TRAIN FOR SUCCESS INC.
DIABETES MELLITUS
4 Contact Hours

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Purpose:

The purpose of this course is to provide the health care professionals; LPN, RN, ARNP, Certified Nursing Assistants (CNA), Home Health Aid (HHA), students, and other individuals with an understanding of Diabetes Mellitus. The course will review three major types of Diabetes, demographic factors that affect / increase the risk for developing Diabetes, some of the complications associated with Diabetes Mellitus, medication management, possible side effects of Diabetic medications, signs and symptoms of hypoglycemia /hyperglycemia and interventions, review patient teaching /education and available resources.

Objectives/ Goals:

After successful completion of this course the students will be able to:

1. Discuss three major types of Diabetes
2. Describe demographic factors that affect / increase the risk for developing Diabetes
3. Describe complications associated with Diabetes Mellitus
4. Discuss medication management for individuals with Diabetes Mellitus
5. Discuss possible side effects of Diabetic medications
6. Describe signs/ symptoms of hypo/hyperglycemia and interventions
7. Discuss the importance of patient education
8. Discuss available community and online resources

INTRODUCTION

DIABETES MELLITUS

Diabetes mellitus is a complex disorder of carbohydrate, protein and fat metabolism which is characterized by hyperglycemia (elevated blood sugar) resulting from defects in insulin secretion, insulin action, or both. Diabetes mellitus is a chronic, lifelong condition and it affects the body's ability to use the energy that is in food.

There are three major types of diabetes:

- Type 1 diabetes,
- Type 11 diabetes, and
- Gestational diabetes.

Type 1 is Insulin Dependent Diabetes mellitus (IDDM) and Type II is Non- Insulin Dependent Diabetes (NIDDM) which is the most prevalent form of the disease. Diabetes that is triggered by pregnancy is called gestational diabetes.

Under normal circumstances /conditions, the body breaks down carbohydrates and the sugars that we eat and turns it into glucose (sugar). Glucose then fuels the cells in the body. However the cells in the body need a hormone called insulin, in the bloodstream to be able to take in the glucose and use it for energy.

When an individual has diabetes mellitus, either the body does not make enough insulin, it cannot use the insulin it does produce, or a combination of both.

When the cells cannot take in the glucose, it builds up within the blood (hyperglycemia) and can lead to dangerous effects on the organs and systems of the body.

High levels of blood glucose can damage the tiny blood vessels in the kidneys, heart, eyes, or nervous system.

When diabetes is left untreated, it can eventually cause heart disease, kidney disease, stroke, blindness, and nerve damage to nerves in the feet among other conditions.

Data and Statistics on Diabetes

Total: 29.1 million people or 9.3% of the U.S. population have diabetes

Diagnosed: 21.0 million people

Undiagnosed: 8.1 million people (27.8% of people with diabetes are undiagnosed)

View the full report at CDC's National Diabetes Statistics Report, 2014.

Type 1 Diabetes

Type 1 diabetes is insulin-dependent diabetes. It used to be called juvenile-onset diabetes, because it often starts in childhood. Type 1 diabetes is an autoimmune condition. It is caused by the body attacking its own pancreas with antibodies. In individuals with type 1 diabetes, the damaged pancreas does not make insulin.

This type of diabetes may be caused by a genetic predisposition. It could also be the result of faulty beta cells in the pancreas that normally produce insulin.

There are several medical risks are associated with type 1 diabetes.

Some of the complications come from:

- Damage to tiny blood vessels in the eyes (called diabetic retinopathy),
- Damage to nerves (diabetic neuropathy), and
- Damage to kidneys (diabetic nephropathy)

Increased risk of heart disease and stroke are also major concerns.

Treatment for type 1 diabetes involves taking insulin, which needs to be injected through the skin into the subcutaneous (fatty) tissue.

The methods of injecting insulin include:

- Syringes
- Insulin pens that use pre-filled cartridges and a fine needle
- Jet injectors that use high pressure air to send a spray of insulin through the skin

- Insulin pumps that dispense insulin through flexible tubing to a catheter under the skin of the abdomen

Type 2 Diabetes

Type 2 diabetes is the most common form of diabetes and accounts for 95% of diabetes cases in adults. Approximately 26 million American adults have been diagnosed with the disease. Type 2 diabetes is often a milder form of diabetes than type 1 diabetes. Type 2 diabetes used to be called adult-onset diabetes, but with the occurrence of obese children and more teenagers are also now developing type 2 diabetes. Type 2 diabetes was also called non-insulin-dependent diabetes.

Type 2 diabetes can cause major health complications, especially in the small blood vessels in the body that nourish the nerves, kidneys and eyes. Type 2 diabetes also increases the individual's risk of heart disease and stroke.

With Type 2 diabetes, the pancreas usually produces some insulin. But either the amount produced is not enough for the body's needs, or the body's cells are resistant to it. Insulin resistance, or lack of sensitivity to insulin, happens primarily in liver, fat and muscle cells.

Individuals who are obese (more than 20% over their ideal body weight for their height) are at particularly high risk of developing type 2 diabetes and its related medical problems. Obese people have insulin resistance. With insulin resistance, the pancreas has to work extra hard to produce more insulin; however, there is not enough insulin to keep sugars normal.

There is no cure for diabetes. Type 2 diabetes can, however, be controlled with:

- Weigh management,
- nutrition, and
- Exercise.

Unfortunately, type 2 diabetes tends to progress, and diabetes medications are often needed.

A hemoglobin A1C test is a blood test that estimates average glucose levels in the blood over the previous three months. Periodic hemoglobin A1C testing may be advised to see how well diet, exercise, and medications are working to control blood sugar and prevent organ damage. The hemoglobin A1C test is typically done a few times a year.

Gestational Diabetes

Diabetes that is triggered by pregnancy is called gestational diabetes (pregnancy, to some degree, leads to insulin resistance). It is often diagnosed in middle or late pregnancy. Because high blood sugar levels in a mother are circulated through the placenta to the baby, gestational diabetes must be controlled to protect the baby's growth and development.

The American Congress of Obstetricians and Gynecologists (ACOG) recommendations include performing the 1 hour blood glucose challenge test to screen for gestational diabetes in low risk pregnant women between 24 weeks and 28 weeks of pregnancy.

The physician may recommend earlier screening if she is at increased risk of developing gestational diabetes. Risk factors may include:

- Family history of diabetes
- Gestational diabetes in an earlier pregnancy
- Obesity
- Having a medical condition associated with the development of diabetes, such as polycystic ovary syndrome or metabolic syndrome.

If the physician determines that the individual is at risk or has a suspicious value on the 1 hour test, the individual may be advised to take a 3 hour glucose tolerance test.

According to the National Institutes of Health, the reported rate of gestational diabetes is between 2% to 10% of pregnancies. Gestational diabetes usually resolves itself after pregnancy. Having gestational diabetes does, however, put mothers at risk for developing type 2 diabetes later in life. Up to 10% of women with gestational diabetes develop type 2 diabetes. It can occur anywhere from a few weeks after delivery to months or years later.

With gestational diabetes, risks to the unborn baby are even greater than risks to the mother. Risks to the baby include abnormal weight gain before birth, breathing problems at birth, and higher obesity and diabetes risk later in life. Risks to the mother include needing a cesarean section due to a very large baby, as well as damage to heart, kidney, nerves, and eye.

An individual is at greater risk for gestational diabetes if:

- Older than 25 when pregnant
- Have a family history of diabetes
- Gave birth to a baby that weighed more than 9 pounds
- Have high blood pressure
- Was overweight before the pregnancy
- Gain too much weight during pregnancy

SYMPTOMS

The individual may not experience any symptoms. The diagnosis is often made during the routine prenatal screening.

If symptoms are present they may include:

- Blurred vision
- Fatigue
- Weight loss
- Nausea and vomiting
- Increased urination
- Increased thirst
- Frequent infections, such as of the vagina, bladder

Exams and Tests

Gestational diabetes often begins halfway through the pregnancy, as mentioned earlier. It is highly recommended that pregnant women should receive an oral glucose tolerance test between the 24th and 28th week of pregnancy to look for the condition. Individuals who have risk factors for gestational diabetes, their physician may order the test earlier in the pregnancy.

TREATMENT

The goals of treatment are:

- To keep the blood sugar (glucose) levels within normal limits during the pregnancy, and
- To make sure the baby is healthy.

Treatment during pregnancy includes working closely with the health care team and:

- Careful meal planning to ensure adequate nutrients throughout pregnancy without excess fat and calories
- Regular exercise
- Controlling excess weight gain throughout pregnancy
- Taking insulin to effectively control blood sugar levels (if needed).

The health care provider should closely monitor the mother and baby throughout the pregnancy. Fetal monitoring will check the health and size of the fetus.

A nonstress test may be completed;

- A machine that hears and displays the baby's heartbeat (electronic fetal monitor) is placed on the abdomen.
- The health care provider is able to compare the pattern of the baby's heartbeat to movements and is able to find out whether the baby is doing well.

DIET AND EXERCISE

The best way for the pregnant woman with gestational diabetes to improve her diet is by eating a variety of healthy foods. It is helpful for her to learn how to read the food label, and check them whenever she is making food choices /decisions.

In general, the diet should:

- Be moderate in protein and fat
- Provide carbohydrates through the foods that include vegetables, fruits, complex carbohydrates (pasta, cereal, bread and rice)
- Be low in foods that contain a lot of sugar, such as fruit juices, sodas and pastries

If managing the diet does not control blood sugar (glucose) levels, the physician may prescribe diabetic medication (tablets or insulin therapy).

RISK DURING PREGNANCY

There are many risks to having diabetes during pregnancy. Complications are more likely when the blood sugar is not well controlled. With good control, most pregnancies have good outcomes.

Pregnant women with gestational diabetes tend to have larger babies at birth. This can increase the chance of problems at the time of delivery, which may include:

- Birth injury because of the baby's large size
- Delivery by C-section
The baby is more likely to have periods of hypoglycemia (low blood sugar) during the first few days of life.

Mothers with gestational diabetes have an increased risk for hypertension (high blood pressure) during pregnancy.

After delivery:

- The mother high blood glucose levels often go back to normal.

- The mother should be closely followed for signs of diabetes.

Other Forms of Diabetes

A few rare kinds of diabetes can result from specific conditions.

For example,

- Diseases of the pancreas, certain surgeries and medications, or infections can cause diabetes. These types of diabetes account for only 1% to 5% of all cases of diabetes.

