The Role of the Certified Diabetic Educator in Managing Type II Diabetes

1 Contact Hours

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Purpose

The purpose of this course is to provide the health care professional with the latest research and evidence based practice when it comes to treating our diabetic population. This course will review the current management principles, treatment, and glucose monitoring for patients with type 2 diabetes. Additionally, this course will also review the role of the diabetic educator.

Objectives

After successful completion of this course, you will be able to:

- State the difference between type 1, type 2 and gestational diabetes.
- State the guidelines used when diagnosing type 2 diabetes.
- Outline current management principles for type 2 diabetes.
- Understand the principles of insulin therapy and oral hypoglycemic agents.
- Identify signs and symptoms of hypoglycemia and hyperglycemia.
- List the actions to take if hypoglycemia or hyperglycemia occur.
- State two certification requirements of the diabetic educator.

Introduction

According to the Centers for Disease Control and Prevention (CDC) (2017), diabetes is the seventh leading cause of death listed on U.S. death certificates. Cardiovascular disease is the leading cause of death among people with diabetes. 68% will die of heart disease or stroke. With the number of people diagnosed with diabetes rising from 1.5 million in 1958 to 23.1 million in 2017, it is truly an epidemic!

The Diabetes Epidemic

With diabetes becoming an epidemic, it is important for health care professionals to understand proper treatment and care for person with type 2 diabetes. According to the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (2017), the current diabetes statistics are:

- 30.3 million people in the United States have diabetes
- 7.2 million people are unaware they have diabetes
- 84.1 million people in the United States have pre-diabetes

This course will review how to care for this patient population and also review the role of the diabetic educator.

Brief Overview of Type 2 Diabetes

Diabetes occurs when your body cannot produce enough insulin and cannot use insulin well enough to control the amount of glucose (sugar) in the blood from defects in insulin production, insulin action, or both. The result of diabetes is that there is too much glucose in the blood. People with diabetes need to take control of their disease and lower their risk of complications otherwise the disease can lead to serious complication and premature death (American Diabetes Association [ADA], 2017a).

Process of Glucose Metabolism

Once the glucose enters your cells, it is used by the cells for energy. When you eat, food breaks down into glucose (or when you are not eating, your liver makes glucose).

Glucose travels through your bloodstream to reach your cells.

Pancreatic beta cells make insulin. The insulin in released from the pancreas when you eat.

Insulin allows glucose to enter cells.

(CDC, 2016)

Types of Diabetes

Type 1

Type 1 is when the immune system mistakenly destroys the insulin-producing cells-in the pancreas. Type 1 diabetes was previously called insulin-dependent or juvenile-onset. Of the three different types of diabetes, less than 5% of people with diabetes has type 1 (ADA, 2017d).

Type 2

Type 2 is when there is insulin resistance and decreased insulin production. Type 2 diabetes was previously called non-insulin-dependent or adult-onset. Type 2 diabetes is increasingly being diagnosed in children and adolescents. Type 2 diabetes accounts for 90-95% of all diagnosed cases of diabetes in adults (ADA, 2017e).

This course will focus on the management of type 2 diabetes.

Gestational Diabetes

Gestational diabetes occurs when there is an insulin resistance caused by pregnancy. When a woman has gestational diabetes, there is a 67% chance that it will develop in future pregnancies. In addition, gestational diabetes increases the

risk of developing diabetes, mainly type 2, by more than seven times greater than those women who do not have gestational diabetes. Only 2-10% of all pregnancies will have gestational diabetes (ADA, 2017b).

Risk Factors to Type 2 Diabetes

The following are risk factors to type 2 diabetes:

- Family history
- Over the age of 45
- Overweight
- Having pre-diabetes
- Having high blood pressure
- Having low HDL
- Inactive lifestyle- not exercising regularly
- Particular ethnic or racial background
- Giving birth to a baby larger than 9 lbs. or history of gestational diabetes

All of these risk factors can result in insulin resistance, increased hepatic glucose production, and insulin deficiency.

(Khardori, 2017; NIDDK, n.d.)

Test Yourself

Type 2 diabetes is when the immune system mistakenly destroys the insulin-producing cells-in the pancreas.

    A. True
    B. False – Correct

Diagnosing Diabetes

There are several ways to diagnose diabetes: hemoglobin A1C (commonly called A1C), fasting plasma glucose, or oral glucose tolerance test.

- A1C: A non-fasting blood specimen is taken to measure the patient's average blood glucose for the past two to three months. If it is ≥6.5%, the person is diagnosed with diabetes.
- Fasting plasma glucose: The patient has nothing to eat or drink (except water) for eight hours prior to the test. If the result is ≥126 mg/dL, then the patient is diagnosed with diabetes.
- Oral glucose tolerance test: The patient's blood is tested before a special sweet drink (glucose), then two hours after the patient drinks the glucose. If the results are ≥200 mg/dL, then the patient is diagnosed with diabetes.

(American Diabetes Association, 2017c

Test Yourself:

Which A1C level will inform the practitioner that the patient has diabetes?

