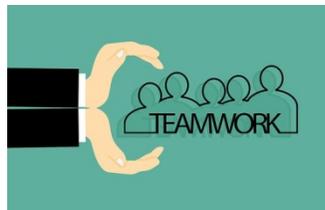


Complications of Diabetes

- Diabetes is a chronic (or lifelong) disease that can result in both long term and short term complications.
- Long term complications are caused by years of high blood sugar levels in the blood vessels.
- Risk of complications increase the longer blood sugar levels are not under control. Many diabetes complications don't appear until after many years of having the disease.
- In the early stages, many long term complications have no symptoms. Most of these complications can be prevented or minimized with regular medical care and blood sugar monitoring.
- Emergency complications are short term complications and can be caused by very high (hyperglycemia) or very low(hypoglycemia) blood sugar levels in people with diabetes.
- Diabetes care is a team approach to effectively help people cope with the vast array of complications that can result from diabetes.



Members of the Diabetes Care Team



Primary Care Physician	Certified Diabetes Educator	Dietitian
Pharmacist	Dentist	Endocrinologist
Eye Doctor	Mental Health Expert	Person with Diabetes & Family & Friends

Potential Diabetes Complications:

- Heart disease
- Kidney disease
- Eye complications
- Diabetic neuropathy and nerve damage
- Foot complications
- Skin complications
- Mental Health disorders
- Diabetic Emergencies

Diabetes and Heart Disease

Heart and blood vessel disease are the most common long-term complications of diabetes.

Coronary artery disease is caused by a narrowing or blocking of the blood vessels to the heart. It is the most common form of heart disease. The blood vessels to the heart are important because the blood flowing through them carries oxygen and other necessary materials. Unfortunately, these blood vessels can become partially or totally blocked by fatty deposits. A heart attack occurs when the blood supply to the heart is reduced or cut off.

People with diabetes have a higher risk for some cardiovascular diseases, including:

- Heart attack (caused by a blockage of the blood vessels supplying blood to the heart)
- Stroke (caused by a blockage of the blood vessels supplying the brain)
- Blocked blood vessels in the legs and feet, which can lead to foot ulcers, infections, and even loss of a toe, foot, or lower leg

Whether a person has diabetes or not, the risk for these problems increase due to:

- Smoking
- Obesity
- Abnormal levels of blood lipids (triglycerides or cholesterol)
- High blood pressure
- Family history of heart attack or stroke before age 50

How to reduce Risk of Complications:

Knowing your ABCs

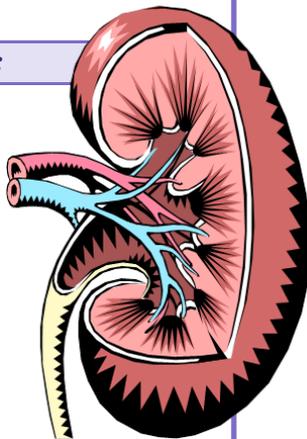
<i>"A" is for A1C</i>	<i>A1C is the blood glucose check "with a memory." It determines average blood glucose control over the past 2 to 3 months.</i>	<i>The American Diabetes Association (ADA) recommends an A1C below 7. However, goals may be different for each individual.</i>
<i>"B" is for blood pressure</i>	<i>Blood pressure (BP) numbers are the force of blood inside the blood vessels. With a high blood pressure, this means that the heart is having to work harder than it should.</i>	<i>The ADA recommends a BP below 130/80.</i>
<i>"C" is for cholesterol</i>	<i>Cholesterol numbers are the amount of fat in the blood. Good cholesterol(HDL), help protect the heart. Bad cholesterol(LDL), can clog the blood vessels, leading to heart disease.</i>	<i>Total Cholesterol <200mg/dL LDL < 100mg/dL HDL for men 40mg/dL or higher HDL for women 50mg/dL or higher</i>

Diabetes & Kidney Disease

- Kidney disease or kidney damage often occurs over time in people with diabetes. This type of kidney disease is called diabetic nephropathy.
- The kidneys' main job is to filter waste and extra water out of the blood to make urine.
- High levels of blood sugar can damage the blood vessels in the kidneys. When the blood vessels are damaged, they are not able to filter waste out of the blood.
- Many people with diabetes also develop high blood pressure, which can also damage your kidneys.
- There are 5 stages of kidney disease. When kidney disease is caught early, there are treatments available to keep the kidney disease from getting worse.
- Unfortunately, when kidney disease is diagnosed later, the stress from years of overworking the kidneys causes the kidneys to lose their filtering ability. This is called end-stage renal disease (ESRD) and treatment usually includes either a kidney transplant or dialysis.

