CONDITION

Central diabetes insipidus

Learn how central diabetes insipidus affects thirst and urination, how it is diagnosed, and how desmopressin and careful fluid management can help.

WHAT IT IS
Vasopressin deficiency causing excessive dilute urine

BODY SYSTEM
Hormone system

MAIN SYMPTOMS
Frequent urination, pale urine, strong thirst, nighttime urination

WHAT CAUSES IT
Hypothalamus or pituitary damage, sometimes unknown

HOW IT IS DIAGNOSED
Water-deprivation and desmopressin testing, copeptin testing

MAIN TREATMENT
Vasopressin replacement and fluid management

CAN IT BE CURED?
Sometimes - may be temporary after surgery

IS IT AN EMERGENCY?
Sometimes - severe confusion, seizures or unconsciousness

LONG-TERM OUTLOOK
Most maintain normal fluid balance with treatment

Overview

Central diabetes insipidus is a condition that causes the body to make unusually large amounts of dilute urine. It develops when the brain does not produce or release enough arginine vasopressin, also called antidiuretic hormone or ADH.

Vasopressin is made in the hypothalamus, a part of the brain involved in fluid balance. It is stored and released by the pituitary gland at the base of the brain. Vasopressin tells the kidneys to return water to the bloodstream instead of allowing it to leave the body as urine.

When too little vasopressin reaches the kidneys, they cannot conserve water normally. This leads to frequent urination and strong thirst. The condition is now sometimes called arginine vasopressin deficiency .

Central diabetes insipidus is not the same as diabetes mellitus, which includes type 1 and type 2 diabetes. Both conditions can cause thirst and frequent urination, but diabetes mellitus involves high blood glucose. Central diabetes insipidus involves the control of water balance.

The condition can be temporary or permanent. For example, it may occur for a limited time after pituitary surgery or a head injury. In other cases, ongoing treatment is needed. With proper treatment and access to water, most people can maintain normal fluid balance.

Symptoms

The main symptoms are passing large amounts of pale urine and feeling very thirsty. Urination may occur throughout the day and night. The need to wake repeatedly to urinate can interfere with sleep, school, work, and travel.

Possible symptoms include:

Infants and young children may not be able to ask for water. Signs can include unusual irritability, poor feeding, slow weight gain, frequent wet diapers, fever, vomiting, or constipation. These symptoms have many possible causes and need medical assessment.

People who can drink whenever they are thirsty may keep their blood sodium within a normal range. Problems are more likely when a person cannot recognize thirst, cannot get water, is vomiting, is unconscious, or depends on someone else for drinks.

Seek urgent medical care for marked weakness, worsening confusion, repeated vomiting, severe dizziness, or an inability to keep up with thirst and urine losses. Call emergency services for seizures, loss of consciousness, or severe confusion. These can be signs of a serious sodium or fluid imbalance.

- Frequent urination, including during the night
- Large amounts of clear or very pale urine
- Strong thirst, often with a preference for cold drinks
- Dry mouth or dry skin if fluid intake does not keep up
- Fatigue, headache, dizziness, or difficulty concentrating
- Bed-wetting in a child who was previously dry at night

Causes and risk factors

Central diabetes insipidus results from damage to, inflammation of, or disease affecting the

hypothalamus or pituitary gland. Sometimes no clear cause is found.

Possible causes include:

After pituitary surgery, diabetes insipidus may be temporary, permanent, or part of a changing pattern of fluid imbalance. For this reason, urine output and blood sodium may need close monitoring after surgery.

A mass or inflammation near the pituitary can affect other pituitary hormones as well. These hormones help regulate the thyroid gland, adrenal glands, growth, menstrual cycles, testosterone production, and reproduction. Symptoms such as unexplained fatigue, menstrual changes, sexual difficulties, or intolerance of cold may prompt broader pituitary testing.

Central diabetes insipidus must be distinguished from nephrogenic diabetes insipidus . In the nephrogenic form, the body produces vasopressin, but the kidneys do not respond to it normally. Some kidney conditions, electrolyte problems, and medicines can cause the nephrogenic form.

Another condition, primary polydipsia, involves drinking excessive amounts of fluid, which then leads to frequent urination. The symptoms may look similar, but treatment is different.

- Surgery involving the pituitary gland or nearby structures
- Head trauma
- Tumors affecting the hypothalamus, pituitary gland, or pituitary stalk
- Inflammatory or autoimmune disorders
- Infections involving the brain
- Conditions that cause abnormal cells or substances to collect in tissues, known as infiltrative disorders
- Reduced blood supply to the hypothalamus or pituitary region
- Rare inherited changes affecting vasopressin production

Diagnosis

Diagnosis begins with a review of symptoms, fluid intake, urine output, medicines, previous surgery, head injuries, and other medical conditions. A clinician may ask how often the person urinates, whether symptoms continue overnight, and whether thirst appeared suddenly or gradually.

Blood and urine tests help show how the body is handling water. Common tests include blood sodium, blood glucose, kidney function, and measures of blood and urine concentration called

osmolality. In central diabetes insipidus, the urine may remain unusually dilute even when the blood becomes more concentrated.

Clinicians also look for other explanations. High blood glucose can pull extra water into the urine. Certain medicines, high calcium, low potassium, kidney disease, and high fluid intake can also increase urine volume.

