RESEARCH JOURNAL OF TRAUMA AND DISABILITY STUDIES

Volume: 02 Issue: 11 Nov– 2023 ISSN: 2720-6866
http://journals.academiczone.net/index.php/rjtds

Diabetes Mellitus in a Child

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Summary. Diabetes mellitus is widespread in children and adolescents. The pathology is characterized by constantly high levels of glucose in the blood. The disease is accompanied by weight loss with good appetite, strong thirst and profuse urination.

In the absence of adequate treatment, the disease progresses rapidly due to active growth and increased metabolism in children.

The first type is most common in children. The disease is characterized by very low levels of insulin; the child requires constant monitoring.

Keywords: coronavirus; COVID-19; diabetes; angiotensin converting enzyme type 2; glucocorticoids.

For type 1 diabetesThe body does not produce enough insulin; it is necessary to constantly monitor its level and administer additionally if necessary. The cause is unknown and the disease cannot be prevented. Symptoms include thirst, constant hunger, excessive urination, fatigue, decreased visual acuity, and weight loss. Symptoms may occur suddenly.

Type 1 diabetes is divided into two subtypes - immune-mediated and idiopathic - depending on the cause of the malfunction of the pancreas.

Immune-mediated diabetes mellitus type 1occurs as a result of the destruction by the immune system of the β-cells of the pancreas, which produce insulin.

Autoantibodies to pancreatic islet cells, insulin, glutamate decarboxylase (GAD), tyrosine phosphatase and zinc transporter 8 (ZnT8A) are found in the blood of people with this form of the disease.

The disease has a pronounced genetic component, so it often occurs in blood relatives already in childhood or adolescence. It has been proven that the likelihood of developing autoimmune type 1

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diabetes mellitus is interrelated with the functioning of the HLA, INS, PTPN22 and IL2RA genes. More than 60 chromosome regions (loci) responsible for the development of pathology have been identified.

Immune-mediated diabetes is often combined with other autoimmune disorders, such as Graves' disease,Hashimoto's thyroiditis, Addison's disease, vitiligo or pernicious anemia.

In idiopathic type 1 diabetes mellitus, there are no antibodies in the blood - markers of autoimmune damage to the pancreas, but insulin production is reduced, and an excess of ketone bodies is detected in the blood and urine.

This is a rare variant of the disease that mainly occurs in African and Asian patients. Idiopathic diabetes most often develops in middle-aged men who are overweight or obese and have a family history of type 2 diabetes.

The pathology is believed to be associated with cellular insensitivity to insulin and periodic dysfunction of pancreatic β-cells that produce insulin. The disease is characterized by an acute onset and requires immediate hospitalization.

In patients with this form of the disease, autoantibodies, markers of type 1 diabetes, are not detected in the blood, but there are all the symptoms of a complete absence of insulin.Vprobable triggers of type 1 diabetes:

genetic disorders, due to which the sensitivity of cells to glucose decreases, the functioning of the pancreas changes, and insulin is produced in insufficient quantities;

viral infections - retroviruses, Coxsackie viruses,rubella,Epstein-Barrcapable of destroying pancreatic cells when entering the organ;

chronic diseases that affect the pancreas -pancreatitis, cystic fibrosis,hemochromatosis;

exposure to heavy metals, nitrates, rodenticides, which are used to kill rodents.

In addition, under certain conditions, autoimmune destruction of the pancreas can be triggered by radiation, chronic stress, consumption of foods containing gluten, soy, cow's milk, unsaturated fats, antioxidants, frequent exposure to ultraviolet radiation, heavy metals, nitrites and nitrates.

Risk factors for type 1 diabetes mellitus

The main risk factor for the disease is family history. So, if blood relatives have been diagnosed with this form of diabetes, then the likelihood of getting sick increases tenfold. In families of patients with type 1 diabetes, the maximum risk of developing the pathology is with first-degree relatives: brothers, sisters, children and parents.

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Many people are concerned about whether the disease is transmittable.The main cause of type 1 diabetes in children is heredity.This is confirmed by the large number of family cases when the disease occurs in a child in the presence of pathology in parents, grandparents.(3)

The autoimmune process is initiated by an external factor – viruses. Chronic insulitis and insulin deficiency are caused by exposure to the ECHO virus, Coxsackie B virus, herpes, rubella, and Epstein-Barr. The disease can be caused by enterovirus, rotavirus, measles and others.

In children with a genetic predisposition, the disease can be triggered by intoxication, artificial feeding, monotonous carbohydrate diet, as well as stress and previous operations.

Type 2 diabetes in children develops due to dysfunction of the pancreas - when b-cells do not produce or secrete insulin. As a result, receptor sensitivity decreases.(2)

Insulin is a hormone produced by the pancreas, which is small in a child. By the age of 10, the iron weighs 50 grams and its length is 12 cm. The main function is the production of insulin. The gland should cope with the task by the age of 5.

The greatest risk of diabetes occurs between the ages of 5 and 11 years.At this time, metabolism is fast, sugar is well absorbed. Every child needs 10 grams of carbohydrates. The exchange is controlled by an incompletely formed nervous system, and failures may occur.

Those at risk include teenagers going through puberty, premature babies and children who experience heavy stress.

The course of the disease depends on the age at which the pathology appeared. In children, diabetes is severe and leads to complications. Parents must understand that diabetes in children requires care and lifelong treatment.

Symptoms and first signs

The disease can develop in a child at any age. There are two peak periods - 5-8 years and puberty, when growth and metabolism are enhanced.(1)

The disease of the first type manifests itself acutely.Signstype 1 diabetes mellitus in children are: severe weakness and dizziness when hungry and full. From the onset of the first symptoms to a diabetic coma can take from 1 to 3 months.

