

Lipka Marta, Kończalska Karolina, Kędziora-Kornatowska Kornelia. Diabetes - diagnosis, treatment, complications and rehabilitation. Journal of Education, Health and Sport. 2020;10(8):322-331. eISSN 2391-8306. DOI <http://dx.doi.org/10.12775/JEHS.2020.10.08.038>
<https://apcz.umk.pl/czasopisma/index.php/JEHS/article/view/JEHS.2020.10.08.038>
<https://zenodo.org/record/3996258>

The journal has had 5 points in Ministry of Science and Higher Education parametric evaluation. § 8. 2) and § 12. 1. 2) 22.02.2019.

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The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 01.08.2020. Revised: 05.08.2020. Accepted: 22.08.2020.

Diabetes - diagnosis, treatment, complications and rehabilitation

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A - study design, B - data collection, C - statistical analysis, D - data interpretation, E - manuscript preparation, F - literature search, G - funds collection.

Abstract

Introduction: Diabetes mellitus is a disease that cannot be completely cured, but by following the recommendations of Healthcare professionals, it is possible to maintain good health for a long time. The most important thing during treatment is to normalize the glucose level and maintain a balanced diet. The aim of the study is to present the problem of diabetes, to present the causes and effects of the disease, and to describe rehabilitation after its complications.

Results: In Poland, more than 2.9 million people are ill and the disease curve is constantly growing. Scientists predict that in a few dozen years there may be half a billion people in the world. Many people are not aware that this civilization disease also affects them. The reasons may be an inappropriate lifestyle, smoking, obesity, lack of physical activity. Early treatment initiation can prevent serious complications such as retinopathy, nephropathy, and peripheral neuropathy that result in DFU and, consequently, lead to limb amputation. Despite accompanying diabetes for several years, some patients report insufficient knowledge about their disease. Educating patients by doctors about the course of the disease and its treatment is an indispensable element during treatment. This improves the patients' quality of life.

Conclusion: Diabetes mellitus is a disease that affects a large part of the population and the incidence continues to increase.

To counteract disease, you need to measure your blood sugar regularly. Exercise and an appropriate diet will help prevent the disease.

Keywords: diabetes; rehabilitation; hyperglycemia; amputation,

Definition

Disturbances in sugar metabolism can lead to serious damage to organs in the human body. It has been shown that a large proportion of people with diabetes are unaware that they are sick, which leads to complications. The most serious complications occur in an untreated or poorly treated civilization disease, resulting in damage to nerves or blood vessels. Diabetes mellitus is the first non-infectious disease recognized by WHO as an epidemic of the 21st century. The World Health Organization defines it as a group of metabolic diseases characterized by hyperglycemia resulting from the action or deficiency of insulin secretion [1]. In the United States, it is the leading cause of mortality among humanity. Over 90-95% of diabetics are patients with type 2, which can be prevented by changing lifestyle [2].

The norm of sugar in the fasting test is in the range of 70-99 mg / dl. A value between 100-125 mg / dL indicates impaired glucose tolerance. We talk about diabetes when the sugar value is 126 mg / dl. Oral glucose tolerance test (OGTT) is also performed. It involves drinking 75 g of glucose on an empty stomach, and blood is drawn after 120 minutes. The intervals are as follows:

- <140 mg / dl - normal result
- 140–199 mg / dl - impaired glucose tolerance
- ≥ 200 mg / dl - diabetes > 126 mg / dl - diabetes [3].

Objective of the work

The study was performed to present the physiotherapeutic treatment of complications of a common disease such as diabetes. The paper distinguishes the extent of diabetes, and describes the causes and effects of the disease. Attention was also paid to the fight against civilization disease.