    A. A1C ≥4.0%
    B. A1C ≥6.5% - Correct
    C. A1C ≥8.5%

Diagnosis Diabetes

	A1C	Fasting Plasma Glucose (FPG)	Oral Glucose Tolerance Test (OGTT)
Normal	<5.7%	<100mg/dL	<140mg/dL
Prediabetes	≥5.7% to <6.5%	≥100mg/dL to <126mg/dL	≥140mg/dL to <200mg/dL
Diabetes	≥6.5%	≥126mg/dL	≥200mg/dL

(American Diabetes Association, 2017c)

Comparison of A1C & Daily Blood Glucose

The A1C level is checked every three to six months to monitor the patient's average blood glucose. Testing is based on risk factors and glycemic control. Although A1C and blood glucose levels do not match perfectly, this is a general comparison.

(ADA, 2017c)

A1C (%)	Estimated Average Glucose (mg/dL)
6	126
7	154
8	183
9	212
10	240
11	269
12	298
13	326
14	354

(ADA, 2017c)

Outline Current Management Principles for Type 2 Diabetes

Diabetes management and treatment starts with the basics:

- Meal planning

- Physical activity
- Blood glucose monitoring
- Education

If the patient's blood glucose is not controlled with the prior methods, then the next level of management in addition to meal planning, physical activity, blood glucose monitoring, and education is the prescription of medications:

- Oral medications
- Injected insulin

(ADA, 2017c)

Basic Management of Diabetes

This next section will discuss the following key principles in managing diabetes. It is often the first step when treating a patient with diabetes, but the conversation should begin when a patient has pre-diabetes. These principles should always be part of the conversation with all patients with diabetes whether or not they are on pharmacological treatments.

- Meal planning
- Physical activity
- Blood glucose monitoring
- Education

(ADA, 2017c)

Meal Planning Overview

The first topic discussed is meal planning. The important key concepts in meal planning for the person with type 2 diabetes are:

- Food diary
- Timing of meals and snacks
- Caloric intake
- Consistent carbohydrate intake
- Nutritional content

These will be discussed in further detail.

(Khardori, 2017)

Effect of Foods on Blood Glucose

Before adjusting their food intake, it is important for patients to identify the effects of certain foods on the blood glucose.

- Educate the patient by instructing them to use a food diary or food record for at least three days in a row
- Depending on medication regimen, also check their blood glucose throughout the day at various times and record on the food diary or food log
- Make sure the patient records the times of meals and blood glucose checks

(ADA, 2017c)

Meal Planning

Important education components to discuss with patients with diabetes include:

- Timing: If timing of meals and snacks fluctuate, then the use of either insulin or oral medication administration must also fluctuate
- Awareness: The patients must be aware of what they are eating and why they are eating it. Using a food log assists most people with seeing their patterns and habits which facilitates change
- Missed meals or snacks: When a patient misses snacks and meals, this may affect the potency of the medication taken

Example: If insulin is given and a meal is skipped, there is an increased risk for hypoglycemia.

(ADA, 2017c)

Caloric Intake

Caloric intake is an integral part of meal planning.

Many patients with type 2 diabetes have excess fat; therefore, are overweight. In the body, excess energy is stored as fat. This excess in energy comes from increased caloric intake. Patients that reduce their caloric intake by approximately 200-500 calories a day generally will lose weight.

When a patient restricts caloric intake, the result in the short term is glycemic control. The long-term benefit of glycemic control is weight loss.

(Khardori, 2017)

Consistent Carbohydrate Intake

Carbohydrates are found in many different foods and is our body's best form of energy because carbohydrates break down into sugar faster than proteins and fat. All carbohydrates will affect your blood glucose. Foods like whole grains and cereals, rice, fruit, and low-fat milk are nutritious sources of carbohydrates (Khardori, 2017).

What is a Carbohydrate?

Any one of the various substances found in certain foods (such as bread, rice, and potatoes) that provide your body with heat and energy and are made of carbon, hydrogen, and oxygen (Merriam-Webster, 2017).

Keys to Consistent Carbohydrate Intake

Carbohydrate counting is important to instruct patients. The carbohydrate goal for patients with type 2 diabetes is on average about 130 grams of carbohydrate a day; however, this number will change depending on caloric needs and preferences (Khardori, 2017).

The following are hints to keeping a stable blood glucose:

Know the Goal

Eating a consistent amount of carbohydrates at each meal will keep the blood glucose at a consistent level. Remember, it is not healthy to cut out all carbohydrates as these are foods the body needs every day.

Monitor Intake

Keeping a food diary will help in tracking carbohydrates.

Serving Sizes

Measure the weights of food and volumes of food to learn about correct serving size.

Methods of Counting

Read the food labels to look at the TOTAL carbohydrates. Remember, the total carbohydrates will be based on serving size. Depending on the serving size ingested, the total carbohydrates will need to be adjusted accordingly. Another option is to use the exchange system to measure carbohydrates.

(Khardori, 2017)

Nutritional Content

Introduction

Close monitoring and follow-up with a nutritionist will assist in tailoring and adjusting all of the components below into a healthy recipe for the person with diabetes. All of the following should be assessed and individualized:

Carbohydrate: Monitor carbohydrate intake, as previously discussed.