Hyperglycemia (High Blood Glucose)

Hyperglycemia is the technical term for high blood glucose (blood sugar). High blood glucose occurs when the body has too little insulin or when the body cannot use the insulin properly.

A number of factors can cause hyperglycemia:

- If the individual has type 1, and may not have taken enough insulin.
- If the individual has type 2, the body may have enough insulin, but it is not as effective as it should be.
- If the individual ate more than planned or exercised less than planned.
- If the individual has stress from illness, for example the flu or cold.
- Or experiencing other stress, for example, family conflicts, financial problems.

Symptoms of Hyperglycemia

The signs and symptoms include the following:

- High blood glucose
- High levels of sugar in the urine

- Frequent urination
- Increased thirst
- Some patients report increase hunger

Part of managing the diabetes, involves checking the blood glucose on a regular basis. The physician will instruct /order the frequency of the blood glucose check and what the blood glucose levels should be. Checking the blood and then treating high blood glucose early will help the individual avoid problems that are associated with hyperglycemia.

Treating Hyperglycemia

- An individual can often lower their blood glucose level by exercising. However, if the blood glucose is above 240 mg/dl, the urine should be checked for ketones. If there are ketones in the urine, do not exercise. Exercising when ketones are present may make the blood glucose level go even higher. The individual need to work with the physician to find the safest way to lower the blood glucose level.
- Reducing the amount of food intake might also help. Individuals can work with a dietitian to make changes in their meal plan. If exercise and changes in the diet does not work, the physician may change the amount of the medication or insulin or the timing of when to take the medication.

If Hyperglycemia goes untreated

Hyperglycemia can be a serious problem if it is not treated. Therefore it is very important to treat it as soon as it is detected. If hyperglycemia remains untreated, a condition called ketoacidosis (diabetic coma) may occur. Ketoacidosis develops when the body does not have enough insulin. Without insulin, the body cannot use glucose for fuel, so the body breaks down fats to use for energy.

When the body breaks down fats, waste products called ketones are produced. The body cannot tolerate large amounts of ketones and will try to get rid of them through the urine. Unfortunately, the body cannot release all the ketones and they build up in your blood, which can lead to ketoacidosis.

Ketoacidosis is life-threatening and requires immediate treatment.
Symptoms include:

- Shortness of breath
- Breath that smells fruity
- Nausea and vomiting
- Very dry mouth

Managing diabetic ketoacidosis (DKA) in an intensive care unit during the first 24-48 hours always is advisable. When treating the patient with DKA, the following points must be considered and closely monitored:

- Correcting fluid loss with intravenous fluids
- Correcting hyperglycemia with insulin
- Correcting electrolyte disturbances, particularly potassium loss
- Correcting acid-base balance
- Treatment of concurrent infection(if present).

Medical IDs

Many individuals with diabetes, particularly those who are using insulin, should have a medical ID with them at all times.

In the event of an emergency; a severe hypoglycemic episode or a car accident, the medical ID can provide vital information about the individual's health status, such as;

- The fact that they have diabetes,
- whether or not they use insulin,
- whether they have any allergies.

Emergency medical personnel are trained to check for a medical ID when they are caring for individuals who cannot speak for themselves.

Medical IDs are often worn as a necklace or a bracelet. Traditional medical IDs have basic, key health information about the individual, and some medical IDs now include

compact USB drives that can carry the individual's full medical record for use in an emergency.

Hypoglycemia (Low Blood Glucose)

Hypoglycemia is a condition characterized by abnormally low blood glucose (blood sugar) levels, usually less than 70 mg/dl. However, it is important to talk to the health care provider about the individual blood glucose targets, and what level is too low for that individual.

Hypoglycemia may also be referred to as an insulin reaction, or insulin shock. Hypoglycemic symptoms are important clues that the individual have low blood glucose. Each person's reaction to hypoglycemia is different. The only sure way to know whether the individual is experiencing hypoglycemia is to check the blood glucose, if possible.

Severe hypoglycemia has the potential to cause:

- Accidents,
- Injuries,
- Coma, and
- Death.

Signs and Symptoms of Hypoglycemia include:

- Shakiness
- Anxiety, Nervousness
- Sweating, clamminess, chills
- Irritability
- impatience
- Confusion (including delirium)
- Sleepiness
- Rapid heartbeat
- Dizziness, Lightheadedness
- Hunger
- nausea

- Blurred or impaired vision
- Tingling or numbness in the tongue or lips
- Headaches
- Weakness
- fatigue
- Anger or sadness
- Lack of coordination
- Seizure
- Unconsciousness

Treatment (follow your facility policy)

1. Consume 15-20 grams of glucose or simple carbohydrates
2. Recheck the blood glucose after 15 minutes (follow your facility policy)
3. If hypoglycemia continues, repeat.
4. Once blood glucose returns to normal, the individual may eat a small snack if the next planned meal or snack is more than an hour or two away.

15 grams of simple carbohydrates commonly used:

- Glucose tablets (follow package instructions)
- Gel tube (follow package instructions)
- 2 tablespoons of raisins
- 4 ounces (1/2 cup) of juice or regular soda (no diet – need sugar)
- 1 tablespoon sugar, honey, or corn syrup
- 8 ounces of nonfat or 1% milk
- Hard candies, jellybeans, or gumdrops (see package to determine how many to consume)

Glucagon

Hypoglycemia may lead to a seizure or unconsciousness (passing out, a coma) if it is left untreated. Glucagon is a hormone that stimulates the liver to release stored glucose into the bloodstream when the blood glucose levels are too low.

Injectable glucagon kits are used as a medication to treat the individual with diabetes that has become unconscious from a severe insulin reaction. Glucagon kits are available by prescription.

Patient teaching is very important, the individuals who are in frequent contact with the diabetic patient such as, family members, should also be instructed on how to administer glucagon to treat severe hypoglycemic events.

Have them **call 911** if they feel that they cannot handle the situation. For example,

- If the hypoglycemic patient passes out,
- Does not regain consciousness, or
- Has a seizure,
- If the family member or significant other does not know how to inject glucagon, or if glucagon is not available.

Patient teaching should include:

- If glucagon is needed; Glucagon is given just like an injection of insulin and can be given in the same areas of the body as insulin:

1. Inject glucagon into the patient's arm, buttock or thigh, following the manufacturer's instructions.
2. When the patient regains consciousness (usually in 5-15 minutes), they may experience nausea and vomiting; Place patient in side lying position.

Do not:

- Do not Inject insulin, this will lower the blood glucose even more,
- Do not give food and /or fluids, the patient can choke (pt is unconscious)
- Do not put hands in their mouth, the patient can choke

NOTE!!

Glucagon is not effective for much longer than 1½ hours and is used only until the patient is able to swallow.

Usual Adult Dose for Hypoglycemia

Less than 20 kg: 0.5 mg (0.5 unit) subcutaneous, IM or IV.

20 kg or more: 1 mg (1 unit) subcutaneous, IM or IV.

Hypoglycemia Unawareness

Most of the time, hypoglycemia symptoms occur when blood glucose levels fall below 70 mg/dl. However, many individuals have blood glucose readings below this level and do not experience any symptoms. This is called hypoglycemia unawareness.

Individuals with hypoglycemia unawareness are also less likely to be awakened from sleep when hypoglycemia occurs at night.

Hypoglycemia unawareness occurs more often in patients who:

- frequently experiences low blood glucose episodes (which may cause them to stop sensing the early warning signs of hypoglycemia)
- have had diabetes for a long time
- Tightly control their diabetes which can increase the chances of having low blood glucose reactions.

Individuals who think they have hypoglycemia unawareness, should speak with the health care provider. The physician /health care provider may adjust/raise the blood glucose targets to avoid further hypoglycemia and risk of future episodes.

Other Causes of Symptoms

Other individuals may start to have symptoms of hypoglycemia when their blood glucose levels are higher than 70 mg/dl. This may occur when the blood glucose levels are very high then start to go down quickly.

Diabetes Tests & Screening

Blood Glucose

A blood glucose test measures the amount of glucose (sugar) in the blood. Glucose comes from carbohydrate foods. It is the main source of energy used by the body.

Hemoglobin A1c (HbA1c) Test

The hemoglobin A1c test, also called HbA1c, glycated hemoglobin test, or glycohemoglobin, is an important blood test that shows how well the diabetes is being controlled.

Urine Tests and Diabetes

Two simple tests that check the urine can assist the physician and the individual monitor for kidney disease and severe high blood sugar.

Oral Glucose Tolerance Test

The oral glucose tolerance test is sometimes used for diagnosing type 2 diabetes. It is still commonly used to diagnose gestational diabetes, a condition that the woman can develop while pregnant.

The following tests are used for the diagnosis of diabetes:

- **A fasting plasma glucose test** measures the blood glucose after at least 8 hours without eating. This test is used to detect diabetes or prediabetes.
- **An oral glucose tolerance test** measures the blood sugar after at least eight hours without eating and two hours after drinking a glucose-containing beverage. This test can be used to diagnose diabetes or prediabetes.
- **In a random plasma glucose test**, the physician checks the blood sugar without regard to when the individual ate the last meal. This test, along with an assessment of symptoms, is used to diagnose diabetes, but not prediabetes.

Positive test results

Positive test results should be confirmed by:

- Repeating the fasting plasma glucose test or the oral glucose tolerance test on a different day.

When first diagnosed with diabetes, the physician may suggest a zinc transporter 8 autoantibody (ZnT8Ab) test. This blood test, along with other information and test results, can help determine if a person has type 1 diabetes and not another type. The goal of having the ZnT8Ab test is a prompt and accurate diagnosis and that can lead to timely treatment.

The immune system of many people with type 1 diabetes produces ZnT8Ab, but patients with other types of diabetes (type 2 and gestational) do not. The KRONUS Zinc Transporter 8 Autoantibody (ZnT8Ab) ELISA Assay detects the presence of the ZnT8 autoantibody in a patient's blood. (FDA 2014)

Fasting Plasma Glucose (FPG) Test

The Fasting Plasma Glucose (FPG) is the preferred test for diagnosing diabetes and is most reliable when it is done in the morning.

If the fasting glucose level is 100 to 125 mg/dL, it reflects a form of prediabetes called impaired fasting glucose (IFG), meaning that the individual is more likely to develop type 2 diabetes but does not have it yet.

A level of 126 mg/dL or above, confirmed by repeating the test on a different day, means that the individual has diabetes.

