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Clinical Implications of CGM in Patients with Type 2

- Identify circumstances where patients with type 2 diabetes may benefit from continuous glucose monitoring (CGM).
- Describe how to interpret CGM data reports using ambulatory glucose profiles (AGP).
- Differentiate between “flash” CGM and “real time” CGM.

Guest Faculty Disclosure

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**Podcast Transcript**

I'm Bob Busker, managing editor of the program. We're here with Dr. Anders Carlson — he's Medical Director at the International Diabetes Center in Minneapolis, and Assistant Professor at the University of Minnesota Medical School. In his recent newsletter issue, Dr. Carlson reviewed the Current State of Continuous Glucose Monitoring Technology in Type 2 Diabetes. And we're here today to talk about some of the clinical implications of CGM in patients with type 2.

eDiabetes Review is jointly presented by the Johns Hopkins University School of Medicine and the Institute for Johns Hopkins Nursing. This program is supported by educational grants from Merck & Co. Inc, NovoNordisk, and Sanofi.

Learning objectives for this audio program include:

- Identify circumstances where patients with type 2 diabetes may benefit from continuous glucose monitoring (CGM).
- Describe how to interpret CGM data reports using ambulatory glucose profiles (AGP).
- Differentiate between “flash” CGM and “real time” CGM.

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Dr. Carlson, thank you for joining us today.

DR. ANDERS CARLSON: Thanks for the invitation. It's a pleasure to be with you today.

**MR. BUSKER: Continuous glucose monitoring. We know it's proved its value in managing type 1 diabetes. And the evidence you presented in your newsletter issue indicates it can be similarly beneficial for patients with type 2. To look at CGM in type 2 diabetes from a clinical perspective, let me ask you to start with a patient scenario.**

DR. CARLSON: A 48-year-old female with type 2 diabetes for seven years comes to your clinic for follow-up. She only checks her fingerstick blood glucose levels once or maybe a twice a day, generally fasting in the morning but sometimes later in the evening. You download her glucose meter data and see an average of 188 mg/dL over the last two weeks.

Her hemoglobinA1c generally falls in the 8% to 9% range, despite her being on maximum doses of metformin, glipizide, and once daily basal insulin glargine, which has been recently titrated up to 38 units at bedtime. She has some symptomatic hypoglycemia, but it's rare, maybe one or two episodes a month, and she usually can predict it because it happens after she is very active. She met with a diabetes educator and a dietitian in the past, but she tells you she knows what she should do and just struggles to do it on her own. Her BMI is 32 and she is motivated to start a weight loss program in the near future.

**MR. BUSKER: What treatment options would you recommend for a patient like this?**

DR. CARLSON: Our options are still the same in the sense that we stress education, nutrition counseling, and lifestyle modification as the pillars of diabetes management. In this case, the only data we have to go on are her A1c, blood glucose log, and occasional symptoms of hypoglycemia. That can be frustrating for both the patient and the clinician since there is not much data there, and that can translate into clinical inertia if you are concerned about increasing a medication dose that might result in hypoglycemia, for instance.

So, in this case, rather than adjusting her medication, you could get a retrospective CGM data collection to help decide on the next therapy and also to demonstrate to her what her glucoses are doing the rest of the day when she's not checking them.

**MR. BUSKER: Retrospective CGM — what is that exactly?**

DR. CARLSON: Retrospective, or what we sometimes call professional CGM, is a CGM that is owned by the clinic and then worn by the patient for just a few days or up to two weeks. In the Haak et al study reviewed in the newsletter, they used one of these devices together with retrospective glucose data on their subjects.

What it means to be retrospective is that patients are blinded to the data so they don't see their blood glucose in real time. The machine itself is recording all of that and the clinic can download it later. During the period that the patient is wearing the device, they keep a detailed log of their medication doses, their diet, their activity, and so on, so that when we sit down to look at the overall glucose pattern we can look for places that may have affected that and then use that to guide our therapy.

These are very visual, so the data that from the retrospective CGM is very objective. It is the continuous glucose readings for that patient's last several days to two weeks, and that can direct our next steps. For instance, we often use CGM patterns to titrate insulin doses or adjust other diabetes medications.

If someone is on basal insulin and they're having a lot of fasting hypoglycemia, we can adjust that dose downward, or if they're having postprandial hyperglycemia that might be a place where we titrate up prandial insulin.

For example, the patient in the case has nocturnal hypoglycemia many nights, more than she's reporting and more than she is having symptoms of, but she is also spiking to nearly 200 mg/dL after most lunch and dinner meals. We can use that to help guide our therapy.

