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The importance of the questionnaire WHOQOL-BREF and neuromarker BNDF in patients with type 2 diabetes mellitus on hemodialysis in the assessment of the degree of brain ischemia

Alisher KHOLIKOV[1]

Republican Specialized Scientific and Practical Medical Center of Endocrinology named after academician Ya.Kh. Turakulov of the Ministry of Health of the Republic of Uzbekistan.

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ABSTRACT

This study aims to evaluate the significance of the WHOQOL-BREF questionnaire, a tool for assessing quality of life, and the biomarker brain-derived neurotrophic factor (BDNF) in patients with type 2 diabetes mellitus (T2DM) complicated by chronic kidney disease (CKD) who are receiving hemodialysis. A total of 90 patients with T2DM and stage III chronic renal failure (CRF) undergoing programmed hemodialysis were examined between January 1, 2019, and December 31, 2020. These patients were divided into three groups based on the severity of chronic cerebral ischemia (CCI). The results showed that as the degree of CCI increased, serum levels of BDNF decreased significantly compared to the control group. Additionally, significant correlations were found between WHOQOL-BREF scores and various clinical, laboratory, and instrumental parameters, including the duration of the disease, fasting blood glucose, glycated hemoglobin levels, BDNF, and blood flow velocity in the carotid and vertebral arteries. The study highlights the importance of the WHOQOL-BREF questionnaire in assessing the quality of life in this patient population and identifies BDNF as a valuable marker for brain ischemia in T2DM patients undergoing hemodialysis.

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[1] PhD, Hemodialysis Department, Republican Specialized Scientific and Practical Medical Center of Endocrinology named after academician Ya.Kh. Turakulov of the Ministry of Health of the Republic of Uzbekistan.

Miya ishemiyasi darajasini baholashda gemodializda 2-toifa qandli diabet bilan og‘rigan bemorlarda WHOQOL-BREF so‘rovnomasi va BNDF neyromarkerining ahamiyati

Kalit so‘zlar:
hayot sifati,
WHOQOL-BREFis,
BNDF;
gemodializ.

ANNOTATSIYA

Ushbu tadqiqot hayot sifatini baholash vositasi bo‘lgan WHOQOL-BREF so‘rovnomasining ahamiyatini va surunkali buyrak kasalligi (CKD) bilan asoratlangan 2-toifa qandli diabet (T2DM) bilan og‘rigan bemorlarda miyadan olingan neyrotrofik omil (BDNF) biomarkerining ahamiyatini baholashga qaratilgan.) gemodializ olayotganlar. 2019-yil 1-yanvardan 2020-yil 31-dekabrgacha dasturlashtirilgan gemodializdan o‘tayotgan T2DM va III bosqich surunkali buyrak etishmovchiligi (CRF) bo‘lgan jami 90 nafar bemor tekshirildi. Bu bemorlar surunkali miya yarim ishemiyasi (SCI) og‘irligiga qarab uch guruhga bo‘lingan.). Natijalar shuni ko‘rsatdiki, CCI darajasi oshgani sayin, qon zardobida BDNF darajasi nazorat guruhiga nisbatan sezilarli darajada kamaydi. Bundan tashqari, WHOQOL-BREF ko‘rsatkichlari va turli klinik, laboratoriya va instrumental ko‘rsatkichlar, shu jumladan kasallikning davomiyligi, ochlikdagi glyukoza, glyukozalangan gemoglobin darajasi, BDNF va karotid va vertebral arteriyalarda qon oqimi tezligi o‘rtasida sezilarli bog‘liqlik aniqlandi. Tadqiqot WHOQOL-BREF so‘rovining ushbu bemor populyatsiyasining hayot sifatini baholashda muhimligini ta’kidlaydi va BDNFni gemodializdan o‘tayotgan T2DM bemorlarida miya ishemiyasi uchun qimmatli marker sifatida aniqlaydi.

Значимость опросника WHOQOL-BREF и нейромаркера BNDF у больных сахарным диабетом 2 типа, находящихся на гемодиализе, в оценке степени ишемии головного мозга

Ключевые слова:
качество жизни,
WHOQOL-BREFis.
BNDF;
гемодиализ.

АННОТАЦИЯ

Целью данного исследования является оценка значимости опросника WHOQOL-BREF, инструмента для оценки качества жизни, и биомаркера нейротрофического фактора мозга (BDNF) у больных сахарным диабетом 2 типа (СД2), осложненным хронической болезнью почек (ХБП), находящихся на гемодиализе. В период с 1 января 2019 года по 31 декабря 2020 года было обследовано 90 пациентов с СД2 и хронической почечной недостаточностью (ХПН) III стадии, находящихся на программном гемодиализе. Эти пациенты были разделены на три группы в зависимости от тяжести хронической ишемии мозга (ХИМ). Результаты показали, что по мере увеличения степени ХИМ сывороточные уровни BDNF

значительно снижались по сравнению с контрольной группой. Кроме того, были выявлены значимые корреляции между показателями опросника WHOQOL-BREF и различными клиническими, лабораторными и инструментальными параметрами, такими как длительность заболевания, уровень глюкозы натощак, уровни гликированного гемоглобина, концентрация BDNF и скорость кровотока в сонных и позвоночных артериях.