Table A. Fasting Plasma Glucose Test

Plasma Glucose Result (mg/dL)	Diagnosis
99 mg/dl and below	Normal
100 to 125 mg/dl	Prediabetes (impaired fasting glucose)
126 mg/dl and above	Diabetes*

*Diabetes is confirmed by repeating the test another day.

Oral Glucose Tolerance Test (OGTT)

Research has shown that the Oral Glucose Tolerance Test (OGTT) is more sensitive than the FPG test for diagnosing prediabetes, but it is less convenient to administer. The OGTT requires that the individual fast for at least eight hours before the test. The plasma glucose is measured immediately before and two hours after the individuals drink a liquid containing 75 grams of glucose dissolved in water.

If the blood sugar level is between 140 and 199 mg/dL 2 hours after drinking the liquid, the individuals have a form of prediabetes called impaired glucose tolerance (IGT), meaning that they are more likely to develop type 2 diabetes but do not have it yet. A two-hour glucose level of 200 mg/dL or above, confirmed by repeating the test on another day, means that you have diabetes.

Table B. 2-hour plasma glucose result

2-Hour Plasma Glucose Result (mg/dL)	Diagnosis
139 and below	Normal
140 to 199	Prediabetes (impaired glucose tolerance)

200 and above	Diabetes*

*Confirmed by repeating the test another day.

Gestational diabetes is also diagnosed based on plasma glucose values measured during the Oral Glucose Tolerance Test (OGTT). Blood sugar levels are checked four times during the test. If the blood sugar levels are above normal at least twice during the test, the individual has gestational diabetes.

Table C. Gestational Diabetes: Above-Normal Results for the Oral Glucose Tolerance Test

When	Plasma Glucose Result (mg/dL)
Fasting	95 or higher
At 1 hour	180 or higher
At 2 hours	155 or higher
At 3 hours	140 or higher

* Some laboratories use other numbers for this test.

Random Plasma Glucose Test

A random blood glucose level of 200 mg/dL or more, and the presence of the following symptoms, can mean that the individuals have diabetes:

- Increased urination
- Increased thirst
- Unexplained weight loss
- fatigue,
- blurred vision,
- increased hunger, and

- sores that do not heal.

The physician will check the blood glucose level on another day using the Fasting Plasma Glucose (FPG) or the Oral Glucose Tolerance Test (OGTT) to confirm the diagnosis of diabetes.

Hemoglobin A1c

Newer guidelines use hemoglobin A1c as a screening tool for prediabetes or diabetes (the test is normally used to measure blood glucose control in diabetes patients over several months).

A hemoglobin A1c (HbA1c) of 5.7% to 6.4% is consistent with prediabetes and indicates a time when it can be reversed by making some lifestyle changes. A hemoglobin A1c (HbA1c) of 6.5% or higher is consistent with diabetes.

PREVENTING DIABETES

While Type 1 diabetes is not preventable, Type 2 diabetes can be with weight loss and moderate physical activity.

NOTE

- An estimated 86 million Americans over age 20 have prediabetes.
- 15-30% of individuals with prediabetes will develop type 2 diabetes within 5 years and they are more likely to have a heart attack or stroke. The risk of death for adults with diabetes is 59% higher than for adults without diabetes.

HEALTHCARE PROVIDERS

Health care providers can help patients prevent or delay type 2 diabetes. Screen and test patients for prediabetes and refer those at risk to an evidence-based diabetes prevention program that is recognized by the CDC; such as the CDC's National Diabetes Prevention Program (National DPP).

Screening, Testing, and Referring Patients

As part of the Prevent Diabetes: STAT initiative, CDC and the American Medical Association have created an on-line toolkit that can help the healthcare provider practice screen, test, and refer patients to evidence-based diabetes prevention programs.

The toolkit includes:

- Risk tests for the patients and resources to help the healthcare provider explain prediabetes and the National DPP to those at risk
- Patient flow diagrams, algorithms, and referral templates to make it easy to identify and counsel patients at risk
- A description of the program to share with other healthcare providers.

CDC-recognized Programs

Programs are offered in varied community locations such as:

- local YMCAs,
- community centers,
- faith-based organizations,
- hospitals and
- worksites
- on-line.

Diabetes Prevention

Prediabetes

The Centers for Disease Control and Prevention (CDC) is a great resource for prediabetes, and general diabetes prevention. For tips on prediabetes, facts, and other helpful information, check online CDC.gov.

Food Labeling

With diabetes management, food can make a huge difference. The FDA is proposing to update the Nutrition Facts label found on most food packages in the United States. The Nutrition Facts label, introduced 20 years ago, helps consumers make informed food choices and maintain healthy dietary practices. (FDA.gov 2014)

ACCU-CHEK /Patient teaching – self monitoring of blood glucose

To test the blood sugar level, collect:

- The blood glucose meter
- a test strip and
- Lancing device.

Wash and dry your hands (using warm water may help the blood flow).
Turn on the meter and prepare a test strip as outlined in the owner's booklet.

Choose the site; do not check from the same finger all the time (rotate sites)
Follow the manufacturer's instructions to prepare the lancing device and
Get a drop of blood from the side of the fingertip or other approved site.
Check the blood sugar by touching and holding the test strip to the drop until it has absorbed enough blood to begin the test.

View the test result and take the proper steps if the blood sugar is too high or low, based on the healthcare professional/physician recommendations.

Discard the used lancet properly.
Record the results in a log/ record book, keep them in the meter's memory or download it to a computer so it can be reviewed later.

ALTERNATE SITES

Some blood glucose meters allow the patient to use a blood sample from non-fingertip (alternate) sites such as:

- The palm,
- forearm or
- Upper arm.

Because the skin of these areas contains fewer nerves than the fingertip, alternate site testing may be more comfortable. It is important to know that while blood from the fingertip can be tested at any time, there are times when alternate site testing may not give the most accurate result.

Alternate site testing should only be used when blood sugar is stable:

- Immediately before a meal
- When fasting
- Close to bedtime

When blood sugar may be changing, always check from the fingertip such as:

- After a meal, when blood sugar is rising quickly
- After exercise
- Whenever the patient thinks/ feels like the blood sugar might be low or falling.

IMPORTANT ALTERNATE SITE TESTING CONSIDERATION

If the patient is considering alternate site glucose testing, please remember:

- Do not ignore the symptoms of low or high blood sugar.

- If the results of a blood glucose test do not match the way the patient feels, confirm it with a fingertip test. If the fingertip result still does not seem to reflect the way the patient feels, contact the physician / healthcare professional.

- Encourage patients to talk to the physician / healthcare professional before using sites other than the fingertip for testing blood sugar.

TREATMENT

Insulin for Diabetes

Insulin is a hormone that controls blood sugar. There are several types of insulin that are used to treat diabetes.

Types of Insulin

Many forms of insulin treat diabetes, including:

- Rapid-acting,
- short-acting,
- Intermediate-acting,
- long-acting, and
- pre-mixed.

Inhaled Insulin

Inhaled insulin is another option for individuals with diabetes to control the blood sugar. Inhaled insulin works for both type 1 and type 2 Diabetes, but should not be used if the individual smokes or has COPD or asthma.

INSULIN PUMP

Insulin pumps are computerized devices that individuals with diabetes use to help manage the blood sugar. The insulin pumps can be worn on the belt or put it in the pocket. The insulin pump releases rapid-acting insulin into the body through a flexible small catheter (tube) which goes under the belly's skin and is taped in place.

The insulin pump works nonstop, according to a programmed plan unique to each individual. The individual can change the amount of insulin delivered. Some physicians prefer the insulin pump because it releases the insulin slowly (works like a normal pancreas). Another advantage of the insulin pump is that the individual does not have to measure insulin into a syringe.

Between meals and overnight, the pump constantly delivers a small amount of insulin to keep the blood sugar in the target range. This is called the basal rate. When the individual eats he/ she can program extra insulin, which is referred to as a bolus dose, into the pump. The individual can calculate how much of a bolus is needed based on the grams of carbohydrates he/ she eats or drinks.

The individual, who uses an insulin pump, needs to check his/ her blood sugar level at least four times a day. The individual sets the doses of the insulin and make adjustments to the dose depending on food and exercise.

Research is mixed on whether the pump provides better blood sugar control than more than one daily injection.

Non-Insulin Treatments

Non-Insulin Diabetes Injectables

Insulin is not the only type of injectable diabetes medicine that the physician may prescribe. Non- insulin injectables such as:

- Albiglutide (Tanzeum)
- Exenatide (Bydureon, Byetta)
- Liraglutide (Victoza)
- Pramlintide (Symlin)
- Dulaglutide (Trulicity)

Albiglutide (Tanzeum)

Albiglutide (Tanzeum) is a man-made version of the hormone called GLP-1 (glucagon-like peptide-1). The intestines release this substance when you eat. It helps to control the blood sugar. After the individual has eaten, albiglutide helps the pancreas release insulin, which moves blood glucose (sugar) into the cells. It also limits how much of the hormone glucagon the body makes. This substance spurs the liver to release stored sugar. The drug also slows down digestion.

Albiglutide (Tanzeum) can be used by adults who have type 2 diabetes and have not had success with other treatments. If the individual is planning to get pregnant, she needs to talk with the physician because researchers have not studied albiglutide in pregnant women.

The most common side effects are:

- Upper respiratory tract infection,
- Diarrhea,
- nausea,
- skin reactions (site of injection)
- Inflammation of the pancreas (pancreatitis) which may be severe.

All GLP-1 drugs, including albiglutide, have a boxed warning noting that in animal studies, this type of drug has been linked to thyroid cancer in some rats and mice. Experts do not know whether it has the same effect in humans.

Exenatide (Bydureon, Byetta)

Byetta came first; injection twice daily. Bydureon is the newer, extended-release version, for injection once a week. The individual cannot take both drugs.

Adults with type 2 diabetes for whom other treatment has not worked can take Exenatide. If the individual is planning to get pregnant, she needs to talk with the physician because researchers have not studied this drug in pregnant women.

Exenatide tells the pancreas to release insulin, which moves glucose out of the bloodstream and into the cells. It also limits how much glucagon the body makes. This hormone prompts the liver to release stored sugar. The drug also slows digestion.

The most common side effects include:

- Nausea,
- vomiting,
- Diarrhea,
- Dizziness,
- Acid stomach,
- constipation,
- headache,
- weakness
- Inflammation of the pancreas (pancreatitis), which may be severe.