**MR. BUSKER: Please step us through the process of using CGM data to change your management approach.**

DR. CARLSON: Once you download the data from the device into a report, you can turn it around to the patient and ask what pattern do you see here, what makes sense on these readings of your blood glucose levels for the last several days or two weeks. Does it agree with what you think or not, and why. It's a great visual tool.

It also empowers patients to see their own data and to use it and then also to see how their diet and activity and lifestyle can affect their glucose levels. In this case, with her having frequent nocturnal hypoglycemia, if you didn't have the CGM data and went purely by A1c and increased her basal insulin, that could have been potentially harmful and put her at risk for more nocturnal hypoglycemia.

In her case, with the elevated postprandial glucose levels, something like a GLP1 receptor agonist or an SGLT2 inhibitor might be a better therapeutic choice to target that postprandial glucose control. And it's quite personalized because we know that one of her concerns is losing weight, so using a medication that can promote weight loss and not contribute to weight gain would be beneficial.

**MR. BUSKER: Analyzing CGM data and sharing the findings with the patient can add a whole new dimension to caring for Type 2 patients. Question, though: how often can you perform a CGM analysis on any particular patient?**

DR. CARLSON: The studies I reviewed in the newsletter issue showed the optimal interval for CGM analyses has not been established in type 2 diabetes. For instance, in the Kesavadev et al study it was a one-time only reading, whereas in the Beck et al study it was a continuous tracing. However, the benefits of CGM use in type 2 diabetes have been demonstrated in those both on and not on intensive insulin therapy.

Most insurance plans will not reimburse CGM if it's done more frequently than once a month, so it's important that you check with that patient's insurance plan to see how often you can perform some of these CGM analyses. One of the benefits to it, however, is that the interpretation and the feedback given to the patient doesn't necessarily need to be face to face, so sometimes these are great tools to use in between clinic visits. For instance, if you're seeing the patients every three to four months, having them do a retrospective CGM once a month can help you maintain the momentum you've had in adjusting and titrating their therapy.

**MR. BUSKER: What do guidelines say about who might benefit the most from CGM?**

DR. CARLSON: The guidelines that exist, especially as mentioned in the Danne et al study reviewed in the newsletter, suggest that CGM could be beneficial for those on intensive insulin therapy or those at high risk for hypoglycemia. So in those instances I would probably perform it more frequently. And if the patient found that this was helpful and reacted to their data, we can set them up with a personal CGM device which will give them the glucose data in real time and they own the device and wear it continuously.

**MR. BUSKER: Which CGM devices are available for patients with type 2?**

DR. CARLSON: The real time CGMs available in the US are the Dexcom, Medtronic, and Eversense, and they give blood glucose readings about every five minutes and then send them to the patient where they can receive it either on a smartphone or on some other type of receiver. Those devices then can alert the patient to high blood glucose or low blood glucose, or the patients can set different preferences within it, so it can be helpful for them to have as a personal device.

The choice to use real time CGM versus professional CGM comes down to patient preference and clinician preference and what you hope to achieve with the CGM.

**MR. BUSKER:** Thank you for that case and discussion, doctor. And we'll return with Dr. Anders Carlson in just a moment.

**MR. BOB BUSKER**

This is Bob Busker, managing editor of *eDiabetes Review*. *eDiabetes Review* is a combination newsletter and podcast program delivered via email to subscribers. Newsletters are published every other month. Each issue reviews the current literature in areas of importance to clinicians treating patients with type 2 diabetes.

In the month following each newsletter, a case-based podcast discussion, like the one you're listening to now, is available to help translate that new clinical information into practice. These podcasts are also available as downloadable transcripts.

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Thank you.

**MR. BUSKER:** Welcome back to this *eDiabetes Review* podcast. We've been talking with Dr. Anders Carlson, from the International Diabetes Center in Minneapolis, about CGM — continuous glucose monitoring — in patients with type 2 diabetes. So to continue from a clinical perspective, please bring us another patient scenario.

DR. CARLSON: This is a 36-year-old male with recently diagnosed type 2 diabetes based on a screening A1c of 7.9% and a fasting glucose of 140 mg/dL. He's got a strong family history of diabetes and is overweight, with hypertension and dyslipidemia. He's met with the diabetes educator and started on metformin with lifestyle changes. However, he is extremely motivated to lose weight and try to minimize the number of medications he takes.

**MR. BUSKER:** How can CGM benefit a patient like this?

DR. CARLSON: Again, CGM can be very useful for pattern recognition and in his case, he wants to focus on diet and lifestyle, which, of course, are fundamental to managing diabetes. We opted to do a real time CGM tracing which would not be blinded to him, so that he could see the blood glucose readings in real time and also maintain a log of his diet and exercise and so on, so we could focus on particular patterns when we met after he completed the study.

