

COMPLEX ULTRASOUND EXAMINATION IN THE CLINICAL DIAGNOSIS OF NEPHROANGIOPATHIES IN LATENT DIABETES TYPE 2

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ABSTRACT

Diabetes mellitus, due to its high prevalence and severe medical and social consequences, is one of the urgent problems of modern medicine. Type 2 diabetes gives the character of a global epidemic to diabetes, which, according to WHO data for 2010, affects 285 million people worldwide. The costs of treatment of diabetes and its complications in the developed countries of the world account for 10-15% of the total health budget. The most dangerous consequences of the global epidemic of diabetes are its systemic vascular complications, which are the main cause of disability and mortality of patients with this pathology. Taking into account the continuous increase in the incidence of DM, as well as an increase in the life expectancy of these patients, a significant increase in kidney damage in this pathology is predicted. Diabetic nephropathy is characterized by significant structural rearrangements of the kidney and is a life-threatening, constantly progressive complication of diabetes.

Key words: 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

Diabetes mellitus is a chronic metabolic syndrome characterized by hyperglycemia, glucosuria and related metabolic disorders. The development of the syndrome is caused by absolute or relative insufficiency of insulin in the body, leading to a violation of carbohydrate metabolism and deep disorganization of intracellular metabolism (Dedova I.I., Shestakova M.V., 2009). The name "diabetes" (from the Greek "diabeto" I pass through) as a term, it was introduced in the ancient era (Artey of Cappadocia, 138-81 BC), the definition of "sugar" (from the Latin "mellitus" - honey, sweet) was added in the XVII century (Thomas Willis, 1674).

Due to its epidemic nature and vascular complications, diabetes mellitus is on a par with the most urgent problems of national importance (Tishova Yu.A., Kalinichenko S.Yu., 2009). According to WHO forecasts, by 2030 the number of patients with diabetes mellitus will increase to 366 million, which gives this pathology the character of a global epidemic (Wild S., Roglic G., Green A. et al., 2004). According to the IDF, the number of people suffering from diabetes is expected to increase to 438 million by 2030 (Antsiferov M.B., 2010). The number of patients with type 2 diabetes has been increasing exponentially in recent years.

One of the main stages in the development of clinical diabetology was the results of the British Prospective Diabetes Study (UKPDS), which convincingly demonstrated the need to maintain

normoglycemia for the prevention of microvascular and neuropathic complications in patients with type 2 diabetes. According to WHO, by 2025, up to 25% of public spending on the healthcare system in many countries of the world will go to the treatment of diabetes and its complications. Thus, diabetes mellitus is the most important medical, social and economic problem of our time (Petunina N.A., 2009).

The majority of patients with type 2 diabetes are persons of working age from 40 to 60 years (Petunina N.A., 2009). The prevalence of type 2 diabetes mellitus, combined with the high frequency and severity of complications of this disease, leads to a constant increase in both direct and non-direct costs of patient management, which is a heavy burden on the economy of even industrialized countries (Wild S., Roglic G., Green A. et al., 2004).

To prevent chronic complications of diabetes, it is extremely important to prescribe effective therapy to patients with type 2 diabetes at the beginning of treatment. In Russia, as in other countries of the world, the number of patients with diabetes is increasing annually. The number of registered patients in our country as of January 1, 2010 was 3.1 million, of which 2.8 million. Type 2 DM (Majorov A.Yu., Surkov E.V., Dedov I.I., 2010). In the last 8 years alone, the number of DM patients in Russia has increased by 40% (Sharafetdinov H.H., Plotnikov O.A., 2010).