Fat: Fat quality is more significant than fat quantity. Saturated fats and trans fats contribute to coronary heart disease. Monounsaturated and polyunsaturated can be protective. Trans fatty acid consumption should be kept at a minimum.

Cholesterol: Total cholesterol should be monitored closely; less than 300mg daily.

Protein: Protein intake should be individualized. Red meat should be substituted with lean meats, fish, eggs, beans, peas, nuts and seeds.

Fiber: Fiber intake should be managed. At least 14 grams per 1000 calories. Higher fiber intake may improve glycemic control.

Sodium: A reduced sodium intake: goal should be 2300 mg per day. Hypertensive patients may need a further reduced sodium intake.

Alcohol: Alcohol intake should be limited to one drink per day for women and two drinks per day for men.

(Khardori, 2017)

Physical Activity

The second topic is physical activity. Physical activity is important for both cardiovascular health and weight management. Exercise will improve glycemic control, control weight, and reduce blood pressure and cholesterol. These will improve the patient's quality of life.

The following are key teaching points about exercise:

- It is recommended that most adults participate in 30 minutes or more of moderate physical activity on most days of the week
- Tracking blood glucose levels before, during, and after exercise will assist with understanding the effect of exercise on blood glucose levels. Understanding the effects of exercise will prevent hypoglycemic episodes from increase physical activity

(Khardori, 2017)

Exercise can be beneficial to the patient with diabetes for many reasons. In order for the diabetic patient to improve their quality for life they must exercise. Which of the following is a benefit of exercise?

   A. Improve glycemic control
   B. Control weight
   C. Reduce blood pressure and cholesterol
   D. **All of the above – Correct**

Glucose Monitoring

The third basic topic in the management of type 2 diabetes is glucose monitoring. The purpose of monitoring blood glucose levels is to help the patient with diabetes maintain safe, healthy, and target-driven glucose control. Glucose monitoring is a tool used to modify interventions with the goal of reducing hyperglycemia and preventing hypoglycemia.

Glucose Monitoring Systems

There are a variety of monitoring systems on the market. They are commonly referred to as glucometers. Some information about glucometers:

- Most glucometers require a very small sample of blood
- They should not be left in extreme cold or hot areas
- The glucose strips are kept in a canister to control humidity
- Common problems include leaving glucometer strip lid open exposing strips to heat, light, and humidity. These affect the accuracy of the glucometer strip
- Errors in glucose monitoring are most commonly attributed to user errors such as failure to use glucose strips that correlate to meter, failure to calibrate the meter correctly (not needed with all meters), dirty meters, improper storage of both meter and strips, and inadequate hand washing before testing.

(Khardori, 2017)

Glucose Monitoring Education

When instructing patients on using the glucometer, the following are suggested topics:

- Glucometer and strips should be brought into clinic or primary care visits. Periodic review of testing procedure should be observed for accuracy
- The storage of the meter and strips should be addressed during education
- If results of glucose monitoring do not meet patient expectations the meter should be brought into clinic or primary care visit and accuracy should be compared against a meter of known accuracy
- Meters today can be downloaded to computers at office or clinic visits to provide accurate depiction of blood glucose readings in a graph or chart format without relying on personal report keeping
- Alternate site testing is available in order to provide the person with diabetes options when checking the blood glucose levels. It is important to teach that alternate sites, such as the forearm, may result in slightly lower readings than those taken from fingertips. The alternate sites may sample venous blood rather than capillary blood, therefore, lowering the true reading. Also, alternate sites may yield significantly delayed results compared with fingerstick readings

(Khardori, 2017)

Frequency of Blood Glucose Monitoring

Frequency of blood glucose monitoring depends on the medications that the patient is taking and the goals of therapy that have been established.

- Patterns can be identified when blood glucose readings are logged along with:
  - Corresponding times of day
  - Relation to food intake
  - Relation to exercise
- Insulin dosage can be adjusted based on blood glucose results
- Readings should be taken at intervals such as:
  - Before meals
  - One to two hours after meals
  - Before, during and after exercise
  - At bedtime
  - Occasionally during the night

(Khardori, 2017)

Continuous Glucose Monitoring

Continuous glucose monitoring (CGM) measures the "glucose content of the interstitial fluid (which correlates well with plasma glucose) using an electrochemical enzymatic sensor" (Khardori, 2017).

There are two types of CGM monitoring devices:

- CGM devices gather the blood glucose data and are downloaded at the clinician's office and the readings can be graphed out to identify patterns. With this device, the patient will not receive any information while wearing the CGM.
- CGM devices provide the patient with real-time results of glucose values on a continuous basis.

(ADA, 2017c)

Education

The last basic topic in the management of type 2 diabetes is education.

How important is diabetes education?

