Blood Glucose after Transplant: Why It Matters

Celebrating a Second Chance at Life Survivorship Symposium
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Learning Objectives

To understand:

1. Normal blood glucose levels
2. Health consequences of having blood glucose levels that are too low or too high
3. How hematopoietic stem cell transplant (HCT) can affect blood glucose levels
4. Steps HCT recipients and their healthcare providers can take to detect and manage blood glucose levels
What is Glucose?

- Glucose is a type of sugar that is commonly found in food
- Our bodies make glucose from “carbohydrate”
- Carbohydrates, fat and protein are three major nutrients our bodies need

Why do our Bodies Need Glucose?

When we eat food that contains carbohydrate or sugar...

...the glucose level in our blood stream increases.

This is important as it provides energy to organs, such as our brain and muscles....

... we also store the glucose in our liver to use when we are fasting.
How do we Keep Glucose Levels Normal?

1. When we Eat
2. Blood Glucose Increases
3. Our Pancreas makes Insulin
4. Insulin Helps Our Muscles and Fat Take Up Glucose from the Blood
5. Blood Glucose Returns to Normal

If we do not make enough insulin or our body does not respond normally to insulin, blood glucose levels increase = “Diabetes”

Is High Glucose (Diabetes) Common?

Estimated Percent of People with Diabetes in 2021

Diabetes is More Common as We Get Older

Percent of People with Diabetes by Age Group

What Happens if Glucose Levels are Too High?

**Short Term:**
- ↑ Urination
- ↑ Thirst
- ↑ Appetite
- ↓ Weight
- Blurred Vision
- ↓ Energy
- Confusion / Coma

**Long Term:**
- Vision Loss
- Kidney Damage
- Numbness in Feet
- Problems with Circulation:
  - Heart
  - Brain
  - Legs
How Can High Glucose Affect Stem Cell Transplant Recipients?

- ↑ Time in Hospital
- ↑ Graft vs Host Disease
- ↑ Kidney Damage
- ↑ Infections
- ↓ Life Expectancy

Long Term Heart Disease Risk after HCT

**Individual Risk Factors**
- Age
- Sex
- Race/Ethnicity
- Family History

**Treatment Factors**
- Chemotherapy
- Radiation

**HCT**

**GVHD**
- Conditioning Treatment
- Inflammation Treatment

Accelerated Heart Disease
How Can HCT Increase Blood Glucose?

Conditioning Treatment before HCT

Intravenous (Parenteral) Nutrition

Immunosuppressive Treatment

Inflammation after HCT

Corticosteroids
Tacrolimus
Cyclosporin
Sirolimus

These factors can either reduce insulin production or decrease our body’s ability to respond to insulin, leading to high blood glucose levels.

Other Factors Increase the Risk of High Glucose

- Age
- First-degree relative (sister, brother, parent) with diabetes
- Race / Ethnicity

- Being overweight or obese by body mass index (BMI)*
- Previously having diabetes while pregnant
- Having or previously having polycystic ovarian syndrome
- Having HIV

- Physical inactivity

*American Diabetes Association 2023 Guidelines
*Calculating Body Mass Index (BMI)*

1. Measure height  
2. Measure weight

3a. Calculate body mass index: Weight (kg) / [Height (m²)]

3b. Use online calculator: nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm

*What the Body Mass Index (BMI) Numbers Mean*

- Underweight = Less than 18.5
- Normal weight = 18.5–24.9
- Overweight = 25–29.9
- Obesity = 30 or greater

Having a BMI in the overweight or obese range, increases our risk of certain conditions such as diabetes.
*Very Important* Caveats

1. The BMI ranges are different for people from Asian-Pacific regions:
   - Underweight < 18.5
   - Normal 18.5–22.9
   - Overweight 23–24.9
   - Obese ≥25

2. Many people with normal BMI may have high glucose

3. Waist circumference measurements may be a better indicator, but are not frequently done in clinical practice

How Can We Tell if We Have High Glucose?

- Symptoms of High Glucose
- Blood Tests with High Blood Glucose
What are Normal and High Blood Glucose Levels?

- Fasting Glucose (at least 8 hours):

<table>
<thead>
<tr>
<th>Normal</th>
<th>Borderline (Pre-diabetes)</th>
<th>High Glucose (Diabetes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100mg/dL Or</td>
<td>100-125mg/dL Or</td>
<td>≥126 mg/dL Or</td>
</tr>
<tr>
<td>&lt;5.6mmol/L</td>
<td>5.6-6.9mmol/L</td>
<td>7.0 mmol/L</td>
</tr>
</tbody>
</table>

How Else Can We Diagnose High Blood Glucose?