Until recently, in accordance with the recommendations of the WHO Committee of Experts (1965), primary (essential, idiopathic) and secondary diabetes mellitus were distinguished. Primary, genetically determined diabetes mellitus was considered as a pathologically unified disease, in the development of which two phases were distinguished — relative and absolute insulin insufficiency. However, back in 1967, D. Kimoin suggested the heterogeneity of diabetes mellitus, which was confirmed by the results of subsequent studies in this area. This was the basis for the WHO Committee of Experts (1980) to consider the classification of diabetes mellitus. In 1985, the WHO research group, taking into account new data, proposed the following classification of diabetes mellitus and related categories of glucose tolerance disorders. In* this classification, insulin-dependent and insulin-independent diabetes mellitus are distinguished.

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

In order to determine the echographic criteria of the kidneys in the norm, we conducted a study of individuals who made up the control group. All of them (55 practically healthy people) underwent a comprehensive echographic examination of the kidneys according to the methods described above. When examined in the "gray scale" mode, clear, even contours of the kidneys were determined. The cup-pelvis system is without features, the cavity is not expanded. When determining the linear dimensions of the kidneys, the following parameters were obtained: the average length of the right kidney was 10.7 ± 0.1 cm, width 4.8 ± 0.1 cm, thickness 4.5 ± 0.1 cm, parenchyma 1.6 ± 0.2 cm ($p < 0.05$). The linear dimensions of the left kidney did not differ significantly and amounted to 10.9 ± 0.1 cm, 4.9 ± 0.1 cm, 4.6 ± 0.1 cm, parenchyma 1.6 ± 0.2 cm, respectively ($p < 0.05$).

The average volume of the right kidney was equal to 122.9 ± 2.7 cm, the left kidney 128.5 ± 2.5 cm ($p < 0.05$). The total kidney volume attributed to the standard body surface area (1.73 m) was 234.8 ± 2.9 cm ($p < 0.05$). The state of intrarenal blood flow was assessed by ultrasound examination with CDK of blood flow and ED. When examining intrarenal blood flow at the level of segmental arteries with an assessment of quantitative characteristics, the following average values of hemodynamic parameters were obtained: the maximum blood flow rate in the right kidney was 40.1 ± 1.9 cm/s, the minimum blood flow rate was 13.0 ± 1.4 cm/s, the average blood flow rate was 21.3 ± 1.2 cm/s ($p < 0.05$).

Similar hemodynamic parameters of intrarenal blood flow in the left kidney were slightly lower and amounted to 39.9 ± 1.8 cm/s, 12.7 ± 1.1 cm/s, 20.5 ± 1.2 cm/s ($p < 0.05$), respectively. The average value of the resistivity index in the right kidney was 0.63 ± 0.01 , the pulsation index was 1.21 ± 0.05 ($p < 0.05$). The indices of the resistivity index and the pulsation index in the left kidney practically did not differ from those on the right and were equal to 0.64 ± 0.01 , 1.23 ± 0.04 ($p < 0.05$), respectively.

When assessing the indicators characterizing the functional state of the kidneys in individuals in this group, it was found that the average daily diuresis was 1581.0 ± 32.0 ml ($p < 0.05$). When

comparing the amount of urine excreted by time of day, daytime diuresis was 803.0±23.0 ml, night 717.0±25.0 ml ($p<0.05$).

When examining urine for the presence of glucose and protein, negative results were obtained. The average urinary albumin excretion in this group was 4.9±0.3 mg/l ($p<0.05$). The serum creatinine index in healthy individuals was 79.13±14.7 mmol/l, and the creatinine content in urine was 1.4±0.4 mmol/L ($p<0.05$).

The average glomerular filtration rate in the study group was 126.1±4.5 ml/min ($p<0.05$). The glomerular filtration rate related to the standard body surface area was 123.3±4.1 ml/min.* 1.73 m² ($p<0.05$).

The main indicators of the biochemical study that we conducted in the control group were: the average fasting blood glucose level of 4.65± 0.09 mmol/l, glycosylated hemoglobin 4.56± 0.10%, uric acid 314.7± 1.75 mmol/l ($p<0.05$). The parameters of lipid metabolism in the examined group were equal to: total cholesterol 4.89±0.11 mmol/l, triglycerides 1.12±0.09 mmol/l, serum HDL 1.61±0.07 mmol/l, LDL- 1.89±0.09 mmol/l ($p<0.05$).