- When the educator is able to transfer positive attitude, knowledge, and skills successfully to the person with diabetes, it will pave the road for the patient to be able to empower themselves. Self-efficacy develops competence and confidence in mastering self-care behaviors needed to understand and control diabetes. This empowerment starts with education
- There are many programs available that focus on diabetes self-management education (DSME). The foundation of these programs is built on providing the patient with diabetes the knowledge needed to care for themselves
- The American Association of Diabetes Educators (Haas et al., 2012) states there are 10 standards for DSME. They are: internal structure, external input, access, program coordination, instructional staff, curriculum, individualization, ongoing support, patient progress, and quality improvement

Effective Diabetes Education

Effective diabetes education should be:

- Informative
- Clear
- Prioritized
- Expeditious
- Concise
- All education should begin broad then tailored to address individual needs, individual barriers, and individual goals

(Haas et al., 2012)

Education & Management of Diabetes

- Management and education of diabetes is a multidisciplinary approach. Education provided to the patient should be collaborative. It should be done by the nurse, primary healthcare provider (MD, NP, or PA), pharmacist, and dietitian. They are all an integral piece in educating the patient with diabetes.
- Education must focus on teaching the patient to change behavior in order to clinically improve their health status.

(Haas, et al., 2012)

Review of the Principles of Insulin Therapy

What is Insulin?

Insulin is a protein. Insulin lowers your blood glucose by moving glucose from the blood into the cells of your body. Insulin does not depend on food intake; insulin lowers your blood glucose no matter what you eat. It is very important to try to balance your food intake and activity level with your insulin.

Two different types of insulin requirements for the body: basal and bolus for prandial (mealtime)

Basal insulin – This is needed for metabolic needs, keeps blood glucose steady, and suppress hepatic glucose production. Basal insulin secretion represents approximately 50% of 24-hour insulin production.

Bolus insulin – This is needed for the food we ingest and to correct the highs in blood glucose levels. Bolus insulin secretion represents 50% of 24-hour insulin production.

(Khardori, 2017)

Insulin

The following slides will break down and compare the different types of insulin. First, there will be a graph highlighting the differences followed by a break-out of all the individual types. Second, there will be further discussion of the three categories that represent the different mechanisms of action for insulin:

- Basal
- Bolus
- Basal-bolus or pre-mix

Some patients with type 2 diabetes will eventually need insulin injections to maintain good glycemic control.

Comparison Chart of the Different Types of Insulin

Type of Insulin	Onset of Action	Peak Effect	Duration of Action
RAPID: lispro, aspart, glulisine	5-15 minutes	45-75 minutes	2-4 hours
RAPID: human insulin (inhaled powder)	3-7 minutes	12-15 minutes	2.5-3 hours
SHORT ACTING: Regular	Approx. 30 minutes	2-4 hours	5-8 hours
INTERMEDIATE: NPH	Approx. 2 hours	4-12 hours	18-28 hours
LONG ACTING: glargine (U-100)	Approx. 2 hours	No peak	20 to >24 hours
LONG ACTING: detemir	Approx. 2 hours	3-9 hours	6-24 hours (dose dependent)
ULTRA LONG ACTING: glargine (U-300)	Approx. 6 hours	No peak	36 hours
ULTRA LONG ACTING: degludec (U-100 and U-200)	60 minutes	No peak	42 hours
PREMIX ANALOG: 75% lispro protamine/25% lispro & 70% aspart protamine/30% aspart	10-20 minutes	1-10 hours	10-16 hours
PREMIX REGULAR: 70% NPH/30%	30-60 minutes	2-10 hours	10-16 hours
PREMIX RAPID AND LONG ACTING: 70% degludec and 30% aspart	15 minutes	Variable	42 hours

(Diabetes Education Online, 2017; Diabetes Forecast, 2017)

Rapid Acting Bolus Insulin

Rapid acting:

- Generic name: lispro, aspart & glulisine
    - Onset of action is within five to15 minutes
    - Peaks within the body within 45-75 minutes

- o Duration of action within the body is about two to four hours
- o Color is clear
- o Brand names: Humalog®, Novolog® & Apidra®

Please note, it is imperative to understand that the meal must be in front of the person with diabetes before the rapid acting insulin is administered due to the rapid onset of action. This will ensure prevention of hypoglycemia.

(Diabetes Forecast, 2017; Khardori, 2017)

Rapid Acting Inhaled Insulin

Rapid acting:

- Generic name: human insulin
- Onset of action is within three to seven minutes
- Peaks within the body within 12-15 minutes
- Duration of action within the body is about two and a half to three hours
- Comes in inhaler in 4-, 8-, and 12-unit cartridges
- Brand name: Afrezza®

(Diabetes Forecast, 2017)

Short Acting Bolus Insulin

Short acting:

- Generic name: regular
  - o Onset of action is within 30 minutes
  - o Peaks within the body within two to four hours
  - o Duration of action within the body is five to eight hours
  - o Color is clear
  - o Brand name: Humulin R®, Novolin R®

  Please note, it is imperative to understand that the meal must be accessible within 20-30 minutes of the short-acting insulin being administered due to the onset of action. This will ensure prevention of hypoglycemia.(Diabetes Forecast, 2017; Khardori, 2017)

Basal Insulin: NPH

Intermediate acting:

- Generic name: NPH (neutral protamine Hagedorn)
  - o Onset of action is approximately two hours
  - o Peaks within the body within four to12 hours
  - o Duration of action within the body is 18-28 hours
  - o Color is cloudy
  - o Brand name: Humulin N®, Novolin N®

  (Diabetes Forecast, 2017; Khardori, 2017)

Basal Insulin: Glargine

Long acting:

