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Quality of life in patients with chronic kidney disease and metabolic syndrome

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Abstract

Quality of life often deteriorates in patients with chronic kidney disease. Metabolic syndrome also is associated with impaired quality of life. Patients with chronic kidney disease concomitant metabolic syndrome may have even more impaired quality of life and clinical condition. In this paper, the latest data on quality of life and its impairments in patients with chronic kidney disease and metabolic syndrome have been summarized with critical review. Furthermore, influence of chronic kidney disease stages and metabolic syndrome components on quality of life have been shown in the paper.

Keywords: Chronic kidney disease; Metabolic syndrome; Quality of life; Prognosis

1. Introduction

The concept of chronic kidney disease (CKD) was developed by the US National Kidney Foundation (NKF). CKD is "the presence of kidney damage or a decrease in the level of kidney function for three months or more, regardless of diagnosis" [1]. Table 1 lists the criteria for defining CKD. There were several reasons for introducing the concept of CKD. One of the main ones was that in recent years the unity of the key links in the pathogenesis of various kidney diseases has been revealed [2, 31]. As can be seen, the value of GFR was used to distinguish between the stages of CKD. It is important to identify risk factors for the development and progression of CKD. At the same time, CKD is not diagnosed, but the patient needs observation and preventive measures. [3, 33]. Obviously, risk factors have certain similarities with those in cardiovascular disease. How to relate to the concept of CKD? Of course, this is not a nosological unit. The diagnosis of the underlying disease must be in each case. The term CKD has been adopted in the United States and many other countries.

The fifth stage of CKD corresponds to the term "terminal renal failure", or "end stage renal disease" of English-speaking authors and requires the initiation of renal replacement therapy (RRT) [32]. Earlier stages of CKD, i.e. I-IV involve the use of a set of measures that allow either to slow down the deterioration of kidney function, or to prepare the patient in the best possible way for RRT. Despite the alertness of Russian nephrologists, the concept of CKD is gaining more and more supporters, because. its benefits are becoming more and more obvious. CKD is not a mechanical combination of chronic kidney damage of various nature. This concept is based on the unity of the leading pathogenetic mechanisms of the progression of the pathological process in the renal tissue, the commonality of many risk factors for the development and progression of kidney diseases, and the resulting similarity in the methods of therapy, primary and secondary prevention [4, 35, 40]. Perhaps, in practice, CKD will take the same place as IHD or COPD. The authors of [5, 34, 39], along with the concept of CKD, consider it necessary to preserve the concept of "terminal renal failure (ESRD)" in Uzbekistan. The condition of ESRD should include patients receiving RRT and persons with stage V CKD who have not yet started substitution treatment or who are not provided with it due to organizational problems.

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The rate of progression of CKD is variable. It largely depends on the nosological form. But CKD itself worsens the patient's prognosis, and not only due to the formation of terminal PI. The leading factors of poor prognosis in patients with CKD are cardiovascular complications: stroke, myocardial infarction, chronic heart failure. Considering that hypertension is a significant risk factor for CKD, during the monitoring of patients with essential hypertension, it is necessary to regularly study GFR, MAU, urinalysis, determination of creatininemia, and ultrasound of the kidneys. Timely detection, prevention and treatment of CKD is an important direction in increasing the duration of active life of the population.

The incidence of metabolic syndrome often coincides with the incidence of obesity and type 2 diabetes. This is a very common disease; in the US > 40% of people > 50 years of age may have metabolic syndrome. Metabolic syndrome can develop in children and adolescents, but a definition has not been established in these age groups.

The development of metabolic syndrome depends on the distribution of fat, as well as its amount. Excess fat in the abdomen (called an apple shape), especially when it results in a high waist-to-hip ratio (reflecting a rather low muscle-to-fat ratio), increases the risk [5, 36, 38]. The syndrome is less common among people who have excess subcutaneous fat around the hips (called a pear shape) and a low waist-to-hip ratio (reflecting a high muscle-to-fat ratio).

Excess fat in the abdomen leads to an excess of free fatty acids in the portal vein, increasing fat accumulation in the liver. Fat also accumulates in muscle cells. Insulin resistance develops in combination with hyperinsulinemia [5, 39, 41, 42]. Glucose metabolism worsens, dyslipidemia and arterial hypertension develop. Serum uric acid levels are usually elevated (which increases the risk of gout), with a prothrombotic state (with elevated levels of fibrinogen and plasminogen activator inhibitor I) and chronic inflammation developing.

