



## Seattle-King County EMS

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# CBT/OTEP 450 Diabetic Emergencies

Print version of EMS Online Course  
[www.emsonline.net](http://www.emsonline.net)

## Introduction

Diabetes affects an estimated 20.8 million people in the United States alone. That's 7% of the population. The recent rise in the rate of diabetes has been called an epidemic by the Centers for Diseases Control and Prevention.

The cause of diabetes continues to be a mystery. However, both genetics and environmental factors such as obesity and lack of exercise appear to play roles. At least one-third of people with diabetes are unaware they have the disease.

### Before You Begin

This is a continuing education and recertification course for EMTs. It covers some EMT-Basic concepts and terminology as well as advanced material. We highly recommend completing the practice exam before completing the exam.

We also recommend that you review an EMT textbook chapter covering diabetic emergencies as a refresher before taking the exam; for example: Chapter 15 – Diabetic Emergencies in *Emergency Care and Transportation of the Sick and Injured*, 9th edition (AAOS).

### Practical Skills

To receive CBT or OTEP credit for this course a trained skills evaluator must evaluate your ability to perform hands-on practical skills including the following:

- Patient assessment
- Blood glucometry
- Oral glucose

### Objectives

1. Recognize the purpose of glucose and insulin...
2. Recognize the characteristics of type 1 and type 2 diabetes...
3. Recognize medical histories suggestive of hypoglycemia and hyperglycemia ...
4. Distinguish between signs and symptoms of hypoglycemia and hyperglycemia...
5. Identify the signs/symptoms of DKA...
6. Recognize the key principles in the assessment and care of patients with a diabetic emergency...
7. Recognize the statement that best explains the relationship between altered mental status and airway management...
8. Recognize proper technique and contraindications for administration of oral glucose...

## Terms

### Terms You Should Know

diabetic coma — An unconscious state caused by high blood glucose. Dehydration and acidosis are associated with this condition.

diabetic ketoacidosis — A condition where acids accumulate in the body caused when insulin is not available and the body burns fat for fuel

glucose — One of the basic sugars; it is the primary fuel, along with oxygen, needed for cellular metabolism.

hyperglycemia — An excess concentration of glucose in the blood.

hypoglycemia — A deficient concentration of glucose in the blood.

insulin — A hormone produced by the pancreas that enables sugar in the blood to enter the cells of the body; it is used in synthetic form to treat diabetes.

ketoacidosis — A condition resulting from metabolism of fatty acids.

Kussmaul respirations — Deep, rapid breathing; usually the result of an accumulation of certain acids when insulin is not available in the body.

type 1 diabetes — A type of diabetes that usually starts in childhood and requires insulin injections for treatment.

type 2 diabetes — A type of diabetes that usually starts in later life and often can be controlled through diet and oral medications.

### New Terms

acidosis — Excessive acid in the body fluids.

glucagon — A hormone produced by the pancreas that causes the liver to convert stored glycogen into glucose and release it into the bloodstream. The action of glucagon is opposite that of insulin.

hyperosmolar nonketotic coma — A complication of type 2 diabetes that results in extremely high glucose levels without the presence of ketones.

ketones — Acids that are the product of fat metabolism.

polydipsia — Excessive thirst persisting for long periods of time despite reasonable fluid intake; often the result of excessive urination.

polyphagia — Excessive eating; in diabetes, the inability to use glucose properly can cause a sense of hunger.

polyuria — The passage of an unusually large volume of urine in a given period.

## Glucose

The cells of the body need glucose to function properly. Glucose, which is a form of sugar, is the body's main source of energy.

## Glucose Production

Food is broken down by the digestive system into three main nutrients:

- Fats
- Carbohydrates
- Proteins

Glucose is a simple carbohydrate and the first to be absorbed into the blood. It is essential for all cells, especially brain cells.

For a healthy person who has not eaten, the pancreas compensates by releasing the hormone glucagon causing the liver to release glucose.

## Insulin

In a healthy person, rising blood glucose levels stimulate the pancreas to secrete insulin. Insulin acts like a funnel that directs glucose into the cells. Insulin helps glucose enter the cells and produce energy.

### Elaboration – Insulin Pumps

Insulin pumps deliver rapid- or short-acting insulin 24 hours a day through a catheter placed under the skin. People of all ages with type 1 diabetes use insulin pumps and those with type 2 diabetes have started to use them as well; however, the total number of people using the device is low.

The elaboration links that appear throughout this course contain supplemental information to aid in your understanding of the topic. The optional external website links are for the purpose of expanding your knowledge; however, the course exams do not cover material from these sources.

## Type 1 Diabetes

Glucose is the basic fuel for the cells in the body. Insulin allows glucose from the blood to enter the cells. In type 1 diabetes, the body does not produce insulin so glucose cannot enter the cells. Since the glucose does not enter the cells, it builds up to a dangerous level in the blood vessels.