It is also possible that the individual may experience low blood sugar or have an allergic reaction to the medicine.

These side effects usually go away after the first month of treatment.

The FDA has also received reports of kidney failure in people taking this medicine. All GLP-1 drugs, including both types of exenatide, have a boxed warning noting that in animal studies, this type of drug has been linked to thyroid cancer in some rats and mice. Experts do not know whether it has the same effect in humans.

Liraglutide (Victoza)

This is another GLP-1 drug for injection once a day. It helps the body release more insulin. This helps move glucose from the bloodstream into the cells.

Used for adults who have type 2 diabetes but have not had results with other treatments. It is taken in combination with metformin or a sulfonylurea drug. If the patient is planning to get pregnant, encourage her to talk with the physician. Liraglutide has not been studied in pregnant women.

Liraglutide cues the pancreas to release insulin. This moves glucose out of the bloodstream and into the cells. It also limits how much of the hormone glucagon the body makes. This substance prompts the liver to release stored sugar. The drug also slows digestion.

Side effects:

The most common side effects include:

- Diarrhea,
- nausea
- headache
- Inflammation of the pancreas (pancreatitis), which may be severe
- It is also possible to have an allergic reaction to liraglutide, or to experience low blood sugar while taking it.
- If the patient becomes dehydrated from nausea, vomiting, or diarrhea, that could lead to kidney failure.

All GLP-1 drugs, including liraglutide, have a boxed warning noting that in animal studies, this type of drug has been linked to thyroid cancer in some rats and mice. Experts do not know whether it has the same effect in humans.

Pramlintide (Symlin)

Pramlintide (Symlin) is a man-made version of a hormone called amylin, which the pancreas makes along with insulin when the blood sugar levels rise.

Pramlintide (Symlin) is approved for individuals with type 1 diabetes who are taking insulin. It is also approved for individuals with type 2 diabetes who are taking insulin, a sulfonylurea drug, or metformin. Researchers have not studied this drug in pregnant women.

Pramlintide is taken with insulin after a meal. The two medications work together to lower the blood sugar. Pramlintide also helps the patient to digest food more slowly. This puts less sugar into the bloodstream. In addition to controlling the A1C levels, pramlintide helps lessen the appetite, therefore the patients eat less.

Side effects:

- Nausea is the most common side effect. Starting this medication at a low dose and increasing it slowly can help fight the nausea.

Other side effects include:

- less appetite,
- vomiting,
- stomach pain,
- tiredness,
- dizziness, or
- indigestion.
- The drug can also cause low blood sugar if the patients do not adjust the amount of insulin they are taking.

Dulaglutide (Trulicity)

This is another GLP-1 drug. Unlike the others, Dulaglutide (Trulicity) is injected only once a week. It helps the body release more insulin and move glucose from the bloodstream into the cells.

The adult with type 2 diabetes who has not had success with other diabetes treatment can use this drug. It can be taken alone, or in combination with pioglitazone, metformin or a sulfonylurea drug. Researchers have not studied this medication in pregnant women.

Like other GLP-1 drugs, dulaglutide prompts the pancreas to release insulin, which moves glucose out of the bloodstream and into the cells. It also limits how much of the hormone glucagon the body makes, since glucagon normally spurs the liver to release stored sugar. This medication also slows digestion.

Side effects:

The most common side effects include:

- Nausea,
- vomiting,
- diarrhea,
- belly pain, and
- less appetite.

All GLP-1 drugs, including dulaglutide, have a boxed warning noting that in animal studies, this type of drug has been linked to thyroid cancer in some rats and mice. Experts do not know whether it has the same effect in humans.

MEDICATIONS

There are different types, or classes, of medications that work in different ways to lower blood glucose (blood sugar) levels:

- Sulfonylureas
- Biguanides
- Meglitinides
- Thiazolidinediones
- DPP-4 inhibitors
- SGLT2 Inhibitors
- Alpha-glucosidase inhibitors
- Bile Acid Sequestrants

Sulfonylureas

A class of oral hypoglycemic agents (medications that lower the level of blood glucose) taken by individuals with type 2 diabetes. The sulfonylureas increase the secretion of insulin by the pancreas. There are two generations of sulfonylureas. The main difference between the first- and second-generation sulfonylureas is in the way they are eliminated from the body. As a consequence, second-generation sulfonylureas are usually taken less frequently each day than first-generation sulfonylureas and generally are preferred when there is poor function of the kidneys.

Sulfonylureas stimulate the beta cells of the pancreas to release more insulin. Sulfonylurea drugs have been in use since the 1950s. Chlorpropamide (Diabinese) is the only first-generation sulfonylurea still in use today. The second generation sulfonylureas are used in smaller doses than the first-generation drugs.

There are three second-generation drugs:

- glipizide (Glucotrol and Glucotrol XL),
- glyburide (Micronase, Glynase, and Diabeta), and
- glimepiride(Amaryl).

These drugs are generally taken one to two times a day, before meals.
All sulfonylurea drugs have similar effects on blood glucose levels, but they differ in side effects, how often they are taken, and interactions with other medications.

Biguanides

Metformin (Glucophage) is a biguanide. Biguanides lower blood glucose levels primarily by decreasing the amount of glucose produced by the liver. Metformin also helps to lower blood glucose levels by making muscle tissue more sensitive to insulin so glucose can be absorbed. It is usually taken two times a day.

A side effect of metformin may be diarrhea, but this is improved when the medication is taken with food.

Meglitinides

Meglitinides are drugs that also stimulate the beta cells to release insulin.
Repaglinide (Prandin) and nateglinide (Starlix) are meglitinides. They are taken before each of three meals.

Because sulfonylureas and meglitinides stimulate the release of insulin, it is possible to have hypoglycemia (low blood glucose levels).

AVOID ALCOHOL.

Alcohol and some diabetes pills may not mix. Occasionally, chlorpropamide and other sulfonylureas, can interact with alcohol to cause:

- Vomiting,
- flushing
- sickness.

Thiazolidinediones

Rosiglitazone (Avandia) and pioglitazone (ACTOS) are in a group of drugs called thiazolidinediones.

These medications help insulin work better in the muscle and fat and also reduce glucose production in the liver. The first drug in this group, troglitazone (Rezulin), was removed from the market because it caused serious liver problems in a small number of people.

Rosiglitazone and pioglitazone have not shown the same problems, but users are still monitored closely for liver problems as a precaution. Both drugs appear to increase the risk for heart failure in some individuals, and there is debate about whether rosiglitazone may contribute to an increased risk for heart attacks. Both drugs are effective at reducing A1C and generally have few side effects.

DPP-4 Inhibitors

A new class of medications called DPP-4 inhibitors help improve A1C without causing hypoglycemia. They work by preventing the breakdown of a naturally occurring compound in the body, GLP-1.

GLP-1 reduces blood glucose levels in the body, but is broken down very quickly so it does not work well when injected as a drug itself. By interfering in the process that breaks down GLP-1, DPP-4 inhibitors allow it to remain active in the body longer, lowering blood glucose levels only when they are elevated. DPP-4 inhibitors do not tend to cause weight gain and tend to have a neutral or positive effect on cholesterol levels.

DPP-4 inhibitors currently on the market in the US:

- Sitagliptin (Januvia),

- saxagliptin (Onglyza),
- linagliptin (Tradjenta),
- Alogliptin (Nesina)

SGLT2 Inhibitors

Glucose in the bloodstream passes through the kidneys, where it can either be excreted or reabsorbed. Sodium-glucose transporter 2 (SGLT2) works in the kidney to reabsorb glucose, and a new class of medication, SGLT2 inhibitors, block this action, causing excess glucose to be eliminated in the urine.

Canagliflozin (Invokana) and dapagliflozin (Farxiga) are SGLT2 inhibitors that have recently been approved by the FDA to treat type 2 diabetes.

SIDE EFFECTS

Because they increase glucose levels in the urine, side effects can include urinary tract and yeast infections.

Alpha-glucosidase inhibitors

Acarbose (Precose) and miglitol (Glyset) are alpha-glucosidase inhibitors. These medications help the body to lower blood glucose levels by blocking the breakdown of starches, such as bread, potatoes, and pasta in the intestine. They also slow the breakdown of some sugars, including table sugar. Their action slows the rise in blood glucose levels after a meal. They should be taken with the first bite of a meal.

SIDE EFFECTS

These drugs may have side effects, including:

- Gas and
- Diarrhea.

Bile Acid Sequestrants

The bile acid sequestrant (BAS) colesevelam (Welchol) is a cholesterol-lowering medication that also reduces blood glucose levels in patients with diabetes. BASs help remove cholesterol from the body, particularly LDL cholesterol, which is often elevated in people with diabetes. The medications reduce LDL cholesterol by binding with bile acids in the digestive system; the body in turn uses cholesterol to replace the bile acids, which lowers cholesterol levels. The mechanism by which colesevelam lowers glucose levels is not well understood. Because BASs are not absorbed into the bloodstream, they are usually safe for use by patients who may not be able to use other medications because of liver problems.

SIDE EFFECTS

Because of the way they work, side effects of bile acid sequestrant (BAS) can include:

- flatulence and
- constipation.

Oral combination therapy

Because those medications listed above act in different ways to lower the blood glucose levels, they may be used together. For example, a biguanide and a sulfonylurea may be used together. Many combinations can be used. Though taking more than one medication can be more costly and can increase the risk of side effects, combining oral medications can improve blood glucose control when taking only a single pill does not have the desired effects. Switching from one single pill to another is not as effective as adding another type of diabetes medication.

All FDA-approved medications used in the treatment of diabetes are either taken orally, injected, or inhaled, and can be found at Drugs@FDA.

