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The Influence of the Autonomic Nervous System on the Vital Functions of the Body

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Abstract: The autonomic nervous system regulates basic life processes such as blood pressure and respiratory rate. This system operates automatically (autonomously), that is, its functioning does not depend on human will. Diseases of the autonomic nervous system can affect any part of the body and any process. Autonomic disorders can be both reversible and progressive.

The autonomic nervous system is the part of the nervous system that controls internal organs, including blood vessels, stomach, intestines, liver, kidneys, bladder, genitals, lungs, pupils, heart, sweat and salivary glands, and digestive glands.

After the autonomic nervous system receives information about the state of the organism and the environment, it stimulates processes in the organism, which can be carried out by the sympathetic division, or slows them down, which can be carried out by the parasympathetic division.

Keywords: Causes, Symptoms, Diagnosis, Treatment.

Input: Signals are sent to the organs they control through systems consisting of two nerve cells. One cell is located in the brain stem or spinal cord. Its nerve fiber connects with another cell located in peripheral clusters of nerve cells (such clusters are called autonomic ganglia). From such a ganglion, nerve fibers that control the activity of an internal organ emerge. Most sympathetic ganglia are located near the spinal cord, on either side of it. The ganglia of the parasympathetic division are located near or inside the organs they control.

Function of the autonomic nervous system

a. The autonomic nervous system controls the body's internal processes, including:
b. Blood pressure
c. Heart rate and breathing rate
d. Body temperature
e. Digestion
f. Metabolism (therefore affects body weight)
g. Water and electrolyte balance (such as sodium and calcium)
h. Biological fluid secretion (saliva, sweat, tears)
i. Urination
j. Defecation

Many organs are controlled primarily by either the sympathetic or parasympathetic divisions of the autonomic nervous system. Other organs are controlled by both divisions. For example, the sympathetic division increases blood pressure, while the parasympathetic division decreases it. The combined work of the two divisions ensures that the body adapts to various situations.

For example, the sympathetic division increases the frequency and strength of heart contractions and dilates the airways, making breathing easier. They force the body to release stored energy. Muscles become stronger. The sympathetic division of the autonomic nervous system makes your palms sweat, your pupils dilate, and your hair stand on end. In emergency situations, it slows down non-essential processes, such as digestion and urination.

Research Methods and Materials: In general, the parasympathetic division is responsible for maintenance and repair. It slows the heart rate and lowers blood pressure. It stimulates the digestive system and eliminates waste. The energy from digested food is stored or used to build tissue.

Sexual activity involves certain parts of the nervous system, namely the system responsible for conscious actions and the transmission of sensory information to the brain (somatic nervous system), along with the sympathetic and parasympathetic divisions of the autonomic nervous system.

The transmission of impulses between nerve cells of the autonomic nervous system occurs through two main chemical messengers (neurotransmitters):

Nerve fibers that release acetylcholine are called cholinergic. Fibers that release norepinephrine are called adrenergic. In general, acetylcholine has a parasympathetic effect, while norepinephrine has a sympathetic effect. However, acetylcholine also has some sympathetic effects. For example, it sometimes causes sweating and makes your hair stand on end.

The causes of vegetative disorders can be diseases that affect the autonomic nerves or areas of the brain that control the processes occurring in the body, or they can occur spontaneously for no apparent reason.

a. Common causes of autonomic disorders:
b. diabetes mellitus (the most common cause);
c. Diseases of the peripheral nervous system
d. aging;
e. Parkinson's disease;
f. Less common causes include:
g. autonomic neuropathies;
h. Multiple system atrophy
i. True autonomic dysfunction
j. Spinal cord diseases
k. Some medications
l. Diseases of the neuromuscular junction (where nerves meet muscles), such as botulism and Lambert-Eaton syndrome
m. Some viral infections, including COVID-19
n. Damage to the nerves of the neck, including those associated with surgical intervention

Autonomic dysfunction associated with COVID-19 is still being studied. It can lead to orthostatic instability and, less commonly, autonomic neuropathy. Orthostatic instability describes dysfunction of the autonomic nervous system that occurs when standing up. Symptoms include dizziness, blurred vision, pressure in the head, rapid heartbeat, tremors, nausea, and difficulty breathing. Even loss of consciousness is possible.