For instance, there was one day where he exercised in the midafternoon and then had a smaller dinner than usual, and by bedtime his glucose was one of the lowest readings he had had in a while. On another instance, there was a weekend night where he indulged in a big meal with a dessert and had a big spike in glucose that lasted well into the night. Now knowing those two things would help him in the future make different or better decisions about his diet and activity and correspond both of those things to how they affect glucose and help him manage his diabetes in a way that he wouldn't necessarily be able to with fingerstick blood glucose monitoring.

**MR. BUSKER:** There's a lot of data being produced by CGM

DR. CARLSON: You're absolutely right, these devices generate a lot of data. Instead of one or two fingerstick readings a day you're getting possibly hundreds of readings in a day. Most CGMs are reporting into something called an ambulatory glucose profile or an AGP. AGPs are a way to display glucose data in a visual form.

**MR. BUSKER:** Visual — how so?

DR. CARLSON: Most of the time you will see an AGP with some basic glucose statistics at the top with the inscription of the time and different glucose ranges. In the middle there will be a plot with the time of day on the X axis and the glucose level for that time period on the Y axis. On the bottom, you'll have the daily CGM tracing so you can see individual days.

Now you can see an example of this at [AGPreport.org](http://AGPreport.org), where we have developed some tools about visualizing and using AGPs in clinical practice. They've been designed to be understandable and easy to interpret for both clinicians and patients, so we often use these as a straightforward visual description of their glucose patterns to show patients right there in the clinic.

**MR. BUSKER:** What are they key things you look for in analyzing an AGP in practice?

DR. CARLSON: When you look at an AGP it's important to note how many days of data they have and whether the data is adequate so you know that you're making a sound decision based on enough actual data. From there I ask patients to write

on the report when they eat, when they exercise, and so on so you can start to see the pattern emerge of their typical week or day.

And then I move on to looking at time and ranges. Particularly important is the time spent in a hypoglycemia glucose range. Many of our therapies have hypoglycemia as a risk and certainly one of our biggest goals in diabetes management is to minimize hypoglycemia. So that's where I usually start, and from there we look at hyperglycemia as well as variability.

Using those factors, you can hone in on different parts of the day that maybe need a little bit extra attention or where an adjustment in therapy might be indicated. And once I put those together, I like to send the whole report home with patients with our markings on it and so they have an actual visualization of their AGP and their glucose profile that they can use at home for comparison to past ones. Or we can pull them up in the electronic medical record when they come in for their next visit.

**MR. BUSKER: How difficult is it to learn how to read an AGP?**

DR. CARLSON: You can think of it as an EKG for diabetes.

They've been designed to be pretty intuitive even for patients to use on their own, so I think most clinicians will find they're fairly easy to understand right off the bat. There are a few metrics in the statistics part that may not be immediately obvious to the clinician. But with time I think more and more people will find those useful.

Our hope is that it becomes standardized and people can talk about it interchangeably. We do have a description on the website [AGPreport.org](http://AGPreport.org) that describes in some detail how to interpret these AGPs, but it does take some practice. I would encourage clinicians to talk to their diabetes educators or their local endocrinologists about reviewing with them how to read and interpret these AGPs.

**MR. BUSKER: Thank you for that explanation. We've got time for one more patient scenario.**

DR. CARLSON: This is a 62-year-old male with longstanding type 2 diabetes going back nearly 20 years. He has complications including mild retinopathy and gradually worsening neuropathy. His A1c is usually in the 8.5% to 10% range and he is very reluctant to take a basal insulin along with the metformin, sulfonylurea, and weekly GLP1 he takes.

He does have hypoglycemia, but it's quite rare and he says he's always able to self-treat it. He works with his hands, and as a mechanic he absolutely refuses to do finger stick blood glucose readings, so we've been limited in titrating his medications because of lack of glucose data. He does not like being reminded of diabetes and thinks it's already a heavy burden on him, and he doesn't want to do anything more than the daily and weekly shots he is doing.

**MR. BUSKER: What would you recommend doing to get this patient under better control?**

DR. CARLSON: I think typically the next step would be to add mealtime insulin, since he is already on three noninsulin therapies and not at A1c goal. But that's not factoring in his unique situation. Moreover, since he is not checking blood glucose levels and he is already at high risk of hypoglycemia, I would not want to give him more insulin without having more data, as that could be quite dangerous.

I think many of us would try to push him for more diabetes education, which I think is always a good idea. And maybe try to push him to check a few finger stick blood glucose levels a few times a day so we can try to see some semblance of a pattern. However, that might be difficult since that hasn't worked for him in the past.

