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STUDYING OF COMORBID PATHOLOGY AT THE 2 TYPES DIABETES AS THE COMPLICATION OF THE METABOLIC SYNDROME

Abstract

The objective was to define features of comorbidity in patients with type 2 diabetes, to estimate a possibility of use of comorbidity indices in the management of these patients.

Materials and methods. Patients with type 2 diabetes participated in the study. The retrospective analysis of medical records with calculation of comorbidity indices using CIRS, Kaplan-Feinstein and Charlson systems was made. Taking into account the received indices, prognostic indicators of mortality risk (%) within the next year and 10-year survival were defined. Correlation between laboratory metabolic syndrome parameters and values of comorbidity indices were defined.

Results. It was defined that in structure of comorbidity in studied patients cardiovascular, nervous and genitourinary disorders prevailed. Besides the specified systems, in women the proportion of endocrine pathology was high. With age, there is a tendency to the prevalence of comorbid pathology of these systems, as well as an increase in the average score of the comorbidity indices for all systems and deterioration in prognostic indicators are revealed. Statistically significant direct link between comorbidity indices and certain components of metabolic syndrome, and with the disease duration was also detected.

Key words: *type 2 diabetes, comorbidity, comorbidity indices, metabolic syndrome*

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CI — comorbidity index, MS — metabolic syndrome, DM — diabetes mellitus.

Introduction

The phenomenon of comorbidity is the simultaneous existence of two or more diseases in the patient that are linked by the mechanisms of pathogenesis occurring at the same time or are a complication of an underlying disease or its treatment. The problem of comorbid pathology prevalence among patients is becoming increasingly important. This is due to the fact that in conditions of comorbidity, many diseases acquire an atypical course, and the risk of complications increases; the problem of polypragmasia is aggravated, and the patients' adherence to treatment decreases. This ultimately leads to difficulties in the diagnosis and management of these patients. This problem is of particular importance in the primary health care sector due to the predominance of elderly patients. Geriatric patients usually have a particularly high level of comorbidity [1, 2].

Within comorbidity, type 2 diabetes mellitus (T2DM) is one of the most important non-infectious

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diseases due to the large variety of comorbid pathology in such patients, very high incidence, and steady increase in the number of patients [3]. According to forecasts by the International Diabetes Federation, the number of patients with diabetes mellitus will exceed 642 million people by 2040, while maintaining the current rate of increase in morbidity [4]. This is due to the increasing age of the population, increasing urbanization, increasing prevalence of inactivity, unhealthy diet and other risk factors. Thus, the prevalence of metabolic syndrome (MS) according to modern data is 2 times higher than the prevalence of DM, and in the next 25 years it is expected to increase its growth rate by 50% [5]. The presence of metabolic syndrome in patients leads to pronounced changes in metabolism, which subsequently may affect the development of type 2 diabetes, hypertension, atherosclerosis of blood vessels and other diseases [6]. All this determines the prerequisites for the emergence of a high level of comorbid pathology in these patients. The study of comorbidity structure in patients with type 2 diabetes is of great importance. Awareness of prevalence of certain system pathology and individual nosological forms in patients of different gender and age can contribute to the improvement of diagnosis and rational choice of therapy. The use of comorbidity index (CI) calculation systems in patients with type 2 diabetes mellitus makes it easier to assess the level of comorbidity among gender and age groups, to assess prognostic indicators of the risk of death and ten-year survival of patients and, if necessary, to change the treatment strategy [7, 8].

The aim was to study the features of comorbid pathology in patients with type 2 diabetes mellitus. The objectives of the study included the determination of comorbidity structure in patients with type 2 diabetes mellitus; calculation of comorbidity indices in patients with type 2 diabetes mellitus using CIRS, Kaplan-Feinstein, Charlson systems, and their comparison; identification of prognostic indicators of mortality in the next year, and the value of the 10-year survival in selected patients; detection of the individual components of the metabolic syndrome and the duration of the disease effect on the level of comorbidity in patients with type 2 diabetes mellitus.