In men, difficulty achieving and maintaining an erection (erectile dysfunction) may be the first symptom of autonomic dysfunction.

Autonomic disorders often cause dizziness when standing up; this is caused by an excessive drop in blood pressure (orthostatic hypotension).

A person may have less tolerance to heat because they sweat less or not at all. Dry eyes and a dry mouth may occur.

Results: With vegetative disorders, the rate of gastric emptying may be slowed (gastroparesis); Such a person experiences a feeling of satiety too early during meals and may vomit. In some patients, the bladder is overactive, causing them to involuntarily leak urine (urinary incontinence). Others have difficulty urinating due to an underactive bladder (urinary retention). Both constipation and fecal incontinence may occur.

During a physical exam, your doctor will look for signs of autonomic dysfunction, such as orthostatic hypotension. For example, your doctor will measure your blood pressure and heart rate while you are lying down, sitting, or just standing, to see how your blood pressure changes with changes in body position. When you stand up, gravity makes it harder for blood to flow back from your leg veins to your heart. This causes your blood pressure to drop. To compensate, your heart pumps harder and your heart rate increases. However, the changes in heart rate and blood pressure are small and short-lived. If the changes are more severe or last longer, you may develop orthostatic hypotension.

Additionally, the doctor may continuously measure blood pressure while the patient performs a Valsalva maneuver (the patient tries to exhale through the nose or mouth but resists the movement—this is how people strain during a bowel movement). The patient will have an electrocardiogram to determine whether the pulse changes are normal during deep breathing and the Valsalva maneuver.

A tilt table test may be performed to determine how blood pressure and heart rate change with position. In this test, the patient lies on a tilt table and their heart rate and blood pressure are measured before and after they are turned to an upright position.

When performed together, the tilt table test and Valsalva maneuver can help doctors determine whether low blood pressure is caused by a disorder of the autonomic nervous system.

The doctor checks to see if the pupils respond adequately to light.

A sweat test may be performed. This test involves placing electrodes filled with acetylcholine on the feet and wrists and stimulating the sweat glands. The amount of sweat produced is then measured and a check is made to see if sweat secretion is normal. The patient may experience a mild burning sensation during this test.

In another test, the thermoregulatory sweat test, a dye is applied to the skin. The patient is placed in a closed, heated chamber to increase sweating. The sweat causes the dye to change color. Doctors can then assess the level of sweating, which can help determine the cause of the autonomic nervous system disorder.

To determine the underlying disease causing the autonomic disorder, the doctor may order other tests, including blood tests.

Discussion: Orthostatic hypotension: The patient is advised to elevate the head of the bed by 4 inches (10 centimeters) and get out of bed slowly. Wearing compression garments, such as an

abdominal binder or compression stockings, may help. You may also want to increase your salt and water intake. This method can help increase blood pressure by increasing blood volume. Sometimes medications are used. Fludrocortisone increases blood volume and therefore increases blood pressure. Midodrine constricts the arteries, keeping blood pressure high. These medications are taken orally.

Decreased or absent sweating. If the patient sweats little or not at all, he or she is advised to avoid heat.

Urinary incontinence: For overactive bladder, oral medications such as oxybutynin, mirabegron, tamsulosin, or tolterodine can be used to relax the bladder muscles. If incontinence persists, a catheter may need to be placed in the bladder. The patient can learn to insert the catheter independently.

Urinary retention: If urinary retention is caused by weak bladder contractions, the patient is taught to use a catheter (a thin rubber tube). The patient inserts a catheter into the urethra and uses it to empty the bladder. The urine is drained from the bladder through the catheter. The catheter is inserted several times a day and removed after the bladder is empty. The patient may be prescribed bethanechol to improve bladder emptying. This medication increases the tone of the bladder.

Constipation: Eating more fiber and taking stool softeners are recommended. If constipation persists, an enema may be necessary.

Erectile dysfunction: Treatment is usually with oral medications such as sildenafil, tadalafil, or vardenafil. Sometimes devices that block blood flow (bands and rings placed under the penis) and/or vacuum devices are used.

