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ASSESSMENT OF RENAL DYSFUNCTION IN PATIENTS WITH CHRONIC HEART FAILURE

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Abstract:

Aim. To study the indicators of renal dysfunction in patients with chronic heart failure (CHF).

Material and methods. 64 patients with postinfarction cardiosclerosis complicated by CHF aged 40-60 years were examined. The patients were divided into two groups according to the functional class (FC) of CHF according to the New York Heart Association (NYHA). Creatinine levels were determined in all patients, and the glomerular filtration rate (GFR) was calculated using the formula MDRD (Modification of Diet in Renal Disease Study). Determination of enzymes in urine — alanine aminotransferase (ALT), aspartate aminotransferase, alkaline phosphatase (ALP), cholinesterase was carried out by spectrophotometric method.

Results. In 33.3% of patients with CHF II FC and in 66.7% of patients with CHF III FC, GFR <60 ml/min/1.73 m2 was noted. The study of the parameters of fermenturia in patients with CHF, depending on the functional state of the kidneys, revealed that in patients with GFR <60 ml/min / 1.73 m2, among which patients with III FC CHF were 66.7%, significantly high indicators of fermenturia were noted. At the same time, the ALT level was 39% ($p<0.01$) and the alkaline phosphatase was 35% ($p<0.001$) higher than in patients without impaired renal function.

Conclusion. In patients with CHF, as the disease progresses, there is a subclinical impairment of renal function, characterized by a decrease in GFR, an increase in the level of residual nitrogen and fermenturia. Determination of the level of enzymes in urine in patients with CHF can be considered as a diagnostic approach for early diagnosis of kidney dysfunction.

Keywords: chronic heart failure, kidney dysfunction, creatinine, glomerular filtration rate, fermenturia

INTRODUCTION

According to various estimates, CHF currently affects at least 15 to 23 million people. According to the national registers of different countries, the average (excluding age) prevalence of CHF in the population ranges from 1 to 5%. These fluctuations may be, in particular, due to the lack of unified international epidemiological criteria for HF. With age, the prevalence of HF increases progressively. Thus, according to the Framingham study, the prevalence of HF among men increases from 0.8% in the age group of 50-59 years to 6.6% — at the age of 80-89 years (in women

from 0.8 to 7.9%, respectively). An analysis of the results of a long—term population observation carried out within the framework of the same Framingham study showed that the risk of HF during life is 21% in men and 20% in women and is significant even if there is no development of MI (11 and 15%, respectively). Morbidity — the number of cases of newly diagnosed HF during the year in the population — represents, according to various data, from 150 to 500 cases per 100 thousand population (0.15–0.5%), and among people over the age of 45, this indicator doubles every 10 years. The above 40-year Framingham population observation showed that the incidence of HF among men increases from 0.3% in the age range of 35-65 years to 1.2% at the age of 85-94 years, and among women — from 0.2 to 0.9%, respectively. Over the past 30-40 years, in Europe and North America, despite the decline in mortality from cardiovascular causes, there has been a steady increase in the prevalence of CHF.

The prevalence of renal dysfunction in CHF according to various studies ranges from 25% to 60%. Similarly, LVEF in CHF, a decrease in glomerular filtration rate (GFR) and the level of Cr are considered as independent signs of an unfavorable prognosis. With GFR<60 ml/min/ 1.73 m2, the risk of mortality increases 2.1 times, with reduced LV systolic function, the risk of death of patients with renal insufficiency increases 3.8 times, with unchanged systolic function — 2.9 times. In numerous epidemiological, prospective, retrospective, clinical studies have established a close association between the severity of renal dysfunction, estimated by the magnitude of reduction GFR/ blood plasma Kr concentrations, and the risk of general death, as well as the occurrence of various cardiovascular events.

The aim of this study was to investigate the parameters of renal dysfunction in patients with with CHF.