Materials and methods

The study was conducted at the Federal State Budgetary Institution of Higher Education Voronezh State Medical University named after N.N. Burdenko, Department of Outpatient Treatment and General Practice; the 6th building of Budgetary Healthcare Institution of Voronezh Oblast Voronezh City Emergency Clinical Hospital No. 10. A retrospective analysis was performed with 70 medical records of outpatients with type 2 diabetes mellitus (mean age of 65.82 ± 9.24 years), including 38 women (mean age of 66.34±8.53 years) and 32 men (mean age of 65.24±9.3 years). Four groups were formed on the onset of old age (60 years) to study the gender and age aspects.

For the calculation of the comorbidity index CIRS, Kaplan-Feinstein, Charlson systems were used. Prognostic indicators of mortality risk during the year and 10-year survival were determined by the Charlson calculation system.

Statistical data processing was performed using Microsoft Excel 2010 and Statistica 20.0 software and using the Kruskal–Wallis H–test. The Kruskal–Wallis H–test is a generalization of the Mann–Whitney test in the case for more than two independent samples. The test does not require the hypothesis of a normal distribution. The null hypothesis H_0 means that only random differences exist between the samples. The alternative hypothesis H_1 means that the differences in the studied parameter that exist between the samples are not random. The differences were considered significant at $p \leq 0.05$. The evaluation of the close relationship between the signs was made using the Spearman's rank correlation coefficient: the coefficient <0.3 was considered to be an indicator of a very weak relationship; 0.3–0.5 — weak; 0.5–0.7 — medium and ≥0.7 — strong.

Results

At the first stage of the study, the overall comorbidity structure among the selected patients was determined (Figure 1).

It was found that in the overall structure of comorbidity pathology of the central and peripheral nervous system (95%) is in the first place, cardiovascular

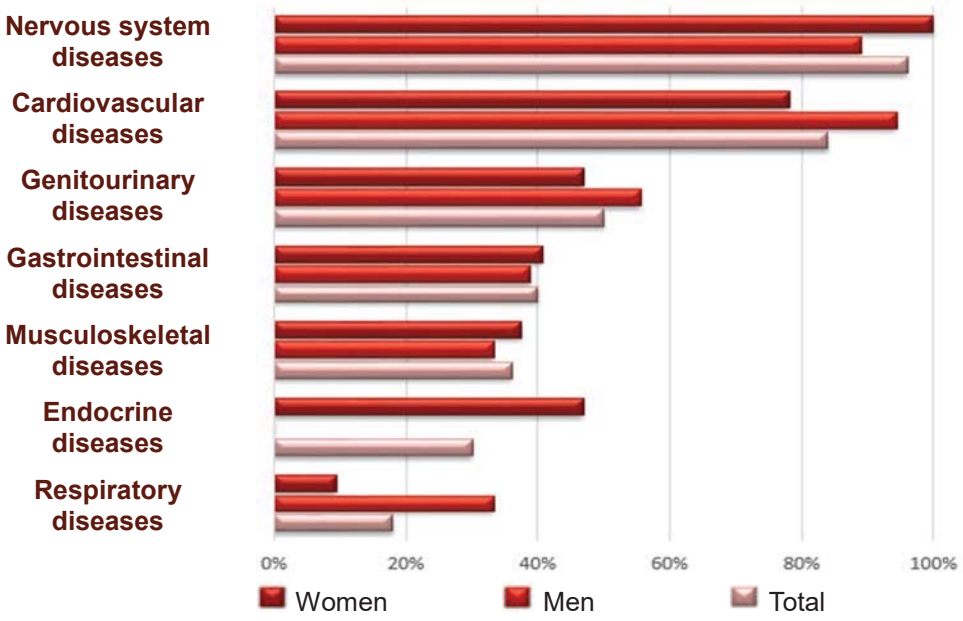

Figure 1. *Structure of comorbid pathology: gender-based and in total*

diseases (86%) — in the second, genitourinary diseases (54%) — in the third place.

