

James L. Holly, M.D.

Progression to Diabetes: Prediabetes and Insulin Resistance

By James L. Holly, MD

Your Life Your Health

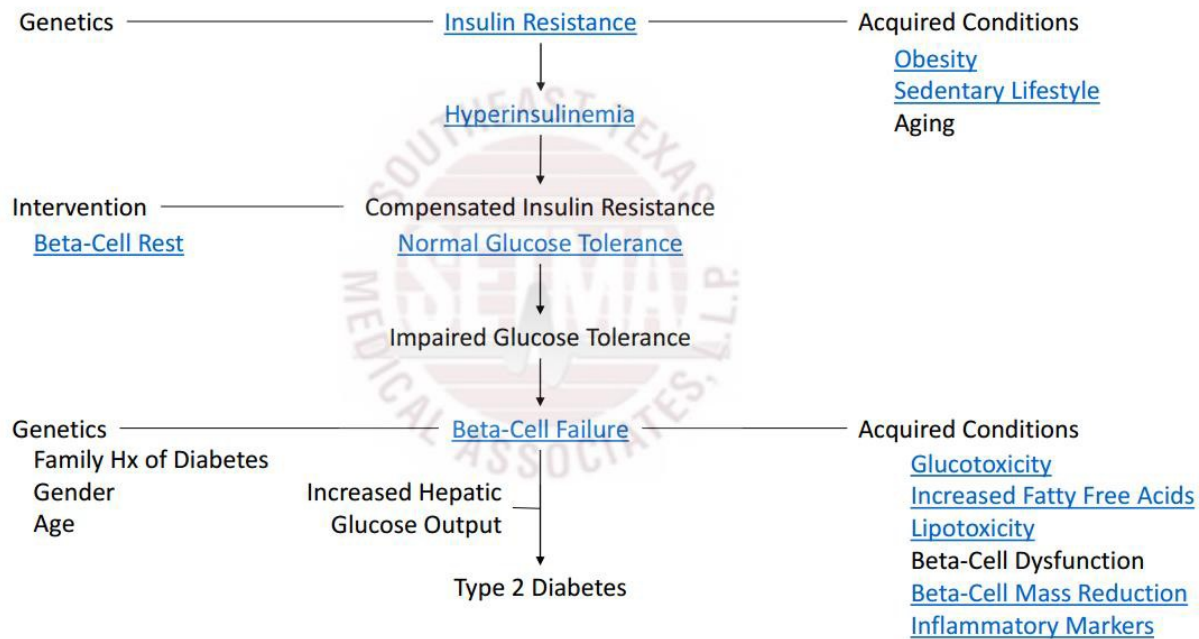
The Examiner

March 9, 2017

In our study published last week, we examined that it is sometime difficult to establish the diagnosis of diabetes. We studied a patient who it was first thought had diabetes and subsequently found to have “prediabetes.” That was good news for him but that case gives us the opportunity to look at whether or not it is possible to delay or avoid the progression of insulin resistance and/or glucose intolerance to full blown diabetes.

The following shows the progression of “patients at risk” of developing diabetes to patients who are insulin resistant to patients who have glucose intolerance to patients who have diabetes.

Progression to Type 2 Diabetes



“Insulin resistance” is a condition where the liver and muscle cells do not respond to insulin as they ought to. Normally, the liver takes nutrients ingested in meals and transforms them into simple sugars

use by the cells of the body. When a meal is ingested, the insulin produced by the pancreas tells the liver to stop producing simple sugar. When a patient has insulin resistance, the liver does not stop producing sugar and the blood sugar levels rise. Also, when insulin is released by the pancreas, muscle cells are signaled to accept sugar into the cells for energy production. When a patient has insulin resistance, the muscle cells ignore the insulin and do not allow sugar into the cells, also increasing the amount of sugar in the circulating blood. Insulin also stimulates fat cells to take up and to store sugar circulating in the blood.

As is seen in our diagram above, several conditions contribute to the development of insulin resistance; they are:

1. Genetics – some people inherit from their parents a tendency toward insulin resistance which can lead to diabetes. This is why it is important to document in a patient's chart. In the ICD-10 diagnostic coding system there are 47 diagnosis associated with a family history of diabetes. They are specific to the type of diabetes and the relationship to the patient of the relative with a diagnosis of diabetes. The relationships which are important are parents, grandparents and siblings (brothers or sisters). This risk factor is different from the other 'acquired conditions' as you cannot change your genetic links.

2. Acquired Conditions

There are three acquired conditions which contribute to insulin resistance. As seen on the diagram, they are age, obesity and sedentary life style. In addition, sleep difficulties can contribute to insulin resistance indirectly through promoting obesity and directly.

Excess Weight

Some experts believe obesity, especially excess fat around the waist, is a primary cause of insulin resistance. Scientists used to think that fat tissue functioned solely as energy storage. However, studies have shown that belly fat produces hormones and other substances that can cause serious health problems such as insulin resistance, high blood pressure, imbalanced cholesterol, and cardiovascular disease (CVD).

