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Cardiomyopathy in diabetes, pathogenesis, diagnostics, treatment

Kardiomiopatia w przebiegu cukrzycy, patogeneza, diagnostyka, leczenie

Diabetic cardiomyopathy generates diagnostic problems as its histopathological picture is not specific for the disturbances of carbohydrate metabolism. A 1995 WHO classification differentiated 5 myopathic groups: dilated, restrictive, arrythmogenic cardiomyopathy of the right ventricle and non-classified cardiomyopathies. It is the American Heart Association (AHA) classification which considers cardiomyopathy group in the course of endocrine diseases which also include diabetic cardiomyopathy. The studies conducted in The United Kingdom (United Kingdom Prospective Diabetes Study) stated that the incidence of cardiac insufficiency was 0, 23–1, and 19% in one year. It is interesting that the study clearly revealed the increase in the risk of cardiomyopathy occurrence by 19% per each unit of glycolytic haemoglobin above the standard. Diabetes is also an adverse predictor of poor prognosis concerning a higher mortality rate. It is evaluated that over 2/3 deaths of diabetic patients are correlated with various disorders of the cardiovascular system [4].

DIABETIC CARDIOMYOPATHY

Diabetic cardiomyopathy is a cardiac insufficiency with ventricular dilation, interstitial fibrosis, myocyte hypertrophy and micro-angiopathy, decreased systolic function of the heart. This diagnosis can be made after elimination of other organic injuries of the heart, including ischemic cardiomyopathy. The initial symptoms are most frequently related to circulatory insufficiency in the course of ventricular dilation combined with hypertrophy and impaired diastolic function. In the electrocardiographic examination changes related to the muscle hypertrophy are initially recorded and in the course of the disease and progress of the heart muscle fibrosis the elongation of QT interval occurs [1].

PATHOPHYSIOLOGY

The main causes of the development of diabetic cardiomyopathy are thought to be glucose metabolism, increase in the oxidation of fatty acids, accumulation of free radicals, micro-angiopathy as well as disorders of the autonomic system. Micro-angiopathy leads to subendocardial fibrosis and consequently to the impairment of diastolic function. Long-term sympathetic activation leads to tachycardia, increases in the peripheral resistance and consequently lowered cardiac output. The result of it among others is the increase in secretion of vasospastic factors which intensify peripheral

resistance and result in the epithelial dysfunctions. It leads to unfavourable remodelling of the heart muscle. It also causes increase in the activity of rennin-angiotensin-aldosteron system the result of which is intensification of metabolism of the free fatty acids in myocytes and increase in oxygen requirement. Moreover, disorders of beta-adrenergic transmission cause the increase in genes expression for troponin and myosin chains as well as connective tissue skeleton. Increase in the secretion of endothelin and insulin-like growth factor leads to the raise in collagen synthesis. All of these factors result in the increase of rigidity in the heart muscle and previously mentioned diastolic dysfunction [6].

SYMPTOMS

The characteristic feature of diabetic cardiomyopathy is a very long asymptomatic period despite the ongoing disease and increasing organic changes. One of the first symptoms is a slight left ventricular diastolic dysfunction. Its physical symptom is overactivity of jugular veins, which is often accompanied by raising, elevated apex beat displaced downward and to the left. Sporadically it is a mitral murmur, which is not a permanent symptom though. Diagnosis is frequently difficult as diabetic patients are very often referred to a cardiologist with the symptoms of ischaemic heart disease or advanced arterial hypertension and the ischaemic or hypertensive pathology eliminates the diagnosis of diabetic cardiomyopathy [3].

DIAGNOSTICS

Diagnostics concerning the diagnosis of diabetic cardiomyopathy should involve each patient treated in the diabetes clinic as it is neither complicated nor expensive, it is generally based on physical examination (overactivity of jugular veins, increased apex beat, mitral incompetence murmur) as well as in the echocardiographic examination which allows precise monitoring of the extent of myocardial hypertrophy and define the component of diastolic insufficiency [5]. Monitoring arterial blood pressure is necessary. Diagnostics of the ischaemic heart disease should be performed. The exercise test may be performed both in the asymptomatic and oligosymptomatic phase. Patients with stenocardiac complaints should be submitted to advanced cardiological diagnostics including coronarography. In patients with cardiomyopathy who had no other etiology proved we can make a diagnosis of diabetic cardiomyopathy [3].