Specialized testing may be needed when routine results do not clearly identify the cause. A supervised water-deprivation test examines whether the kidneys concentrate urine when fluids are withheld and how the body responds to desmopressin, a medicine that acts like vasopressin. Because withholding water can cause dangerous dehydration or a high sodium level, this test should only be done under medical supervision.

Some medical centers use copeptin testing. Copeptin is released into the blood along with vasopressin and is easier to measure. Testing copeptin after carefully controlled stimulation can help distinguish central diabetes insipidus from nephrogenic diabetes insipidus and primary polydipsia.

Magnetic resonance imaging, or MRI, may be used to examine the hypothalamus, pituitary gland, and nearby structures. The clinician may also order tests for other pituitary hormones. Follow-up imaging or laboratory testing may be recommended if the cause is uncertain or if an abnormality is found.

Treatment and management

Treatment depends on the severity of the vasopressin deficiency, the underlying cause, and the person's ability to drink in response to thirst.

Desmopressin is the main medicine for central diabetes insipidus. It is a manufactured form of vasopressin that helps the kidneys conserve water. It may be given as a tablet, nasal preparation, injection, or another formulation, depending on the clinical situation and local availability.

The timing and amount of desmopressin must be individualized by a clinician. Some people with partial vasopressin deficiency may need treatment only at certain times, such as overnight. Others need regular treatment throughout the day.

Desmopressin reduces urine output but does not automatically reduce fluid intake. Drinking more fluid than the body needs while desmopressin is active can dilute the blood sodium. This is called hyponatremia . Symptoms may include headache, nausea, unusual tiredness, confusion, or, in severe cases, seizures.

A clinician may recommend a planned period when desmopressin is delayed or adjusted so

that the body can release excess water. This approach should follow an individualized medical plan rather than being started without guidance.

Practical management may include:

A person who is unable to drink or take desmopressin may need urgent assessment. Hospital treatment can include carefully selected intravenous fluids, desmopressin, and frequent checks of blood sodium and urine output. Sodium abnormalities generally need to be corrected in a controlled way.

Treatment of the underlying cause may also be needed. This could involve care for a pituitary tumor, inflammation, infection, or another disorder. Treating the cause does not always restore vasopressin production, so ongoing monitoring remains important.

- Keeping water available and drinking according to thirst unless a clinician gives different instructions
- Taking desmopressin exactly as directed
- Knowing the symptoms of both dehydration and low blood sodium
- Having a written plan for vomiting, diarrhea, fasting, surgery, or missed medicine
- Carrying medical identification that states the diagnosis and usual treatment
- Bringing enough medicine when traveling and keeping it accessible

Complications

Without enough fluid intake, central diabetes insipidus can cause dehydration and a high blood sodium level, called hypernatremia . Symptoms may include intense thirst, dry mouth, weakness, irritability, confusion, muscle twitching, or reduced alertness.

The risk is higher in infants, older adults, people with impaired thirst, and anyone who cannot get water independently. Hospitalized people are also at risk if desmopressin is delayed or omitted, or if their fluid needs are not recognized.

Treatment can cause the opposite problem. Too much desmopressin combined with excessive fluid intake can lead to low blood sodium. Mild hyponatremia may cause few symptoms, but a rapid or severe fall can affect the brain.

Long-term sleep disruption from nighttime urination may contribute to fatigue, poor concentration, and reduced quality of life. Frequent urination can also make work, school, and travel more difficult. Treatment should address these day-to-day effects while maintaining safe fluid balance.

Follow up

Routine follow-up usually includes a review of thirst, urine volume, nighttime urination, desmopressin use, fluid habits, and any symptoms of sodium imbalance. Blood sodium and kidney function may be checked, especially after treatment changes or during illness.

People with pituitary disease may need periodic testing of other pituitary hormones. Repeat MRI scans may be appropriate when the original cause is uncertain, an abnormality needs observation, or new symptoms develop.

Contact the treating clinician promptly if urine output or thirst changes significantly, desmopressin seems less effective, headaches or nausea develop after treatment, or an illness makes it difficult to drink or keep medicine down. A clinician should also be contacted before planned surgery, fasting, or procedures that limit access to water.

Emergency assessment is appropriate for severe confusion, seizures, loss of consciousness, or a rapid decline in alertness. These symptoms are not part of routine follow-up.

Sources

- National Institute of Diabetes and Digestive and Kidney Diseases. "Diabetes Insipidus." National Institutes of Health. Last reviewed April 2021.
- Christ-Crain M, Bichet DG, Fenske WK, et al. "Diabetes insipidus." Nature Reviews Disease Primers . 2019;5:54. doi:10.1038/s41572-019-0103-2.
- Tomkins M, Lawless S, Martin-Grace J, Sherlock M, Thompson CJ. "Diagnosis and Management of Central Diabetes Insipidus in Adults." The Journal of Clinical Endocrinology & Metabolism . 2022;107(10):2701-2715. doi:10.1210/clinem/dgac381.
- Baldeweg SE, Ball S, Brooke A, et al. "Society for Endocrinology Clinical Guidance: Inpatient management of cranial diabetes insipidus." Endocrine Connections . 2018;7(7):G8-G11. doi:10.1530/EC-18-0154.
- Fenske W, Refardt J, Chifu I, et al. "A Copeptin-Based Approach in the Diagnosis of Diabetes Insipidus." The New England Journal of Medicine . 2018;379:428-439. doi:10.1056/NEJMoa1803760.