The analysis of the data obtained in the control group showed that the average value of the linear dimensions of the right and left kidneys are quite comparable, and the value of the average volume of the left kidney is greater than the right one. The data of hemodynamic parameters of intrarenal blood flow in the right and left kidneys also do not differ significantly, i.e. they are practically equal.

We carried out a correlation analysis between the indicators obtained by complex kidney echography and the main clinical and laboratory data in the control group, as a result of which the following dependencies were established. The total kidney volume was associated with male sex ($g=0.42$, $p=0.002$), body weight ($g=0.54$, $p=0.001$), height ($g=0.54$, $p=0.001$) and body surface area ($g=0.64$, $p=0.001$).

The correlation between the thickness of the kidney parenchyma and the male sex ($g=0.37$, $p=0.01$), body weight ($g=0.43$, $p=0.00b$), body surface area ($g=0.46$, $p=0.003$) was revealed. The analysis of hemodynamic parameters of intrarenal blood flow revealed that the maximum blood flow rate correlated with male sex ($g=0.42$, $p=0.001$), age ($g=0.49$, $p=0.003$) and the level of systolic blood pressure ($g=0.33$, $p=0.04$).

The minimum blood flow rate was associated with the male sex of the metric indicators; the index of peripheral resistance - from the sex of the subjects, anthropometric indicators and lipid metabolism; and the index of pulsation from lipid metabolism.

The value of glomerular filtration rate depended on anthropometric, hemodynamic parameters and the level of carbohydrate metabolism. When conducting an ultrasound examination of the kidneys in a group of patients with type 2 diabetes with normoalbuminuria, it was found that the average length of the right kidney was 11.1± 0.1 cm, width 5.0± 0.1 cm, thickness 4.6±0.1 cm, parenchyma 1.7± 0.1 cm ($p<0.05$). There was a slight excess of the average linear dimensions of the left kidney relative to the right, which were equal, respectively, 11.2 ± 0.1 cm, 5.1± 0.1 cm, 4.7± 0.1 cm, 1.7± 0.1 cm ($p<0.05$).

The average value of the volume of the right kidney was 142.3±4.3 cm, and the average volume of the left kidney was statistically significantly higher and was equal to 147.5±4.6 cm ($p<0.05$). The value of the total kidney volume attributed to the standard body surface area was 249.7±4.7

cm³ x 1.73 m² (p<0.05). In an echographic study using the blood flow CDC, ED, ZD, a qualitative assessment of the state of intrarenal blood flow was performed.

CONCLUSIONS

1. The earliest echographic criteria for kidney damage in patients with type 2 diabetes mellitus are changes in intrarenal hemodynamics - an increase in linear hemodynamic parameters of intrarenal blood flow ($V_{max} - 49.1 \pm 2.0$ cm/sec., $V_{mjn} - 14.7 \pm 1.3$ cm/sec., $V_{med} - 24.9 \pm 1.3$ cm/sec.) $p < 0.05$ and intrarenal vascular resistance (0.71 ± 0.01) $p < 0.05$ in combination with increased glomerular filtration rate (153.3 ± 8.5 ml/min x 1.73 m²) $p < 0.05$.
2. Complex echography makes it possible to trace the increase in changes in intrarenal hemodynamics in type 2 diabetes mellitus, which significantly increase depending on the stage of diabetic nephropathy ($p < 0.05$).
3. A comparative assessment of echographic criteria for 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 increased intrarenal vascular resistance index (0.71 ± 0.01) $p < 0.05$ in patients with type 2 diabetes mellitus.
4. The proposed algorithm for the examination of patients with type 2 diabetes mellitus using complex echography with Doppler techniques in combination with laboratory research methods allows diagnosing the early stages of diabetic nephropathy and differential diagnosis with nonspecific kidney lesions.

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