- Generic name: glargine (U-100)
    - Onset of action is approximately one to two hours
    - Does not peak; relatively flat
    - Duration of action within the body is 20 to 24 hours
    - Color is clear
    - Brand name: Lantus®, Basaglar®

*Do NOT mix in syringe with other insulins
(Diabetes Forecast, 2017; Khardori, 2017)

Basal Insulin: Detemir

Long acting:

- Generic name: detemir
    - Onset of action is approximately two hours
    - Peak- three to nine hours
    - Duration of action is six to 24 hours depending of the dose. At higher doses, mean duration of action is longer and less variable.
    - Color is clear
    - Brand name: Levemir®

*Do NOT mix in syringe with other insulins

(Diabetes Forecast, 2017; Khardori, 2017)

Basal Insulin: Glargine

Ultra-long acting:

- Generic name: glargine (U-300)
    - Onset of action is approximately six hours
    - Does not peak; relatively flat
    - Duration of action within the body is 36 hours
    - Color is clear
    - Brand name: Toujeo®

*Do NOT mix in syringe with other insulins
(Diabetes Forecast, 2017; Khardori, 2017)

Basal Insulin: Degludec

Ultra-long acting:

- Generic name: degludec (U-100 and U-200)
    - Onset of action is approximately 60 minutes
    - Does not peak; relatively flat
    - Duration of action within the body is 42 hours
    - Color is clear
    - Brand name: Tresiba®

*Do NOT mix in syringe with other insulins
(Diabetes Forecast, 2017; Khardori, 2017)

Basal-Bolus or Pre-Mix Insulin

Pre-mix analog

- Generic name: 75% lispro protamine/25% lispro & 70% aspart protamine/30% aspart
    - Onset of action is within ten to 20 minutes
    - Peak within one to ten hours
    - Duration of action within the body is ten to 16 hours
    - Color is cloudy
    - Brand name: Humalog Mix 75/25® & Novolog 70/30®

(Diabetes Forecast, 2017; Khardori, 2017)

Basal-Bolus or Pre-Mix Insulin

Pre-mix regular

- Generic name: 70% NPH/30%
    - Onset of action is within 30-60 minutes
    - Peak within two to ten hours
    - Duration of action within the body is ten to16 hours
    - Color is cloudy
    - Brand name: Humulin 70/30® & Novolin 70/30®

(Diabetes Forecast, 2017; Khardori, 2017)

Basal-Bolus or Pre-Mix Insulin

Pre-mix rapid and long-acting

- Generic name: 70% degludec/30% aspart
    - Onset of action is within 15 minutes
    - Peak is variable
    - Duration of action within the body is 42 hours
    - Color is clear
    - Brand name: Ryzodeg 70/30®

(Diabetes Forecast, 2017; Khardori, 2017)

Current Concentrations of Insulin Available in the United States

- U-100 = 100 units per 1 mL

(most commonly used insulin concentration)

- U-200= 200 units per 1 mL
- U-300= 300 units per 1 mL
- U-500 = 500 units per 1 mL

(used with people on large doses of insulin; increases the concentration and decreases the volume needed with each injection)

(Diabetes Forecast, 2017; Khardori, 2017)

Insulin Schedule

- Depending on the type of insulin, people may take anywhere from one to four injections a day
- It is important that the insulin injections are administered on a regular schedule to help optimize blood glucose control

Insulin Storage

- An open vial of insulin can be stored at room temperature or in the refrigerator
- Once a vial is opened it should be used within 28 days. After the 28 days, the insulin loses its potency and effectiveness
- Expiration date on the bottle of insulin is the valid date of expiration until it is opened, it will expire in 28 days
- There never should be clumps or threads visualized in the vial of insulin; if this occurs, throw the bottle away

Insulin Absorption

There are four common injection sites when administering insulin: abdomen, arm, thigh, and buttocks. Insulin absorption is affected by site location, body temperature, use of exercising limb, and whether there is rubbing of the site. The following play a role in insulin absorption:

- Insulin is absorbed the fastest in the abdomen and arm
- Insulin is slower in the thigh and buttocks
- The abdomen is the preferred site for injection as it has the steadiest rate of absorption
- The abdomen is the easiest for most to visualize and has the least amount of nerve endings. This makes the injection less painful
- Never inject insulin in the arm or leg prior to exercising

(Khardori, 2017)

Insulin Injection Technique

It is important to rotate insulin injection sites on the body. Never administer into the same site two times in a row. This will assist with better absorption in the body.

Note! Insulin is always administered subcutaneously.

Oral Hypoglycemic Agents

The following medications are the classifications of diabetic oral medications given for type 2 diabetes:

- Sulfonylureas
- Meglitinides
- Biguanides
- Thiazolidediones (TZD's)
- Dipeptidyl peptidase-4 (DPP-4) inhibitors
- Alpha-glucosidase inhibitors
- Sodium-glucose co-transporter 2 (SGLT2) inhibitors

Sulfonylureas

Sulfonylureas are the most widely used drugs for type 2 diabetes.