Это исследование подчеркивает важность использования опросника WHOQOL-BREF для оценки качества жизни данной группы пациентов, а также определяет BDNF как ценный маркер ишемии мозга у пациентов с СД2, находящихся на гемодиализе.

SUMMARY

The aim of the research is to study the significance of quality-of-life indicators and brain-derived neurotrophic factor BNDF in patients with type 2 diabetes mellitus complicated by chronic kidney disease and receiving programmed hemodialysis.

MATERIAL AND METHODS

We examined and surveyed a total of 90 patients with type 2 diabetes mellitus and stage III CRF on program hemodialysis from January 1, 2019, to December 31, 2020. Of these, 43 were women and 47 were men. The average age of men was 67 ± 4.2 years, and the average age of women was 64 ± 5.6 years. The control group consisted of 20 patients of the corresponding age. The number of hemodialysis sessions in patients ranged from 2 to 162.

RESULTS

According to the degree of chronic cerebral ischemia (CCI), patients were divided into 3 groups: Group 1 – 36 (40.0%) patients with stage 5 diabetic nephropathy with grade 1 CCI; Group 2 – 32 (35.5%) patients with stage 5 diabetic nephropathy with grade 2 CCI; Group 3 – 22 (24.4%) patients with stage 5 diabetic nephropathy with grade 3 CCI.

Research into biomarkers for diagnosing various brain lesions has been ongoing for over 20 years, but the ideal biomarker has not yet been found. Among biochemical markers, the determination of the level of neurospecific proteins is actively being studied. In patients with type 2 diabetes mellitus undergoing programmed hemodialysis, this issue is also relevant due to frequent cerebrovascular complications, but few such studies have been conducted.

CONCLUSION

Questionnaire for determining quality of life indicators – WHOQOL-BREFis the most sensitive and informative for determining the quality of life in patients with type 2 diabetes mellitus with CKD; 2) Serum levels of BDNF in groups of patients with type 2 diabetes mellitus significantly decrease compared to the control group as the degree of CCI increases.

2) Significant correlations were identified WHOQOL-BREF and laboratory and instrumental parameters. A correlation was found with the duration of the disease, fasting glycemia levels, glycated hemoglobin levels, BNDF in the blood, and blood flow velocity in the carotid and vertebral arteries.

INTRODUCTION

Diabetes mellitus (DM) is a global health problem due to its steadily increasing prevalence, reaching pandemic proportions, significant pharmacoeconomic costs for timely diagnosis and the search for effective treatment, high social losses, and mortality, including among the working-age population [1,2].

Brain damage is considered the most common and dangerous complication of diabetes mellitus, characterized by multiple clinical manifestations, which is due to the involvement of both central and peripheral structures, and starts in the earliest stages of type 2 diabetes mellitus (type 2 diabetes).

Chronic kidney disease (CKD) is an inevitable and natural outcome of most nephropathies, regardless of their nature, including type 2 diabetes [3,4]. At the same time, the spectrum of chronic kidney diseases has significantly expanded over the past decades, which is explained primarily by the general aging of the population and the increase in the incidence of arterial hypertension, diabetes mellitus, and atherosclerosis with an increase in vascular lesions of the kidneys. As a result, in recent years there has been a tendency towards a steady increase in the number of patients suffering from CKD [5, 6]. According to various data, CKD is detected in 100 to 600 people per 1 million adults worldwide and increases with age per 1 million people, in Russia – from 212 to 595 per 1 million people. [7, 8].

There is growing interest worldwide in the use of common tools for the early detection of cerebrovascular complications by assessing QOL in a wide range of diseases and conditions. Particular attention is being paid to simple and accessible research tools, including a questionnaire WHOQOL-BREF.[9, 10].

There are only a few publications in the literature devoted to the study of this issue in patients suffering from CKD and receiving hemodialysis. In addition, the contribution of cerebrovascular complications is unclear. CKD in the deterioration of quality-of-life indicators in this category of patients.

Brain-derived Neurotrophic Factor (BDNF) is one of the best-characterized members of the neurotrophin family, which has received much attention in recent years. It is considered one of the key mediators of neuronal survival and recovery, and a decrease in BDNF levels is a common mechanism underlying the development of various neurodegenerative diseases.

All of the above served as the reason for this study.

The aim of this research is to study the significance of quality of life indicators and brain-derived neurotrophic factor BNDF in patients with type 2 diabetes mellitus complicated by chronic kidney disease and receiving programmed hemodialysis.

MATERIAL AND METHODS

We examined and surveyed a total of 90 patients with type 2 diabetes mellitus and stage III CRF on program hemodialysis from January 1, 2019 to December 31, 2020. Of these, 43 were women and 47 were men. The average age of men was 67 ± 4.2 years, and the average age of women was 64 ± 5.6 years. The control group consisted of 20 patients of the corresponding age. The number of hemodialysis sessions in patients ranged from 2 to 162.

