RENAL HEMODYNAMICS AND GLOMERULAR FILTRATION IN PATIENTS WITH HYPERTENSION DISEASE AT THE AGE OF 40-60 YEARS

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Goal.
To study the parameters of renal hemodynamics and total glomerular filtration rate (GFR) and their relationship with cardiovascular risk factors in patients with hypertension (HD).

Keywords:
Glomerular filtration rate, hypertension disease, the functional state of kidneys, renal hemodynamics

Material and methods.

102 patients with HD (35 men and 67 women aged 40-60 years), who made up the main group, were examined. The control group included 20 people (10 men and 10 women) of comparable age with normal blood pressure (BP). To assess renal hemodynamics and GFR, the method of dynamic renal angioscintigraphy was used.

According to the ARIC (The Atherosclerosis risk in Communities) study, which included individuals aged 45-64 years, in chronic kidney disease, the incidence of coronary heart disease (CHD) increases from 4.4% to 11%, cerebrovascular disease - from 4.4% to 10% and diabetes mellitus-from 13% to 24% [1]. Currently, much attention is paid to the study of the relationship between kidney damage in hypertension (HD) and neurohumoral and metabolic disorders leading to cardiovascular complications [2,3]. In the HOT (Hypertension Optimal Treatment Study) and INSIGHT studies (Intervention as a Goal n Hypertension Treatment) it was found that in patients with adequately controlled hypertension in 13-30% of cases, there is a moderate decrease in renal function with creatinine clearance < 60 ml / min [4,5]. This explains the interest in studying the functional activity of the kidneys at the initial stages of the formation of HD and identifying its relationship with other significant risk factors (FR) for cardiovascular diseases. The sexual dimorphism of a number of risk factors and pathogenesis of cardiovascular diseases described in the literature [6,7] suggests the existence of sexual differences in the functional activity of the kidneys in patients with HD.
The aim of this study was to study the parameters of renal hemodynamics and total glomerular filtration rate (GFR) and their relationship with cardiovascular risk factors in patients with HD.

Materials and methods

The main group included 35 men and 67 women aged 40 to 60 years, hospitalized for grade II-III HD (according to the WHO classification,1999); the control group consisted of 20 people (10 men and 10 women) of comparable age with normal blood pressure figures. The criteria for exclusion from the study were the presence of symptomatic arterial hypertension, clinical manifestations of atherosclerosis, including

CHD, cerebrovascular disease, clinical and laboratory manifestations of chronic liver and kidney diseases, diabetes mellitus, and inflammatory diseases of any localization.

All patients underwent laboratory and instrumental examination, provided for by the medical and economic standard, and dynamic renal angioscintigraphy.

To assess renal hemodynamics, the method of dynamic angioscintigraphy of the $C^{99m}Ts$ kidneys in a sitting position using a gamma camera was used. The GFR index was calculated taking into account the surface area of the body. Normal values of GFR were considered to be 90-130 ml/min/m^2. The level of GFR < 90 ml/min/m^2 was regarded as hypofiltration, >130 ml/min/m^2-as hyperfiltration [8]. In the future, the GFR is given in ml/min, taking into account the surface area of the body.

Standard statistical methods and the Statistica 6.0 software package were used for statistical processing of the results. The numerical results were expressed in the form of M±σ. The significance of the differences was evaluated using a single-factor analysis of variance and the χ2 criterion. Spearman correlation coefficients (rs) were also calculated. The differences were considered significant at $p<0.05$.

Results

The groups were comparable in age, duration and degree of GB, body mass index(BMI), creatinine level ($p > 0.05$).

Renal angioscintigraphy revealed changes in renal hemodynamics in both men and women with HD. Renal hypoperfusion was registered in 4.3% of women and 18% of men, hypoperfusion-in 95.7% and 82%, respectively (χ2, $p = 0.003$). When comparing the perfusion parameters in women, significantly ($p < 0.05$) lower levels were noted, renal blood flow in both kidneys, vascular volume in the right kidney, and specific blood flow in both kidneys compared to similar indicators in men. There was no significant asymmetry in the parameters of renal blood flow in both men and women.

Nephroptosis as a possible cause of decreased blood flow in men was found in 18.8% of cases, among women-in 28% (χ2, $p = 0.18$).