Belly fat plays a part in developing chronic, or long-lasting, inflammation in the body. Chronic inflammation can damage the body over time, without any signs or symptoms. Scientists have found that complex interactions in fat tissue draw immune cells to the area and trigger low-level chronic inflammation. This inflammation can contribute to the development of insulin resistance, type 2 diabetes, and CVD. Studies show that losing the weight can reduce insulin resistance and prevent or delay type 2 diabetes.

Physical Inactivity

Many studies have shown that physical inactivity is associated with insulin resistance, often leading to type 2 diabetes. In the body, more glucose is used by muscle than other tissues. Normally, active muscles burn their stored glucose for energy and refill their reserves with glucose taken from the bloodstream, keeping blood glucose levels in balance.

Studies show that after exercising, muscles become more sensitive to insulin, reversing insulin resistance and lowering blood glucose levels. Exercise also helps muscles absorb more glucose without the need for insulin. The more muscle a body has, the more glucose it can burn to control blood glucose levels.

Other Causes

Other causes of insulin resistance may include ethnicity; certain diseases; hormones; steroid use; some medications; older age; sleep problems, especially sleep apnea; and cigarette smoking.

Does sleep matter?

Studies show that untreated sleep problems, especially sleep apnea, can increase the risk of obesity, insulin resistance, and type 2 diabetes. Night shift workers may also be at increased risk for these problems. Sleep apnea is a common disorder in which a person's breathing is interrupted during sleep. People may often move out of deep sleep and into light sleep when their breathing pauses or becomes shallow. This results in poor sleep quality that causes problem sleepiness, or excessive tiredness, during the day.

How does insulin resistance relate to type 2 diabetes and prediabetes?

Insulin resistance increases the risk of developing type 2 diabetes and prediabetes. Prediabetes usually occurs in people who already have insulin resistance. Although insulin resistance alone does not cause type 2 diabetes, it often sets the stage for the disease by placing a high demand on the insulin-producing beta cells. In prediabetes, the beta cells can no longer produce enough insulin to overcome insulin resistance, causing blood glucose levels to rise above the normal range.

Once a person has prediabetes, continued loss of beta cell function usually leads to type 2 diabetes. People with type 2 diabetes have high blood glucose. Over time, high blood glucose damages nerves and blood vessels, leading to complications such as heart disease, stroke, blindness, kidney failure, and lower-limb amputations.

Most people with prediabetes develop type 2 diabetes within 10 years, unless they change their lifestyle. Lifestyle changes include losing 5 to 7 percent of their body weight—10 to 14 pounds for people who weigh 200 pounds—by making changes in their diet and level of physical activity.

What are the symptoms of insulin resistance and prediabetes?

Insulin resistance and prediabetes usually have no symptoms. People may have one or both conditions for several years without knowing they have them. Even without symptoms, health care providers can identify people at high risk by their physical characteristics, also known as risk factors. People with a severe form of insulin resistance may have dark patches of skin, usually on the back of the neck. Sometimes people have a dark ring around their neck. Dark patches may also appear on elbows, knees, knuckles, and armpits. This condition is called acanthosis nigricans.

Who should be tested for prediabetes?

The American Diabetes Association (ADA) recommends that testing to detect prediabetes be considered in adults who are overweight or obese and have one or more additional risk factors for diabetes. However, not everyone who is overweight will get type 2 diabetes. People without these risk factors should begin testing at age 45.

Risk factors for prediabetes—in addition to being overweight or obese or being age 45 or older—include the following:

- being physically inactive
- having a parent or sibling with diabetes
- having a family background that is African American, Alaska Native, American Indian, Asian American, Hispanic/Latino, or Pacific Islander American
- giving birth to a baby weighing more than 9 pounds
- being diagnosed with gestational diabetes—diabetes that develops only during pregnancy
- having high blood pressure—140/90 mmHg or above—or being treated for high blood pressure
- HDL cholesterol level below 35 mg/dL or a triglyceride level above 250 mg/dL
- having polycystic ovary syndrome (PCOS)
- having prediabetes, impaired fasting glucose (IFG), or impaired glucose tolerance (IGT) on an earlier testing
- having other conditions associated with insulin resistance, such as obesity or acanthosis nigricans
- having cardiovascular heart disease (CVD)

If test results are normal, testing should be repeated at least every 3 years. Testing is important for early diagnosis. Catching prediabetes early gives people time to change their lifestyle and prevent type 2 diabetes and CVD. Health care providers may recommend more frequent testing depending on initial results and risk status.

In addition to weight, the location of excess fat on the body can be important. A waist measurement of 40 inches or more for men and 35 inches or more for women is linked to insulin resistance and increases a person's risk for type 2 diabetes. This is true even if a person's BMI falls within the normal range.

How to Measure the Waist

To measure the waist, a person should

- place a tape measure around the bare abdomen just above the hip bone
- make sure the tape is snug but isn't digging into the skin and is parallel to the floor
- relax, exhale, and measure