Risk Factors for Kidney Disease:

- High blood sugar levels
- High blood pressure
- Smoking
- Poor nutrition
- High salt diet
- Inactivity
- Overweight
- Family history
- Heart disease



Ways to Reduce the Risk:

- Control blood sugar and blood pressure
- Take medications as prescribed
- Quit smoking
- Work with dietitian on meal plan
- Get enough sleep
- Maintain/get to healthy weight

Symptoms:

Kidney disease produces little to no symptoms until almost all function is gone. The first symptom of kidney disease is usually fluid buildup. Other symptoms of kidney disease include loss of sleep, poor appetite, upset stomach, weakness, and difficulty concentrating. Testing is usually the only way to know if there is kidney disease.

People with diabetes should be tested every year if:

- ✓ Have been diagnosed with type 2 diabetes
- ✓ Have been diagnosed with type 1 diabetes for more than 5 years

Diabetes & Eye Complications

Eyes can become damaged if blood sugar levels remain high over a period of time. This can cause damage to the blood vessels in the back of the eyes. This leads to poor vision or blindness.

Diabetes is the primary cause of blindness in adults.



Types of Diabetic Eye Complications:

1. Blurry Vision

- High blood sugar and/or rapid changes in blood sugar levels can cause blurry vision. This is because the lens in the middle of the eye cannot change shape when it has too much sugar and water in the lens.
- This is not the same problem as diabetic retinopathy and usually corrects itself when blood sugar levels normalize.

2. Retinopathy

- Retinopathy is caused by damage to the blood vessels of the Retina (the layer of tissue at the back of the eye. It senses light and changes it into signals that are sent to the brain). Retinopathy occurs when tiny blood vessels leak blood and other fluids. This causes the retinal tissue to swell, which results in cloudy or blurred vision.
- The longer a person has diabetes, the higher the risk for developing diabetic retinopathy. If left untreated, diabetic retinopathy can cause blindness.
- There are two major types of retinopathy: nonproliferative and proliferative.
 1. **Nonproliferative** is the early stage and there are usually no or mild symptoms.
 2. **Proliferative** is the more advanced stage where the retina is deprived of oxygen and new, fragile blood vessels can begin to grow in the retina. The new blood vessels may leak blood thus clouding vision. Another concern with proliferative retinopathy is retinal detachment.

3. Cataracts

- Cataracts are clouding of the eye's lens.
- Adults with diabetes are 2-5 times more likely than those without diabetes to develop cataracts and the disease also tends to develop earlier in people with diabetes.

4. Glaucoma

- Glaucoma is a condition that damages the eye's optic nerve (the bundle of nerve fibers that connects the eye to the brain).
- Some types of glaucoma are associated with elevated pressure inside the eye.
- In adults, diabetes nearly doubles the risk of glaucoma.

5. Macular Edema

- Macular edema is swelling in an area of the retina called the macula (which is responsible for our color vision and fine detail vision).
- This condition can destroy the sharp vision in this part of the eye, leading to partial vision loss or blindness. Macular edema usually develops in people who already have other signs of diabetic retinopathy.

Regular eye exams are crucial for detecting eye complications early when the problem can be monitored and treated to keep vision.

Eye exam guidelines for diabetes:

Type 1 diabetes: Yearly eye exams should start within 5 years of diagnosis.

Type 2 diabetes: Yearly eye exams should start right after diagnosis.

Pregnancy: Women with type 1 and type 2 diabetes need an eye exam before pregnancy or within the first 3 months. Your doctor may want you to repeat the exam later in your pregnancy and until your baby is 1 year old.

Gestational Diabetes: Women who develop gestational diabetes don't usually need an eye exam because they don't develop diabetic eye disease during pregnancy.