How they work: Sulfonylureas stimulate the pancreas to make more insulin. They can be used alone or with other diabetic medications

Medications: glimepiride (Amaryl®, glyburide (Glynase®), glipizide (Glucotrol®, Glucorol XL®)

Possible side effects: May cause low blood glucose

Precautions: Should not be used by people allergic to sulfa drugs

Education: Should be taken up to 30 minutes before a meal. May be taken one to two times per day as ordered. At higher doses, may cause weight gain. Discretion should be used when administered to the elderly population as this drug clears through the kidneys.

(Diabetes Forecast, 2017; Khardori, 2017)

Meglitinides

How they work: Short acting glucose lowering drugs by increasing the amount of insulin produced by the pancreas, which lowers the blood glucose

Medications: repaglinide (Prandin®), nateglinide (Starlix®)

Possible side effects: Weight gain, less risk of hypoglycemia but still has potential

Precautions: Do not use this medication for pregnant or breastfeeding women

Education: Work quickly and do not stay in the body long, so they need to be taken at or just before each meal.

(Diabetes Forecast, 2017; Khardori, 2017)

Biguanides

How they work: Biguanides work by reducing glucose production in the liver and improve insulin sensitivity in the muscle and fat cells.

Medication: metformin (Glucophage®)

Possible side effects: Diarrhea, upset stomach, loss of appetite

Precautions: Should not be started as initial therapy in people over 80 years old or with reduced kidney function

Education: Patients may have a metallic taste in mouth. It can decrease total cholesterol and LDL. It can be taken one to two times a day with food, as ordered. May help with weight loss efforts.

(Diabetes Forecast, 2017; Khardori, 2017)

Metformin was chosen for initial therapy because of glycemic efficacy, absence of weight gain and hypoglycemia, general tolerability, and favorable cost. The majority of guidelines recommend metformin as first-line therapy (Diabetes Forecast, 2017; Khardori, 2017).

Thiazolidinediones (TZDs)

How they work: Thiazolidinediones (TZDs) reduce insulin resistance to help muscle and fat cells use insulin more effectively

Medications: pioglitazone (Actos®), rosignlitazone (Avandia®)

Possible side effects: Weight gain, swelling in ankles and legs

Precautions: Not to be used by people with liver diseases or serious heart failure

Education: Need to be taken for four to six weeks before seeing an effect. Birth control pills are less effective.

(Diabetes Forecast, 2017; Khardori, 2017)

Dipeptidyl Peptidase-4 (DPP-4) Inhibitor

How they work: Dipeptidyl peptidase-4 (DPP-4) inhibitors improves the levels of insulin produced by the body after meals. This helps to lower blood glucose levels after meals. Decreases the amount of glucose made by the liver. This helps to lower fasting blood glucose.

Medications: sitagliptin (Januvia®), saxaglipin (Onglyza®), linagliptin (Tradgenta®), alogliptin (Nesina®)

Possible side effects: Cold-like symptoms, stuffy nose, sore throat, coughing, high cholesterol, high triglycerides and weight gain

Precautions: Pregnancy and moderate renal insufficiency

Education: This classification of medication is often taken alone or with a biguanide or a TZD. The patient should have periodic kidney function tests.

(Diabetes Forecast, 2017; Khardori, 2017)

Alpha Glucosidase Inhibitors

How they work: Decrease the absorption of carbohydrates from the digestive tract, thereby lowering the after-meal glucose levels. They are not used as usual first-line therapy because of reduced efficacy, expense, and poor tolerance.

Medications: miglitol (Glyset®), acarbose (Precose®)

Possible side effects: Gas, bloating, diarrhea

Precautions: Not recommended if patient has history of inflammatory bowel disease

Education: Take with first bite of food. If the patient skips a meal, he or she should skip the medication. Hypoglycemia can happen if used with other diabetes medications, must treat with glucose, such as glucose gel/tablets.

(Diabetes Forecast, 2017; Khardori, 2017)

Sodium-Glucose Co-Transporter 2 (SGLT2) Inhibitors

How they work: SGLT2 inhibitors work by blocking reabsorption of glucose in the kidney, and increasing glucose excretion in the urine

Medications: canagliflozin (Invokana®), dapagliflozin (Farxiga®), empagliflozin (Jardiance®)

Possible side effects: Genital yeast infections, urinary tract infections (UTI), dehydration, and a modest increase in LDL cholesterol. There is a slight increase risk for hypoglycemia

Precautions: Contraindicated with patients on dialysis or end stage renal disease

Education: FDA added warnings for an increased risk for diabetic ketoacidosis (DKA) in type I and type II diabetes, and serious UTI requiring hospitalization. Signs and symptoms of DKA should be closely monitored. Hypoglycemia can happen if used with other diabetes medications, must treat with glucose, such as glucose gel/tablets.

