to continue their usual diet (Am. J. Cardiol. 2007; 100[12]:1759-66).

To define metabolic syndrome, the investigators used the Edu-

cation Program Adult Treatment Panel III (ATP III) criteria, in which metabolic syndrome is indicated by the presence of at least three of the following risk factors: increased waist circumference (at least 102 cm in men and 88 cm in women), increased triglyceride level (at least 150 mg/dL), decreased HDL cholesterol level (less than 40 mg/dL in

men or 50 mg/dL in women), increased blood pressure (at least 130 mm Hg systolic or at least 85 mm Hg diastolic), and increased fasting glucose level (100 mg/dL or higher). The authors also devised a continuous z score of all five metabolic syndrome variables to more accurately reflect overall metabolic changes.

Participants were aged 40-65 years and were overweight or mildly obese (body mass index of 25-35 kg/m²) and had no history of diabetes, hypertension, or cardiovascular disease. At baseline, 40% (69 of 171 participants) met the ATP III criteria.

After 6 months, improvements were seen in many metabolic syndrome parameters among both exercise groups, compared with controls.

For example, mean waist circumference dropped by 1.1 cm among all patients in the low/moderate and low/vigorous groups and by 2.6 cm for the high/vigorous group, but rose by 0.6 cm among controls. Likewise, the z score for the control

group did not change over the 6 months, but it fell by 0.8 in the low/moderate group, 0.3 in the low/vigorous group, and 1.4 in the high/vigorous group.

A surprising finding, the authors noted, was that although a low amount of moderate-intensity exercise showed a significant improvement in both z score and total ATP III score at 6 months, a low amount of exercise with high intensity actually showed no significant improvement over the sedentary controls. They theorized that this may be because lower-intensity exercise relies more on fat oxidation, whereas higher-intensity exercise entails more carbohydrate oxidation.

"Our findings clearly indicate that a modest amount of moderate-intensity exercise is adequate for obtaining significant health benefits," Ms. Johnson and her colleagues wrote. "This is an exercise prescription likely to be perceived by the general public and clinicians alike as an obtainable goal." ■