Diabetes and Nerve Damage

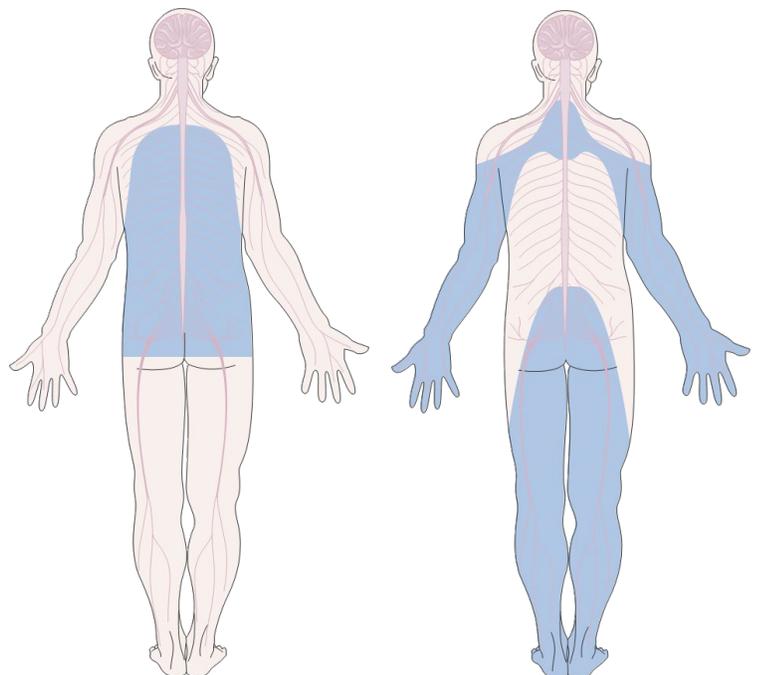
Nerve damage due to high blood sugars is called diabetic neuropathy. The damage to the nerves can affect the ability of the nerve to send signals. These signals give information to the brain about pain and temperature. The nerves in the legs and feet are the most frequently injured. This complication of diabetes is common and can be very serious.

Types of Diabetic Neuropathy

- 1. Peripheral Neuropathy**
 - Peripheral Neuropathy is the most common type of neuropathy and it is caused by damage to the nerves of the peripheral nervous system (feet, legs, hands, & arms).
- 2. Autonomic Neuropathy**
 - Autonomic Neuropathy is caused by damage to the nerves of internal organs (heart, bladder, stomach, intestines, sex organs, and eyes).
- 3. Focal Neuropathies**
 - Focal Neuropathies usually are caused damage to a single nerve (typically in the hands, head, torso, or leg).
- 4. Proximal Neuropathy**
 - Proximal Neuropathy is nerve damage in the hip, buttock, or thigh. This type is rare but can be disabling.

Complications of Diabetic Neuropathy

- Amputation of toe, foot or leg
- Damage to joint
- Urinary tract infection
- Hypoglycemic unawareness
- Slow digestion in stomach (gastroparesis)
- Diarrhea or constipation
- Blood pressure drops (dizziness when standing)
- Sexual dysfunction
- Increased/decreased sweating
- Changes in vision



Diabetes and Foot Complications

The nerve damage caused by diabetic neuropathy can cause tingling, pain, or a loss of feeling in the feet. This can make a person with diabetes unaware of cuts and sores that can become infected. Also, diabetes can result in a lower amount of blood flow in the legs and feet (peripheral vascular disease) which inhibits infections from healing. Infections that do not heal properly increase risk of developing ulcers or gangrene (death of tissue due to lack of blood) and increase risk of amputation.

Prevent/Treat Foot Complications

- ✓ Manage diabetes. Keep blood sugar levels in range.
- ✓ Perform feet self-exams daily. Check for sores, cuts, blisters, redness, or calluses.
- ✓ Wash with warm water, mild soap. Watch for temperature of the water and dry off completely.
- ✓ Keep toenails trimmed straight across and smooth corners with nail file.
- ✓ Wear well fitted socks/stockings and shoes at all times. Do not go barefoot.
- ✓ Have diabetes doctor check feet at every appointment.
- ✓ See a foot doctor (Podiatrist) yearly or more often as needed.

Potential Foot Complications

- ❖ Dry skin
- ❖ Calluses
- ❖ Bunions
- ❖ Fungal Infections
- ❖ Foot Ulcers
- ❖ Poor Circulation
- ❖ Amputation



Diabetes and Skin Complications

Diabetes can affect a person's skin just as it does many other areas of the body. Sometimes, skin conditions can be the first indication that a person has diabetes.