Epidemiology

Diabetes is one of the most common chronic diseases nowadays. It affects a large proportion of the population, and scientists report that in 2000 there were 171 million cases worldwide. And after 11 years, there is a sharp increase in the number of sick people - 346 million. According to the World Health Organization, data from 2014 show that 422 million people were sick worldwide. More and more cases are growing every year. Predictions made by scientists and researchers suggest that there could be one and a half billion cases of the disease in 2030. The greatest upward trend in the incidence is observed in developing countries, India and Latin America. Developed countries show a lower incidence rate, the largest group of patients comes from cities and mainly affects the elderly. In the world, the number of sick women is greater than that of men, but this is due to the greater number of women living on Earth compared to the opposite sex [4,5]. Research carried out in 2014 shows the highest incidence in Oceania, both for women and men, it was 13% in this region. The fewest reported patients were found in sub-Saharan Africa, with equal 5% for each sex. Considering Europe itself, Poland was 13th among men and 15th among women in the increase in the incidence rate out of 44 countries. According to the latest research from 2018, there were 2.9 million adults and 22,000 children with diabetes in Poland. Statistics show that Poland is also struggling with an increase in the number of patients. Over the past 30 years, the percentage of men with disease increased by 143%, in women - an increase of 66%. In 2014, people with diabetes in Poland accounted for almost 10% of the population. The most numerous group of patients are people over 60 [6]. Scientific research clearly shows that the risk of death caused by cardiovascular disease is from 1.7 to 4 times higher with accompanying diabetes compared to people without the disease of civilization [5].

Pathophysiology and risk factors

The cause of diabetes is a malfunction of the pancreas - an organ responsible for the secretion of the hormone insulin. This, in turn, regulates the metabolism of sugars to ensure their proper amount in the body. Mutations of some genes, incl. LEP or ADIPOQ cause inefficiency in insulin secretion, which is beyond human control [7]. Pancreatic dysfunction is also caused by the immune system, where in type 1 diabetes, the body destroys its own cells. It is an autoimmune phenomenon, where the body's antibodies themselves destroy the beta cells of the pancreas, necessary for the production of insulin [8].

Insulin resistance is another factor contributing to the development of diabetes. The decreased sensitivity of cells to insulin increases the number of people suffering from metabolic diseases. Scientific research confirms that obesity affects the occurrence of insulin resistance. Excessive amounts of fatty acids (FFA) in adipose tissue may have a negative effect on the insulin receptor, which translates into disturbances in carbohydrate metabolism in the body, which in turn gives rise to diabetes [9].

More and more studies prove that tobacco smoking contributes to the development of type 2 diabetes. Smoking itself is harmful and causes many health problems, and diabetics are even more exposed to the accelerated development of atherosclerosis, as a consequence of the emergence of ischemic heart disease and cerebrovascular disease. People with diabetes have a higher risk of developing cardiovascular diseases, but smoking only exacerbates this [10].

Tobacco smoke adversely affects the work of the vascular endothelium, contributing to tissue hypoxia. Damage to small and large blood vessels causes damage to internal organs and can aggravate inflammation. Hence, smoking works in a similar way to hyperglycemia in diabetes. High glucose concentration adversely affects the endothelium and leads to its damage. Endothelial dysfunction and its inflammation multiply in diabetes with smoking [11].

