DIABETES MELLITUS
NEW TREATMENT FOR AN OLD DISEASE

DIABETES MELLITUS – WHAT IS IT?

Diabetes is a disease caused by the inability of the body's cells to absorb sugar (glucose). Insulin is a hormone made by the pancreas and released into the blood that is required for cells to absorb sugar. Diabetes mellitus is caused by either a decrease in the production and release of insulin by the pancreas or by the loss of the cell's ability to respond to insulin. In either case, all cells in the body are deprived of sugar, which then accumulates in the blood. Diabetics suffer fewer consequences the closer they can keep their blood sugar within normal range.

Diabetes mellitus appears in two major forms: Type 1 and Type 2. Type 1 diabetes occurs in approximately 10% of cases. It was previously called juvenile onset diabetes because it usually affects younger patients. It is characterized by insulin deficiency secondary to beta cell destruction in the pancreas. Survival requires multiple daily insulin shots to maintain normal blood sugar levels. The amount and timing of the injections depends on diet, activity level, and general health. Frequent blood sugar readings must be carefully monitored and the amount of insulin given varies to provide optimal control.

Type 2 occurs in approximately 90% of the cases. It usually affects older patients who are often obese. There is a dangerous new trend in which more children and adolescents are being diagnosed with type 2 diabetes due to obesity and sedentary lifestyles. Type 2 is characterized initially by increased levels of insulin and then followed by diminished and abnormal release of insulin, as well as marked resistance of cells to insulin's effects. Initially, type 2 diabetes can be managed by weight reduction and oral medications.

DIABETES MELLITUS – HOW DO I KNOW IF I HAVE IT?

Type 1 diabetes is usually first seen in young patients with complaints of increased thirst and appetite and the need to urinate. Weight loss, fatigue and infection often accompany this initial presentation, and patients can be very ill. Patients with Type 2 diabetes usually present over the age of 40 with gradual complaints of increased thirst and need to urinate, which may occur for weeks or months before the diagnosis is made. Weight loss, fatigue, blurred vision, and numbness or burning in the hands and feet are common complaints. Because an infection makes both types of diabetes worse, diabetes is often diagnosed in conjunction with treatment for an acute infection. Type 2 diabetes is an insidious disease. One may have the disease for many years before diagnosis.

A diagnosis of type 2 diabetes mellitus is made if the blood sugar measurement in the morning before eating (fasting blood sugar) is 126 mg/dl or greater on two separate, consecutive occasions. It can also be diagnosed if a hemoglobin A1C is greater than 6.5%. A positive glucose tolerance test would further support this diagnosis, although it is

usually not necessary. "Prediabetes," or impaired glucose tolerance/insulin resistance, is diagnosed if the fasting blood sugar is consistently between 100 mg/dl and 125 mg/dl, or if a hemoglobin A1C is consistently between 5.75% and 6.4%. If untreated these individuals may suffer significant atherosclerotic vascular damage before progressing to diabetes. Treatment is the same as for diabetics, which includes diet, exercise, and in some cases, medication.

DIABETES – WHY DID I GET IT?

A person may inherit a predisposition for diabetes. However, other unknown factors must also exist for diabetes to develop. These factors may include exposure to viruses or chemicals, alteration of the immune system where cells that make insulin are attacked, or the action of insulin is blocked at the cellular level. If one parent has type 1 diabetes, the risk of their offspring acquiring type 1 diabetes is 2 to 5 %. If one sibling has type 1 diabetes, the risk of a second sibling acquiring type 1 diabetes is 5 to 10 %. If there is a family history of diabetes, and a person is obese and living a sedentary lifestyle, the risk of developing type 2 diabetes greatly increases.

DIABETES MELLITUS – HOW CAN IT HURT ME?

Acute complications of diabetes occur when the blood sugar becomes very high. This is often caused by infection, illness, excessive consumption of food or sweets, or failure to take insulin or oral medications. Type 2 diabetics are unable to transport sugar across their cell membranes for energy. Their cells are starving in spite of high blood sugar concentrations. Thus, cells rely on another energy source: fats. As cells increasingly rely on fat as their source of fuel, they produce ketones that make the blood acidic. As blood sugar becomes elevated, dehydration occurs secondary to excessive urination, which consequently depletes sodium, potassium, and phosphorus levels in the blood. This condition may result in shock and death. Treatment involves careful administration of insulin, fluid, sodium, potassium, and phosphorus replacement, as well as the treatment of any underlying illness.

Chronic complications of diabetes are preventable but depend on keeping blood sugar as close to normal as possible. Chronic complications of diabetes include the following:

- **Accelerated atherosclerosis**: Cholesterol plaques form and block arteries to the heart, brain, kidneys, and legs. This causes a 2-3 times increase in the incidence of heart attacks and cerebrovascular accidents. It also causes a 12 times increase in the loss of circulation to lower extremities compared to those who do not have diabetes. *A diabetic has the same risk of having a heart attack as a non-diabetic who has already had a heart attack!*
- **Retinopathy:** Small arteries in the back of the eyes become injured and, if left untreated, may lead to loss of vision or blindness.
- **Nephropathy:** Destruction of the small arteries in the kidney causes kidney failure in 30 to 40 % of type 1 diabetics and over 10 % of type 2 diabetics. A group of

medications called ACE inhibitors or angiotensin receptor blockers can slow this process.