The risks of developing metabolic syndrome include:

- Obstructive sleep apnea syndrome
- Non-alcoholic steatohepatitis
- Chronic kidney disease
- Polycystic ovary syndrome (for women)
- Low plasma testosterone, erectile dysfunction, or both (for men)

In recent years, the metabolic syndrome has been of great interest to researchers, characterized by the presence of tissue insulin resistance (IR), hyperinsulinemia (GI), impaired glucose tolerance (IGT), primary arterial hypertension (AH), dyslipidemia, as well as abdominal obesity and hyperuricemia in one patient [8, 43]. The problem of obesity in combination with various metabolic disorders and/or diseases is the focus of modern medical research. According to WHO data for 2003, about 1.7 billion people on the planet, that is, almost one in four inhabitants, are overweight or obese. Over the past 10 years, the incidence of obesity worldwide has increased by an average of 75%, and an increase in the number of obese people is predicted in all regions of the world. It is estimated that by 2025, 40% of men and 50% of women will be obese. In recent decades, scientists and clinicians have begun to consider various metabolic disorders and/or diseases associated with obesity in a complex manner and to speculate about the commonality of these conditions. Back in the 60s of the last century, attempts were made to combine some of the interrelated metabolic disorders that accelerate the development of vascular atherosclerotic diseases and diabetes mellitus [9, 45]. In 1988, G. Reaven for the first time combined carbohydrate metabolism disorders, arterial hypertension (AH) and dyslipidemia into the concept of "syndrome X" and suggested that IR and compensatory GI could be the basis of these conditions. The author described syndrome X in people with normal body weight, but later showed that in most cases with such disorders there is obesity, usually of the abdominal type. In 1989, N. Kaplan described the "deadly quartet", including abdominal obesity among the important components of the syndrome, along with hypertension, IGT, and hypertriglyceridemia. In 1990, metabolic disorders and diseases that develop in obese individuals were combined into the concept of "metabolic syndrome" (MS). In subsequent years, the concept of MS continued to be intensively developed, replenishing this state with new components [8, 46, 47].

According to the criteria of the components, the following variants of MS can be distinguished: complete (combination of hypertension, dyslipidemia, obesity, non-insulin dependent diabetes mellitus - NIDDM) and incomplete (does not include one of the listed components). A number of researchers propose to talk about the presence of MS in identifying any two of the following criteria: abdominal-visceral obesity, IR and GI, dyslipidemia (lipid triad), AH, IGT/DM type 2, early atherosclerosis/CHD, impaired hemostasis, hyperuricemia and gout, microalbuminuria , hyperandrogenism. According to other researchers, the combination of individual components can be considered within the framework of the MC only if there is a mandatory establishment of the fact of IR. The complexity of the situation lies in the fact that both points of view have the right to exist. It should be noted that the presence or absence of any manifestations of MS

largely depends on individual compensatory mechanisms, and in different patients, the compensation reserves for various manifestations of MS can be expressed in different ways. The prevalence of MS in the general population is high, ranging from 14–24% and increasing with age. Thus, among people aged 20-29 years, MS can be diagnosed in 6.7% of the population; 60-69 years old - in 43.5%, 70 years and older - in 42%. Within the framework of the WHO international project "MONICA", Yu.P. Nikitin et al. conducted an epidemiological study of the prevalence of MS components among the unorganized urban population of Novosibirsk. The study used the MS definitions developed by WHO. According to the results of this study, 39.5% of men and women aged 26-64 years have 2 or more components of MS, 10.7% have 3 or more components. The proportion of persons with two or more signs of MS was higher among women than among men and amounted to 42.9 and 36.3%, respectively [10, 49, 50]. In 1999, a WHO working group for the first time developed and presented the following diagnostic criteria for MS:

- BMI > 30 kg/m2 and/or WC/VR for men > 0.9 and for women > 0.85;
- TG ≥ 1.7 mmol/L (≥ 150 mg/dL);
- HDL cholesterol < 0.9 mmol/l (< 35 mg/dl) for men and < 1.0 mmol/l (< 39 mg/dl) for women;
- BP > 160/90 mm Hg. Art., as well as the fact of antihypertensive therapy;
- Fasting glucose ≥ 6.1 mmol/L (110 mg/dL);
- Microalbuminuria (urinary albumin excretion rate ≥ 20 μg/min or albumin/creatinine ratio > 30); (BMI, body mass index; WC, waist circumference; OB, hip circumference; TG, triglycerides; HDL cholesterol, high-density lipoprotein cholesterol; BP, blood pressure). In type 2 diabetes mellitus or impaired glucose tolerance, two of the above criteria are sufficient to diagnose MS.