And, of course, you could add another medication such as an SGLT2 inhibitor or switching him to a different insulin delivery device such as a patch pump, but in this case, you're doing those things somewhat blindly because we just don't have enough data.

**MR. BUSKER: As you've been pointing out throughout our discussion, making changes when you don't have enough data can be very dangerous. Tell us how CGM could be helpful here.**

DR. CARLSON: In this case something like a flash CGM. Currently in the US we have the Freestyle Libre as the only flash CGM, and that was reviewed in the newsletter in the Haak et al study. These devices are factory calibrated, so they do not require routine finger stick blood glucose checks, and they can be worn for ten days, so there is pretty minimal work to keep this device up and running.

It's worn on the back of the arm, which is rather discreet, and it's simply used by flashing a reader device over the sensor and that will give the patient their current blood glucose level. In this case the patient isn't checking any finger stick blood glucose levels, but in the Haak et al study it was noted that patients started to scan about seven times per day. So, going from zero to seven blood glucose readings in a day will help us guide therapy.

**MR. BUSKER: All right — seven scans a day. What does he do with those results?**

DR. CARLSON: This is where education is key, he needs to learn both how to use the data to prevent problems, but also how to use it to solve them. For instance, if he flashes the glucose monitor before a meal and let's say he has a blood glucose that's high, he may want to reduce the amount of carb in his meal or the portion size, or perhaps take a walk or something after that meal. Moreover, he can then use that information to think about how he got high in the first place and maybe adjust the meal before or snacking earlier in the day to avoid those highs in the future.

On the other hand, let's say he's starting to have some low blood glucose levels at work and he starts feeling a little shaky. In the past he would typically eat an entire bag of candy or a full candy bar to bring his glucose up and he wouldn't know how high he was spiking after that because he wasn't able to check. But now if he had a CGM on, he might want to just have a little carbohydrate, like 10 to 15gm, wait a little while, and then rescan his glucose and then only treat with further carbohydrate if he's still low. Again, this requires quite a bit of education, but now we have some data to go by and we're not just blindly guessing. With more education I think we can help him with the regimen that he is currently on.

**MR. BUSKER: Thank you for today's cases and discussion, Dr. Carlson. Let's wrap things up now by revisiting our learning objectives. To begin: circumstances where patients with type 2 diabetes can benefit from CGM.**

DR. CARLSON: As a clinician, I'm always looking for new and better tools to help my patients live better with their diabetes. And I think newer technologies like CGM are going to go revolutionize how we talk to patients about glucose patterns and how we start or stop medication therapies. I think it's helpful for unmasking patterns, especially hypoglycemia, in those on high-risk therapies for that. And I also think we're going to see patients starting to use the flash CGM as a method to track their glucose instead of fingerstick blood glucose levels.

Moreover, I think we might see patients with type 2 diabetes start to use real-time CGM because they want to see their data in the real time and adjust medication, lifestyle, diet, and so on in response to those actual real time blood glucose levels.

**MR. BUSKER: And our second learning objective: interpreting CGM data using the ambulatory glucose profile — or AGP.**

DR. CARLSON: The AGP gives very good practical information about a patient's glucose pattern. It provides the when, the why, and the how much the glucose changes during the day. It's so easy to visualize the patterns of hypoglycemia and hyperglycemia that readily emerge, and they're present so both the clinician and the patient can see them and react to those findings.

I think as it becomes more standardized across different devices and platforms, it will become even easier for people to understand and react to, almost like an EKG for diabetes. And as an aside, clinicians can bill for interpretation of continuous glucose monitoring data, which is something that we haven't been able to do in the past with fingerstick blood glucose checks.

**MR. BUSKER: And finally: differentiating between real time CGM and flash CGM.**

DR. CARLSON: Both real time and flash CGM can be used either professionally — in the sense that the clinic owns the device — or personally, where the patient owns the device. Flash monitoring is calibrated in the factory, so it does not require fingerstick blood glucose checks, which may be preferable to some patients. The flash system does not have any alarms for hypoglycemia or hyperglycemia, so the real time monitors may be preferred for patients who want or would benefit from alarms.

The real time systems also can connect with smartphones and in some cases allow other individuals like family or friends to visualize that patient's CGM data. It's up to the patient and their preferences as well as the clinician, to have a conversation about the pros and cons of each of them and which one would be best for that individual.

**MR. BUSKER: From the University of Minnesota Medical School and the International Diabetes Center in Minneapolis, Dr. Anders Carlson, thank you for participating in this eDiabetes Review Podcast.**

DR. CARLSON: Thank you. It's been my pleasure to be here with you today.

**MR. BUSKER: To receive CME credit for this activity, please take the post-test at [www.ediabetesreview.org](http://www.ediabetesreview.org)**

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