- **Hypertension:** High blood pressure in diabetics is often caused by diabetic nephropathy and is made worse by obesity. If not treated, it *dramatically increases* the chances of developing a heart attack, stroke, blindness, or kidney failure.
- **Neuropathy:** Damage to the small nerves in the body causes a variety of problems. Depending on which nerves are involved, symptoms may include the following: numbness or burning of the feet, impotence, dizziness on standing, pain, urinary incontinence and diarrhea.
- **Infections:** Diabetes impairs the immune system and makes you more susceptible to bacterial and fungal infections.
- **Diabetic foot:** A combination of decreased blood flow to the foot, decreased sensation in the foot, and increased susceptibility to infection leads to this common complication of diabetes. Unrecognized injuries may become severely infected and lead to the amputation of a toe, foot, or sometimes a leg.

DIABETES MELLITUS – WHAT CAN I DO ABOUT IT?

The most important things you can do to prevent acute or chronic complications of diabetes include the following:

1. Accept that you have diabetes and learn all you can about it. Good sources of information about diabetes include your doctor or nurse practitioner, the American Diabetes Association (800-342-2383) or www.diabetes.org, diabetic teaching programs offered by your physician or community, and the library or bookstore.

2. Obtain a glucometer, a glucose measuring device, and measure your blood sugar at least once a day. Medicare covers the cost of diabetic testing supplies with a prescription.

3. Keep a record of your hemoglobin A1C. This is a blood test that your doctor will check periodically. It measures what percentage of hemoglobin, a protein in red blood cells that carries oxygen, is coated with glucose (glycated). The A1C test is a reflection of your average blood sugar level during the past two-three months. It should be under **6.5 %**.

4. Keep a record of your daily blood sugar readings, meals and snacks, diabetic medications (oral, inhaled, or injection), activity, weight, blood pressure, and your general health. Always bring any recorded information with you to review with your doctor, nurse practitioner, or diabetic teaching specialist.

5. Optimal control: Maintain your fasting blood sugar (no caloric intake for eight hours) between 90 and 130 mg/dl; your two hour postprandial (after meals) blood sugar under 180 mg/dl; bedtime blood sugar under 140 mg/dl; and your early morning (2:00 to 4:00 AM) blood sugar over 100 mg/dl. Accepting less tight controls is often necessary because of the risk of developing hypoglycemia.

6. Hypoglycemia means low blood sugar. It is a complication of treatment that may occur with the use of insulin as well as oral blood sugar lowering medications. Some of its symptoms include feeling anxious, sweating, shaking, hunger, confusion, dizziness, drowsiness, abnormal behavior, blurred vision, slurred speech, and ultimately seizures and unconsciousness. It is important to recognize these symptoms early and consume sugar-rich candy, glucose tablets, or juice immediately. Always follow with a snack or meal to sustain the blood sugar. Wear a medic alert bracelet identifying you as a diabetic.

7. If you are diagnosed with type 2 diabetes and are overweight, you may be able to reduce or eliminate your need for diabetic medications by weight loss. Avoid fat, sugar, salt, and excessive amounts of processed or refined carbohydrates and starches. Consult an experienced dietitian trained in diabetic education.

8. Daily exercise lowers blood sugar and diabetic medication requirements. Thirty minutes of daily exercise is good for your cardiovascular system, lowers cholesterol, and helps you lose weight. Be sure to discuss cardiovascular risk factors with your doctor before beginning a vigorous exercise program.

9. As a diabetic you need "sick day guidelines." If you become sick, your blood sugar, appetite, and need for diabetic medications may become unpredictable. It is very important to drink plenty of fluids and measure blood sugar frequently. If you have type 1 diabetes you will also need to test for the presence of urinary ketones. Test your blood sugar often and adjust your medication accordingly.

10. Maintain your blood pressure under 130/80.

11. Have an annual eye examination by an ophthalmologist.

12. Check your feet every day. Look for cuts, red spots, blisters, or swelling. If you are unable to see the bottom of your feet, use a mirror, or ask for assistance. See your doctor if you get a foot injury. Wash and carefully dry your feet daily, especially between the toes and apply lotion over the tops and bottoms of your feet. Trim toenails straight across and file edges with an emery board or nail file. If you are not able to trim your toenails, schedule an appointment with a podiatrist. Medicare covers an annual podiatry visit, and more frequent visits if necessary. Avoid nail salon pedicures and never cut the cuticles. Wear comfortable, well fitting shoes and cotton socks. Avoid activities that can injure the feet: walking barefoot, using a heating pad or bottle, and getting into the bathtub before testing the temperature.

13. Obtain urine for microalbumin test annually to detect early kidney damage.

14. Take medication called angiotensin converting enzyme inhibitors (ACEs) or angiotensin receptor blockers (ARBs). Both medications dramatically slow or prevent the development of diabetic kidney disease and are recommended for all diabetic and

hypertensive patients. Common names for ACEs include Vasotec, Privivil, Zestril, Altace, and Lotensin. Common names for ARBs include Atacand, Avapro, Cozaar, Diovan and Micardis.