In the absence of carbohydrate metabolism disorders, it is recommended to establish the fact of insulin resistance (IR). It is known that the "gold standard" for measuring tissue sensitivity to insulin is the euglycemic hyperinsulinemia clamp test proposed by R.A. De Fronzo et al. Due to the invasiveness, high cost and complexity of execution, this research method is used only in specialized scientific institutions and is not used in wide clinical practice. The proposed modifications of the test with intravenous infusion of glucose and subsequent administration of tolbutamide to suppress endogenous glucose production by the liver are also laborious and rather expensive, and therefore have not been widely used in clinical practice. Currently, the oral glucose tolerance test (OGTT) is mainly used in clinical practice. The patient on an empty stomach is measured the level of glucose and insulin in the blood serum, after which a load of 75 g of glucose is carried out. Further, at intervals of 1 and 2 hours, the levels of glucose and insulin in the blood plasma are determined. It is important to note that OGTT makes it possible to determine not tissue resistance to insulin, but the presence and severity of GI. At the same time, it is known that it is compensatory HI that is a consequence of IR and a link in the pathogenesis of the development of clinical manifestations of MS. Thus, the identification of GI is no less important than IR. The problem is that currently there are no single generally accepted criteria for GI. According to the literature, this indicator varies within the range of 5.3–25.0 μU/ml. The main difficulty in the development of uniform diagnostic criteria for GI lies in the method of determination and kits for determining the concentration of insulin. Along with determining the level of insulin by a direct method, there are calculated indicators that characterize the insulin response.

Quality of life (QoL) is a complex interdisciplinary concept. Health-related QoL is an important indicator of the psychological burden of disease. Analysis of QoL allows assessing the patient's satisfaction with his life in a situation of illness and identifying the most problematic areas. Monitoring of QoL is one of the standard criteria for the effectiveness of the treatment, along with the control of somatic indicators, assessment of risks and outcomes. Chronic kidney disease (CKD) is no exception, a condition that is common in various regions of the world.

CKD can impose restrictions on many areas of a patient's life. These restrictions are associated not only with the development of complications, but also with the need for constant pharmacotherapy, dietary restrictions, and contacts with medical staff. In stage 5D CKD, this QoL deficiency may be more pronounced due to progressive complications of end-stage renal disease, restriction of freedom of movement, diet and the need to control fluid intake, narrowing the circle of communication, etc. A detailed analysis and control of QoL in patients at various stages of CKD is one of necessary conditions for the implementation of a modern approach to P4 format nephrology - predictive, preventive, personalized and partner [6, 7]. The quality of life of patients treated with hemodialysis has been the subject of a significant number of studies. Meanwhile, publications devoted to QoL at the predialysis stage of CKD treatment are very few and are mainly devoted to patients with severe renal dysfunction (CKD stages 3–5) [8–10]. Only a few studies provide information on the quality of life of patients in the early stages of the disease (CKD stages 1–2) [11, 12]. At the same time, QoL indicators can be important not only for analyzing the effectiveness of treatment, but also for assessing the prognosis [11, 13, 14].

Purpose

The purpose of this pilot study is to conduct a comparative analysis of the quality of life of patients at various stages of CKD progression, including with concomitant MS.