In determining comorbidity structure depending on gender, the following data were obtained: In men, the most common pathology are cardiovascular diseases (97%), in the second place — pathology of the nervous system (88%), and in the third one — pathology of the genitourinary system (56%). In women, the pathology of the nervous system prevails (100%), diseases of the cardiovascular system are in second place (80%), and diseases of the genitourinary system and endocrine system are in third place (48%). A greater proportion of endocrine pathology in women may be associated with hormonal imbalance that occurs in the menopausal and postmenopausal period.

The structure of comorbidity in the studied age groups is shown in Figures 2, 3.

In the study of age groups, it was found that in the group of men at the age of 60 years (56-60 years) cardiovascular diseases (89%), pathology of nervous system (81%) and genitourinary diseases (45%) also prevail. In men aged over 60 (60–75 years), cardiovascular diseases (100%) and diseases of the nervous system (100%) come to the fore. In the age groups among women (57-60 years and 60–74 years) pathology of the nervous system (100% in both groups), cardiovascular diseases (63% and 85% respectively, in groups), urogenital and endocrine system pathology (50% and 46%) also prevail.

Among the pathology of the cardiovascular system in the studied patients the following nosological forms were identified: hypertensive heart disease (I11.0, I11.9) — in 95% of patients, ischemic heart disease (I20.8, I25.1) — in 57%, cardiac arrhythmias (I48.0, I48.1, I48.2) — in 21.4%, varicose veins of lower extremities (I83.9) — in 16.7%, which in men were with more severe course compared to women, with a history of myocardial infarction (I25.2) and cerebrovascular accident (I61.2, I63). Among the diseases of the nervous system, diabetic polyneuropathy (G63.2, in 89.6% of patients), cerebrovascular disease (I67.9, in 64.6%) and degenerative spine disease (M42.1, in 39.6%) occupy leading positions in men and women. The pathology of the genitourinary system in the studied patients includes: chronic pyelonephritis (N10) — in 40% of patients, chronic prostatitis (N41.1) and BPH (N40) — in 36% and 32%, respectively, urolithiasis (N20, N21) — in 20%, and chronic cystitis (N30.1) — in 12%. Comorbid pathology of the endocrine system was detected only in women, and it is represented by mastopathy (N60.1) — in 80% of the subjects, thyroid diseases (E04.1, E04.2, E06.3) — in 53.3%.

At the next stage in the selected patients, mean CI values using CIRS, Kaplan-Feinstein, Charlson systems were calculated and prognostic indicators of the death risk were determined in the next year and 10-year survival (Table 1, 2).