15. The American Diabetic Association recommends daily aspirin for diabetics unless contraindicated. Discuss the use of aspirin with your doctor or nurse practitioner.

16. Cholesterol goals: Total cholesterol less than **200** milligrams per deciliter (mg/dL), LDL less than **70** mg/dL, HDL greater than **40** mg/dL **in men** and **50** mg/dL **in women,** and triglycerides less than **150** mg/dL.

MEDICATIONS

There are oral and injectable medications for diabetes, as well as inhaled and injectable insulin. Some of these medications include:

1. ORAL MEDICATIONS by CLASS:

a. **Sulfonylureas** increase the release of insulin from the pancreas and improve the cell's response to insulin. Common generic/brand names include the following: Diabeta, Glynase or Micronase (glyburide), Glucotrol (glipizide), and Amaryl (glimepiride).

b. **Biguanides** work by preventing the production of glucose in the liver, increasing the cell's sensitivity to insulin and thereby increasing the uptake of sugar. Glucophage (metformin) is the most common type of drug in this class. It has several advantages over sulfonylureas. Both sulfonylureas and insulin can cause weight gain, but this is not the case with Glucophage (metformin) therapy. Sulfonylureas can induce hypoglycemia, but this rarely occurs with metformin therapy alone. Metformin may also lower cholesterol. Taken with a sulfonylurea medication, metformin can lower blood sugar sufficiently to delay the need for insulin. It is considered a very safe and useful medication, especially in obese type 2 diabetics. However, it can be dangerous and should not be taken if someone is ill, recently received intravenous radiologic contrast agents, or has any of the following chronic illnesses: heart failure, renal failure, liver disease, lung disease, or alcoholism. Glucovance and Metaglip are combinations of Glucophage and a sulfonylurea.

c. **Alpha glucosidase inhibitors** - Precose and Glyset delay the absorption of carbohydrates (sugar) in the intestine and lessen your blood sugar rise after a meal. They may be taken alone or in combination with other oral medications.

d. **Meglitinides** - Prandin and Starlix stimulate the release of insulin from the pancreas. The advantage of this medication is it takes effect rapidly (usually within an hour) and leaves the system rapidly, making it ideal to use with meals.

e. **DPP-4 inhibitors** - Januvia, Onglyza, Tradjenta, and Nesina lower blood sugar by producing more insulin in presence of glucose and reducing glucose produced by the liver when not needed. A combination of Glucophage and Januvia is **Janumet.**

f. **TZDs** - Actos enhances the effects of insulin at the cell level and decreases the production of glucose in the liver. **ActosplusMet**, **ActosplusMetRx** are combinations of Actos and metformin. **Duotact** is a combination of Actos plus a Sulfonylurea.
g. **SGLT2 inhibitors** - Invokana, Jardiance, and Farxiga reduce renal glucose reabsorption and increase urinary glucose excretion.

2. INJECTABLE MEDICATIONS:

a. **GLP-1 receptor agonists** - are a class of diabetic medications called **incretin mimetics** given by subcutaneous injection prior to a meal. They increase insulin secretion only in the presence of elevated blood glucose and, as a secondary benefit, decrease appetite and promote weight loss. Byetta is injected twice a day. Victoza is injected once a day to improve the performance of beta cells in the pancreas. Trulicity, Tanzum, and Ozempic are injected once a week.
b. **Pancreatic hormone -** suppresses glucose production in the body and slows transfer of glucose from the stomach into the bloodstream. Symlin is a drug that is given by subcutaneous injection just before a major meal. It suppresses the release of glucagon, a hormone that tells your liver to release sugar into the bloodstream, makes you feel full at meals, and slows the rate food moves from the stomach into the small intestine.

3. **INSULIN:**
   a. Insulin is given by subcutaneous injection. It is essential for type 1 diabetics and is often needed for type 2 diabetics. There are a variety of insulins with different times from injection to onset of action, peak activity, and duration of action. The most suitable one for you will depend on your unique needs. Individualized combinations of these insulins may be given either once or several times a day. Your doctor or nurse practitioner will teach how to inject insulin. Some patients choose to have insulin pumps placed beneath their skin and are able to receive the constant infusion of insulin as well as extra amounts with meals. Examples of long acting insulin are Lantus, Levemir, Toujeo and Tresiba. Examples of quick acting insulin are Humalog, Novolog, and Aphidra.
   b. Afrezza is an example of inhaled insulin.

Maintaining your blood sugar as close to normal as possible can significantly lessen the chance of developing long-term complications of diabetes. This can be accomplished by maintaining a proper diet, daily exercise, one or more daily blood sugar measurements, appropriate changes in your medication as ordered by your provider, and by maintaining a normal body weight. It is important to keep your blood pressure and cholesterol in an acceptable range, see your ophthalmologist, dentist, and podiatrist at least once a year, and to take care of your feet. By caring for yourself and applying the knowledge and technology available to you, you can live a long and healthy life with diabetes.

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