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Assessment of Essential Microelements Deficiency in Different Stages of Chronic Kidney Disease

Rajabov N. M., Akhmedova N. Sh.

Bukhara State Medical Institute, Bukhara, Uzbekistan

Abstract Chronic kidney disease (CKD) is one of the most common diseases among the population of the earth, and is the leading cause of death and disability. Risk factors causing CKD are widespread, among which the role of vital micronutrients is very important. This research paper presents the results of the study of zinc, copper and iron trace elements deficiency in patients in the early stages of CKD and their clinical course. The results showed that correlations were found between disease stages and micronutrient deficiency.

Keywords Chronic kidney disease, Zinc, Copper, Trace elements

1. Introduction

Although many achievements have been achieved as a result of the research carried out in the world, many questions in the field of diagnosis and prevention of CKD of social importance in practical medicine have not yet been resolved. [4,6].

In recent years, research aimed at studying the problem of the development of micronutrients shows that the relevance of this problem is related to a number of factors called the biogeochemical state. These factors are related to ecological, anthropogenic and climatic geographical features, which have a permanent effect on the human body. [1-5].

In the study of the problem, it was found that a lot of scientific research work has been carried out on the determination and correction of micronutrient status in the terminal stage of chronic kidney disease, and information on micronutrients in the II-III stages of the disease and in the period before dialysis is very rare. At the same time, kidney failure, which is important for maintaining the homeostasis of the body, causes a change in the micronutrient status and an increase in the development of the disease, an increase in complications from the cardiovascular and digestive systems. [1,2,3,6].

Today, among the population of the earth, the number of people with chronic kidney failure is continuously increasing [1,5,7,9]. CKD takes one of the leading places among chronic non-infectious diseases, occurring from 6% to 20% in different countries. Also, in many cases, due to the fact that patients need expensive replacement therapy (dialysis or kidney transplantation), the quality of life decreases, disability and death are high. [6,8,10].

CKD is a collective expression indicating damage to kidney tissue regardless of etiological origin. The presence of any marker of kidney damage (albuminuria/proteinuria, pathological deposits in the urine, morphological changes) for three months or more, or a glomerular filtration rate (GFR) <60 ml per minute per 1.73 m2 of body surface area for the same period is considered CKD. The concept of CKD was developed in the clinical recommendations of the international organization Kidney Disease: Improving Global Outcomes (KDIGO) [4,11].

The purpose of this research workis to assess the diagnostic and prognostic effectiveness of early detection of essential micronutrient deficiency in patients with various stages of chronic kidney disease development.

2. Materials and Methods

180 patients aged 18-60 with different levels of CKD were included in the study. 41.1% of patients (n=74) men and 59.9% (n=106) were formed by women. The average age of patients is 48.3±equal to 1.4. In order to assess kidney function, serum creatinine, cystatin, urea, BKFT, and renal reserve indicators were studied in all patients. Also, the amount of essential microelements iron, copper and zinc was studied by clinical analysis and IFA method.

Statistical processing of the obtained data was carried out by calculating the following parameters: arithmetic mean (M), arithmetic mean error (m), confidence interval. Differences between indicators were considered significant when the probability level was $r < 0.05$.

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3. Analysis of Results

At the initial stage of the scientific research work, the risk factors causing CKD were studied in the patients involved. It was based on the patient's anamnesis, past illnesses, genetic anamnesis, objective and subjective examination results (Fig. 1).

The results of the analysis showed that the most common risk factors for CKD were hypertension and obesity and overweight, which were respectively 65.2±1.8 and 51.3±was 1.9% (r>0.01). Next are chronic heart failure, type 2 diabetes, and CKD, which respectively account for 39.4±3.8%; 37.6±3.9% and 31.4±was 2.0% (r>0.05).

This means that cardiovascular diseases and metabolic syndrome play an important role in the development of CKD.

In the next stages of the research, the level of deficiency of zinc, copper and iron elements from essential trace elements in patients with different clinical stages of CKD was compared.

