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COMPREHENSIVE ULTRASOUND EXAMINATION IN THE CLINICAL DIAGNOSIS OF NEPHROANGIOPATHIES IN ASYMPTOMATIC TYPE 2 DIABETES

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Abstract:

Diabetic nephropathy is one of the most common causes of terminal chronic renal failure (ESRD). Over the past decade, in the USA and a number of countries in Europe and Asia, DN has reached the 1st place in terms of the need for replacement therapy for renal insufficiency. According to epidemiological studies, the prevalence of DN in type 2 diabetes in the Russian Federation is 39.3-40.6%. The risk of kidney damage in patients with type 2 diabetes, according to many authors, depends on the duration of the disease. With a duration of DM 10-15 years, the frequency of DN is 15-20%, 20 years - 20-35%, and with a longer course of DM - up to 50%. A feature of kidney damage in type 2 diabetes is the absence of pronounced clinical symptoms at the beginning, which is the reason for its late diagnosis.

Keywords

arterial hypertension, diabetic nephropathy, microalbuminuria, diabetes mellitus, glomerular filtration rate, ultrasound examination, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, color Doppler mapping, energy Dopplerography.

Introduction

The American Diabetological Association proposed in 1997 a new classification of diabetes mellitus, which was adopted in 1999 by WHO. In the new classification of diabetes, it is proposed not to use the terms "insulin-dependent" and "insulin-independent", leaving only the name "type 1 and type 2 diabetes mellitus" Type 2 diabetes is a chronic disease characterized by inadequate insulin secretion by the p cells of the pancreatic insular apparatus and the development of insulin resistance (Petunina N.A., Antsiferov M.B., 2009).

Violation of lipid metabolism in type 2 diabetes is characterized by: an increase in the amount of very low-density lipoprotein cholesterol, a decrease in high-density lipoprotein cholesterol (HSLP VP) and a change in the spectrum of these particles, which is manifested by a relative decrease in large and an increase in small particles, a decrease in the duration of their stay in the circular bed (Balabolkin M.I., Klebanova E.M., Kreminskaya V.M.,

1999). In addition, patients with type 2 diabetes have hypertriglyceridemia and an increase in the level of non-esterified fatty acids, an increase in low-density lipoproteins, the predominance of dense particles of small size and oxidized forms among them (Medvedeva I.V., Dorodnova E.F., Pugacheva T.A. et al., 2003; Kesavulu M.M., Giri R., Kameswara R. et al., 2000).

It should be noted that type 2 diabetes (primarily its characteristic IR) is an integral part of the metabolic syndrome. Metabolic syndrome leads to the development of compensatory hyperinsulinemia, which in turn triggers a cascade of pathological mechanisms leading to the development of hypertension, hyperlipedemia and obesity (Dedov I.I., Shestakova M.V., 2007).

In the early stages of the disease, a chronic increase in glucose levels contributes to the gradual development of insulin secretion disorders, and later leads to depletion and a decrease in the mass of pancreatic p cells. In addition, hyperglycemia is a powerful factor in the progression of atherosclerosis and damage to the nervous system. The absence of clinical symptoms with a moderate (7-10 mmol/ l) increase in glycemia creates the illusion of well-being and is considered as the reason for low patient referral to medical institutions. This leads to the fact that at the time of detection of type 2 diabetes, patients already have complications of the disease in the form of visual impairment (retinopathy), kidney damage (nephropathy), vascular damage to the heart, brain and lower extremities.

Chronic hyperglycemia plays a key role in the development and progression of vascular complications that lead to significant economic costs for the provision of medical and social care to patients (Petunina N.A., 2010; Wright J., 2000; Shiraiwa T., Kaneto N., Miyatsuka T. et al., 2005).

The costs of treating such patients include not only the cost of hypoglycemic drugs, but also the costs associated with the treatment of complications of the disease (Rodbard N., Jellinger P., Davidson J. et al., 2009). "The era of diabetic coma is over, the era of complications has come" — these words of Professor P. Kempler (2004) vividly characterized a new era in diabetology (cit. Akhmetova A.S., 2009). Taking into account the continuous increase in the incidence of diabetes in developed countries (every 10-15 years the number of patients increases by an average of 2 times), as well as an increase in the life expectancy of these patients, a significant increase in the prevalence of diabetic kidney damage is predicted.