Acanthosis Nigricans	<ul style="list-style-type: none">• Darkening and thickening of the skin• Can be found on neck, armpits, groin, hands, elbows or knees• Usually seen in those who are overweight
Atherosclerosis	<ul style="list-style-type: none">• Thickening of arteries-blood vessels supplying the skin become narrow• Can affect blood vessels in or near the heart and blood vessels throughout the body• Can cause hair loss, thinning skin, thick & discolored toenails, and cold skin
Bacterial Infections	<ul style="list-style-type: none">• Several types of bacterial infections affect people with diabetes• Boils (infections of the hair follicles)• Carbuncles (infections in the skin and tissue underneath)
Diabetic Dermopathy	<ul style="list-style-type: none">• Also called shin spots• Light brown scaly patches on fronts of the legs
Digital Sclerosis	<ul style="list-style-type: none">• Stiffening of the finger joints• Thick, waxy, tight skin on the back of hands, toes, and fingers
Itching	<ul style="list-style-type: none">• Also called Pruritus• Can be caused by dry skin, yeast infections, or poor circulation• Usually affects the lower part of legs & feet
Disseminated Granuloma Annulare	<ul style="list-style-type: none">• Rashes on fingers, hands, feet and sometimes the trunk• Cause sharply defined ring shaped or arc shaped raised areas on the skin
Eruptive Xanthomatosis	<ul style="list-style-type: none">• Firm, yellow, pea like bumps on the skin• Itchy
Fungal Infections	<ul style="list-style-type: none">• Itchy red rashes often surrounded by tiny blisters and scales• Warm, moist folds on the skin• Include jock itch, athlete's foot, ringworm, and vaginal infections

Preventing/Treating Skin Complications

- Follow health care provider's advice regarding nutrition, exercise, and medications
- Maintain control of blood sugar level within the range recommended by health care provider
- Practice proper skin care
- See a dermatologist

Diabetes and Mental Health

- One area that often gets overlooked in diabetes is mental health.
- Caring for diabetes everyday (testing blood glucose levels, taking medications/insulin, going to doctors' appointments, planning meals, etc.) is a fulltime job and it can often leave people with diabetes feeling overwhelmed and worn out. Stress and/or untreated mental health issues can make managing diabetes harder, including controlling blood sugar levels and dealing with daily diabetes care. Regular physical activity, getting enough sleep, and relaxation exercises can help.



- Untreated mental health issues can make diabetes worse, and uncontrolled diabetes can make mental health issues worse.

Types of Mental Health Issues

Depression

Anger

Stress/Anxiety

Diabetes
Distress

Eating
Disorders

Ways to Deal with Mental Health Issues and Diabetes

- ✓ Get in touch with your health care provider
- ✓ Seek support from a family member or friend
- ✓ Consider seeing a mental health counselor with experience in chronic health conditions
- ✓ Join a diabetes support group in your community
- ✓ Limit alcohol and caffeine intake, eat healthy foods, and get enough sleep

DIABETES EMERGENCIES

TYPES OF DIABETES EMERGENCIES:

1. Diabetic ketoacidosis (DKA)
 - When the body cannot produce enough insulin, it begins to break down fat as fuel. This process produces a buildup of acids in the bloodstream called ketones.
 - This is a serious, sometimes life threatening complication of type 1 diabetes and, much less commonly, of type 2 diabetes.
2. Hyperosmolar hyperglycemic state (HHS)
 - Hyperglycemia (blood sugar levels generally greater than 600 mg/dL) with an excessive urination caused by the very high blood sugar and leading to dehydration.
 - Occurs in patients with Type 2 diabetes
 - Caused more by insulin resistance than insulin deficiency (as in DKA).
 - Higher mortality rate than DKA.
3. Hypoglycemia
 - Severe hypoglycemia usually occurs when glucose is < 50 mg/dL.
 - Hypoglycemia isn't a direct complication of diabetes, but rather a complication of its treatment
 - Hypoglycemia most often occurs in people with type 1 diabetes on insulin.
 - It can be due to an increase in the patient's insulin dose, skipping meals or heavy exercise.
 - Hypoglycemia can also occur in people with type 2 diabetes who take insulin and/or oral hypoglycemic medications.



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References:

Diabetic retinopathy preferred practice pattern guidelines. American Academy of Ophthalmology website.
<https://www.aao.org/preferred-practice-pattern/diabetic-retinopathy-ppp-updated-2016>.

<https://www.cdc.gov/diabetes/managing/mental-health.html>

<https://www.niddk.nih.gov/health-information/diabetes>

American Diabetes Association <https://www.diabetes.org>