Among the studied patients, 18.9% of CKD stage 1 patients (n=34), 53.9% of patients with CKD stage 2 (n=97) and patients with CKD stage 3a/b 27.2% (n=49) was formed. The CKD-EPI formula based on the amount of cystatin in the blood was used to determine CKD stages.

Zinc, copper and iron levels were determined in all patients and the results were compared. The results showed that the deficiency of micronutrients can be found in the form of mono-poly deficiency. In our patientsiron deficiency was observed in 14.1%, zinc deficiency in 36.2%, copper deficiency in 11.4% and oleic deficiency in -38.3% cases (r>0.01).

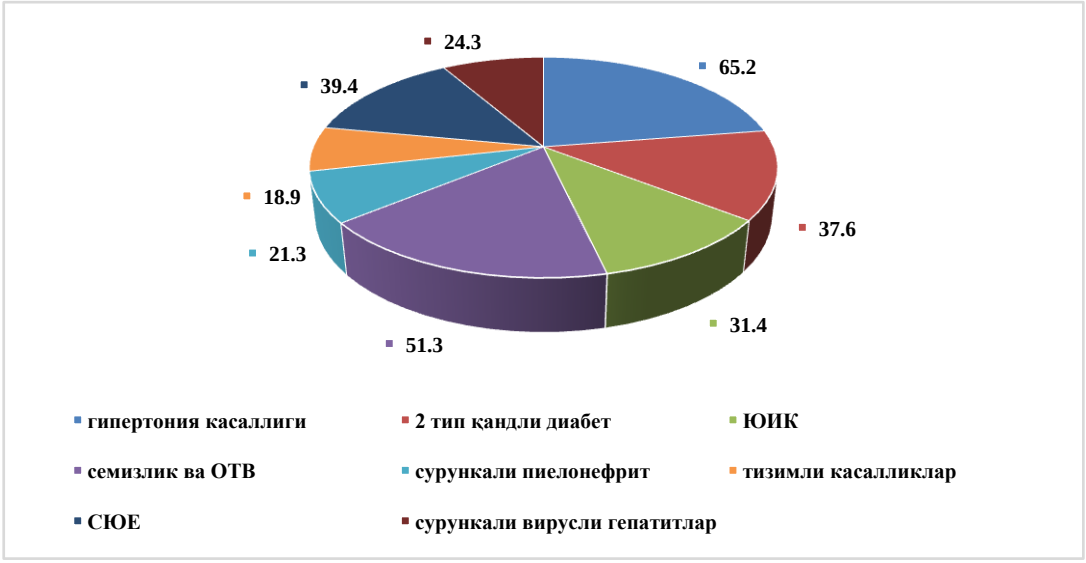

Figure 1. Frequency of occurrence of risk factors causing CKD (%)

