



## Diabetes Insipidus

*This information will give you and your family basic facts about diabetes insipidus. The glossary at the end defines certain terms used throughout. If you have questions about the diagnosis and treatment of this disorder, feel free to talk with your physician and nurse. They will be glad to help you.*

### **What is diabetes insipidus?**

Diabetes insipidus is a rare disorder of water metabolism. This means that the balance between how much water or fluid you drink is not balanced with the fluid you urinate. Diabetes insipidus is caused by a lack of, or nonresponse to, the antidiuretic hormone vasopressin. This hormone controls water balance by concentrating urine. Patients with diabetes insipidus urinate too much, so they need to drink a lot to replace the fluid they lose.

Vasopressin is made by the cells of the hypothalamus (located in the brain) and is stored and secreted by another part of the brain called the posterior pituitary gland. The antidiuretic hormone is then released into the bloodstream where it causes tubules within the kidney to reabsorb water. Water that cannot be reabsorbed is passed out of the body in the form of urine. Decreased secretion

of vasopressin causes less water to be reabsorbed and more urine to be formed. When vasopressin is present at normal levels, more water is reabsorbed and less urine is formed.

You should not confuse diabetes insipidus with the metabolic disease, diabetes mellitus. Diabetes mellitus is a different disease caused by a lack of, or an impaired response to, the hormone insulin. This hormone is made by the pancreas and helps in carbohydrate metabolism.

Without insulin, a person cannot make use of the carbohydrates he or she takes in, such as sugar. The hormone insulin affects sugar so that it can enter the body's cells and be used for energy. When insulin is insufficient or not present, an abnormally high amount of sugar will be in the blood and urine. The chart at the end of this booklet explains in greater detail the difference between diabetes insipidus and diabetes mellitus.

There are two types of diabetes insipidus. While the symptoms of these two disorders are similar, the causes are different. The next sections describe central diabetes insipidus and nephrogenic diabetes insipidus.

## **Central diabetes insipidus**

If you have been diagnosed with central diabetes insipidus, there are some things you should know about how the disorder is caused and what you and your doctor can do about it.

### **What causes it?**

In central diabetes insipidus, the antidiuretic hormone vasopressin is either missing or present at a low level. This low level or lack of vasopressin is due to a malfunction in the part of your brain, the posterior pituitary gland, which releases the hormone into your bloodstream. Injury to the head, tumors, neurosurgical operations, infections, or bleeding can affect your brain's ability to release the right amount of vasopressin.

### **What are the symptoms?**

- excessive urination (polyuria) which is followed by
- excessive thirst (polydipsia)

Patients with central diabetes insipidus are often extremely tired because they cannot get enough sleep uninterrupted by the need to urinate. Their urine is very clear and odorless. These symptoms can appear at any time. Because they lose so much water from urination, they also feel very thirsty. If this disorder is untreated, they could become seriously dehydrated, and their bodies will not have enough water to function properly.

## **Nephrogenic diabetes insipidus**

Nephrogenic diabetes insipidus is much less common than central diabetes insipidus. If you have been diagnosed with nephrogenic diabetes insipidus, your doctor or nurse will discuss the disorder and its treatment with you. They will be happy to answer your questions.

### **What causes it?**

Nephrogenic diabetes insipidus may be caused by kidney diseases that make the kidneys unable to respond to vasopressin. While there is enough vasopressin in the body (unlike in central diabetes insipidus), the kidneys cannot respond to the hormone's signal to reabsorb water. The disease may be acquired or inherited by male children.

### **What are the symptoms?**

The symptoms of nephrogenic diabetes insipidus are similar to central diabetes insipidus; that is, excessive urination (polyuria) followed by excessive thirst (polydipsia).

### **How is it treated?**

The first step in treating this disease is correct diagnosis. In addition to the medications available, balancing your water or fluid intake with your urine output is also part of treatment. If this disorder is untreated, you could become seriously dehydrated, and your body will not have enough water to function.

## **What tests can find out if I have central diabetes insipidus or nephrogenic diabetes insipidus?**

The two most common tests used to diagnose diabetes insipidus are the following:

- water deprivation test/vasopressin test
- hypertonic saline infusion test.

Other tests which may be used are the urine specific gravity test and the serum or urine osmolality test. These tests measure the concentration of solid particles in your urine. Patients with diabetes insipidus have urine with fewer solids than that of people without the disease.

