Diabetes Mellitus Masterclass
Chapter 3

WHAT'S YOUR GOAL?

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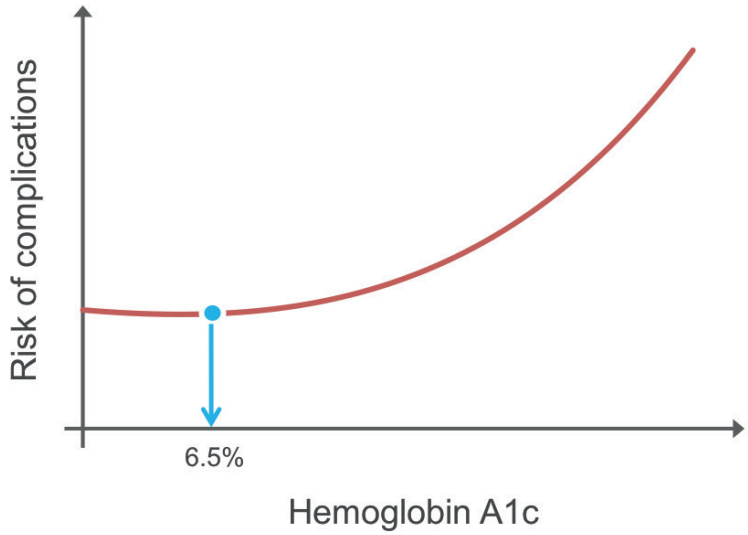
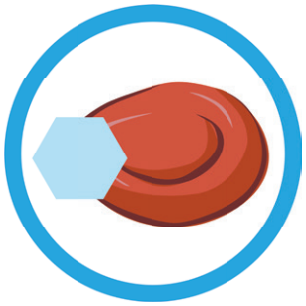
MARKERS OF GLYCEMIC CONTROL

Prior to 1990–2000, it was unclear whether intensive glucose control actually prevented complications of diabetes. Several in-depth studies have since confirmed that intensive treatment to lower blood sugars minimizes the risk of long-term complications.



Hemoglobin A1c



The **hemoglobin A1c** is the most commonly used tool for assessing glucose control.

Benefits

- Direct reflection of high glucose
- Reflects long-term glucose control (90–120 days, based on normal lifespan of a red blood cell)
- Does not require fasting and can be drawn at any time of day

Limitations

- Requires normal RBC lifespan (anything that causes a shorter or longer lifespan will lead to inaccurate values)
- Only reflects average blood sugars (doesn't provide details about glucose swings)
- May be inaccurate in patients with abnormal hemoglobin structure or in renal failure

If hemoglobin A1c is inaccurate, consider using an alternative marker.

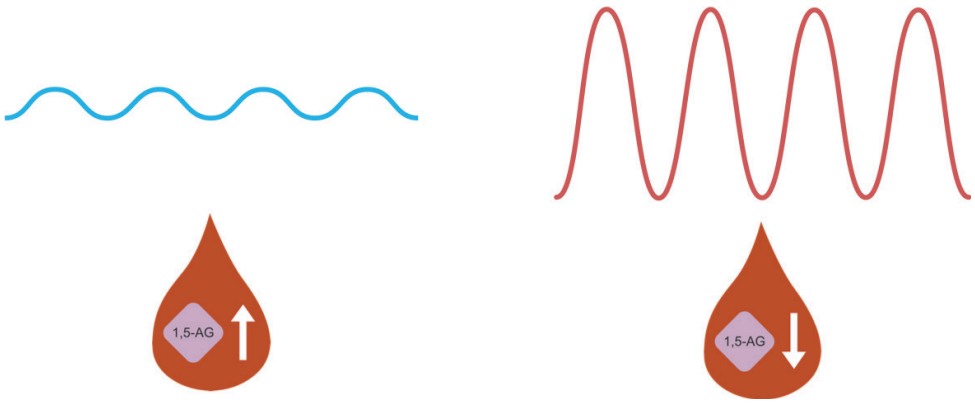
Alternative markers

Fructosamine or glycated albumin

- Proteins modified by glucose (similar to hemoglobin)
- Do not rely on normal RBC lifespan
- Require normal protein levels
- Reflect glucose control over the last 2–4 weeks

1,5 anhydroglucitrol (1,5-AG)

- Useful for measuring frequency of hyperglycemia and glucose variability
- Competes with glucose for reabsorption from the kidneys
- If glucose is low, 1,5-AG is reabsorbed, leading to high levels in the blood
- If glucose is high, glucose is reabsorbed and 1,5-AG is lost in the urine, leading to low levels in the blood
- Inaccurate with average blood sugars > 200 mg / dL or A1c of 8.5%, due to persistent glucosuria
- Best used in patients with A1c at goal, when you suspect wide variability in glucose levels



SETTING INDIVIDUAL GOALS

Current guidelines recommend patients with diabetes target a hemoglobin A1c of 6.5–7.0%, but advise individualizing these goals to best suit each patient. The ultimate goal is to minimize the risk of complications from hyperglycemia, while avoiding hypoglycemia. There are a number of factors to consider.