Insulins and Diabetic medications approved by the FDA between 2013-2015:

LUCENTIS	ranibizumab	February 6, 2015
TRULICITY	duglaglutide	September 18, 2014
JARDIANCE	empagliflozin	August 1, 2014
AFREZZA INHALATION POWDER	insulin human	June 27, 2014
TANZEUM	abliglutide	May 2014
FARXIGA	dapaglifozin	January 2014
DUETACT	pioglitazone hydrochloride and glimepiride	January 2013

Insulins and Diabetic medications approved by the FDA between 2000-2012:

Brand Name	Generic Name	Approval Date

Brand Name	Generic Name	Approval Date
LUCENTIS	ranibizumab	August 2012
JANUMET XR	sitagliptin and metformin HCl extended-release	February 2012
JENTADUETO	linagliptin plus metformin hydrochloride	February 2012
BYDUREON	exenatide synthetic	January 2012
JUVISYNC	sitagliptin and simvastatin	October 2011
TRADJENTA	linagliptin	May 2011
KOMBIGLYZE XR	saxagliptin/metformin hydrochloride extended-release	November 2010
VICTOZA	liraglutide	January 2010
ONGLYZA	saxagliptin	July 2009
PRANDIMET	repaglinide/metformin hydrochloride	June 2008

Brand Name	Generic Name	Approval Date
JANUMET	sitagliptin/metformin HCl	March 2007
JANUVIA	sitagliptin phosphate	October 2006
ACTOplus met	pioglitazone hydrochloride and metformin hydrochloride	August 2005
LEVEMIR	insulin detemir	June 2005
BYETTA	exenatide	April 2005
SYMLIN	pramlintide	March 2005
APIDRA	insulin glulisine	February 2004
METAGLIP	glipizide/metformin HCl	October 2002
AVANDAMET	rosiglitazone maleate and metformin HCl)	October 2002
LANTUS	insulin glargine	April 2000

Brand Name	Generic Name	Approval Date
NOVOLOG	Insulin aspart	November 2001
NOVOLOG 70/30	70% insulin aspart protamine and 30% insulin aspart	November 2001

SOME COMPLICATIONS

Diabetes can affect any part of the body. When the blood sugar level stays high for a long time, the individual may have a greater chance of a:

- Heart attack,
- a stroke,
- kidney damage,
- Blindness.

Other long-term complications of diabetes may include:

- Bone and joint disorders,
- skin problems,
- digestive problems,
- sexual dysfunction, and
- Problems with teeth and gums
- And other complications listed below

Heart Disease

Individuals with diabetes have a higher than average risk of having a heart attack or stroke; (more than twice as often as people without diabetes).

There is a link between diabetes, heart disease, and stroke. Two out of three people with diabetes die from heart disease or stroke (cardiovascular disease).

When the blood vessels are clogged, this can lead to stroke, heart attack, and other health issues /problems.

Types of Heart Disease

Types of Heart Disease:

- Coronary Artery Disease,
- Heart Failure

CORONARY ARTERY DISEASE

Coronary artery disease, sometimes called hardening of the arteries, is caused by narrowing or blocking of the blood vessels that go to the heart.

The blood carries oxygen and other needed nutrients/ substances to the heart. If the blood vessels to the heart become totally or partially blocked by fatty deposits, then the blood supply is reduced or completely cut off. Then a heart attack (myocardial infarction or MI) can occur.

The Warning Signs of a Heart Attack

Warning signs such as:

- chest pain or chest discomfort
- pain or discomfort in the arms, neck, jaw, back or stomach
- difficulty breathing /shortness of breath
- sweating
- nausea or indigestion
- light-headed
- fatigue /tiredness

Patient teaching:

- If experiencing warning signs of a heart attack, call 911.
- All of these symptoms may not be experience or they occur then go away.
- Chest pain that does not go away after resting may signal a heart attack.
- Diabetes can cause nerve damage that can make heart attacks painless or "silent."

Heart Failure

With heart failure, the heart is less able to pump blood. Heart failure may be caused by several problems, such as:

- heart attack,
- coronary artery disease and
- high blood pressure.

In congestive heart failure, another heart condition, fluid builds up inside body tissues such as the lungs. Then breathing becomes difficult.

Warning signs of heart failure

Warning signs can differ among people but they often include:

- Difficulty breathing /shortness of breath
- Fatigue / weakness
- nausea
- swelling of the feet and ankles (due to fluid retention)

Peripheral Arterial Disease (PAD)

Peripheral arterial disease (PAD) occurs when the blood vessels in the legs are narrowed or blocked by fatty deposits and blood flow to the feet and legs is reduced.

Encourage the patient to speak with the physician if they are experiencing:

- Mild leg pain,
- troubling walking,
- tingling in the legs or other symptoms of PAD.

If the patients have Peripheral arterial disease (PAD) they have an increased risk for heart attack and stroke. An estimated 1 out of every 3 people with diabetes over the age of 50 have Peripheral arterial disease (PAD). However, many of those with warning signs do not realize that they have PAD and therefore do not get treatment.

Diabetes and Peripheral arterial disease (PAD)

If the patients have diabetes, they are more likely to have Peripheral arterial disease (PAD), a heart attack, or stroke. But patients can reduce the chances of having those problems by taking special care of the blood vessels.

High Risk for Peripheral arterial disease (PAD)

Just having diabetes puts the individual at risk, but the risk is even greater under the following conditions:

- Smoking
- High blood pressure
- Abnormal blood cholesterol levels
- Overweight
- Not physically active
- Over age 50
- History of heart disease
- have had a heart attack or stroke
- Family history of heart disease, heart attack, or stroke.

The patient cannot change the family history or age, but taking care of the diabetes and the conditions that come with it can lower the chances of having Peripheral arterial disease (PAD).

Warning Signs of PAD

Many individuals with diabetes and Peripheral arterial disease (PAD) do not have any symptoms. Some individuals may experience mild leg pain or trouble walking and assume that it is just part of the aging process; getting older.

Others may experience the following symptoms:

- Leg pain, especially when walking or exercising, which disappears after a few minutes of rest
- Numbness, tingling, or coldness in the lower legs or feet
- Sores or infections on the feet or legs that heal slowly

Peripheral arterial disease (PAD) Diagnosis

Ankle brachial index (ABI)

The ankle brachial index (ABI) is one test used to diagnose PAD. This test compares the blood pressure in the ankle to the blood pressure in the arm. If the blood pressure in the lower part of the leg is lower than the pressure in the arm, the individual may have PAD.

An expert panel brought together by the American Diabetes Association recommends that individuals with diabetes over the age of 50 have an ABI to test for PAD. Individuals with diabetes who are younger than 50 may also benefit from testing if they have other Peripheral arterial disease (PAD) risk factors.

Other tests that may be used to diagnosis PAD include:

- Angiogram: a test in which dye is injected into the blood vessels using a catheter and X rays are taken to show whether arteries are narrowed or blocked.
- Ultrasound: a test using sound waves to produce images of the blood vessels on a viewing screen.
- MRI (magnetic resonance imaging): a test using special scanning techniques to detect blockages within blood vessels.

Treating Peripheral arterial disease (PAD)

Individuals with PAD are at very high risk for heart attacks and stroke, so it is very important to manage cardiovascular risk factors.

Here are some steps to take:

- Quit smoking
- Aim for an A1C below 7%. The A1C test measures the average blood glucose (sugar) over the past 2 to 3 months.
- Lower the blood pressure to less than 140/80 mmHg.
- Get the LDL cholesterol below 100 mg/dl.
- Talk to the physician / health care provider about taking aspirin or other antiplatelet medications. These medications have been shown to reduce heart attacks and strokes in individuals with PAD.

Studies have also found that exercise, for example, walking can be used to treat PAD and to prevent it. Medications may help relieve symptoms.

In some cases, surgical procedures are used to treat PAD:

- Angioplasty (balloon angioplasty): a procedure in which a small tube with a balloon attached is inserted and threaded into an artery; then the balloon is inflated, opening the narrowed artery. A wire tube (a stent) may be left in place to help keep the artery open.
- Artery bypass graft: a procedure in which a blood vessel is taken from another part of the body and is attached to bypass a blocked artery.

Diabetic ketoacidosis (DKA)

Diabetic ketoacidosis (DKA) is a very serious condition that may lead to diabetic coma (passing out for a long time) or even death.

When the cells do not get the glucose they need for energy, the body begins to burn fat for energy, which produces ketones.

Ketones are chemicals that the body creates when it breaks down fat to use for energy. The body does this when it does not have enough insulin to use glucose, the body's normal source of energy.

When the ketones build up in the blood, they make it more acidic. They are a warning sign that diabetes is out of control or that the individual is getting sick.

High levels of ketones can be poisonous to **the body.** When levels get too high, the patient can develop Diabetic ketoacidosis.

Diabetic ketoacidosis may happen to anyone with diabetes, though it is rare in people with type 2.

Treatment for Diabetic ketoacidosis usually takes place in the hospital. But patients can help prevent it by learning the warning signs and checking their urine and blood on a regular basis.

Warning Signs of Diabetic ketoacidosis (DKA)

Diabetic ketoacidosis (DKA) usually develops slowly. But when vomiting occurs, this life-threatening condition can develop in a few hours. Early symptoms include the following:

- Thirst and /or mouth is very dry
- Frequent urinating
- High blood glucose levels
- High/ increased levels of ketones within the urine

Then, other symptoms appear:

- Frequently feeling tired
- Flushed or dry skin
- Fruity breath/ odor
- Nausea
- Vomiting
- abdominal pain
- Difficulty breathing
- Confusion
- Difficult time paying attention

Managing diabetic ketoacidosis (DKA)

Managing diabetic ketoacidosis (DKA) in an intensive care unit during the first 24-48 hours always is advisable. When treating patients with DKA, the following points must be considered and closely monitored:

- Correcting fluid loss with intravenous fluids
- Correcting hyperglycemia with insulin
- Correcting electrolyte disturbances, (particularly potassium loss)
- Correcting acid-base balance
- Treatment of concurrent infection(if present)

Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNS)

Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNS) is a serious condition that is most commonly seen in older individuals. HHNS can happen to patients with either type 1 or type 2 diabetes that is not being controlled properly, but it occurs more often in patients with type 2. Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNS) is usually brought on by something else, such as an illness or infection.

In HHNS, blood sugar levels rise, and the body tries to get rid of the excess sugar by passing it into the urine. Initially, there is increased urine production, and the individual goes to the bathroom more frequently. Later on, the patient may not have to go to the bathroom as often, and the urine becomes very dark and they may experience increased thirst. At this time it is important to drink liquids, even if not feeling thirsty because the individual can become dehydrated.

If Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNS) continues, the severe dehydration will lead to:

- seizures,
- coma and
- eventually death.

Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNS) may take days or even weeks to develop. Know the warning signs of HHNS.

Warning Signs

- Blood sugar level over 600 mg/dl
- Dry, parched mouth
- Extreme thirst (although this may gradually disappear)
- Warm skin
- Dry skin that does not sweat
- High fever (over 101 degrees Fahrenheit)
- Sleepiness or confusion
- Loss of vision
- Hallucinations (seeing or hearing things that are not there)
- Weakness on one side of the body

Avoiding HHNS

Employ better diabetes management. HHNS only occurs when diabetes is uncontrolled. The best way to avoid HHNS is to check the blood sugar regularly. Follow the physician / healthcare professional orders regarding monitoring the blood sugar; several times per day, such as before or after meals.