With the water deprivation test, you will be asked not to drink any fluids. Your doctor will tell you how long you must abstain from drinking. Then, laboratory tests will be done to show any change in the amount and concentration of particles in your urine.

The vasopressin test is done if the water deprivation test does not result in sufficiently concentrated urine. Vasopressin is given by the doctor or nurse by injection to test your body's reaction to the hormone.

During the hypertonic saline infusion test, you will receive a mixture of salt and water by intravenous infusion. Your doctor or nurse will then draw blood from you which will be tested for osmolality and vasopressin content.

The serum or urine osmolality test is done to find out the concentration of particles in your blood or urine.

The urine specific gravity test is also a way to find out the concentration of solid particles in urine. Patients with diabetes insipidus have fewer particles in urine, so their specific gravity measurements will be below normal.

## **What is the therapy for central diabetes insipidus?**

If you are treated for central diabetes insipidus, you will sniff a drug called DDAVP (Desmopressin), a derivative of vasopressin. You will be shown the right way to use this drug by your physician, nurse, or pharmacist.

## **What is the therapy for nephrogenic diabetes insipidus?**

If you have nephrogenic diabetes insipidus, water pills (thiazide diuretics) may be prescribed by your doctor. You may be confused as to why you need to take diuretics for this disorder. Thiazide diuretics have been shown to stimulate the production of a hormone that helps your body retain salt. This added amount of salt keeps you from losing too much water.

## **What should I do while I am being treated for diabetes insipidus?**

It is important for you to remember these things while you are treated for diabetes insipidus:

It is very important that you balance your water intake with your urinary output. However, it is also very important that you do not drink too much water. If you drink too much water, this could cause very serious side effects. This is the reason why it is so important for you and your physician to discuss a specific plan to meet your individual needs.

Call your doctor or nurse when you notice that you cannot balance your urinary output with your water intake. A sign of this imbalance is that you will urinate a large amount of clear, odorless fluid. After urination, you will be very thirsty and feel the need to drink a large amount of water.

Call your doctor or nurse if you have side effects from the medications that were ordered for you. When you are at the Clinical Center, your physician, nurse, or pharmacist will discuss with you how the drugs work, how and when to take them, and their side effects. You may also want to refer to any written information they give you.

And of course, always feel free to ask your doctor or nurse any questions you have about your diagnosis and treatment.

## True/False statements

**1.Q:** Excessive urination is polydipsia.

**A: False.**

Excessive urination is called polyuria.

**2. Q:** Patients who have diabetes insipidus are seldom very thirsty.

**A: False.**

Patients are usually very thirsty. The medical term for this thirst is polydipsia.

**3. Q:** Call your doctor or nurse if you cannot balance your fluid intake and fluid output.

**A: True.**

This is necessary so that too much water is not lost before medical action can be taken.

**4. Q:** Patients with diabetes insipidus become dehydrated if their fluid intake and fluid output are not balanced.

**A: True.**

**5. Q:** The lack of or deficiency of the antidiuretic hormone vasopressin causes central diabetes insipidus.

**A: True.**

**6. Q:** Infections, tumors, neurosurgical operations, bleeding, and head injuries may cause central diabetes insipidus.

**A: True.**

**7. Q:** Nephrogenic diabetes insipidus is acquired or may be inherited by male children.

**A: True.**

**8. Q:** In diabetes mellitus, the hormone vasopressin (made in the pancreas) is deficient, or the body's cells are unresponsive to it.

**A: False.**

Remember, diabetes mellitus is not the same as diabetes insipidus. The hormone lacking in diabetes mellitus is insulin.

**9. Q:** Patients do not need to call their doctor or nurse if they can't balance their fluid intake and fluid output.

**A: False.**

Patients should call their doctor or nurse so that they do not become dehydrated.

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## Glossary

### Antidiuretic

Any agent that reduces the output of urine.

### Central diabetes insipidus

A metabolic disease caused by the lack of the antidiuretic hormone vasopressin, or a poor response to it. Symptoms of this disease are excessive urination of large amounts of colorless urine followed by excessive thirst. It is not related to diabetes mellitus.

### Dehydration

A condition that results from the body losing too much water.

### Diabetes

A general term relating to disorders characterized by excessive urine excretion

(polyuria) as in diabetes mellitus and diabetes insipidus. When used alone, the term refers to diabetes mellitus.

### Diabetes insipidus: central and nephrogenic

Disorders of water balance.