Psychosocial factors

Encourage tight control

- Motivated
- Good disease insight
- Excellent support systems

Less aggressive control

- Poor social support
- Struggling with self-care
- Difficult living situations
- Mental illness

Risk of hypoglycemia

Encourage tight control

- Young patients
- Clear symptoms with hypoglycemia
- No complications

Less aggressive control

- Hypoglycemia unawareness
- Elderly patients
- Multiple complications of diabetes
- Multiple comorbidities

Age, disease duration, and diabetes complications

Encourage tight control

- Young patients
- Newly diagnosed
- Long-term diabetes without complications

Less aggressive control

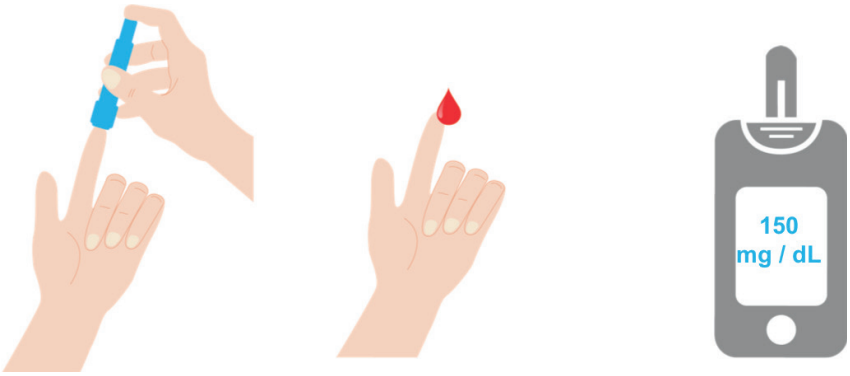
- Elderly patients
- Long-standing diabetes (less likely to prevent cardiovascular disease)
- Established diabetic complications

BLOOD GLUCOSE MONITORING

Self-monitoring of blood glucose (SMBG)

One of the primary tools we have for managing diabetes is self-monitoring of blood glucose levels, or SMBG.

This involves the patient using a small lancet to prick the tip of their finger to obtain a small drop of blood. This is applied to a strip, which has been inserted into their blood glucose meter. After a few seconds, the blood glucose value appears.



Benefits of SMBG

- Allows patients to evaluate their response to new therapies
- Provides information regarding effects of dietary changes
- Helps patients recognize symptoms of hypoglycemia and hyperglycemia
- Helps patients on basal insulin determine appropriate dose titration
- Helps patients on mealtime insulin with appropriate dosing at meals

SMBG can be difficult for patients to perform on a regular basis, especially if they are unsure how to use the data. Some tips for using SMBG to provide useful information for you and your patient.

- Check several times per day, only for the week prior to patient's clinic visit, using a glucose log.
- Use a three day glucose diary with blood sugar checks seven times daily, but just for three days.
- Consider continuous glucose monitoring for certain patients.

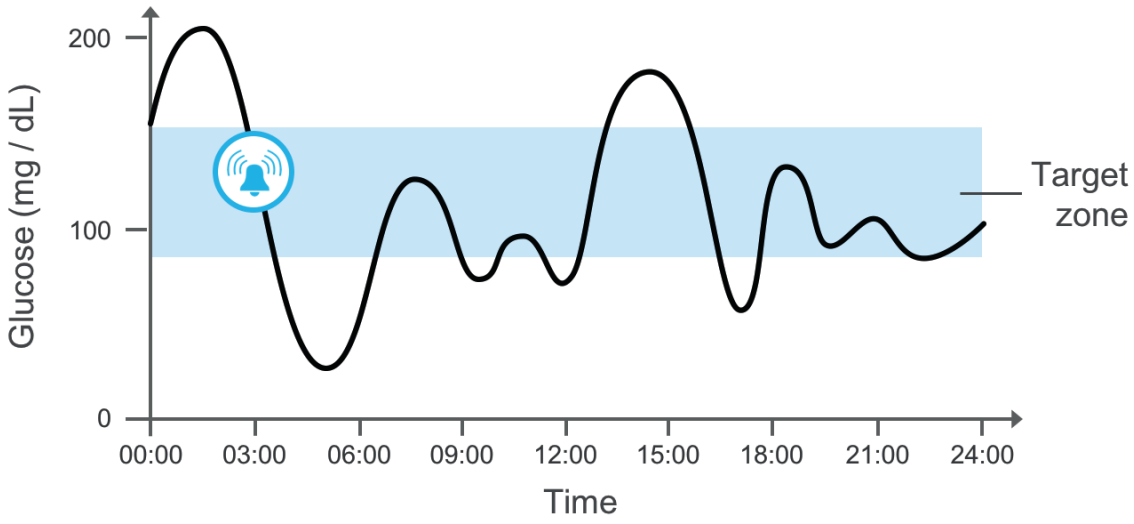
Continuous glucose monitoring (CGM)