2. Material and methods

120 patients with CKD and MS were examined. 27 patients were at the stage of conservative treatment. Among them, there were 17 patients with CKD stage 1, 39 with CKD 2, 44 with CKD 3, 20 with CKD 4 and 7 with CKD 5. When analyzing the data, the patients were divided into three groups. The first two groups included patients at the pre-dialysis stage of treatment: the 1st group - with CKD stages 1-2, the 2nd - with CKD stages 3-4-5. The average age of patients in the three above groups was 42.1±14.2, 45.8±11.4 and 44.4±12.2 years, respectively. Duration of CKD (median and interquartile range) for persons with CKD stages 1-2 - 12 (4-19) years, for patients with CKD 3-4-5 at the predialysis stage - 14 (6-22) years, in the group of patients at hemodialysis - 16 (7–25) years. During the analysis, patients on hemodialysis were classified according to the duration of this type of therapy. QOL indicators were determined in the period from 1999 to 2007. The Uzbek-language version of the SF-36 Health Survey methodology was used to assess health-related QoL [15, 16]. The results are evaluated on eight main scales. The spread of scores on each scale is from 0 to 100. The higher the score, the better the quality of life. The questionnaire includes the following scales: the ability to withstand physical activity (physical functioning - FF); role-playing physical functioning (RPF), which characterizes the influence of physical condition on daily activities; pain intensity and impact of pain on daily activities (B); general health (OH); general activity/energy (E); social functioning (SF); role emotional functioning (REF), which characterizes the influence of the emotional state on daily activities, and mental health (MP). In addition, two integral indicators of QoL were calculated, which are made up of individual indicators of the questionnaire: the total indicator of physical health (SPH) and the total indicator of mental health (SPH) [17]. The indicators of the SF-36 methodology were conventionally divided into two groups: the physical component of QoL and the psychosocial component of QoL. The physical component includes assessments of the scales of physical functioning, role physical functioning, pain, general health, and overall physical health. The psychosocial component includes indicators of general activity/energy, social functioning, mental health, role emotional functioning, and the overall mental health index. Statistical analysis of the obtained data was carried out using the methods of parametric and nonparametric statistics. Data are presented as means and standard deviations or median and interquartile range. To assess intergroup differences, we used: when comparing two groups, Student's t-test or Mann-Whitney U-test, and in cases of multiple group comparisons, one-way analysis of variance (ANOVA) or Kruskal-Wallis H-test. The critical level of significance of the null hypothesis (about the absence of significant differences and influences) was taken equal to 0.05.

3. Results

The results of a comparative analysis of the quality of life of patients with CKD stages 1–2, with CKD stages 3, 4 and 5 at the predialysis stage and in the treatment of hemodialysis are presented. CKD progression is associated with the following trends: decreased physical activity and exercise tolerance; increasing restrictions on daily activities due to the physical condition of patients; decrease in patient satisfaction with general health; an increase in the intensity of the pain syndrome and the limiting effect of pain on daily activities. Lower values of the total physical health index in groups with lower GFR values were regular. There were no significant differences between the groups of patients in terms of the total indicator of mental health and partial indicators included in its composition.

According to the results of pairwise comparison of groups in patients treated with hemodialysis, the parameters of the physical component of QoL are significantly lower than in patients with CKD stages 1–2 and 3–4–5 stages. With MS There was a decrease in resistance to physical stress, satisfaction with one's health in general, and a total indicator of physical health. No statistically significant differences were found between the groups of patients on hemodialysis and pre-dialysis stages of CKD in terms of the psychosocial component of QoL. However, the group of patients on hemodialysis included patients with different durations of renal replacement therapy. In this regard, patients on hemodialysis were divided into subgroups depending on the duration of treatment. This comparative analysis also included a group of patients with CKD stages 3, 4 and 5 at the predialysis stage with MS. The results of multiple comparisons indicate that with an increase in the duration of treatment on hemodialysis, all indicators of the physical component of QoL decrease. According to pairwise comparison, significant differences between the groups of patients who were at the pre-dialysis stage of CKD with MS and who received hemodialysis for no more than two years were noted only in terms of general health. This indicator includes an assessment of the state of health in general, the prospects for the course of the disease and treatment, and comparison with others in terms of health. The deterioration of other indicators of the physical component of QoL was revealed at later stages of renal replacement therapy. The compared groups of patients did not differ in such parameters of the psychosocial component of QoL as mental health,

the impact of the emotional state on daily activities, and the total index of mental health. At the same time, according to multiple comparison data, a decrease in indicators of energy and social functioning was revealed with an increase in the duration of hemodialysis therapy. A decrease in the indicator of social activity occurs after 8 years of renal replacement therapy, and in terms of energy - after 5 years. Differences in these indicators between patients at the pre-dialysis stages who started hemodialysis treatment and received replacement therapy for no more than 5 years were not statistically significant.