Teach patients to talk with their health care team about their target blood sugar range and when to call if their blood sugars are too high or too low and not in their target range.

When the patient feels sick, they need to monitor the blood sugar more frequently, and drink a glass of liquid (alcohol-free drink and caffeine-free) every hour. Also it is very important to work with the healthcare team to develop their own sick day plan.

High Blood Pressure (Hypertension)

Nearly 1 in 3 American adults have high blood pressure and 2 in 3 people with diabetes report having high blood pressure or take prescription medications to lower their blood pressure. The heart has to work harder when blood pressure is high, and the risk for heart disease, stroke and other problems increases.

High blood pressure will not go away without treatment. Lifestyle changes, diet changes and, at times, medication is needed to lower the blood pressure.

Blood pressure is the force of blood flow inside the blood vessels. It is recorded as two numbers, such as 120/80. The first number is the pressure as the heart beats and pushes blood through the blood vessels (systolic pressure). The second number is the pressure when the vessels relax between heartbeats (diastolic pressure).

Blood Pressure Values:

- Healthy blood pressure: below 120/80
- Early high blood pressure: between 120/80 and 140/90
- High blood pressure: 140/90 or higher

The lower the blood pressure, the better the chances of delaying or preventing a heart attack or a stroke.

When the blood moves through the vessels with too much force, it is high blood pressure or hypertension. The heart has to work harder when blood pressure is high, therefore the risk for heart disease and diabetes goes up. High blood pressure raises the individuals risk for heart attack, stroke, eye problems and kidney disease.

Patient Teaching

High blood pressure is a silent problem; therefore encourage the individuals to have their blood pressure checked at regular health care visit.

To help reduce the blood pressure, teach patients to:

- Work with their health care provider to find a treatment plan that is right for them.
- Eat whole-grain breads and cereals.
- Try herbs and spices to flavor foods, instead of salt.
- Check food labels and choose foods with less than 400 mg of sodium per serving.
- Work on losing weight (as applicable) or take steps to prevent weight gain.
- Limit alcohol consumption and consult the health care provider about whether it is safe to drink alcohol.
- Quit smoking.
- Ask the health care provider about medications to help reduce high blood pressure. Such as: angiotensin converting enzyme (ACE) inhibitors, Angiotensin II receptor blockers (ARBs), beta blockers, calcium channel blockers and diuretics.

GASTROPARESIS

Gastroparesis is a disorder that can affect people with both type 1 and type 2 diabetes in which the stomach takes too long to empty contents (delayed gastric emptying). The vagus nerve controls the movement of food through the digestive tract. If the *vagus nerve* is damaged or stops working, the muscles of the stomach and intestines do not work normally, and the movement of food is slowed down or stopped.

Just as with other types of neuropathy, diabetes can damage the vagus nerve if blood glucose levels remain high over a long period of time. High blood glucose causes

chemical changes in nerves and damages the blood vessels that carry oxygen and nutrients to the nerves.

Signs and symptoms of gastroparesis may include but not limited to the following:

- Nausea
- Vomiting undigested food
- Heartburn
- Feeling of fullness when eating early in meal
- Decreased appetite
- Weight loss
- Abdominal bloating
- Erratic blood sugar levels
- Gastroesophageal reflux
- Stomach wall spasms

The symptoms may be mild or severe, depending on the individual.

Complications of Gastroparesis

Gastroparesis can make the diabetes worsen by making it more difficult to control or manage the blood sugar (glucose) levels. When the food has been delayed in the stomach eventually enters the small intestine and absorption takes place, the blood sugar levels rise.

When food stays too long in the stomach, it may lead to problems such as:

- Bacterial overgrowth
- the food may harden into solid masses (bezoars) that may cause nausea, vomiting, and obstruction in the stomach. Bezoars can be dangerous if they block the passage of food into the small intestine.

There are a variety of tests that can be performed to diagnose gastroparesis, such as:

- **Barium X-ray**
  After fasting for 12 hours, the patient will drink a thick liquid containing barium, which covers the inside of the stomach, making it show up on the X-ray. Normally, the stomach will be empty of all food after 12 hours of fasting. If the X-ray shows food in the stomach, gastroparesis is likely. With patients who have diabetes, the physician may have special instructions about fasting.

- **Barium Beefsteak Meal**
  the patient will eat a meal that contains barium, which allows the physician to watch the stomach as it digests the meal. The amount of time it takes for the barium meal to be digested and leave the stomach gives the physician an idea of how well the stomach is functioning. This test may help locate emptying problems that do not show up on the liquid barium X-ray. Individuals who have diabetes related gastroparesis usually digest fluid normally, so the barium beefsteak meal can be more useful.

- **Radioisotope Gastric-Emptying Scan**
  The patient will eat food that contains a radioisotope, a slightly radioactive substance that will show up on the scan. The dose of radiation from the radioisotope is small and not dangerous. After eating, the patient will lie under a machine that detects the radioisotope and shows an image of the food in the stomach and how quickly it leaves the stomach. Gastroparesis is diagnosed if more than half of the food is still in the stomach after two hours.

- **Gastric Manometry**
  The test measures the electrical and the muscular activity within the stomach. The physician passes a thin tube down the throat into the stomach. The tube contains a wire that takes measurements of the stomach's electrical and muscular activity as it digests the liquids and solid food. The measurements show how the stomach is working and whether there is any delay in digestion.
- **Blood tests**
  The physician may also order laboratory tests to assess blood counts and to measure electrolyte and chemical levels.

To rule out other causes of gastroparesis, the physician may order an upper endoscopy or an ultrasound.

- **Upper Endoscopy**
  After giving the patient a sedative, the physician passes a long, thin tube called an endoscope through the mouth and gently guides it down the esophagus into the stomach. Through the endoscope, the physician view the lining of the stomach to check for anything that is abnormal.
- **Ultrasound**
  To rule out gallbladder disease or pancreatitis as a source of the problem, an ultrasound test may be completed, which uses harmless sound waves to outline and define the shape of the gallbladder and pancreas.

Treatment

The most important treatment goal for diabetes-related gastroparesis is to manage the blood glucose levels as well as possible.

Treatments may include but not limited to:

- Insulin,
- oral medications,
- changes in what and when to eat,
- In severe cases, tube feedings and intravenous feeding.

For the patient with gastroparesis, the food is being absorbed more slowly and at unpredictable times therefore to better manage blood glucose, the patients may need to try to:

- Take insulin more often
- Take the insulin after they eat instead of before
- Check the blood glucose levels frequently after they eat and administer insulin whenever necessary.

(The physician will give specific instructions based on the patients' particular needs).

Several medications are used to treat gastroparesis. The physician may try different medications or combinations of medications to find the most effective treatment.

Meal and Food Changes

Changing eating habits can help control gastroparesis. The dietitian or physician may give specific instructions to improve symptoms. It can be helpful to eat less food at one time. Some great examples include:

- Eat six small meals a day instead of three large meals
- Eat slowly,
- sit upright after eating, and
- take a walk after meals.

The physician may also recommend that;

- the patient avoid high-fat and high-fiber foods. Fat naturally slows digestion which can further slow down digestion. Fiber can be difficult to digest and it may be possible that the undigested fiber can form bezoars.
- Depending on the severity, the physician may order liquid meals or may prescribe medications to help speed up digestion.

Kidney Disease (Nephropathy)

Inside the kidneys, there are millions of tiny blood vessels that act as filters. The kidneys function includes removing waste products from the blood.

Diabetes can damage the kidneys and cause them to fail (the filtering system breaks down). Failing kidneys lose the ability to filter out waste products, resulting in kidney disease.

The process

When we eat, our bodies digest the protein we eat, this process creates waste products. In the kidneys there are millions of very small blood vessels/capillaries with even smaller holes in them that functions as filters. As the blood flows through the blood vessels, small molecules such as waste products squeeze through the holes. These waste products become part of the urine. Useful substances, such as protein and red blood cells, are too big to pass through the holes in the filter and stay in the blood. Diabetes can damage this system.

High levels of blood sugar make the kidneys filter too much blood. All this extra work is hard on the filters. After many years, they start to leak and useful protein is lost in the urine. Having small amounts of protein in the urine is called microalbuminuria.

When kidney disease is diagnosed early, during microalbuminuria, several treatments may keep kidney disease from getting worse. Having larger amounts of protein in the urine is called macroalbuminuria. When kidney disease is caught later during macroalbuminuria, end-stage renal disease (ESRD), often follows.

Overtime, the stress of overwork causes the kidneys to lose their ability to filter effectively. Waste products then start to build up in the blood. Finally, the kidneys fail

resulting in ESRD, is very serious. An individual with ESRD needs to have a kidney transplant or dialysis; to have the blood filtered by machine.

Preventing Diabetic kidney disease

Diabetic kidney disease can be prevented by:

- Keeping blood sugar in the appropriate target range. Research has shown that tight blood sugar control reduces the risk of microalbuminuria by 1/3. In patients who already had microalbuminuria, the risk of progressing to macroalbuminuria was cut in half. Other studies have suggested that tight control can reverse microalbuminuria

Stroke

A stroke occurs when the blood supply to part of the brain is suddenly interrupted. Then brain tissue is damaged. Most strokes happen because a blood clot blocks a blood vessel in the brain or neck.

A stroke can cause:

- Problems with movement,
- pain,
- numbness
- problems with thinking,
- problems remembering
- problems speaking.

Some individuals may also experience emotional problems, such as depression, after a stroke.

For individuals with diabetes, the chances of having a stroke are 1.5 times higher than in people who do not have diabetes. But the risk can be lowered by those individual taking measures to take care of their health.

Having diabetes raises the patient's risk for stroke, however the risk is even greater if:

- over age 55
- family background is African American
- already had a stroke or a transient ischemic attack (TIA or mini-stroke)
- family history of stroke or TIAs

- have heart disease
- have high blood pressure
- overweight
- have high LDL (bad) cholesterol and low HDL (good) cholesterol levels
- not physically active
- smoking

Lower the risk of having a stroke

- Lower the risk by keeping the blood glucose within target range
- Keep blood pressure within target range
- Keep cholesterol on target with healthy eating, physical activity, and medication if needed.
- Stop smoking.