(Diabetes Forecast, 2017; Khardori, 2017)

Hypoglycemia: Low Blood Glucose

The patient taking either oral hypoglycemic agents or insulin should be educated on the signs & symptoms of low blood glucose. These include:

- Sweaty or a clammy feeling
- Shakiness
- Headache
- Hunger
- Fast heartbeat
- Confusion
- Dizziness
- Numbness or tingling around the lips

If not treated right away, hypoglycemia can lead to:

- Seizures
- Unconsciousness
- Coma

(Hamdy, 2017)

Causes of Low Blood Glucose

The following are causes of low blood glucose:

- More exercise than usual
- Skipping or delaying a meal or snack
- Eating less carbohydrates than recommended at meals or snacks
- Drinking alcohol without food
- Taking too much diabetes medication

To Treat Low Blood Glucose

The following steps are used to correct episodes of hypoglycemia:

- Confirm blood glucose reading by rechecking blood glucose
- Drink 4 oz. (1/2 cup) of juice OR take two to three glucose tablets, to equal 15 grams of carbohydrates
- Wait 15 minutes, check blood glucose again
- If blood glucose reading is <80 mg/dL, then treat with another 15g of carbohydrates
- Be sure to eat a snack if the next meal is more than 30-60 minutes away

Note: In the hospital setting, if a patient is conscious, the above measures are taken. If a patient is NPO, unable to swallow, or unconscious, administration of D50W is recommended if intravenous (IV) access is available.

(Hamdy, 2017; Hulkower, Pollack, & Zonszein, 2014; NIDDK, 2016)

Glucagon

Glucagon is for treating severe hypoglycemia that may occur in individuals treated with insulin or oral hypoglycemic agents. The following are important educational reminders that all patients with diabetes and their families should be aware of:

- Glucagon is given when an individual is unable to take a fast-acting glucose and is having a severe low blood glucose
- Make sure their family, friends and co-workers know where to find their glucagon and know how to use it
- Glucagon is an injection that is given like insulin in the subcutaneous tissue
- The patient with hypoglycemia should be placed on their side due to potential vomiting from glucagon

Note: In the hospital setting, if a patient does not have IV access and is NPO, unable to swallow, or unconscious, then glucagon administration is recommended.

(Hamdy, 2017; Hulkower, Pollack, & Zonszein, 2014; NIDDK, 2016)

Test Yourself:

In what scenario would you use glucagon?

A. A patient's blood glucose level is 60 mg/dL and he complains of shakiness
B. A patient's blood glucose level is 250 mg/dL and he complains of a headache
C. A patient is unconscious with a blood glucose level of 35 mg/dL - Correct

Hyperglycemia: High Blood Glucose

The patient with type 2 diabetes should be educated on the signs and symptoms of high blood glucose. These include:

- Being hungrier than normal
- Feeling tired or weak
- Itchy skin
- Urinating more often
- Increased thirst
- Blurry vision
- Frequent infections

Over time, hyperglycemia will increase the patient's risk for developing long-term complications such as:

- Heart disease
- Neuropathy
- Retinopathy
- Nephropathy

(Hieronymus, 2017; Zitkus, 2012)

Cause of High Blood Glucose

The following are causes of high blood glucose:

- Eating too much food; especially carbohydrates.
- Not enough medication (Insulin or oral agents).

- Infection and/or illness.
- Higher than usual stress and anxiety.
- Less activity than usual.

(Hieronymus, 2017; Zitkus, 2012)

Treatment of High Blood Glucose

The following steps should be discussed with the patient to be used to correct episodes of hyperglycemia:

- If you are feeling symptoms, contact health care professional.
- Increase sugar-free and caffeine-free fluids to avoid dehydration.
- Take your medications as prescribed.
- Follow the recommended meal plan.
- Test your blood glucose levels more frequently until they are back into normal range.
- Look for the reason- Too much food? Lack of exercise? Forgotten medication? Illness? Emotional stress?

(Hieronymus, 2017; Zitkus, 2012)

Treating High Blood Glucose During Illness

The following steps should be discussed with the patient to be used to correct episodes of hyperglycemia during illness:

- Take your diabetes medication as needed, after checking your blood glucose level
- Increase water to decrease dehydration
- Try to eat food or drink liquids containing carbohydrates
- Test your blood glucose more frequently, possibly every two to four hours
- Call the primary care provider if blood levels are uncontrollable

(Hieronymus, 2017; Zitkus, 2012)

Educate on Prevention of Hypoglycemia & Hyperglycemia

The following general information should be provided to the patient with type 2 diabetes:

- Test blood glucose levels when there is a suspicion of hypoglycemia
- Adjust medications before exercise, if necessary
- If drinking alcohol, have with meals
- Snack if meals are skipped
- Frequent low blood glucose reactions must be reported to the health care provider. It is important to learn how to adjust medications, meal plan, and/or exercise

(Khardori, 2017)

Role of Certified Diabetes Educator® (CDE®)

The CDE® is a valuable team member to both hospital and outpatient facilities. Their roles and expertise vary; therefore, to state the exact role is difficult. Listed below are examples of ways the CDE® are used when treating patients with type 2 diabetes:

- Developing protocols, policies, and order sets for the treatment and management of the patient with type 2 diabetes.
- Reviewing blood gluco-metrics.
- Bedside education for all newly diagnosed prediabetic and diabetic patients.

- Education to front line staff, including, but limited to, nurse aides, nurse techs, dietary, pharmacy, medical staff, nursing staff.

(National Certification Board for Diabetes Educators, 2017)

Role of the Diabetes Educator: Definition of Certified Diabetes Educator

What is a Certified Diabetes Educator?