Continuous glucose monitors involve inserting a small sensor under the skin. This sensor measures glucose levels in the interstitial fluid between cells and transmits the value to a receiver. The patient can then monitor their blood sugars in real time, as well as monitor trends over hours, days or weeks.

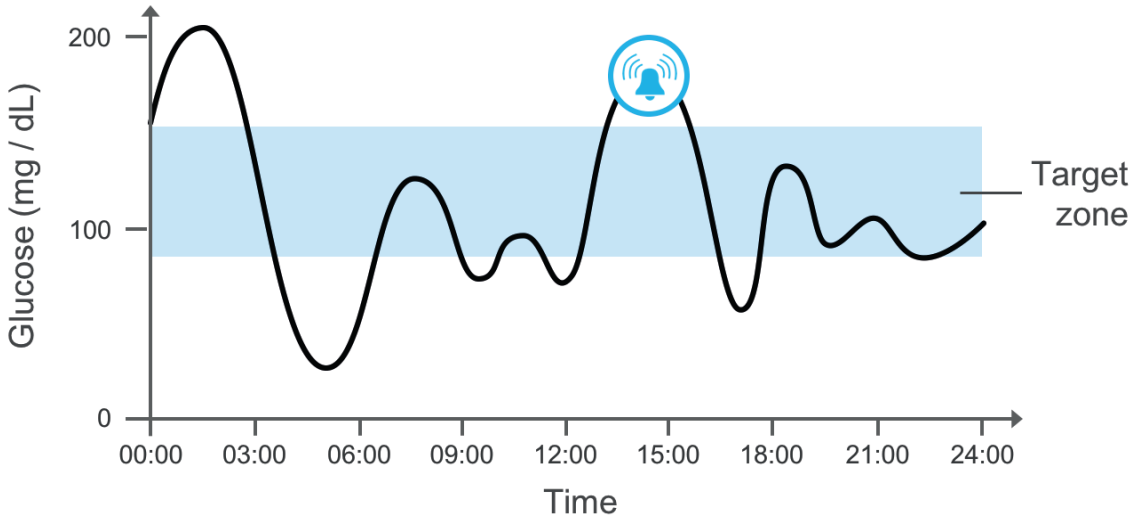
Benefits

- Alarms to alert patients to high blood sugars, low blood sugars or rapid changes in blood sugars
- Newer CGM devices allow for glucose monitoring without any fingersticks
- Can help patients with A1c < 7.0 % to maintain control with lower risk of hypoglycemia
- Can help patients with A1c above goal with insulin adjustments and improve control
- Can help prevent severe lows for patients with hypoglycemia unawareness

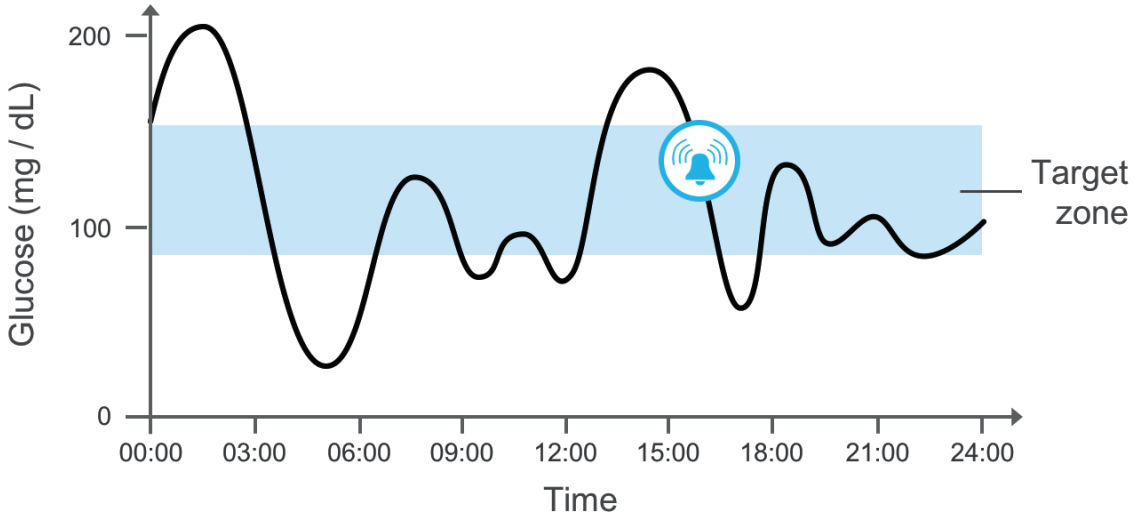
The example of a CGM tracing below shows where the patient would get an alarm, notifying them of a rapid drop in blood sugar. This would allow them to act before experiencing symptoms of hypoglycemia and avoid a severe low, or decrease the duration of the low.