Purpose of the Study

Detection and early diagnosis of vascular disorders in patients with type 2 diabetes without clinical signs of renal artery stroke using bilateral scanning.

Material and Research Methods

To solve the tasks on the basis of the GUZ "Republican Clinical Hospital" of the Ministry of Health of the Republic of Tatarstan, the results of the examination of 182 patients were

analyzed. Of these, 115 patients with type 2 diabetes and 67 with hypertension. The main group consisted of 115 patients with type 2 diabetes, which included 58 (50.4%) patients with normoalbuminuria and 57 (49.6%) patients with microalbuminuria.

Of 58 patients with normoalbuminuria, 19 (32.8%) men and 39 (67.2%) women, aged 38 to 73 years, mean age 53.9± 1.3 years. Of 57 patients with microalbuminuria, 19 (33.3%) men and 28 (66.7%) women, aged 36 to 75 years, mean age 54.7± 1.4 years. The average duration of type 2 diabetes was 6.9±0.5 years. The criteria for inclusion in the group were the absence of kidney disease, arterial hypertension and renal artery stenosis.

Treatment for patients: diet therapy - 28, tablet therapy - 48, insulin therapy - 39. The diagnosis of type 2 diabetes in patients was made based on the analysis of the data obtained during the collection of anamnesis, clinical and laboratory studies. Patients with arterial hypertension, severe atherosclerosis of the terminal aorta, renal artery stenosis, nephroptosis, chronic pyelonephritis, glomerulonephritis, urolithiasis, diabetic nephropathy in the proteinuria stage were excluded from the group of patients with type 2 diabetes.

The comparison group is represented by 67 patients with hypertension, 35 (52.2%) men and 32 (47.8%) women, aged 30 to 67 years, whose average age was 52.5 ± 1.5 years. The group of patients with hypertension did not include patients with kidney diseases, symptomatic hypertension and impaired carbohydrate metabolism. The duration of the course of arterial hypertension is from 3 to 15 years, on average, the duration of the disease is 7.1 ± 0.7 years. The diagnosis of hypertension was verified in accordance with the Russian Guidelines for the diagnosis and treatment of arterial hypertension in 2008. The criteria for the diagnosis of hypertension were blood pressure 140/90 mmHg and more. Among 67 patients with arterial hypertension, the blood pressure level ranged from 140/90 mmHg to 165/105 mmHg.

Research results and their discussion

Then the intrarenal blood flow was studied at the level of segmental arteries in patients with type 2 DM with normoalbuminuria with a qualitative and quantitative assessment of it. A qualitative assessment of the Doppler frequency shift spectra indicates that the blood flow rate drops sharply immediately after reaching the maximum systolic velocity with the formation of a high amplitude sharply defined peak. There is a marked decrease in the blood flow rate in the diastole, especially the final diastolic blood flow rate. When quantifying the hemodynamic parameters of intrarenal blood flow, the following parameters were obtained: the average value of the maximum blood flow rate in the right kidney was 49.1 ±2.1 cm/s, the minimum blood flow rate was 14.7±1.3 cm/s, the average blood flow rate was 24.9±1.3 cm/s ($p<0.05$). The average values of the blood flow velocity in the left kidney slightly differed from the values obtained in the right kidney and were respectively 48.5±2.1 cm/s, 14.5±1.2 cm/s, 24.7±1.2 cm/s ($p<0.05$). The average value of the resistivity index in the right kidney was 0.71±0.01, and the pulsation index was 1.39±0.04 ($p<0.05$).

The average values of the peripheral resistance index and the pulsation index in the left kidney differed slightly from those in the right kidney and amounted to 0.70±0.02 and 1.40±0.03, respectively ($p<0.05$).

As can be seen from the data obtained, the linear dimensions and the average value of the volume of the left kidney in patients with type 2 DM with normoalbuminuria exceeded similar indicators of the right kidney. Hemodynamic parameters of intrarenal blood flow in both kidneys in patients of this group did not differ significantly.

Comparative analysis of linear kidney sizes of patients with type 2 DM with normoalbuminuria and the control group revealed a slight increase in linear kidney sizes in the group of patients with type 2 DM with normoalbuminuria. The average kidney volume in patients with type 2 DM normoalbuminuria (142.3±4.3 cm) is significantly higher than in the control group (122.9±2.7 cm3) ($p<0.05$).