The first signs of the development of diabetes mellitus in children:

increased urination (over 2 liters per day);

thirst and dry mouth;

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increased appetite with a sharp decrease in body weight;

severe course of infectious diseases;

rapid fatigue without exercise;

absent-minded attention;

increased blood glucose (exceeds 120 mg) in the analysis;

rapid decrease in visual acuity;

nausea and vomiting.

Parents may notice that the urine has become sticky, and starched stains remain on their underwear. Dryness of the mucous membranes and epidermis may be observed - peeling of the skin on the soles and palms. Symptoms of diabetes mellitus in children include irritation in the corners of the mouth ("seizures") and stomatitis. Pustules, boils, and diaper rash appear. (3) In girls, the development of the disease is accompanied by vulvitis, in boys – by balanoposthitis. If the disease first appears during a girl's puberty, it can cause menstrual irregularities.

It is difficult to identify symptoms in children, so they pay attention to accompanying manifestations. Young children are characterized by nocturnal enuresis, itching, restlessness, and digestive problems. When sick, an infant greedily drinks milk and water. The sweet, sticky urine makes the diapers hard. Such signs indicate a moderate to severe form of pathology. In mild forms, the disease is diagnosed by blood and urine tests.

Diagnosis of diabetes mellitus

The first person to identify symptoms of the disease is the pediatrician who observes the child. The doctor looks for the classic signs: increased urination, thirst, hunger, and weight loss.(8)

During the examination, the doctor may notice diabetic blush, decreased skin turgor and a crimson tongue. If symptoms of diabetes are detected, the pediatrician transfers the patient to an endocrinologist for treatment and observation.

To make an accurate diagnosis, the child is sent for laboratory testing. It is necessary to take a blood test to check your sugar level; daily monitoring is used. They also check insulin, proinsulin, glucose tolerance, level of glycosylated hemoglobin, blood CBS.(5)

Blood test results table

results	Capillary blood glucose (mmol/l)	
	on an empty stomach	2 hours after taking glucose
Norm	<5.5	<7.8

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Impaired glucose tolerance <6.1 7.8-11.1

Diabetes >6.1 >11.1

The urine is tested for glucose and ketone bodies. The criteria for identifying the disease are: glycosuria, hyperglycemia, acetonuria, ketonuria.

As part of the preclinical detection of type 1 pathology in genetically predisposed children, Abs to glutamate decaboxylase and β-cells are determined. The structure of the gland is assessed using ultrasound.

Based on the patient's complaints, urine and blood test results, and research results, the doctor makes a diagnosis.

Chronic complications of type 1 diabetes mellitus

Chronic complications of type 1 diabetes are classified depending on the caliber of damaged vessels into macroangiopathy (affecting arteries) and microangiopathy (capillaries). Diabetic macroangiopathy most often means atherosclerosis - the deposition of cholesterol plaques in the lumen of blood vessels. As a result, blood circulation is impaired and may occurstrokeorheart attack. In addition, diabetic macroangiopathy often affects the lower extremities and develops what is called diabetic foot.(11Diabetic foot is a complication of type 1 diabetes, in which the soft tissues of the sole are subject to increased trauma and infection. Microangiopathies include diabetic retinopathy (eye damage), diabetic nephropathy (kidney damage), diabetic neuropathy (nervous system damage). Diabetic retinopathy is characterized by numerous hemorrhages in the retinal vessels.Eye damage in type 1 diabetes mellitus occurs in 90% of patients with a pathology duration of more than 20 years.(13) In addition, the regeneration of small vessels is disrupted. Because of this, wounds on the body do not heal well. So, even a small cut can turn into a deep festering ulcer. Regular blood glucose monitoring and drug treatment can prevent or at least delay such complications.

Treatment of the disease

When a diagnosis is made, the doctor, in accordance with clinical recommendations, prescribes observation and examination of the child every month. Monitoring the condition allows you to make adjustments to therapy, prevent exacerbations and prevent the pathology from becoming severe.(10)

Treatment of diabetes in children includes medications, special exercises and diet.

Proper nutrition. The specialist develops a balanced diet in terms of calories and nutritional

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supplements. A complex of vitamins is required. The diet should limit the consumption of baked goods and potato dishes. Unsweetened fruits and vegetables can be eaten in any quantity. The child needs to be provided with 6 fractional meals a day.

Exercise helps lower glucose levels and improve insulin sensitivity. The load must be accurately dosed and selected by the attending physician. During and after exercise, you need to take carbohydrates.

Medicines. Children are prescribed medications with insulin. In most cases, a single dose every day is sufficient. The doctor selects the dose and administration schedule. In addition to the main treatment or for mild diabetes mellitus in children, tablets are indicated.

Treatment prognosis

Parents are concerned about whether the pathology can be cured. If you follow the diet, insulin administration schedule and recommended exercise, the disease becomes mild. In case of gross violations of the doctor's instructions, specific complications appear early. Patients should be monitored for life by an endocrinologist-diabetologist.

Disease prevention

No specific prevention has been developed for children with diabetes. For people at risk, it is important to maintain a normal weight, ensure daily physical activity, improve immunity, and be examined by an endocrinologist twice a year.(14)

Timely vaccination helps prevent the development of diseases that are caused by diabetes: measles, mumps.

It is necessary to ensure that the child drinks sufficient amounts of liquid - at least 2 liters, in addition to tea and juices.

It is necessary to protect the child from stress; if there is excessive anxiety, it is better to consult a specialist.

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