### Diabetes mellitus

A chronic disease caused by a lack of the hormone insulin or a poor response to it.

### Diuretics (thiazide)

Substances that increase the amount of urine excreted.

### Hypertonic saline test

A test that involves water loading and saline infusion. After this, blood is drawn for measuring osmolality and vasopressin content.

### Hypothalamus

A part of the brain located below the cerebrum. Here, nerve cells form vasopressin that concentrates urine.

### Insulin

A hormone formed in the pancreas and secreted in the blood for proper fat, protein, and carbohydrate metabolism.

### Kidneys

Two abdominal organs located in the lower back. The kidneys filter the blood and excrete the end products of body metabolism in the form of urine. The kidneys regulate all the water in the body by selectively excreting or reabsorbing water, resulting in diluted or concentrated urine.

### Nephrogenic diabetes insipidus

A rare disorder of water metabolism

in which the kidneys fail to respond to vasopressin. It may be acquired or inherited by male children.

**Pancreas**

A large gland lying in the upper portion of the abdomen. It secretes enzymes into the intestines for digestion and manufactures insulin, which it secretes into the bloodstream.

**Pituitary**

An endocrine gland located at the base of the brain. Vasopressin is stored in the posterior lobe and is secreted when the blood osmolality becomes high.

**Polydipsia**

Excessive thirst.

**Polyphagia**

Excessive desire to eat.

**Polyuria**

Excessive urination.

**Serum osmolality**

Indicates the concentration of solid particles in the liquid part of the blood.

**Urine**

The liquid excreted by the kidneys. Normally, it is clear and amber. The normal specific gravity is from 1.024-1.030. Urine does not normally contain sugar (as in diabetes mellitus).

**Urine osmolality**

A more accurate measurement of the number of solids in urine. In diabetes insipidus, the osmolality is low.

**Urine specific gravity**

A measure of solid particles in the urine. The reading varies from 1.005 (low concentration of solids) to 1.030 (high concentration of solids). In diabetes insipidus, the specific gravity is often less than 1.005.

**Vasopressin**

An antidiuretic hormone that concentrates urine.

**Vasopressin test**

A test done if the water deprivation test does not result in sufficiently concentrated urine. Vasopressin is given by the doctor or nurse by subcutaneous injection to assess the body's reaction to the hormone.

## Comparison of Diabetes Insipidus and Diabetes Mellitus

	Central diabetes insipidus	Nephrogenic diabetes insipidus	Diabetes mellitus
<b>How common is the disease?</b>	Uncommon	Uncommon	Common
<b>What causes the disease?</b>	The mechanism for secreting vasopressin malfunctions.	The kidneys are unable to respond to the diuretic hormone vasopressin. It is acquired or may be inherited by male children.	Enough of the hormone insulin is not secreted, or the body's cells do not respond to it. Heredity, obesity, pregnancy, and drugs can also lead to diabetes mellitus.
<b>What do these hormones do and why are they important?</b>	Vasopressin is a hormone that controls water metabolism. It is made in the hypothalamus (a part of the brain) and is stored and secreted by the posterior pituitary gland (also in the brain)	Vasopressin causes tubules within the kidney to reabsorb water. Water that is not absorbed is released as urine.	Insulin is made in the pancreas, where it controls carbohydrate metabolism. It controls sugar (glucose) levels in the body.
<b>What are the signs and symptoms of the disease?</b>	Sudden or gradual urination of large amounts of clear, colorless fluid, followed by excessive thirst (polydipsia). Dehydration can occur if fluid balance is not maintained.	Same as central diabetes insipidus: polyuria followed by polydipsia.	Excessive urination (polyuria), excessive thirst (polydipsia), and excessive appetite (polyphagia). May be sudden or gradual with no symptoms. Tiredness, weight gain or loss, skin infections that do not heal.
<b>What diagnostic tests detect the disease?</b>	Water deprivation test/ vasopressin test.  Hypertonic saline infusion test.	Water deprivation test/ vasopressin test.  Hypertonic saline infusion test.	Fasting blood sugar 2-hour post-prandial test blood sugar test Glucose tolerance test Hemoglobin A1C blood test
<b>What treatments combat the disease?</b>	Balance fluid intake and urine output.  Replace antidiuretic hormone, vasopressin, if possible, underlying cause of disease.	Balance urine output with fluid intake.  Diuretics.	Correct sugar/insulin intake.  Prevent progression of disease.  Diet. Oral or injectable medication.



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