All 90 patients underwent all studies, including general clinical (complete blood count, complete urine analysis and according to Nechiporenko), biochemical (blood sugar, glycemic profile, HbA1C, urea, creatinine, blood electrolytes, lipid spectrum, coagulogram, etc.), hormonal blood tests (C-peptide, insulin) of the research laboratory

of the RSNPMC of Endocrinology of the Ministry of Health of the Republic of Uzbekistan ECG, ultrasound of internal organs, Dopplerography of the main arteries of the head, if necessary, patients were referred for additional examination – X-ray, ultrasound of internal and genital organs, consultation with a cardiologist, neurologist, nephrologist, ophthalmologist, surgeon, and other studies. We assessed the quality of life of patients before hemodialysis and in the dynamics of treatment using the WHO Short Form Quality of Life Questionnaire (WHOQOL-BREF) and the Hamilton Depression Scale.

Statistical calculations were performed in the Microsoft Windows software environment using the Microsoft Excel-2007 and Statistica version 6.0, 2003 software packages. The data obtained are reflected in the dissertation as M±m, where M is the average value of the variation series, and M is the standard error of the average value. The reliability of differences between independent samples was determined using the Mann-Whitney and Student methods.

According to the degree of chronic cerebral ischemia (CCI), patients were divided into 3 groups: Group 1 – 36 (40.0%) patients with stage 5 diabetic nephropathy with grade 1 CCI; Group 2 – 32 (35.5%) patients with stage 5 diabetic nephropathy with grade 2 CCI; Group 3 – 22 (24.4%) patients with stage 5 diabetic nephropathy with grade 3 CCI.

RESULTS AND DISCUSSION

Table 1 shows the distribution of examined patients by gender and age.

Table 1.

Distribution of patients by gender and age

Age, years	Number of men	Number of women
18-44 (young age)	11 (23.4%)	10 (23.3%)
45-59 (average age)	16 (34.0%)	11(25.6%)
60-74 (old age)	18 (38.3%)	20(46.5%)
75 and older (senior age)	2 (4.3%)	2 (4.6%)
Total: n = 90	47 (52.2%)	43(47.8%)

As can be seen from Table 1, patients in the age category from 60 to 74 years predominated among both men and women – 18/20 cases, respectively.

Table 2 provides a comparative analysis of the content of brain-derived neurotrophic growth factor (BNDF) in the serum of patients in the compared groups.

Table 2.

Comparative analysis of the content of brain-derived neurotrophic growth factor (BNDF) in the serum of patients in the compared groups

Indicator	Control group	1 group	2 group	3 group	p-value
BDNF, ng/ml	21.6±1.23	8.12±0.28	6.17±1.02	4.02±0.09	0,001

Note: *Normal BDNF levels are from 15 to 24 pg/ml*

As shown in Table 2, serum BDNF levels in groups of patients with type 2 diabetes mellitus significantly decreased compared to the control group as the degree of CCI increased.

Next, to assess the validity of the questionnaire WHOQOL-BREF The most significant clinical laboratory and functional indicators were selected: – duration of the disease, fasting glycemia levels, glycated hemoglobin level, blood flow velocity in the carotid artery, in the vertebral artery. The results of the correlation calculations are presented in Table 3.

Table 3.

Correlation relationship (R) of the values of the WHO short questionnaire WHOQOL-BREF with laboratory and instrumental indicators

Questionnaire	Glycemia On an empty stomach mmol/l	HbA1C %	BNDF in blood, ng/ml	Duration of illness, years	Blood flow velocity In the carotid artery	Blood flow velocity In the vertebral artery
WHOQOL-BREF	0.67	0.59	0.64	0.73	0.68	0.76

As can be seen from Table 3, significant correlations were identified. WHOQOL-BREF and laboratory and instrumental parameters. A correlation was found with the level of fasting glycemia, glycated hemoglobin, BNDF in the blood, duration of the disease, and blood flow velocity in the carotid artery, in the vertebral artery.

Thus, all the above data indicate the need to use quality of life assessment, determining levels BNDF in patients with type 2 diabetes and CKD to develop measures to prevent the development of stroke in patients on programmed hemodialysis.

CONCLUSIONS

1) Questionnaire for determining the quality of life indicators – WHOQOL-BREF is the most sensitive and informative for determining the quality of life in patients with type 2 diabetes mellitus with CKD.

2) Serum levels of BDNF in groups of patients with type 2 diabetes mellitus significantly decrease compared to the control group as the degree of CCI increases.

3) Significant correlations were identified WHOQOL-BREF and laboratory and instrumental parameters. A correlation was found with the duration of the disease, fasting glycemia levels, glycated hemoglobin levels, BNDF in the blood, and blood flow velocity in the carotid and vertebral arteries.

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