Autonomic neuropathies are disorders of the peripheral nerves responsible for automatic (without conscious participation) control of processes occurring in the body (autonomic nerve fibers).

Autonomic neuropathies can develop due to diabetes, amyloidosis, autoimmune diseases, cancer, alcohol abuse, and certain medications.

The patient may feel dizzy when getting out of bed; he may have difficulty urinating; constipation and vomiting may occur; men may experience erectile dysfunction.

To identify autonomic dysfunction and its possible causes, the doctor will conduct a physical examination and various tests.

If possible, the cause of the symptoms is eliminated.

The nervous system consists of the central and peripheral systems. The central nervous system is the brain and spinal cord. The peripheral nervous system is the nerves that connect different parts of the body to the brain or spinal cord. Peripheral nerves include:

Autonomic nerves - they control the body's functioning automatically (without conscious participation).

Somatic nerves, which provide voluntary (conscious) control of muscles and the transmission of sensory information to the brain.

Autonomic neuropathies are a type of peripheral neuropathy, a disease in which the peripheral nerves of the entire body are damaged. In autonomic neuropathies, the fibers of the autonomic nervous system are more severely damaged than the fibers of the somatic system.

The immune system begins to produce antibodies against the surface of nerve fibers, or the nerve fiber sheath, which speeds up the transmission of nerve impulses. (This tissue is called the myelin sheath.)

Sometimes antibodies are formed against acetylcholine receptors (proteins that are necessary for the nerve cell to respond to the action of acetylcholine). Acetylcholine is one of the chemical messengers (neurotransmitters) involved in the transmission of nerve impulses from one nerve cell to another in the autonomic system.

Other causes of autonomic neuropathies include malignant tumors and psychotropic drugs (including alcohol and excessive amounts of toxins).

Men may have difficulty achieving and maintaining an erection (erectile dysfunction). Some patients have an overactive bladder, causing them to leak urine involuntarily (urinary incontinence). Others have difficulty urinating because their bladder is underactive (urinary retention). The rate of gastric emptying may be slowed (gastroparesis); the person may feel full too early during meals and may vomit. Severe constipation may occur.

If somatic nerves are also damaged, the patient may develop loss of sensation or tingling in the arms and legs, and muscle weakness.

Doctors may suspect the presence of autonomic dysfunction based on symptoms. Your doctor will perform a physical examination and special tests to identify signs of autonomic dysfunction and possible causes (such as diabetes or amyloidosis).

If an autoimmune reaction is suspected, the patient's blood is tested for antibodies to acetylcholine receptors. These antibodies are found in about half of people with autonomic neuropathy, which develops as a result of an autoimmune reaction.

If the cause of the autonomic dysfunction can be identified, the cause is treated. Neuropathies that develop as a result of autoimmune reactions are sometimes treated with drugs that suppress the immune system (immunosuppressants) and reduce the reaction. These drugs may include, for example, azathioprine, cyclophosphamide, and prednisone.

Summary: If the symptoms of autoimmune autonomic neuropathy are severe, the patient may be given intravenous immunoglobulin (a solution containing large amounts of different antibodies taken from the blood of people with normal immunity) or plasmapheresis. In plasmapheresis, blood is taken from the patient, the abnormal antibodies are removed by filtration, and the filtered blood is returned to the patient.

Horner syndrome affects one side of the face, causing drooping of the eyelid, constriction of the pupil, and decreased sweating on that side. The syndrome is caused by damage to the nerve fibers that connect the eye to the brain.

a. Horner syndrome can be an independent disease or the result of a disease that destroys the nerve fibers between the brain and the eye.

b. The upper eyelid droops, the pupil constricts, and less sweat is produced on the affected part of the face.

c. The doctor will check to see if the pupil is dilated and will perform imaging tests to determine the cause.

d. If the cause is identified, it is treated.

e. (See also Overview of the Autonomic Nervous System.)

f. Horner syndrome can develop at any age.

g. Causes of Bernard-Horner syndrome

Some nerve fibers that connect the eye to the brain take a circuitous route. From the brain, they travel to the spinal cord, then up the chest, back up the neck, along the carotid artery, and then through the skull to the eyes. If these fibers are torn anywhere along this route, the patient develops Horner's syndrome.

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