TREATMENT

The treatment of patients with cardiac insufficiency in the course of diabetes should in the first place be based upon a very thorough metabolism control, normalization of the body mass and an accurate glycaemia control. Drugs of the first choice are angiotensin converting enzyme inhibitors. The conducted studies prove that these medications have more advantages in the population of the diabetic patients than in people with cardiac insufficiency who are not diabetics [9]. A reduction in the risk of adverse cardiac events was also noted in diabetic patients with no overt cardiac insufficiency who received a prophylactic treatment with ramipril [2]. Angiotensin II receptor blockers are another group; however, their efficacy has not been proved in large groups of patients. A commonly used group of drugs are beta-adrenolytics. Their effectiveness is connected with the restoration of the autonomic system balance, decrease of cardiovascular system overload, normalization of myocyte metabolism through the decrease of free fatty acids metabolism and the reduction of oxygen

requirement. However, diuretics and aldosterone receptor antagonists are only attributed to the treatment of the symptomatic circulatory insufficiency. Detailed guidelines concerning the treatment of diabetic patients with circulatory insufficiency were formulated in cooperation with European Society of Cardiology (ESC) and the European Association for the Study of Diabetes (EASD) [7].

CONCLUSIONS

It is estimated that about 5% population suffer from diabetes, half of which are the cases of undiagnosed and untreated diabetes. Additionally, around 10%, of the population should be classified in the category of a pre-diabetic state which has a similar, pathogenic significance to diabetes. In recent years the incidence of the disease has dramatically risen, especially in the developing countries. The type of childhood diabetes is also more frequently detected. A bigger and bigger problem in the developing countries is the treatment of its complications including cardiological and vascular complications responsible for 60% deaths in diabetic patients [10]. Therapy applied in this group of patients should be complex and different from the generally accepted treatment plan which normalizes glycaemia by means of oral anti-diabetic drugs or insulin. It should also concern prevention of adverse cardiac events through the prophylaxis of cardiomyopathy development, arterial hypertension and coronary disease. An essential role in the prophylaxis of such diseases is played by both angiotensin converting enzyme inhibitors and beta-blockers, whereas the symptomatic circulatory insufficiency also by diuretics and aldosterone receptor antagonists [8, 11]. The essential factors enabling the decrease in the risk of cardiomyopathy development are also rigorous adherence to a diet with a simultaneous increase of physical activity and body mass reduction.

REFERENCES

1. Avogaro A., Vigili de Kreutzenberg S., Negut C. et al.: Diabetic cardiomyopathy: a metabolic perspective. Am J Cardiol. 93 (8A): 13A–16A, April 2004. doi:10.1016/j.amjcard.2003.11.003. PMID 15094099.
2. Effects of ramipril on cardiovascular and microvascular outcomes in people with diabetes mellitus: results of the HOPE study and MICRO-HOPE substudy. Heart Outcomes Prevention Study Evaluation Study Investigators. Lancet, 355, 253, 2000.
3. Hunt S. A., Baker D. W., Chin M. H. et al.: American College of Cardiology/ American Heart Association. ACC/AHA Guidelines for the evaluation and Management of Heart Failure in Adult: Executive Summary. A Report of American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1995 Guidelines for the evaluation and Management of Heart Failure). J. Am. Coll Cardiol., 38, 2101, 2001.
4. Kannel W. B., McGee D. L.: Diabetes and cardiovascular disease. The Framingham study. JAMA 241, (19): 2035–8, May 1979. doi:10.1001/jama.241.19.2035. PMID 430798.
5. Moir S., Hanekom L., Fang Z. Y. et al.: Relationship between myocardial perfusion and dysfunction in diabetic cardiomyopathy: a study of quantitative contrast echocardiography and strain rate imaging. Heart, 92, October 2006.
6. Niebisz A. B., Karnafel W.: Przewlekła niewydolność serca w cukrzycy, Kardiologia na co Dzień, 2 (1), 31, 2007.
7. Ryden L., Standl E., Bartnik M. et al.: Guidelines on diabetes, pre-diabetes, and cardiovascular diseases. The Task Force on Diabetes and Cardiovascular Diseases of the European Society of Cardiology (ESC) and of the European Association for the Study of Diabetes (EASD). Eur. Heart J. 28, 88, 2007.