Over the past decades, scientists have recorded a huge increase in the prevalence of obesity in the world. In Poland, about 60% of men and over 50% of women suffer from obesity. Research confirms that there is a correlation between obesity and the incidence of type 2 diabetes. The NHANES study conducted in America shows that with increasing BMI, the risk of diabetes increases. In overweight people with BMI less than 30, the incidence was 2%, while in obese people with BMI above 35, the risk increased to 13% [12]. The current lifestyle and rush during the day are conducive to excessive stress. Emotional tension disturbs the sugar balance in the body. Reaching for snacks or sweets due to stress may lead to hyperglycaemia, which promotes the development of diabetes [13]. Lack of physical activity is another factor contributing to the onset of diabetes, which worsens insulin sensitivity and glucose uptake by skeletal muscles [14]. It is estimated that the presence of cardiovascular diseases is a consequence of low physical effort in 20%. Statistics conducted in Poland in 2004 show that Poles spend an average of 8 hours a week on physical activity, while they spend about 18 hours a week passively [15]. Dunstan in his research noticed a decrease in fasting glucose and insulin levels after 8 weeks of exercise in the group of people with type 2 diabetes compared to the control group [12]. Exercise reduces the level of glucose in the body, working muscles prevent hyperglycemia through an increased demand for simple sugars. it worsens insulin sensitivity and glucose uptake by skeletal muscles [14]. It is estimated that the presence of cardiovascular diseases is a consequence of low physical effort in 20%. Statistics conducted in Poland in 2004 show that Poles spend an average of 8 hours a week on physical activity, while they spend about 18 hours a week passively [15]. Dunstan in his studies observed a decrease in fasting glucose and insulin levels after 8 weeks of exercise in the group of people with type 2 diabetes, compared to the control group [12]. Exercise reduces the level of glucose in the body, working muscles prevent hyperglycemia through an increased demand for simple sugars. it worsens insulin sensitivity and glucose uptake by skeletal muscles [14]. It is estimated that the presence of cardiovascular diseases is a consequence of low physical effort in 20%. Statistics conducted in Poland in 2004 show that Poles spend an average of 8 hours a week on physical activity, while they spend about 18 hours a week passively [15]. Dunstan in his studies observed a decrease in fasting glucose and insulin levels after 8 weeks of exercise in the group of people with type 2 diabetes, compared to the control group [12]. Exercise reduces the level of glucose in the body, working muscles prevent hyperglycemia through an increased demand for simple sugars. Statistics conducted in Poland in 2004 show that Poles spend an average of 8 hours a week on physical activity, while they spend about 18 hours a week passively [15]. Dunstan in his research noticed a decrease in fasting glucose and insulin levels after 8 weeks of exercise in the group of people with type 2 diabetes compared to the control group [12]. Exercise reduces the level of glucose in the body, working muscles prevent hyperglycemia through an increased demand for simple sugars.

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The prevalence of diabetes in the elderly in Poland is 30%, which accounts for almost 9% of the incidence of diabetes in the elderly [8]. The aging process is associated with a number of diseases with an increased risk of developing neurodegenerative diseases, cardiovascular diseases and diabetes. Structural and physiological changes in the aging process are the cause of a greater incidence of civilization disease. With age, insulin resistance increases, as well as insulin secretion dysfunction, which is associated with a large number of patients with 21st century disease in seniors. It should be noted that the elderly are a group of the population where the risk of cardiovascular diseases is much higher compared to middle-aged people, and diabetes intensifies their occurrence.

Consequences and complications of diabetes

Diabetes mellitus is a disease that leads to many complications on the part of organs and systems. Complications are a consequence of a long-term disease, they may also result from the lack of proper treatment or the patient's lack of awareness about the disease. Research conducted by a team consisting of Donata Kurpas, Teresa Czech and Bożena Mroczek on the quality of life of people with diabetes shows that diabetes complications are a common occurrence. They concern 81% of respondents. They affect the overall quality of life of patients [17].

According to studies carried out among patients hospitalized in the hospital in Września, 21% of patients are unaware of the risk of diabetes complications [15].

Complications of diabetes include retinopathy with potential blindness; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations and Charcot joints; ischemic heart disease; stroke [2].

Nephropathy is one of the most dangerous complications, it leads to changes in the structure of the kidneys and, consequently, to their failure. Initially asymptomatic, these changes can be detected by urine chemistry, glycemic control, lipidemia, blood pressure control, smoking cessation and serum creatinine testing. Diabetic kidney disease accelerates the development of coronary heart disease [18].

Another complication of diabetes is diabetic retinopathy, which consists in gradual damage to the blood vessels of the eye's retina. The cause is incorrect blood glucose levels and high blood pressure. It is also one of the leading causes of blindness in people aged 20-74. Early treatment initiation can prevent complete blindness [19].

Type 2 diabetes contributes to neuropathy. It leads to changes in the walls of blood vessels, causing the loss of their elasticity, and the formation of atherosclerosis. As a result, blood circulation in the extremities is disturbed, ischemic and, consequently, leads to amputation. Diabetic foot syndrome occurs in approximately 20% of people diagnosed with diabetes. Diabetic foot has a specific appearance, it is dry, ulcerated and even tissue necrosis occurs.