MATERIAL AND METHODS

64 patients with postinfarction cardiosclerosis complicated by CHF aged 40-60 years were examined. The patients were divided into two groups according to functional class (FC) of CHF according to New York Heart Association (NYHA) classification by 6-min walk test (6mx) and clinical status score (CGS). Group I consisted of 34 patients with II class CHF and Group II consisted of 30 patients with III class CHF. The control group (GC) consisted of 14 healthy volunteers.

Patients with diabetes mellitus (DM) did not participate in the study. All patients were determined the level of Cr, using the MDRD formula (Modification of Diet in Renal Disease Study) to calculate GFR. Urinary enzymes - alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), cholinesterase (CE) were determined by spectrophotometric method.

Statistical processing of the results was carried out on a personal computer of IBMPC/AT type using ECXEL 6.0 spreadsheet package. The parameters were described as: arithmetic mean ± standard deviation (M±SD). Correlation analysis, calculating Pearson's linear correlation coefficient or Spearman's rank correlation coefficient, was used to examine the relationship between quantitative variables. Differences were considered significant at a significance level of p<0.05.

Table 1

Characteristics of patients with CHF depending on the functional state of the kidneys (M±SD)

Indicators	Patients with GFR≥60 ml/min/1.73 m2 (n=28)	Patients with GFR<60 ml/min/1.73 m2 (n=18)
Age (years)	53,42±6,2	55,3±4,8
FC CHF		
II	68,7%	31,3%
III	36,4%	63,6%
6mwt	344,6±21,8	237,5±9,4
SACC	5,6±0,51	8,1±0,67 (p<0,001)
LVEF	49,4±1,88	44,6±2,54
Cr	88,8±8,4	124,6±11,3(p<0,001)
GFR	75,3±11,7	54,6±5,3(p<0,001)

RESULTS AND DISCUSSION

Analysis of the results of the study showed that in patients with FC II CHF, the Cr index was 109.4±8.9 mmol/l, which is 24.85% higher than in GC (p<0.05). In patients with III FC, this indicator exceeded the values in GC by 40.3%, is 125.4=6.8 mmol/l (p<0.001). The initial parameters of SLE were 76.4=19.12 ml/min/1.73 m2 in patients with CHF II FC and 66.3=12.8 ml/min/1.73 m2 in patients with CHF III FC, respectively. The level of residual nitrogen in patients with II and III FC was 59.4% (p<0.05) and 85% (p<0.01) higher compared to the indicators of GC, amounting to 30.08±2.57 and 34.87±2.49 mol/l vs 18.9±0.37 mol/l, respectively.

At the same time, GFR<60 ml/min/1.73 m2 was detected in 33.3% of patients with CHF II FC and in 66.7% of patients with CHF III FC (Table 1). The level of Cr in patients with GFRt60 ml/min/1,73m2 it was 89.5±9.2 mol/l, whereas in patients with GFR <60 ml/min/1.73 m2 -123.9±12.1 mmol/l (p<0.001). The study of exercise tolerance indicators based on the results of the 6mx test, depending on the functional state of the kidneys, revealed that in patients with GFR< 60 ml/min / 1.73 m2, this indicator was 344.6 ±21.8 m and in patients with GFR<60 ml/min / 1.73 m2 -235.0±8.24 m. The SHOCK index in patients with CHF was also characterized by a more severe clinical

course of the disease in patients with GFR<60 ml/min/ 1.73 m2 – 8.1±0.67 points, compared with patients with GFR<60 ml/min /1.73 m2, this indicator was 5.6±0.51 points.