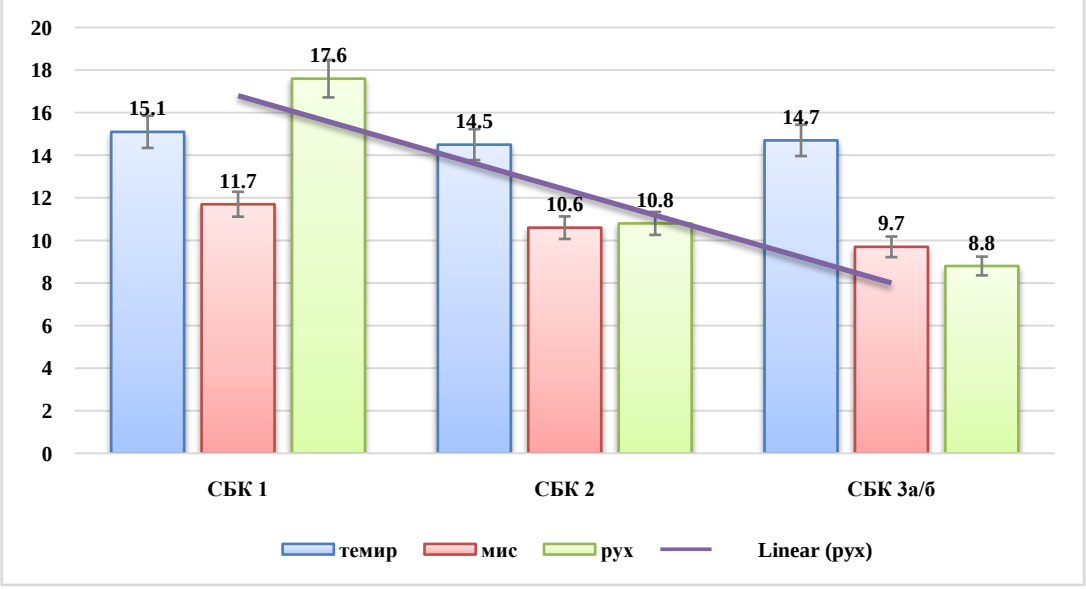

Figure 2. The status of the development of essential micronutrient deficiency with the CKD stages (in men)

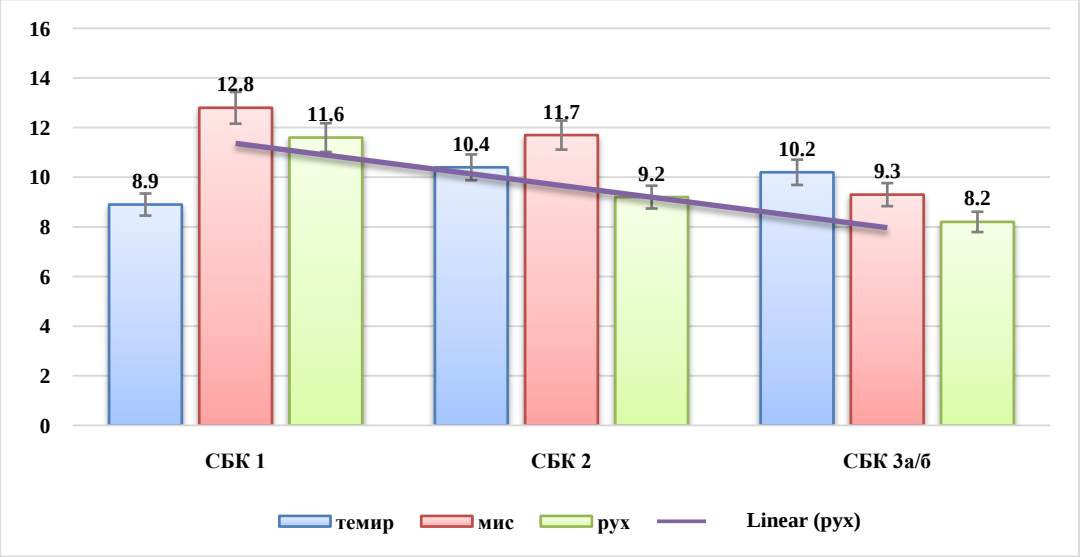

Figure 3. The relationship between the development of essential micronutrient deficiency and the stages of CKD (in women)

The following results were obtained when micronutrient deficiency was studied in relation to CKD stages (Figures 2 and 3).

The analysis of results was carried out in separate groups based on gender. Because the standard indicators of essential micronutrients are different depending on gender and have diagnostic value.

The analysis of the indicators showed that there is a positive correlation between the severity of the stages of the clinical course of CKD and the expression of essential microelements, that is, the development of the disease was characterized by a decrease in the indicators of microelement deficiency.

The results of the comparative assessment depending on gender showed that iron microelement deficiency was more evident in the early clinical stages of the disease, while its amount approached the norm as the clinical stage of the disease worsened, and this was also confirmed by other indicators of ferrokinetics.

Among the essential micronutrients, indicators of zinc micronutrient deficiency status were evident in the early stages of the disease. In men, CKD was 17.6 µmol/l in stage 1, 10.8 µmol/l in stage 2 and 8.8 µmol/l in stage 3a/b.

In women, this indicator is correspondingly 11.6; It was 9.2 and 8.2 µmol/l.

In conclusion, it can be said that the deficiency of essential micronutrients is also important as a risk factor in the development and deterioration of CKD. Early detection and elimination of their deficiency is one of the important measures in preventing the development and complications of nephropathy.

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