In the tracing below, the patient would get a *high* alert, allowing them to treat their high blood glucose between meals and before developing symptoms of hyperglycemia.



Here, if the patient were checking their blood sugar in anticipation of a meal, they would see that blood sugar is above goal, but dropping. They may need to take less insulin than they normally would for that meal, to prevent overshooting their target blood sugar.



Another type of CGM is the intermittent, retrospective or **professional** CGM, typically performed through the physician's office. The patient wears a **blinded** CGM for **3–7 days** to help diagnose problems with blood sugars that may not be obvious with SMBG.

Consider this option in several situations

- Concern for nocturnal hypoglycemia, since the continuous monitor will allow you to review your patient's blood sugars overnight.
- Detecting what is known as the *dawn phenomena*—early morning hyperglycemia, which occurs due to an increase in stress hormones. This can help you understand the cause of morning hyperglycemia for your patients.
- Evaluating post-prandial hyperglycemia—which can be missed if it resolves quickly, but can still cause significant elevations in hemoglobin A1c.

LIFESTYLE INTERVENTIONS

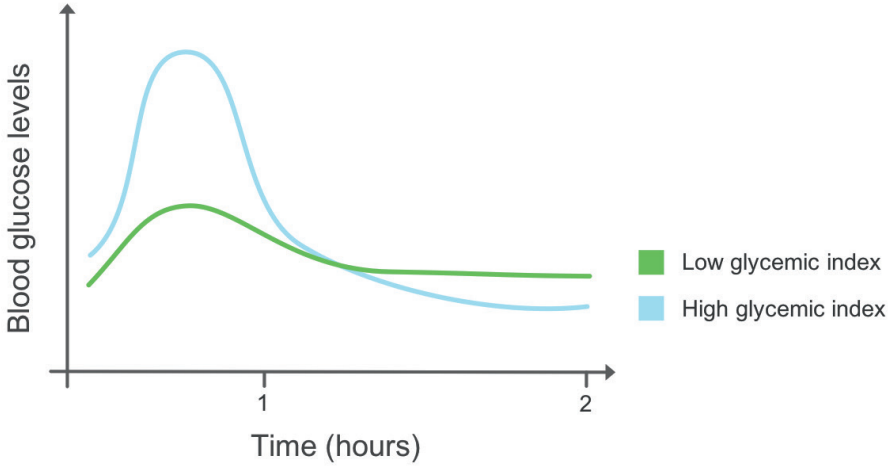
An important element of diabetes control, particularly for patients with type 2 diabetes, is lifestyle modification including dietary changes, increased physical activity, and weight loss. This should be started at time of diagnosis, whether or not other medications are needed at that time.

Nutrition recommendations

- There is no one-size-fits-all diabetes diet
- Emphasis should be on portion control
- Avoid sweetened beverages
- Address patient's personal and cultural preferences to maximize success with any diet
- Consider having patients meet with a registered dietician at time of diagnosis

Patients on mealtime insulin do need to be aware of the concept of **carbohydrate counting**—being able to calculate the amount of carbohydrates in a meal. Larger carbohydrate intake will require more insulin, while low carbohydrate meals will require less.

Other basic advice for your patients with type 2 diabetes includes choosing high fiber, **low glycemic index foods**. The glycemic index ranks foods on how quickly they raise blood sugars after eating. Foods with a high glycemic index, such as white rice, bagels, and pretzels, are rapidly digested and can cause larger fluctuations in blood sugars. Low glycemic index foods, such as oatmeal, lentils, and fruits, result in more stable blood sugars.



Exercise and weight loss recommendations

- 150 minutes of moderate intensity exercise (e.g., brisk walk) per week, or 75 minutes / week of vigorous activity
- For type 2 diabetes, strive for 5% weight loss from their weight at initial diagnosis
- If a patient is obese, a 7% weight loss is optimal

READING LIST

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