Table 2

Indicators of fermenturia in patients with CHF depending on the functional state of the kidneys (M ±SD)

Indicators	Control Group (GC)	1-Group FC II (n=34)	2-Group FC III (n=30)
ALT	2,53±0,02	3,82±0,15*	4,68±0,13**
AST	2,69±0,02	3,75±0,11*	4,13±0,12*
ALP	0,81±0,01	1,48±0,12*	1,86±0,08**
HE	59,63±2,82	82,69±3,21*	90,73±3,44*

The analysis of fermenturia in patients with CHF showed that patients with CHF II FC had a significant increase in the level of enzymes in the urine: ALT — by 50.9%, AST — 39.4%, SCHF by 82.5%, HE by 38.7% (p<0.05) compared to GC (Table 2). In patients with CHF III FC, the fermenturia indices were ALT — 4.68±0.13 u/l, AST — 4.13±0.12 u/l, ALF — 1.86±0.08 u/l and HE — 90.79±3.44 u/l, which is 85.0% (p<0.001), 53.5% (p<0.05), 129.6% (p<0.001) and 52.3% (p<0.001), respectively, are higher compared to healthy individuals.

The results of the study show that patients with CHF with both II and III FC have a significant increase in the indicators of fermenturia.

In patients with FC III, the increase in ALT and AST indicators was 1.8 and 1.5 times, respectively, higher than the GC indicators, which indicates deep damage in the cytoplasmic membranes of the tubular epithelium. The increase in the GFR index in patients with CHF III FC compared to FC II was 25.7%.

The study of the indicators of fermenturia in patients with CHF, depending on the functional state of the kidneys, showed that in patients with GFR <60 ml/min / 1.73 m2, among which patients with III FC CHF were 66.7%, significantly high indicators of fermenturia were noted. At the same time, the ALT level was 39% (p<0.01) and the alkaline phosphatase was 35% (p<0.001) higher than in patients without impaired renal function (Table 3).

The results of the study showed that in patients with CHF, as the disease progresses, there is a subclinical impairment of renal function, characterized by a decrease in GFR, an increase in the level of residual nitrogen and fermenturia. It is known that the studied transaminases — ALT and AST are localized mainly in the cytosol of epithelial cells of the proximal tubular apparatus of the nephron, and they are not filtered through the basement membrane of the glomeruli of nephrons. A noticeable increase in ALT and AST in patients with CHF indicates deep damage to the cytoplasmic membranes of the tubular epithelium with the release of cytosol components into the lumen of the tubules. For by studying the state of the glomerular filter, it is possible to determine the activity of the enzyme — HE in the urine. In patients with CHF and renal dysfunction, there was a marked increase in this indicator. This is confirmed by an increase in the level of alkaline phosphatase, especially in patients with severe renal dysfunction, since the enzyme of alkaline phosphatase is associated with the brush border and the cytoplasmic membrane of the tubular epithelium of the renal tubules. In connection with the above, the determination of the activity of alkaline phosphatase in urine can be used to assess the degree of damage to the surface structures of cytomembranes. Determination of the level of enzymes in urine in patients with CHF can be considered as a diagnostic approach for early diagnosis of kidney dysfunction. Analysis of the data obtained showed a direct correlation between an increase in the level of enzymes in urine and a moderate level of Cd in blood (r= 0.49), and there is a negative strong correlation (r=-0.71) between GFR and the level of enzymes in urine.

Table 3

Fermentometry in patients with CHF according to renal functional status (M±SD)

Indicators	Patients with GFR≥60 ml/min/1.73 m2 (n=28)	Patients with GFR<60 ml/min/1.73 m2 (n=18)
ALT	3,32±0,23	4,62±0,15**
AST	3,56±0,19	4,25±0,11
ALP	1,42±0,09	1,92±0,13**
HE	78,45±4,33	87,54±4,23*

CONCLUSION

The patients with II-III class of CHF have, along with increasing of Cr level, and decreasing of FFR, impairment of tubuloepithelial renal system, characterized by fermenturia. In patients with CHF, fermenturia increases with the progression of the disease and renal dysfunction. Fermenturia in patients with CHF indicates the presence of abnormalities in the tubuloepithelial renal system in the early stages of renal dysfunction, which allows the determination of fermenturia in CHF to be considered as an early marker of renal functional status assessment.

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