The study of GFR revealed hypofiltration in 37% of women and 21% of men with HD; hyperfiltration was registered, respectively, in 30% and 57% (χ2, $p < 0.001$). GFR in women was significantly lower than in men: 91.4±30.5 and 145.4±27.9 ml / min, respectively ($p<0.001$). Significantly lower GFR values were found in patients with HD. Significant differences between GFR levels in men and women of the control group.

When analyzing correlations between GFR indicators and risk factors for cardiovascular diseases in men, there was a positive relationship of an average degree between GFR and tobacco smoking ($r=0.61$; $p<0.05$). In women, a negative relationship of average strength between GFR and BMI was established ($r=-0.41$; $p<0.005$). No relationship was found between the GFR and such indicators as the concentration of total cholesterol and fibrinogen.

Discussion

The study included patients aged 40-60 years, since this age group is characterized by an equal frequency of HD among men and women [9]. It should be noted that our study was dominated by patients with severe forms of hypertension (II-III degree), hospitalized for hypertensive crises. A slightly higher concentration of creatinine in the blood serum of men is probably associated with greater muscle mass in males [10]. Tobacco smoking was more common among men. Overweight (25kg/m^2<BMI<30kg/m^2) was more common in men, although the incidence of obesity (BMI>30kg/m^2) was higher in women. However, all these differences reached a degree of statistical confidence (χ2, $p=0.24$). The differences in the prevalence of risk factors and the indicators of treatment adherence, which were higher among women, correspond to population observations [11].

Our results on the prevalence of individuals with renal hypoperfusion among patients with HD are consistent with the literature data [7,12-14,22]. It is assumed that renal hypoperfusion is the earliest sign, and possibly a prerequisite for the development of HD. In a number of studies, renal hypoperfusion was detected in the early stages of HD among young patients [15,16], while our data were obtained in the group of older patients. A more pronounced decrease in renal blood flow in women is indirectly confirmed by the data obtained by N.P. Maslova and E.I. Baranova (1997), indicating a higher vascular tone of the renal arteries in women [7].

Many authors point to the predominance of hyperfiltration in the early stages of HD [14, 17-19, 22] with the subsequent development of hypofiltration as the disease progresses [14, 17, 22]. We found a multidirectional change in glomerular filtration in men and women of comparable groups. Hypofiltration was significantly more common in women, while hyperfiltration was significantly more common in men. There are few studies devoted to the study of sexual differences in renal function. The prevalence of hyperfiltration in the early stages of HD among men under the age of 35 was revealed in the work of T. A. Dyakova [14]. However, no comparison was made with the sick women. Hyperfiltration is the main non-immune mechanism of the progression of hypertensive nephropathy, leading to a decrease in GFR over time [14, 17].

In the group of men, we found a positive correlation of an average degree between GFR and tobacco smoking ($r=0.61$; $p<0.05$). Similar results obtained by T. A. Dyakova [14] in young men suggest a common pathogenetic mechanisms of the formation of HD in men of different age categories. In women, we found a negative relationship of average strength between the GFR and BMI ($r=-0.41$; $p<0.005$). Similar results were obtained by other authors [20,21]. However, in these studies, patients with arterial hypertension of the first degree with obesity were examined, their average age was 37 years, the share of women did not exceed 25%, gender differences were not analyzed. Data on the higher prevalence of obesity among women suggest that obesity is a significant pathogenetic factor in the development of renal dysfunction in patients with HD.

Conclusions

1. In patients with HD II-III art. at the age of 40-60 years, the predominance of renal hypoperfusion is revealed, while in women there is a significantly more pronounced decrease in renal blood flow than in men.
2. Sexual dimorphism of the total glomerular filtration rate was revealed in patients with GB II-III st. at the age of 40-60 years: hypofiltration was significantly more frequent in women, while hyperfiltration was significantly more frequent in men. GFR in women was significantly lower than in men of comparable age.
3. In men with HD, a positive correlation of the average degree between the indicators of GFR and tobacco smoking was revealed ($r=0.61$; $p<0.005$); in women, a negative correlation of the average strength between OSF and BMI ($r=0.41$; $p<0.005$).

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