Warning signs of a stroke

Typical warning signs of a stroke develop suddenly and may include but not limited to:

- weakness on one side of the body or
- numbness on one side of the body
- sudden confusion
- trouble understanding
- trouble talking
- dizziness,
- loss of balance, or difficulty walking
- vision problems (trouble seeing out of one or both eyes)
- double vision
- severe headache

Patient teaching:

If experience warning signs of a stroke, call 9-1-1 immediately. Getting treatment as soon as possible after a stroke can help prevent permanent damage to the brain.

If the blood flow to the brain is blocked for a short time, the patient may have one or more of the warning signs temporarily, meaning they have had a TIA (mini-stroke). TIAs put the individual at risk for a stroke in the future.

Stroke diagnosis

A variety of tests may be performed if a stroke is suspected:

- The health care provider will check for changes in how the body is working. For example, the physician of healthcare provider will check the patient's ability to move the arms and legs. The health care provider/physician can check brain functions such as the patient's ability to read or to describe a picture.

- **CT and MRI tests** use special scans to provide images of the brain.

- An **ECG (electrocardiogram)** provides information on heart rate and rhythm.

- An **ultrasound examination** can show problems in the carotid arteries, which carry blood from the heart to the brain.

- In a **cerebral arteriogram**, a small tube is inserted into an artery and positioned in the neck. The health care provider injects dye into the artery. Then the provider takes X-rays to look for narrowed or blocked arteries.

TREATMENTS FOR STROKE

Clot-busting medications has to be given within hours after a stroke to minimize damage.

Surgical treatments
Several options for surgical treatment of blocked blood vessels are available. These include:

- **Carotid artery surgery** (carotid endarterectomy) removes buildups of fat inside the artery and restores blood flow to the brain.
- **Carotid stenting** can remove a blockage in a blood vessel to the brain. A small tube with a balloon attached is threaded into the narrowed or blocked blood vessel. Then the balloon is inflated, opening the narrowed artery. A wire tube, or stent, may be left in place to help keep the artery open.

Other treatments

Care after a stroke includes treatments and exercises to restore function or help patients relearn skills. Physical therapy, occupational and speech therapy may be included, as well as psychological counseling.

Steps to prevent future problems should include patient teaching regarding:

- Quitting smoking,
- healthy eating,
- physical activity,
- managing blood glucose,
- managing blood pressure and
- managing cholesterol levels.

Eye Complications

The individuals with diabetes have a higher risk of blindness than individuals without diabetes. With regular checkups, they may be able to keep minor problems from getting worse. And if they do develop a major problem, there are treatments that often work well if they begin them right away.

Eye Insight/ how the eye works

The eye is a ball covered with an outer membrane. The covering in front is curved and clear. The curved area is the cornea, which focuses light while protecting the eye. After light passes through the cornea, it travels through a space called the anterior chamber, which is filled with a protective fluid called the aqueous humor, through the pupil (which is a hole in the iris, the colored part of the eye), and then through a lens that performs more focusing. Finally, light passes through another fluid-filled chamber in the center of the eye (the vitreous) and strikes the back of the eye, the retina. The retina records the images focused on it and converts those images into electrical signals, which the brain receives and decodes. One part of the retina is specialized for seeing fine detail. This tiny area of extra-sharp vision is called the macula. Blood vessels in and behind the retina nourish the macula. (ADA 2013)

Glaucoma

Glaucoma is a group of diseases that damage the eye's optic nerve and can result in vision loss and blindness. However, with early detection and treatment, there is a possibility that the individual can often protect the eyes against serious vision loss.

Individuals with diabetes are 40% more likely to suffer from glaucoma than people without diabetes. The longer the individual has had diabetes, the more common glaucoma is. The risk also increases with age.

Glaucoma occurs when pressure builds up in the eye. In most cases, the pressure causes drainage of the aqueous humor to slow down so that it builds up in the anterior chamber. The pressure pinches the blood vessels that carry blood to the retina and optic nerve. Vision is gradually lost because the retina and nerve are damaged.

Glaucoma is detected through a comprehensive dilated eye exam that includes the following:

Visual acuity test. This eye chart test measures how well the patient can see at various distances.

Visual field test. This test measures the peripheral (side vision). It helps the eye care professional tell if the patients have lost peripheral vision, a sign of glaucoma.

Dilated eye exam. In this exam, drops are placed in the eyes to widen, or dilate, the pupils. The eye care professional uses a special magnifying lens to examine the retina and optic nerve for signs of damage and other eye problems. After the exam, the patient's close-up vision may remain blurred for several hours.

Tonometry is the measurement of pressure inside the eye by using an instrument called a tonometer. Numbing drops may be applied to the eye for this test. A tonometer measures pressure inside the eye to detect glaucoma.

Pachymetry is the measurement of the thickness of the cornea. The eye care professional applies a numbing drop to the eye and uses an ultrasonic wave instrument to measure the thickness of the cornea.

There are several treatments for glaucoma. Some use drugs to reduce pressure in the eye, while others involve surgery.

Glaucoma Treatments

Immediate treatment for early-stage, open-angle glaucoma can delay progression of the disease, therefore, early diagnosis is very important.

Glaucoma treatments include:

- medications,
- laser trabeculoplasty,
- conventional surgery, or a combination of any of these.

While these treatments may save remaining vision, they do not improve sight that is already lost from glaucoma.

Medications

Medications, in the form of pills or eye drops, are the most common early treatment for glaucoma. When they are taken regularly, the eye drops lower eye pressure.

- Some medications cause the eye to make less fluid. Others lower pressure by helping fluid drain from the eye.
- Before beginning glaucoma treatment, encourage the patient to tell the eye care professional about other medications and supplements that they are taking. Sometimes the drops can interfere with the way other medications work.

Glaucoma medications need to be taken regularly as directed by the eye care professional. Most patients reports no problems, however, some medications can cause headaches or other side effects. For example, drops may cause stinging, burning, and redness in the eyes.

Several medications are available to treat glaucoma. If the patients have problems with one medication, update the eye care professional. Treatment with a different dose or a new medication may be possible.

Patient teaching is very important; because glaucoma often has no symptoms, patients may be tempted to stop taking, or may forget to take, their medication. Explain the need to use the drops or pills as long as they help control the eye pressure. Regular use is very important.

Laser trabeculoplasty.

Laser trabeculoplasty helps fluid drain out of the eye. The physician may suggest this step at any time. In many cases, the patient will need to keep taking glaucoma medications after the procedure.

Laser trabeculoplasty is performed in the physician's office or the eye clinic. Before the surgery, numbing drops are applied to the eye. The patients sit facing the laser machine and the physician holds a special lens to the eye. A high-intensity beam of light is aimed through the lens and reflected onto the meshwork inside the eye. The patient may see flashes of bright green or red light. The laser makes several evenly spaced burns that stretch the drainage holes in the meshwork. This allows the fluid to drain better.

Laser surgery can cause side effects, such as inflammation. The physician may give some drops to take home for any soreness or inflammation inside the eye. The patient will need to make several follow-up visits to have the eye pressure and eye monitored.

If the patients have glaucoma in both eyes, usually one eye will be treated at a time. Laser treatments for each eye will be scheduled several days to several weeks apart.

Studies show that laser surgery can be very good at reducing the pressure in some patients. However, its effects can wear off over time. The physician may suggest further treatment.

Conventional surgery.

Conventional surgery makes a new opening for the fluid to leave the eye. The physician may suggest this treatment at any time. Conventional surgery often is done after medications and laser surgery have failed to control pressure.

Conventional surgery, called trabeculectomy, is performed in an operating room. Before the surgery, the patients are given medication to help them relax. The physician makes small injections around the eye to numb it. A small piece of tissue is removed to create a new channel for the fluid to drain from the eye. This fluid will drain between the eye tissue layers and create a blister-like filtration bleb.

For several weeks after the surgery, the patients need to put drops in the eye to fight infection and/ or inflammation. These drops will be different from those the patients may have been using before surgery.

Conventional surgery is performed on one eye at a time. Usually the operations are four to six weeks apart.

Conventional surgery is about 60% to 80% effective at lowering eye pressure. If the new drainage opening narrows, a second operation may be needed. Conventional surgery works best if the patients have not had previous eye surgery, such as a previous cataract operation.

Sometimes after conventional surgery, the vision may not be as good as it was before conventional surgery.

Conventional surgery can cause side effects, including:

- cataract,
- problems with the cornea,
- inflammation,
- infection inside the eye, or
- low eye pressure problems.

If you have any of these problems, tell your doctor so a treatment plan can be developed.

Patient teaching

To properly apply the eye drops, follow these steps:

- Perform hand hygiene (Wash hands).
- Hold the bottle upside down.
- Tilt head back.
- Hold the bottle in one hand and place it as close as possible to the eye.
- With the other hand, pull down the lower eyelid. This will form a pocket.
- Place the prescribed number of drops into the lower eyelid pocket. If you are using more than one eye drop- wait at least 5 minutes before applying the second eye drop.
- Close the eye or press the lower lid lightly for at least 1 minute.

CATARACTS

Researchers suspect that there are several causes of cataract, such as diabetes and smoking. Or, it may be that the protein in the lens just changes from the wear and tear it takes over the years.

A cataract is a clouding of the lens in the eye that affects vision. Most cataracts are related to aging. Cataracts are very common in older people. By age 80, more than half of all Americans either have a cataract or have had cataract surgery.

A cataract can occur in either or both eyes. It cannot spread from one eye to the other.

The lens lies behind the iris and the pupil. It works like a camera lens. It focuses light onto the retina at the back of the eye, where an image is recorded. The lens also adjusts the eye's focus, so that you can see things clearly both up close and far away. The lens is made of mostly water and protein. The protein is arranged in a way that keeps the lens clear and allows light to pass through it.

As the individual gets older, some of the protein may clump together and begin to cloud a small area of the lens. This is a cataract. Over time, the cataract may grow larger and cloud more of the lens, making it more difficult to see.

Although most cataracts are related to aging, there are other types of cataract:

1. **Secondary cataract.**

   Cataracts can form after surgery for other eye problems, such as glaucoma. Cataracts also can develop in patients who have other health problems, including diabetes.

   Cataracts are sometimes linked to steroid use.

2. **Traumatic cataract.**

   Cataracts can develop after an eye injury, sometimes years later.

3. **Congenital cataract.**

Some babies are born with cataracts or develop them in childhood, often in both eyes. These cataracts may be so small that they do not affect vision. If they do, the lenses may need to be removed.