One of its symptoms is weakening of the skeletal muscles of the lower extremities. It is accompanied by disturbances in the sensation of pain, touch and temperature, as a result of which the patient does not feel the resulting wounds on the feet. There are also deformities of the feet and nails. There are 4 clinical phases of this state:

- Phase 1 - Hot, red, swollen diabetic foot, resembling tissue inflammation.
- Phase 2 - fractures and dislocations of the foot joints.
- Phase 3 - foot deformity, joint destruction.
- Phase 4 - Ulceration around the foot arch [19,20].

The number of patients with diabetes increases every year, which is associated with an increase in costs by the state for hospitalization, reimbursed drugs or medical devices for diabetics. Part of the expenses is borne by the patients themselves, including non-reimbursed medicines, sugar measuring strips, medical visits. According to the Supreme Chamber of Control, the costs of diabetes treatment in 2016 increased by 8.5% compared to 2015. The costs of hospitalization of diabetes complications increased in complications of DFU and kidney diseases, while it decreased in strokes, heart and eye diseases. The number of amputations in 2016 due to complications of diabetes also increased by over 16% compared to 2015, PLN 7.1 million was allocated for this purpose, which is PLN 900 thousand more than in the previous year [21]. With the curve growing as new patients with diabetes emerge, it should be assumed that.

Prevention

Type 2 diabetes can be prevented or delayed by diet modification and lifestyle changes, type 1 diabetes cannot be prevented, it results from insufficient insulin secretion by pancreatic beta cells [22]. Changing your lifestyle and eating habits plays an important role in preventing disease development. Studies conducted with the participation of nearly 290,000 people show that increased consumption of grain-containing foods, i.e. bran or sprouts, eliminates the risk of diabetes by 21%. Limiting simple sugars or replacing them with low-calorie sweeteners will have a positive effect on disease prevention. According to scientists, consuming more than 2 servings of sweetened drinks a day is associated with a 26% increase in the development of metabolic disease. Drinking alcohol in limited amounts has a beneficial effect on your health. It is recommended to drink red wine in moderate amounts as it has antioxidant properties and reduces the occurrence of cardiovascular diseases. On the other hand, drinking more than 3 drinks a day increases the risk of diabetes by 43%. Exercise reduces the risk of many diseases, including diabetes. A decrease in BMI, weight loss, pressure control, reduction of blood glucose are just some of the advantages of physical activity. According to WHO recommendations, moderate physical effort 30 minutes 5 times a week or high-intensity endurance training 3 times a week for 20 minutes is recommended for maintaining health and preventing chronic diseases [23]. The Da Qing IGT and Diabetes Study, this study aimed to assess how lifestyle changes would affect the prevention of type 2 diabetes. Less than 600 people studied and lasted 6 years. The results obtained in the first control group were 68%, this was the frequency of the disease. The group of people who changed their diet without exercising had a 44% chance of getting sick.

In the group of respondents, where regular physical exertion combined with a change in nutrition took place, the risk of developing the disease was 46%. Exercise is better than medicine. This can be stated after the publication of studies comparing the effects of pharmacotherapy and physical activity on the occurrence of the disease. The respondents received metformin twice a day, although, looking at the result of a group of people after 150 minutes of exercise per week, it is much better (60%) than pharmacotherapy, which saw a 30% reduction in the risk of diabetes [12].

The main tool for prevention is public education. The hospital in Poznań, after completing patient surveys, shows how big the problem is. Over 30% of patients do not have sufficient knowledge about the course of the disease and its prevention. Out of 107 people, only 1 person was not interested in deepening the knowledge about nutrition in diabetes, and 99% of people showed such willingness, which proves still low awareness about the disease. That is why it is so important for medical personnel to educate patients about the course and complications of the disease [24]. November 14 was declared the world day for combating diabetes, there are numerous preventive programs aimed at educating the public about the prevention and treatment of this disease. People participating in them have the opportunity to get tested and detect the risk of disease [25]. To prevent diabetes, you need to control your blood sugar. In Poland, almost half of the population does not know about their disease, so it is worth checking the glucose concentration in the body to detect the onset of the disease [26]. Keep your feet in mind, as they may have lesions, wounds, or swelling, indicative of ulceration. Regular foot control, especially in the elderly, prevents the development of a diabetic foot, which in the worst case leads to amputation [27].