Type 1 diabetics receive insulin through an injection or pump.

## Type 2 Diabetes

In type 2 diabetes, either the body does not produce enough insulin or the cells ignore the insulin that is produced. Type 2 diabetes is the most common form of diabetes accounting for nearly 90 percent of all cases.

Type 2 diabetes can be controlled by diet and exercise, oral medication or injected insulin. The oral medications prescribed for this type of diabetes stimulate the pancreas to produce more insulin. Some type 2 diabetics must use injected insulin.

### Elaboration - Complications of Diabetes

The complications of type 1 and type 2 diabetes include:

- Kidney failure
- Blindness
- Heart disease
- Stroke
- Lower extremity amputations

### Elaboration - Oral Medications

There are a number of types of medications available to treat type 2 diabetes. Most are taken in pill form. An oral diabetic medication can control diabetes through one of the following actions:

- Stimulating the pancreas to make more insulin
- Decreasing the amount of glucose made by the liver
- Slowing the absorption of starches
- Making the body more sensitive to insulin
- Preventing the breakdown of a naturally occurring compound that reduces blood glucose

You should be familiar with the names and effects of these medications so you can recognize them in the field.

## Hypoglycemia

Hypoglycemia is a condition where there is not enough glucose in the blood. It occurs as a result of: too much insulin, too little food intake or too much exercise. Without a constant supply of glucose the brain cannot function properly.

A medical history that suggests hypoglycemia can include:

- Insufficient food intake
- Excessive insulin dosage
- Normal to excessive activity
- Rapid onset
- Absent thirst
- Intense hunger
- Headache
- Seizures

- Recent illness
- Change in diet

## Hyperglycemia

Hyperglycemia is a condition where there is too much glucose in the blood. In hyperglycemia, the pancreas does not produce enough insulin or the body doesn't effectively use the insulin. Hyperglycemia occurs as a result of too little insulin, not enough exercise or too much food.

A medical history suggesting hyperglycemia can include:

- Recent infection
- The Three Ps (polyphagia, polydipsia, polyuria)
- Vomiting, abdominal pain
- Flu-like symptoms, nausea
- Insufficient insulin dosage
- Gradual onset
- Normal activity level

## The Diabetic Balance

A diabetic must carefully maintain blood glucose levels by balancing insulin, diet and exercise; otherwise, hypoglycemia or hyperglycemia can occur.

## The Three P's

If diabetes is left untreated or undiagnosed, blood glucose levels will rise. This can cause the Three P's:

- Polydipsia (constant thirst)
- Polyuria (excessive urination)
- Polyphagia (ravenous appetite)

## Ketones and Ketoacidosis

When glucose is not available to the cells, the body burns fat for energy. Byproduct of fat metabolization are substances called ketones. Ketones are acids that build up in the blood. Ketones can poison the body by changing the pH balance. The kidneys respond by excreting glucose and ketones. This condition is known as *ketoacidosis*.

## Insulin Reaction

Insulin reaction, sometimes called *insulin shock*, begins when a diabetic is hypoglycemic. Because there is not enough glucose in the blood, the body reacts severely because the cells can not produce energy.

Signs and symptoms of insulin reaction, which develop quickly, can include:

- Cold, pale, clammy skin

- Abnormal or hostile, bizarre behavior (intoxicated appearance)
- Shaking, trembling, weakness
- Full, rapid pulse
- Normal or elevated blood pressure
- Dizziness, headache, blurred vision
- Extreme hunger
- Seizures

## Diabetic Ketoacidosis

Diabetic ketoacidosis (DKA) is a condition in which the body burns fat instead of glucose. If there is no insulin to funnel glucose to the cells, the body must burn fat.

Ketoacidosis usually develops slowly. However, if vomiting occurs, this life-threatening condition can develop in a few hours. The signs are:

- High blood glucose levels
- The Three P's (frequent urination, dehydration and extreme thirst)
- Altered LOC (advanced DKA)

Sometimes you can detect a fruity odor on a patient's breath. This is due to the high level of ketones in the blood. Virtually ALL patients with DKA are type I diabetics who require insulin. It is a serious condition that can lead to diabetic coma or even death.

### Elaboration – Diabetic Ketoacidosis

It is common for DKA to present with high blood sugar, severe dehydration, rapid breathing (Kussmaul respirations), an altered mental status and sometimes a distinctive fruity odor on the breath. The most common events that cause DKA are:

- Infection
- Missed insulin injection
- Undiagnosed diabetes
- Heart attack, stroke, trauma, stress and surgery

Ketoacidosis occurs rarely in people with type 2 diabetes. However, some with type 2 diabetes, especially the elderly, can experience a similar condition called hyperosmolar hyperglycemic nonketotic coma (HHNC).