4. **Radiation cataract.**

   Cataracts can develop after exposure to some types of radiation.

The most common symptoms of a cataract are:

- Cloudy or blurry vision.
- Colors seem faded.
- Glare, headlights, lamps, or sunlight may appear too bright.
- A halo may appear around lights.
- Poor night vision.
- Double vision or multiple images in one eye. (This symptom may clear as the cataract gets larger.)
- Frequent prescription changes in eyeglasses or contact lenses.
- These symptoms also can be a sign of other eye problems.

Cataract is detected through a comprehensive eye exam that includes:

1. **Visual acuity test.** This eye chart test measures how well you see at various distances.
2. **Dilated eye exam.** Drops are placed in the eyes to widen, or dilate, the pupils. The eye care professional uses a special magnifying lens to examine the retina and optic nerve for signs of damage and other eye problems. After the exam, close-up vision may remain blurred for several hours.
3. **Tonometry.** An instrument measures the pressure inside the eye. Numbing drops may be applied to the eye for this test.

The eye care professional also may do other tests to learn more about the structure and health of your eye.

Cataract treatment

The symptoms of early cataract may be improved with:

- new eyeglasses,
- brighter lighting,
- anti-glare sunglasses,
- magnifying lenses.
- If these measures do not help, surgery is then surgical intervention can be performed.
- Surgery involves removing the cloudy lens and replacing it with an artificial lens.

A cataract needs to be removed only when vision loss interferes with the everyday activities, such as driving, reading, or watching TV. The patient and the eye care professional can make this decision together. The patients should understand the benefits and risks of surgery, then they will be able to make an informed decision about whether cataract surgery is right for them.

Sometimes a cataract should be removed even if it does not cause problems with the vision. For example, a cataract should be removed if it prevents examination or treatment of another eye problem, such as age-related macular degeneration or diabetic retinopathy. If the eye care professional finds a cataract, the patients may not need cataract surgery for several years. In fact, they might never need cataract surgery. By having the vision tested regularly, the patients and the eye care professional can discuss if and when they might need treatment.

If cataracts are present in both eyes that require surgery, the surgery will be performed on each eye at separate times, usually four to eight weeks apart.

Many individuals who need cataract surgery also have other eye conditions, such as age-related macular degeneration or glaucoma.

There are two types of cataract surgery:

1. **Phacoemulsification**, or **phaco**.

   A small incision is made on the side of the cornea, the clear, dome-shaped surface that covers the front of the eye. The physician inserts a tiny probe into the eye. This device emits ultrasound waves that soften and break up the lens so that it can be removed by suction. Most cataract surgery today is done by phacoemulsification, also called small incision cataract surgery.

2. **Extracapsular surgery**.

   The physician makes a longer incision on the side of the cornea and removes the cloudy core of the lens in one piece. The rest of the lens is removed by suction.

After the natural lens has been removed, it often is replaced by an artificial lens, called an intraocular lens (IOL). An IOL is a clear, plastic lens that requires no care and becomes a permanent part of the eye. Light is focused clearly by the IOL onto the retina, improving the vision. The patient will not feel or see the new lens.

Some individuals cannot have an IOL. They may have another eye disease or have problems during surgery. For these patients, a soft contact lens, or glasses that provide high magnification, may be recommended.

Retinopathy

Diabetic retinopathy is a general term for all disorders of the retina caused by diabetes. There are two major types of retinopathy:

1. nonproliferative and
2. proliferative.

Nonproliferative retinopathy

The most common form of retinopathy is nonproliferative retinopathy. With this type, the capillaries in the back of the eye balloon and form pouches. Nonproliferative retinopathy can move through three stages (mild, moderate, severe) as more and more blood vessels become blocked.

Macular edema

Retinopathy does not usually cause vision loss at this stage, however,
the capillary walls may lose the ability to control the passage of substances between the blood and the retina. Fluid can leak into the part of the eye where focusing occurs (the macula). When the macula swells with fluid, a condition called macula edema, vision

blurs and can be lost entirely. Although nonproliferative retinopathy usually does not require treatment, macular edema must be treated, but fortunately treatment is usually effective at stopping and sometimes reversing vision loss.

Proliferative retinopathy

In some individuals, retinopathy progresses after several years to a more serious form called proliferative retinopathy. In this form, the blood vessels are so damaged they close off. In response, new blood vessels start growing in the retina. These new vessels are weak and can leak blood, blocking vision, which is called vitreous hemorrhage. The new blood vessels can also cause scar tissue to grow. After the scar tissue shrinks, it can distort the retina or pull it out of place, a condition called retinal detachment.

Treatment of diabetic retinopathy

Several treatments have prevented blindness in many people. Treatments such as:

- Scatter photocoagulation,
- focal photocoagulation, and
- vitrectomy.

The earlier retinopathy is diagnosed, the more likely these treatments will be successful. The best results occur when sight is still normal.

In **photocoagulation**, the eye care professional makes tiny burns on the retina with a special laser. These burns seal blood vessels and stop them from growing and leaking.

In scatter photocoagulation (panretinal photocoagulation), the eye care professional makes hundreds of burns in a polka-dot- pattern on two or more occasions. Scatter photocoagulation reduces the risk of blindness from vitreous hemorrhage or detachment of the retina, but it only works before bleeding or detachment has progressed very far. This treatment is also used for some kinds of glaucoma.

Side effects of scatter photocoagulation are usually minor. They include several days of blurred vision after each treatment and possible loss of peripheral vision.

In focal photocoagulation, the eye care professional aim the laser precisely at leaking blood vessels in the macula. This procedure does not cure blurry vision caused by macular edema, however it does keep it from getting worse.

Whenever the retina has already detached or there ia an increased blood leakage into the eye, photocoagulation is no longer useful. The next option is vitrectomy, which is surgery to remove scar tissue and cloudy fluid from inside the eye. The earlier the operation occurs, the more likely it is to be successful. When the goal of the operation is to remove blood from the eye, it usually works. Reattaching a retina to the eye is much more difficult and works in only about half the cases.

There are two types of treatment for macular edema:

- Focal laser therapy that will slow the leakage of fluid, and
- Medications that can be injected into the eye that will slow the growth of new blood vessel and reduce the leakage of fluid into the macula.

Risk for Retinopathy

Several factors influence whether the individual develops retinopathy:

- Blood sugar control
- Blood pressure levels
- How long the patients have had diabetes
- Genes

The longer the patients have had diabetes, the more likely they are to have retinopathy. Almost everyone with type 1 diabetes will eventually have nonproliferative retinopathy. And most people with type 2 diabetes will also develop this. But the retinopathy that destroys vision, proliferative retinopathy, is less common.

Individuals who keep their blood sugar levels closer to normal levels are less likely to have retinopathy or to have milder forms.

The retina can be seriously damaged before the patient notice any change in vision. Many individuals with nonproliferative retinopathy have no symptoms. Even with proliferative retinopathy, the more dangerous form, patients sometimes have no

symptoms until it is too late to treat them. For this reason, patient teaching is very important. Teach patients to follow up and have their eyes examined regularly by an eye care professional.

Eye Care - Patient teaching

There are some steps to take to avoid eye problems:

- Keep blood sugar levels under tight control. In the Diabetes Control and Complications Trial, people on standard diabetes treatment got retinopathy four times as often as people who kept their blood sugar levels close to normal. In individuals who already had retinopathy, the condition progressed in the tight-control group only half as often.
- Take control of high blood pressure. High blood pressure can make eye problems much worse.
- Quit smoking.
- **Follow up with the** eye care professional at least once a year for a dilated eye exam. Having the regular doctor look at the eyes is not enough or having the eyeglass prescription tested by an optician is not enough. Only optometrists and ophthalmologists can detect the signs of retinopathy. Only ophthalmologists can treat retinopathy.

Follow up with the eye care professional if:

- vision becomes blurry
- having difficulty reading signs or books
- seeing double
- one or both eyes hurt
- the eyes get red and stay red
- experiencing pressure in the eye
- seeing spots or floaters
- straight lines do not look straight
- cannot see things at the side as before.

Diabetes Public Health Resource
Registry of Recognized Programs

The national registry of recognized diabetes prevention programs lists contact information for type 2 diabetes prevention programs in communities across the United States. Programs with pending recognition have agreed to use an evidence-based curriculum that meets the duration, intensity, and reporting requirements described in the *DPRP Standards*. Full recognition means that a program has demonstrated effectiveness by achieving all of the performance criteria detailed in the *DPRP Standards*.

The Centers for Disease Control and Prevention (CDC) established the CDC Diabetes Prevention Recognition Program (DPRP) www.cdc.gov/diabetes/prevention/recognition) as part of the National Diabetes Prevention Program - (www.cdc.gov/diabetes/prevention). The DPRP provides information to people at high risk of type 2 diabetes, their health care providers, and health payers on the location and performance of local type 2 diabetes prevention programs. The purpose of DPRP is to recognize organizations that have demonstrated their ability to effectively deliver a proven type 2 diabetes prevention lifestyle intervention. The recognition program helps to assure that decisions about individual participation, patient referral, and health insurance benefits are based on accurate, reliable, and trustworthy information.

Here are some ways in which employers and Insurers can join the American Medical Association (AMA) and CDC to prevent type 2 diabetes:

EMPLOYERS CAN:

- Include prediabetes screening and testing as part of annual biometrics screenings
- Promote awareness of prediabetes to employees and their dependents/families
- Encourage senior leadership to get screened themselves, and demonstrate a focused commitment to diabetes prevention
- Work with their insurance carriers to include an evidenced-based diabetes prevention program as a covered benefit for all employees

INSURERS CAN

- Offer clients benefit packages that include screening and testing for prediabetes
- Offer evidence-based, CDC-recognized diabetes prevention programs to clients as an extension of current disease management and prevention programs
- Promote awareness of prediabetes as a serious medical condition to all of their clients

COMMUNITY-BASED ORGANIZATIONS (INCLUDING HEALTH SYSTEMS) CAN:

- Become a provider of the diabetes prevention program; a medical background is not needed to become a lifestyle coach trained to administer the CDC Diabetes Prevention Program Curriculum.
- Make diabetes prevention a priority for their members, group, stakeholders, etc.

MEDICAL ASSOCIATIONS AND SOCIETIES CAN:

- Provide educational content to members that empowers them to prioritize prediabetes for their patients
- Help connect members with community-based providers of the diabetes prevention program

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