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Sodium Imbalance basic level

Overview

Patients who have a tumor in or around the pituitary gland may develop sodium imbalance after surgery to remove the tumor. Sodium imbalance is caused by abnormally high or low levels of antidiuretic hormone (ADH) that is secreted by the pituitary gland. ADH regulates the body's water and salt balance. Diabetes Insipidus (DI) develops when ADH levels are abnormally low. The Syndrome of Inappropriate Antidiuretic Hormone (SIADH) develops when ADH levels are abnormally high.

What is sodium imbalance?

The brain and kidneys control water retention in the body. In the brain, the connection between the hypothalamus and pituitary gland controls a majority of the hormone function. Antidiuretic hormone (ADH), also called vasopressin, is produced in the hypothalamus and secreted by the posterior pituitary gland in response to the body's need to retain water. Pituitary surgery can alter this process and cause one of these conditions:

- **Diabetes Insipidus (DI)** occurs when the body does not have enough ADH. This results in loss of water and important electrolytes. When the body loses water, the salt level goes up. High salt levels can lead to problems such as dehydration, confusion and other neurological changes.
- **Syndrome of Inappropriate Antidiuretic Hormone (SIADH)** occurs when the body has too much ADH. This results in water retention, decreased urination, and diluted blood levels, most critically salt. Low salt levels can lead to nausea, vomiting, fatigue, seizure and even coma when left untreated.

What are the symptoms?

The symptoms of DI include: constant urination, excessive thirst, and dehydration if the patient does not have access to any water. After pituitary surgery, patients typically experience dry mouth because they are unable to breathe through their nose. However, in DI the thirst is much more intense, unquenchable, and leads to excessive drinking. If the body does not have enough ADH to keep normal fluid balance, this results in frequent urination. Patients who suffer from DI urinate more

Diabetes Insipidus (DI)

Symptoms = Excessive thirst
Dehydration
Clear urine
Urinating more than normal

What to do = Drink clear fluids
Avoid drinks with caffeine and alcohol (diuretics)
Call your doctor

Syndrome of Inappropriate Antidiuretic Hormone (SIADH)

Symptoms = Tiredness
Nausea and vomiting
Confusion
Water retention
Urinating less than normal

What to do = Restrict fluid intake
Take medications as directed

than 1 liter per day and/or urinate frequently during the day and night.

The symptoms of SIADH include: decreased urination, headache, nausea, vomiting, confusion and seizure.

What are the causes?

Diabetes insipidus and SIADH can result from manipulation or damage to the pituitary gland during surgery, head trauma or general brain injury. SIADH can also be caused by cancers, trauma, lung disorders, medications and surgery.

Who is affected?

Diabetes insipidus usually occurs after pituitary tumor surgery and is not present before except in rare cases [1]. In 98 to 99% of cases, diabetes insipidus that develops after surgery will resolve within months. SIADH can result from pituitary surgery in as many as 25% of patients but is temporary [2].

How is a diagnosis made?

After pituitary surgery, your blood levels, urine output, and fluid intake will be closely monitored. Blood levels will be drawn every six hours until they are stable. Based on your blood levels and your clinical exam, you may or may not have a sodium imbalance that needs treatment.

What treatments are available?

Treatment to correct sodium imbalance varies depending if the ADH levels are too high or too low. Treatment options include regulation of fluids and / or hormone replacement medication.

Treatment of DI includes increased fluid intake and hormone replacement with a synthetic ADH called desmopressin or DDAVP. Your endocrinologist will continue to monitor your fluid status and salt levels after you leave the hospital to make sure you still need to take the replacement. Typically, DI is temporary and resolves within a few days after surgery. However, if you had DI before your pituitary tumor surgery you are more likely to continue replacement therapy for a period of time after surgery or as directed by your physician/endocrinologist.

Treatment of SIADH is restriction of fluid intake. This limits the amount of free water that you are allowed to drink in a 24 hour period. The dietary office and nurses will keep track of how much water you drink and tell you when you have reached your limit for the day. Typically, fluid restriction will help restore the body's salt level to normal within a day or so. Your endocrinologist will continue to monitor your blood levels. If you continue to have low salt levels, your treatment may include a medication called demeclocycline.

Recovery & prevention

Follow up care with an endocrinologist is important after pituitary surgery. The endocrinologist will conduct a history and physical exam as well as frequently check your blood levels to determine if you need to continue or start hormone replacement or fluid regulation. Diabetes insipidus and SIADH can be easily controlled with medication and regulation of fluids under the supervision of your health care team.

Sources & links

If you have questions, please contact the Mayfield Clinic at 800-325-7787 or 513-221-1100. For information about the University of Cincinnati Neuroscience Institute's Brain Tumor Center, call 866-941-8264.

Sources

1. Greenberg M. Handbook of Neurosurgery: 7th edition, p.635, 2010
2. Hickey J. The Clinical Practice of Neurological and Neurosurgical Nursing, pp. 203-204, 2003
3. Powers C, Friedman A. Diagnosis and Management of Hyponatremia in Neurosurgical Patients. *Contemporary Neurosurgery* 29:1-6, 2007

Glossary

antidiuretic hormone (ADH): a hormone secreted by the posterior pituitary gland that acts on the kidneys to regulate the quantity of salt in body fluids and the amount of urine excreted by the kidneys. Also called vasopressin.

diabetes insipidus: a disorder of the pituitary gland causing an underproduction of the hormone vasopressin. Leads to high salt levels in the bloodstream, excessive passing of urine, and extreme thirst.

diuretic: a substance that increases urination and removal of water from the body.

hormone: a chemical substance produced in the body that controls and regulates the activity of certain cells or organs.

hyponatremia: low salt levels in the blood.

hypernatremia: high salt levels in the blood.

Syndrome of Inappropriate Antidiuretic

Hormone (SIADH): a disorder of the pituitary gland causing overproduction of the hormone vasopressin. Leads to low salt levels in the bloodstream, nausea, vomiting, fatigue, seizure and coma.

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