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STUDY OF ENZYMURIA INDICATORS IN PATIENTS WITH RENAL DYSFUNCTION AND CHRONIC HEART FAILURE

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Abstract

Chronic heart failure (CHF) is the most common, progressive, and unfavorable disease of the cardiovascular system, and is also the most frequent cause of patient hospitalization. According to the Framingham study, CHF incidence doubles every ten years. CHF significantly worsens patients' quality of life and increases the risk of death by up to 4 times. The annual mortality rate in patients can be 15-50%. The risk of sudden death in patients with CHF is 5 times higher than in those without chronic heart failure. The most common cause of CHF is ischemic heart disease (IHD), which accounts for 54-68.6% of patients with CHF (1,9). Myocardial infarction is one of the main causes of CHF development and is characterized by post-infarction remodeling of the left ventricle (LV): structural and functional restructuring of the LV and impairment of systolic and diastolic functions. CHF is one of the most important determinants in the development of chronic kidney disease (CKD). A number of retrospective studies have established that there is a correlation between the development of chronic heart failure (CHF) and renal dysfunction (RD), which leads to a deterioration in patients' lives (5,12). An increase in overall and cardiovascular mortality in CKD is observed even with a slight decrease in renal function and is especially pronounced in patients with cardiovascular diseases, including those with chronic heart failure (6,13). The results of epidemiological and population studies indicate that even subclinical impairment of renal function is an independent risk factor for cardiovascular complications (CVC) and mortality. It is evident that in CHF, the creatinine level is analogous to the ejection fraction and is an independent predictor of adverse outcomes (4,7). Patients with both CKD and CHF have a high risk of developing renal failure and require replacement therapy. The results of numerous epidemiological, prospective, retrospective, clinical, and specially planned studies show that severe renal dysfunction can cause various cardiovascular conditions, including myocardial infarction (MI), sudden death, cerebral ischemic stroke, and primary heart failure (10).

Introduction

The aim of our investigation is to study the functional state of the kidneys and indicators of enzymuria in patients with CHF.

68 patients aged 40 to 60 years with post-infarction cardiosclerosis (PIC) complicated by chronic heart failure (CHF) were examined. Patients were divided into two groups according to the New York Heart Association (NYHA) functional classification of CHF. The clinical status assessment scale (CSAS) and the six-minute walk test (6MWT) results were used to determine the functional class (FC). The 1st group consisted of 36 patients with CHF FC II according to the NYHA

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classification, the 2nd group - 32 patients with CHF FC III. 20 healthy volunteers were included in the control group. Patients with diabetes mellitus were not included in the study. All patients underwent the following tests: determination of creatinine (Cr), calculation of glomerular filtration rate (GFR) using the MDRD (Modification of Diet in Renal Disease Study) formula (4), and spectrophotometric determination of alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), and cholinesterase (CE) in urine (2). Statistical processing of the test results was carried out on an IBM PC/AT personal computer using the EXCEL 6.0 Windows-95 spreadsheet. The indicators were recorded as follows: arithmetic mean ± standard deviation (M±SD). The relationship between variables was analyzed using Pearson's correlation coefficient. Spearman's correlation coefficient was used to assess qualitative and quantitative characteristics. $P<0.05$ was used as the criterion for statistical significance.

Analysis of the examination results showed that in patients of group II with CHF FC II, the level of creatinine was 109.4±8.9 µmol/l, which is 24.85% higher than in the control group ($P<0.05$). In patients with CHF FC III, it increased by 40.3% compared to the control group and amounted to 125.4±6.8 µmol/l ($P<0.001$). The initial GFR values in patients with CHF FC II were 76.4±19.12 ml/min/1.73 m2, and in patients with FC III - 66.3±12.8 ml/min/1.73 m2 (Table 1).

Among these patients, GFR <60 ml/min/1.73m2 was observed in 33.3% of CHF FC II patients and 66.7% of CHF FC III patients. At GFR ≥60 ml/min/1.73m2, the creatinine level was 89.5 ± 9.2 µmol/l, while at GFR <60 ml/min/1.73m2 it was 123.9 ± 12.1 µmol/l ($P<0.001$). It was established that the amount of residual nitrogen in patients of groups II and III increased by 59.4% ($P<0.05$) and 85% ($P<0.01$) respectively, compared to the control group, and amounted to: 30.08±2.57 mmol/l, 34.87±2.49 mmol/l, and 18.9±0.37 mmol/l in the control group..

Table 1 Indicators of the relationship between chronic heart failure patients and kidney functional status

Indicators	GFR ≥60 ml/min/1.73 m2 patients with (n = 41)	GFR Patients with < 60 ml/min/1.73 m2 (n = 27)
Age	50,2 ± 7,1	56,3 ± 4,2
Chronic heart failure functional class II III	 27 (65,9%) 14 (34,1%)	 9 (33,3%) 18 (66,7%)
Creatinin (µmol/l)	89,5 ± 9,2	123,9 ± 12,1 (p<0,001)
Glomerular filtration rate (ml/min/1.73 m2)	76,1 ± 13,7	53,8 ± 5,9 (P<0,001)

Compared to the control group, in patients with CHF FC II, the levels of enzymes in urine increased as follows: ALT - by 50.9%, AST - by 39.4%, IF - by 82.5%, CE - by 38.7% ($P<0.05$). In patients with CHF FC III, the enzymuria indicators were ALT - 4.68±0.13 units/l, AST - 4.13±0.12 units/l, IF - 1.72±0.08 units/l, and CE - 90.79 ±3.44 units/l, which increased by 85.0% ($P<0.001$), 53.5% ($P<0.01$), 112.8% ($P<0.001$), and 52.3% ($P<0.01$), respectively, compared to the control group. The study results showed that enzymuria indicators were significantly elevated in both FC II and FC III CHF. In patients with CHF FC III, compared to the control group, the levels of ALT and AST

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increased by 1.8 and 1.5 times, respectively, indicating severe damage to the cytoplasmic membrane of the tubular epithelium and its release into the tubules that form the components of the cytosol (3,7). The IF analysis indicators in patients with CHF FC II and III also increased, indicating a breach in the integrity of the cytoplasmic membrane of the renal tubular epithelium, which is an early predictor of renal dysfunction (11).

Analysis of the obtained results shows a direct moderate correlation (r=0.49) between blood creatinine levels and urinary enzyme levels, while there is a strong negative correlation (r=-0.71) between glomerular filtration rate and urinary enzyme levels. Thus, in patients with CHF FC II-III, renal dysfunction is observed, characterized by damage to the tubuloepithelial apparatus of the kidneys. This can be considered as early markers of renal dysfunction - an increase in creatinine levels, a decrease in GFR, and increased enzymuria. p.

Conclusions

1. In patients with CHF, as the disease progresses, kidney function also becomes subclinically impaired, characterized by a decrease in GFR, enzymuria, and an increase in residual nitrogen levels.
2. Determining enzyme levels in the urine of patients with CHF can be used as a diagnostic method for early detection of kidney dysfunction.

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