Analysis of the indicators obtained during the study of intrarenal hemodynamics showed that their values in patients with type 2 diabetes with normalbuminuria were significantly higher (Vmax - 49.1 ±2.1 cm/s, Vmjn - 14.7±1.3 cm/s, Vmed -24.9±1.3 cm/s) than in the control group (Vmax - 40.1 ±1.9 cm/s, Vmin -13.0±1.4 cm/s, Vmed - 21.3±1.3 cm/s) ($p<0.05$), indicating an increase in ($r=0.41$, $p=0.004$), body weight ($r=0.35$, $p=0.04$) and body surface area ($g=0.36$, $p=0.02$).

The average blood flow rate correlated with the male sex ($g=0.37$, $p=0.01$), at the same time, a negative relationship was found with the age of the subjects ($g=-0.46$, $p=0.002$) and the level of systolic blood pressure ($g=-0.33$, $p=0.004$). The correlation dependence of the peripheral resistance index in the control group with female sex ($g=0.38$, p=0;02), age of the subjects ($g=0.31$, $p=0.04$), body weight ($g=0.32$, $p=0.04$), body surface area ($g=0.36$, $p=0.02$), and the concentration of LDL in the blood serum ($g = 0.65$, $p = 0.03$).

The pulsation index was directly dependent on the level of LDL in the blood serum ($g=0.58$, $p=0.04$). The relationship of glomerular filtration rate with body weight ($g=0.52$, $p=0.002$), body surface area ($g=0.57$, $p=0.004$), systolic blood pressure ($g=0.57$, $p=0.001$) and diastolic blood pressure ($g=0.46$, $p=0.005$), and also from the fasting blood glucose level ($g = 0.54$, $p = 0.004$).

It was found that the level of creatinine in the blood serum was directly dependent on the level of cholesterol ($g= 0.35$, $p=0.02$) and triglycerides ($g=0.31$, $p=0.03$) in the blood serum. The value of the albumin level in urine correlated with the values of systolic and diastolic blood pressure, respectively ($g=0.58$, $p=0.02$; $g=0.40$, $p=0.03$).

Thus, it was found that in the group of healthy individuals, the value of the total kidney volume depended on anthropometric indicators. The value of hemodynamic parameters of intrarenal blood flow depended on: the maximum speed of blood flow from the sex of the subjects, anthropometric indicators and the level of systolic blood pressure; the minimum and average speed of blood flow — from the sex of the subjects and antro.

Patients with type 2 diabetes, with hypertension and in the control group underwent laboratory tests that included a general blood test and oci, liver function tests, determination

of urea, creatinine, total cholesterol, triglycerides, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, glucose, glycosylated hemoglobin, serum uric acid, blood velocity glomerular filtration. Urine was examined for glucose, protein, creatinine.
Ultrasound scanners HDI 3000 SonoCT, HDI 5000 SonoCT (USA), IU-22 (Philips) were used for kidney examination. Ultrasound of the kidneys was performed on an empty stomach in a supine, sideways and standing position, using the maneuver of deep inhalation and protrusion of the anterior abdominal wall. Longitudinal and transverse scanning was carried out in real-time mode with sensors with 4-2 MHz, 7-4 MHz and 5-1 MHz, in B-mode, in the mode of color mapping of blood flow, energy Dopplerography of kidney vessels in 2-D and 3-D images. The length, width, and thickness of both kidneys were determined. Then the volume of the right and left kidneys was calculated according to the formula proposed by N. Hricak: V=0.523*A*B*C, where V is the volume of the kidney, A is the length, B is the width and C is the thickness of the kidney, and the total volume of the kidneys was calculated.

Conclusions

1. Complex echography allows us to trace the increase in changes in intrarenal hemodynamics in type 2 diabetes mellitus, which significantly increase depending on the stage of diabetic nephropathy ($p<0.05$).
2. Comparative evaluation of echographic criteria of diabetic nephropathy and kidney damage in patients with arterial hypertension revealed a more significant increase in kidney volume (249.7±4.7 cm x 1.73 m) $p<0.05$, increased intrarenal blood flow ($p<0.05$) and an increase in the index of intrarenal vascular resistance (0.71±0.01) $p<0.05$ in patients with diabetes mellitus 2 types.

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