## Diabetic Coma

Diabetic coma is a state of unconsciousness resulting from complications of diabetes including severe hypoglycemia, diabetic ketoacidosis or hyperglycemia combined with profound dehydration.

## Gestational Diabetes

Gestational diabetes is a type of diabetes that begins during pregnancy. It usually becomes apparent in the 24th to 28th weeks of pregnancy. In many cases, the blood glucose level returns to normal after delivery.

The symptoms are usually mild and not life-threatening to the pregnant woman. However, increased maternal glucose levels are associated with larger birth weight and

an increased rate of prenatal complications, including birth trauma, hypoglycemia, jaundice and fetal death.

The majority of gestational diabetics adjust their food intake and exercise to lower their blood sugar; however, some cases may require insulin injections.

## Assessment

Assessment for a diabetic emergency begins with an initial assessment and determination of SICK or NOT SICK based on respiratory effort, pulse, mental status, skin signs and body position.

For a conscious patient, an accurate past medical history is important and includes key questions such as:

- When did you eat last?
- How much did you eat?
- Have you taken your insulin today?
- Has there been a change in your health, stress or exercise level?
- When did the symptoms begin?

You should maintain a high index of suspicion for all patients with an altered level of consciousness. For an unconscious patient, you must assure the ABCs and search for clues such as medic alert tags or medical history from a family member.

## Glucometry

Blood glucometry is an effective tool for determining if a case of altered mentation is diabetes related. To check blood glucose level with a glucometer follow these steps:

## Emergency Care

Hypoglycemia is the most common diabetic emergency. A patient with hypoglycemia needs sugar immediately and often responds quickly after eating or a drinking sugary food or liquid. The key treatment principles for a hypoglycemic episode include:

- Request medic unit, if indicated
- Maintain airway
- Administer oxygen
- If able to swallow, give oral glucose
- Monitor vital signs and LOC

Your primary care for the hyperglycemic diabetic is to maintain the airway and provide rapid transport.

## Oral Glucose

A hypoglycemic patient needs a quick source of sugar such as honey, orange juice, candy or granulated sugar or a bead of commercial sugar preparation. Here are some guidelines:



- Ask patient if able to swallow, if not don't administer
- Position upright
- Ask patient to sip or chew sugar-containing substance
- Monitor patient's response to glucose
- Repeat blood glucometry

Because some patients respond quickly to a sugar drink or glucose, they may not see the need to be evaluated at the hospital. Be familiar with your department's guidelines for leaving a diabetic patient at home.

### Ability to Swallow

You should use a patient's ability to swallow as an indicator for whether or not to give oral glucose. Ask the patient if he or she can swallow — if not, don't give oral glucose.

This check will help prevent aspiration of the oral glucose. Do not check the gag reflex by inserting a tongue blade in the patient's mouth.

### Airway Protection

A person with an altered level of consciousness may not have the protective reflex to prevent aspiration of oral contents into the lungs. As the brain approaches unconsciousness, it predisposes the person to a weakened glottic closure response.

The ability to swallow is an effective indicator of the ability to maintain an airway. Use this as a more "patient-friendly" way of evaluating airway protection instead of checking gag reflex by inserting an object into the back of the throat. If a patient can swallow, then it is likely he or she safely can take oral glucose.

### Summary

In type 1 diabetes, the body does not produce insulin. In type 2 diabetes, either the body does not produce enough insulin or the cells ignore the insulin that is produced.

The causes of hypoglycemia are too much insulin, too little food intake or too much exercise. The causes of hyperglycemia are too little insulin, not enough exercise or too much food.

A medical history suggesting hypoglycemia can include:

- Insufficient food intake
- Excessive insulin dosage
- Normal to excessive activity
- Rapid onset
- Absent thirst
- Intense hunger
- Headache
- Seizures

A medical history suggesting hyperglycemia can include:

- Recent infection
- The Three P's

- Vomiting, abdominal pain
- Flu-like symptoms, nausea
- Insufficient insulin dosage
- Gradual onset
- Normal activity level

Signs of diabetic ketoacidosis are:

- The Three P's
- High blood glucose levels
- Altered LOC

The key principle in the assessment and care of a diabetic emergency is to quickly determine SICK or NOT SICK based on respiratory effort, pulse, mental status, skin signs and body position.

The key principles of treatment for a hypoglycemic episode include:

- Request medic unit, if indicated
- Maintain airway
- Administer oxygen
- If able to swallow, give oral glucose
- Monitor vital signs and LOC

Your primary responsibility for the hyperglycemic diabetic is to maintain the airway and provide rapid transport.

A contraindication for administration of oral glucose is inability to swallow.

Guidelines for administering oral glucose include:

- Ask patient if able to swallow, if not don't administer
- Position upright
- Ask patient to sip or chew sugar-containing substance
- Monitor patient's response
- Repeat blood glucometry