- A Certified Diabetes Educator® (CDE®) is a health professional who possesses comprehensive knowledge of and experience in prediabetes, diabetes prevention, and management.
- The CDE® educates and supports people affected by diabetes to understand and manage the condition. CDEs have passed a rigorous exam to show they have this specialized knowledge.
- Diabetes impacts a person in every area of their life—diet, lifestyle, health, etc. Successful self-management involves knowledge about a broad range of topics such as nutrition, medication, exercise and coping skills.
- To earn the CDE® credential, an educator must show they understand all of the different aspects related to managing the disease, not just one area.
- Diabetes self-management education from a CDE® can lead to better control, which makes you feel like yourself again. It can also decrease short and long-term complications that may cause unnecessary pain and suffering.

(National Certification Board for Diabetes Educators, 2017)

Role of the Diabetes Educator: What is Diabetes Education

What is Diabetes Education?

- Diabetes education, also known as diabetes self-management training (DSMT) or diabetes self-management education (DSME), is a collaborative process through which people with or at risk for diabetes gain the knowledge and skills needed to modify their behavior and successfully self-manage the disease and its related conditions.
- Diabetes education can take place in a group or one-on-one setting as part of a formal (recognized or accredited education program) or informal format.

(National Certification Board for Diabetes Educators, 2017)

Diabetes Educator Certification Requirements

For a diabetes educator who has not previously taken or passed the examination, it will be necessary to complete a number of requirements prior to sitting for the examination. An overview of requirements is shown below; see the NCBDE website for complete information:

1. Meet the discipline/licensure requirement
2. Obtain minimum professional practice experience providing DSME
3. Obtain minimum continuing education hours
4. Apply and pay the application fee then pass the exam

(National Certification Board for Diabetes Educators, 2017)

Meet the Discipline/Licensure Requirement

One must be:

a) A clinical psychologist, registered nurse, occupational therapist, optometrist, pharmacist, physical therapist, physician (M.D. or D.O.), or podiatrist holding a current, active, unrestricted license from the United States or its territories.

OR

b) A dietitian or dietitian nutritionist holding active registration with the Commission on Dietetic Registration, physician assistant holding active registration with the National Commission on Certification of Physician Assistants, exercise specialist holding active certification as an American College of Sports Medicine (ACSM) Certified Clinical Exercise Specialist®, or exercise physiologist holding active certification with the ACSM as a Registered Clinical Exercise Physiologist®, health educator holding active certification as a Master Certified Health Education Specialist with the National Commission for Health Education Credentialing;

OR

c) A health professional with a master's degree or higher in social work from a United States college or university accredited by a nationally recognized regional accrediting body. To verify the program of study specific to social work, an official transcript that indicates that the advanced degree in social work was awarded must be submitted with the Application for the Examination.

(National Certification Board for Diabetes Educators, 2017)

Obtain Minimum Professional Practice Experience Providing DSME

Professional Practice Experience

After meeting the discipline requirement AND before applying for the examination, both of the following professional requirements must be met in United States or its territories:

a) Minimum of 2 years (to the day) of professional practice experience in the discipline under which the individual is applying for certification (examples: if an individual applies for certification as a registered nurse, 2 years of experience working/volunteering as a registered nurse is required; if an individual applies as a registered dietitian, 2 years of experience working/volunteering as a registered dietitian is required).

AND

b) Minimum of 1000 hours of DSME experience with a minimum of 40% of those hours (400 hours) accrued in the most recent year preceding application. In meeting the hourly requirement*, professional practice experience is defined as responsibilities, within the past 4 years (maximum window), that include the direct provision of DSME, as defined by NCBDE.

(National Certification Board for Diabetes Educators, 2017)

Obtain Minimum Continuing Education Hours

Continuing Education

After meeting the Discipline requirement and before applying for the Examination, the following requirement must be met:

Minimum of 15 clock hours of continuing education activities applicable to diabetes within the two (2) years prior to applying for certification.

(National Certification Board for Diabetes Educators, 2017)

Apply and Pay the Application Fee Then Pass the Exam

$350 for initial certification

$250 for renewal certification

(National Certification Board for Diabetes Educators, 2017)

Conclusion

Diabetes can be a devastating disease. However, with appropriate drug therapy, lifestyle modification, patient education and tight glycemic monitoring, diabetics can lead a long and fulfilling life today.

The role of the diabetic educator is rapidly expanding and presents an opportunity for you to become an expert in the education and counseling of patients with diabetes. Consider taking the certification exam and opening up a world of new opportunities for yourself and your patients.

Resources

American Association of Clinical Endocrinologists (AACE): www.aace.com

American Association of Diabetes Educators (AADE): www.diabeteseducator.org

American Diabetes Association (ADA): www.diabetes.org

Centers for Disease Control (CDC): http://www.cdc.gov/diabetes/

Diabetes Self-Management: www.diabetesselfmanagement.com

National Certification Board for Diabetes Educators (NCBDE): https://www.ncbde.org/

National Institutes of Diabetes and Digestive and Kidney Diseases (NIDDK): www.niddk.nih.gov

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Note: All dosages given are for adults unless otherwise stated. The information on medications contained in this course is not meant to be prescriptive or all-encompassing. You are encouraged to consult with physicians and pharmacists about all medication issues for your patients.