1. Two Hour Glucose Tolerance Test

<table>
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<tr>
<th>Normal</th>
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<th>High Glucose (Diabetes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;140mg/dL Or</td>
<td>140-199mg/dL Or</td>
<td>≥200mg/dL Or</td>
</tr>
<tr>
<td>7.8 mmol/L</td>
<td>7.8-11.0mmol/L</td>
<td>≥11.1mmol/L</td>
</tr>
</tbody>
</table>

2. Hemoglobin A1c (HbA1c)**

<table>
<thead>
<tr>
<th>Normal</th>
<th>Borderline (Pre-diabetes)</th>
<th>High Glucose (Diabetes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5.7% Or</td>
<td>5.7–6.4% Or</td>
<td>≥6.5% Or</td>
</tr>
<tr>
<td>&lt;39mmol/L</td>
<td>39–47 mmol/mol</td>
<td>≥48 mmol/mol</td>
</tr>
</tbody>
</table>

3. Symptoms of high glucose and random glucose ≥200mg/dL (11.1mmol/L)
**A Note About Hemoglobin A1c (HbA1c) Test**

1. Red blood cells from bone marrow contain hemoglobin
2. Hemoglobin carries oxygen
3. Glucose tags onto hemoglobin

What Happens if Glucose Levels Are Too Low?

**Symptoms:**
- Hungry
- Sweating or pale, cold and clammy
- Anxious or irritable
- Heart racing
- Weakness / Tingling
- Confusion / Seizures / Coma

**How to Know if These Symptoms are from Low Glucose**
- Check glucose with symptoms
- <70mg/dL (<4mmol/L)
How Can HCT Lead to Low Blood Glucose?

- Reducing or stopping corticosteroids leads to low cortisol levels
- Continuing blood glucose-lowering medications when corticosteroids or other HCT related medications are reduced
- Loss of appetite or fasting while taking glucose lowering medications
- Infections can sometimes lead to low blood glucose

Treating High Blood Glucose

- Nutrition:
  - Avoid concentrated sweets / sugars
  - Balance food intake
- Physical Activity:
  - 30 minutes a day, 5 days a week
Glucose and Cancer

- There are many medications available to treat high blood glucose
- It is important that the doctor who is treating your blood glucose knows that you had a stem cell transplant, and all of the medications that you are taking
- Tell the doctor helping you to take care of your blood glucose about all of your symptoms
- Ideally, your oncology doctor and diabetes doctors should be able to communicate with each other easily
Diabetes Medication and Side Effects

• Every medication potentially has side effects

• There are a growing number of diabetes medications, but many of these medications were not studied in people who previously had a stem cell transplant

• Sometimes we treat people with insulin after transplant as it can quickly lower blood glucose
  • Doses can be adjusted easily
  • It does not typically cause side effects other than lowering blood glucose

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A Note About Insulin

Insulin can come as...
Pens

Vials and syringes..

Or Insulin pumps
Another Note about Insulin

• Insulin makes your blood glucose go down with few other side effects, so can work very well

• However, there are different types of insulin, so you should ask your doctor how your insulin works

• Insulin can make your blood glucose go too low, which can be dangerous

Monitoring Your Blood Glucose

Fingerstick monitoring

Fingerstick free: Continuous glucose monitors
Finally, Supplements and Herbs to Treat Blood Glucose

- Many of our current prescribed medications originally came from herbs, animals, flowers, or other natural sources
  - Metformin came from French lilac
  - Other diabetes medications were discovered in the saliva of a reptile!
  - Cyclosporin came from a fungus!!
  - Tacrolimus from a bacteria!!
- However, currently FDA approved medications are regulated regarding consistency, dose, and quality, while herbal medications and supplements are not
- We have a lot to learn about medicines, but talk with your doctor regarding the safety of any herbs (including herbal teas), or supplements you are taking or considering taking

In Conclusion

- High blood glucose can cause short-term and long-term issues after transplant
- Know the symptoms of low and high blood glucose
- Ask about the right treatment for you to reduce your risk of short- and long-term complications related to high blood glucose
- Thank you!
QUESTIONS?

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LET US KNOW HOW WE CAN HELP YOU

Visit our website: bmtinfonet.org
Email us: help@bmtinfonet.org
Give us call: 888-597-7674