Rehabilitation

Early implementation of rehabilitation allows to slow down the development of the disease and reduce the risk of serious complications. A patient with a diabetic foot should avoid overloading it. Use orthopedic aids such as elbow crutches or a wheelchair. Adapted footwear that does not cause pressure on the heel is also used. [27]

Physiotherapeutic treatment of the patient who will undergo amputation begins before the surgery. During this period, the patient, under the supervision of a psychologist, tries to accept the fact that part of the limb has been removed. Upper limb strengthening exercises are also performed to make it easier for the patient to move around with crutches and move from bed to wheelchair [1,28].

Quick implementation of rehabilitation after the surgery allows you to prevent contractures and ensures a faster return to optimal physical fitness. Already on the first day after the surgery, the patient should move the joints, and breathing exercises are recommended. Correct positioning is also important in order to prevent contractures. Patients should avoid positions with bent knee joints and do not place fittings [28].

Some patients will develop phantom pain and stump pain. In order to minimize it or completely cure it, mirror therapy is used, among others. It consists in inducing the illusion of the limb, thus reducing the symptoms, thanks to the feedback of the organ of vision [29, 30].

Hardening the stump is to thicken the epidermis to reduce its sensitivity and prepare it for stress and pressure. The water is poured alternately with hot and cold water, rubbed with a sponge, stroked, rubbed, and compressed (classical massage techniques).

Along with the number of treatments performed, we increase the intensity of the stimuli. This is to prepare the stump for prosthesis. The patient should be informed about the stump care and bandaging techniques. The postoperative wound should be washed with gray soap foam, gently dried, disinfected and then covered with a clean dressing, covered with clean underwear or bandaged. The next stage is prosthesis and gait re-education, which begins with the use of a walking frame or handrail. When stabilization is achieved, we introduce balance exercises, climbing stairs [29]. Patient education is essential, they should be knowledgeable about their disease and know the possible consequences of neglect or poor treatment. The patient is instructed how to independently determine the blood glucose level at home, how to properly select meals and control the regularity of consumed food. The aim is to achieve the greatest possible self-reliance and self-control skills [18].

In order to diagnose and control the progression of retinopathy, a fundus examination with a mydriatic should be performed regularly. It has been shown that early treatment of retinopathy can reduce the risk of blindness by 57%. In the event of vision loss, the home environment should be adjusted to the needs of a blind patient, and exercises involving other senses should be performed with him, so that he can function independently to some extent [31].

In the treatment of diabetic neuropathy, physiotherapeutic procedures are used, including laser therapy, magnetotherapy, kinesiotherapy, climatotherapy, hydrotherapy. The aim of this procedure is to reduce pain in patients and improve well-being. It is also important to change the diet and introduce regular physical activity in order to lower blood glucose levels and lower blood pressure [32].

Summary

The number of people suffering from diabetes is systematically growing. According to the data, in 2014, there were 422 million people with diabetes, forecasts estimate that within 15 years this number will increase to 1.5 billion cases [4].

Type 2 diabetes mellitus is a metabolic disorder that may be asymptomatic for a long time. Genetic predisposition and age are not the only factors that trigger diabetes. Diet and lifestyle also play an important role. Often, patients are unaware that they have diabetes, but after its diagnosis, treatment should be started as soon as possible to prevent serious complications. Both in the prevention and treatment of diabetes, the most important thing is to maintain blood glucose levels within the recommended standards. [8,14,26]

Treatment of the patient should include comprehensive medical and physiotherapy care. You should be under constant medical care, control your glucose levels at home and change your lifestyle to a more active and healthy one. [12,26]

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