8. Shekelle P. G., Rich M. W., Morton S. C. et al.: Efficacy of angiotensin-converting enzyme inhibitor and beta-blockers in the management of left ventricular systolic dysfunction according to race, gender, and diabetic status. A meta-analysis of major clinical trials. J. Am. Coll Cardiol., 41, 1529, 2003.
9. Shindler D. M., Kostis J. B., Yusuf S. et al.: Diabetes mellitus, a predictor of morbidity and mortality in the Studies of Left Ventricular Dysfunction (SOLVED) Trials and Registry. Am. J. Cardiol., 77, 1017, 1996.
10. Tatoń J., Czech A., Bernas M.: Diabetologia kliniczna, PZWL, 54, Warszawa 2008.
11. Zuanetti G., Latini R., Maggioni A. P. et al.: Effect of ACE inhibitor lisinopril on mortality in diabetic patients with acute myocardial infarction. Circulation, 96, 4239, 1997.

SUMMARY

Diabetes is one of the principal problems concerning the health of contemporary society. It causes numerous dangerous complications among which cardiological complications take up the first place because they can lead to quick deaths of patients. Cardiomyopathy is an essential and at the same time insidiously developing complication of diabetes. It is the result of the combined action of unfavourable factors such as: endotheliopathy, autonomic system dysfunction, disturbances of carbohydrate metabolism and consequently ischaemic heart disease as well as arterial hypertension. The problem of diabetic cardiomyopathy demands a regular monitoring of cardiovascular system and a quick introduction of pharmacological treatment at its first symptoms. There are opinions more and more frequently presented that suggest prophylactic administration of cardiological drugs in the group of asymptomatic patients. According to the European Society of Cardiology, two groups of medications are recommended: angiotensin converting enzyme inhibitors and beta-adrenalytics. The treatment of cardiomyopathy in diabetic patients should also include normalization of the body mass and an accurate metabolic compensation.

STRESZCZENIE

Cukrzyca jest jednym z głównych problemów dotyczących zdrowia współczesnego społeczeństwa. Jest przyczyną wielu groźnych powikłań, wśród których powikłania kardiologiczne zajmują czołowe miejsce, gdyż mogą prowadzić do szybkiego zgonu pacjenta. Istotnym i jednocześnie podstępnie rozwijającym się powikłaniem cukrzycy jest kardiomiopatia. Jest ona wynikiem skojarzonego działania niekorzystnych czynników, takich jak: endoteliopatia, dysfunkcja układu autonomicznego, zaburzenia przemiany węglowodanów, i co za tym idzie choroby niedokrwiennej serca oraz nadciśnienia tętniczego. Problem kardiomiopatii cukrzycowej wymaga okresowego monitorowania układu krążenia i szybkiego wdrożenia leczenia farmakologicznego przy pierwszych jej objawach. Coraz częściej prezentowane są również opinie sugerujące zapobiegawcze stosowanie leków kardiologicznych w grupie pacjentów bezobjawowych. Do zaleceń Europejskiego Towarzystwa Kardiologicznego zalicza się dwie grupy leków: inhibitory konwertazy angiotensyny oraz beta-adrenolityki. Leczenie kardiomiopatii u pacjentów z cukrzycą powinno również obejmować normalizację masy ciała i precyzyjne wyrównanie metaboliczne.