4. Discussion

The opinions of researchers regarding the association of QOL in patients with a decrease in kidney function at the pre-dialysis stages of CKD are ambiguous. Kayumov et al. [8] indicate a positive correlation between the integral indicator of QoL (according to the Quality of Well-Being method) and GFR. In the work of one author [9, 30], conducted using the Taiwanese version of the WHOQOL-BREF QoL questionnaire, noted a significant decrease in life satisfaction as CKD progressed on two of the four scales of the questionnaire: physical health and interaction with the environment. Another author [10, 29] on the material of elderly patients (over 65 years of age) showed that a statistically significant decrease in QoL of patients occurs only when GFR falls to 45 ml/min/1.73 m2. In the combined group of patients with CKD stages 3b and 4, a significant decrease was recorded in eight out of ten indicators of the SF-36 questionnaire. At the same time, between the groups of patients who were at earlier stages of CKD, there were no significant differences in terms of QoL. In the studies of authors [11], M.C. Alyavi et al [12, 28] found no relationship between QOL and CKD stage, and GFR was not included in the number of independent predictors of QOL indicators [9, 26, 27]. In a prospective study, the dynamics of GFR in patients with CKD stages 3-5, who are at the pre-dialysis stage, did not correlate with the dynamics of QoL [13]. The results of those few studies that compared the quality of life of patients on hemodialysis and those at the stage of conservative treatment do not match. Thus, in the above-mentioned work by Alyavi et al et al. [14, 24, 25] noted a significant deterioration in all indicators of the SF-36 method when switching from conservative therapy of CKD to hemodialysis. However, in a study by Mukhamedova et al. [15, 22, 23] showed that patients on hemodialysis are distinguished by significantly reduced indicators of physical activity compared to the predialysis stage, while maintaining the integral indicator of mental health of the SF-36 method. And in the work of Mukhamedova et al. [16, 21], based on a small number of observations, demonstrated that patients on hemodialysis had worse indicators of physical functioning and energy and more pronounced pain syndrome than patients on the pre-dialysis stage. According to these authors, the assessments of most of the scales that are part of the psychosocial component of QoL (SF, REF, PZ) in patients on hemodialysis were slightly better than in patients at the stage of conservative therapy. Data on the absence of negative dynamics of QoL during the transition to hemodialysis treatment are presented [17, 18, 19, 20]. According to Iskhakov et al et al. [21], the quality of life of patients on hemodialysis (estimated by the integral indicator of the Sickness Impact Profile method) is even higher than in patients with moderate and severe decline in kidney function who were at the stage of conservative treatment.

5. Conclusion

As CKD progresses, indicators of the physical component of QoL decrease: physical activity, exercise tolerance, assessment of general health status, and restrictions on daily activities due to physical condition and pain. There is no deterioration in indicators of the psychosocial component of QoL as GFR decreases. There is a decrease in a number of QoL indicators as the duration of treatment on hemodialysis increases.

Thus, the use of the OHIP-49-RU specific questionnaire for QoL in patients with CKD and MS showed the dependence of QoL on the characteristics of the Ms components, due to the general state of health. In the study group, the psychological component, reflected in the “Psychological discomfort” and “Psychological disorders” scales, as well as the social component, was of paramount importance in reducing QoL. Along with this, a significant decrease was noted in the physical component. More than 50% decrease in QoL was noted in the social component of the disease. Also, the “loss” of QoL is also associated with the “Physical pain” scale.

Integral indicators of the ΣOHIP-49-RU QoL index in the study and control group confirm a significantly more clinically severe state of in patients with CKD and MS compared with patients without general somatic pathology (120.7±15.23 and 29.8±10 ,43 points respectively). In general, subjective self-assessment using the OHIP-49-RU questionnaire showed a significantly low level of QoL in terms of its dental parameters in patients with CKD. Thus, monitoring of dental QoL indicators by patients' self-assessment of their health can provide valuable screening information that complements the analysis of objective clinical data on the condition of HD patients.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest.

Statement of ethical approval

The study has been approved at the Tashkent Pediatric Medical Institute's ethical committee.

Statement of informed consent

All patients' informed consents have been obtained before enrolling the study.

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