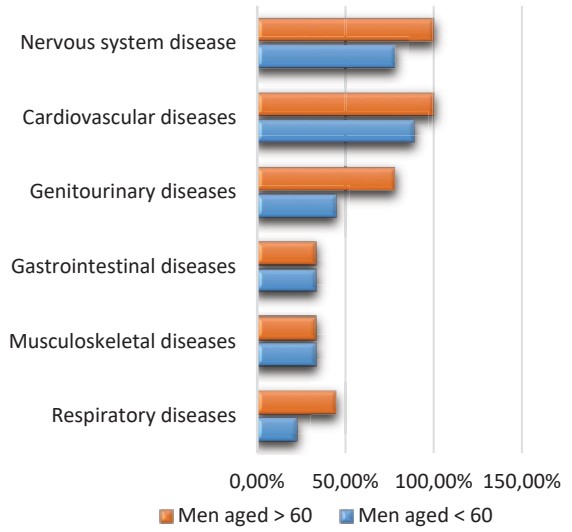

Figure 2. *Structure of comorbid pathology in age group, men*

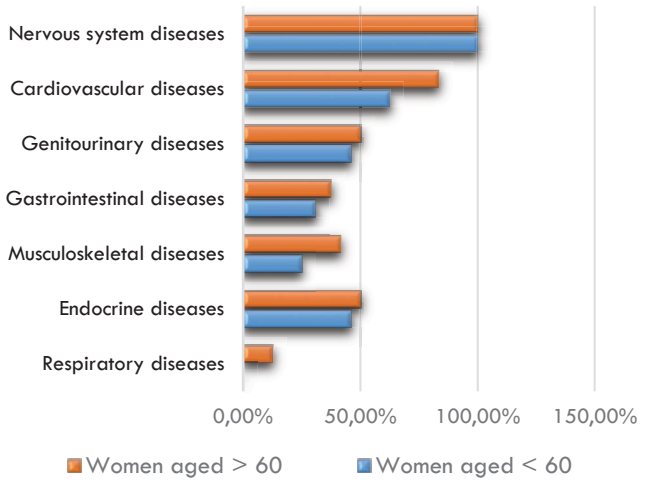

Figure 3. *Structure of comorbid pathology in age groups, women*

Table 1. *Mean comorbidity indices in subjects of different gender and age groups*

Index / Study group	CIRS, mean score	Kaplan-Feinstein, mean score	Charlson, mean score
All studied	13.14+3.54	9.77+2.67	6.54+2.32
Men	11+3.64	8.23+2.56	6.45+2.08
including:			
Men up to 60 years (inclusive)	8.48+2.54	7.56+2.54	4.6+1.75
Men older than 60 years	14.0+2.53	10.1+0.5	8.1+1.23
Women	12.6+3.21	10.5+3.2	6.7+2.45
including:			
women up to 60 years (inclusive)	9.2+1.34	7.5+1.3	4.5+1.2
Women older than 60 years	14.4+3.7	11.9+2.56	7.7+1.9

Table 2. *Prognostic indicators in subjects of different gender and age groups*

Group / Parameter	All studied	Men including:	Men up to 60 years (inclusive)	Men older than 60 years	Women including:	women up to 60 years (inclusive)	Women older than 60 years
Mortality risk:							
85%	76%	66.7%	33.3%	100%	81.25%	25%	100%
52%	24%	33.3%	66.7%	0%	18.75%	75%	0%
10-year survival:							
21% and below	76%	66.7%	33.3%	100%	81.25%	25%	100%
53%	18%	27.7%	55.6%	0%	12.5%	50%	0%
77%	6%	5.5%	11.1%	0%	6.25%	25%	0%

Table 3. *Frequency of metabolic syndrome components occurrence in studied patients*

MS component	Incidence, absolute	Incidence, relative
Carbohydrate metabolism disorder	70	100%
Lipid metabolism disorder	65	93%
Obesity	70	100%
Hypertension	68	97%

Table 4. *Mean values of metabolic syndrome components in patients*

Component of metabolic syndrome	Glucose at the time of the first visit	Glucose at the time of the last visit	Total cholesterol at the time of the last visit	Waist size at the time of the first visit	Body mass index at the time of the first visit	Systolic BP
Mean value	9.51+1.34 mmol/l	7.93+0.88 mmol/l	6.43+0.96 mmol/l	103.16+8.41 cm	34.04+4.89 kg/m²	165±5.28 mm Hg

It was found that the mean CI values across all systems tend to increase with age, both in men and women. The highest mean values of CI were observed in the group of women aged over 60 years. A large percentage (76%) of the studied patients have a very high risk of mortality during the year (85%) and low (21% and below) 10-year survival rate. In patients aged over 60 years, these prognostic parameters were observed in 100% of cases.

Further, the influence of individual components of the metabolic syndrome on comorbidity rate was analyzed.

Incidence and mean values of these components in patients are presented in Tables 3 and 4.

The following data were obtained during Spearman correlation analysis: significant strong positive correlation (r=0.83, p≤0.05) was found between blood glucose recorded at the time of the first visit and CI by Charlson. The same relationship was found between blood glucose at the time of the last visit and CI using CIRS system (r=0.74, p≤0.05) and using Kaplan-Feinstein and Charlson systems — a significant positive correlation of moderate strength (r=0.71 and r=0.68 respectively, p≤0.05). When studying the effect of total blood cholesterol at the time of the last visit on the comorbidity rate of patients, a significant strong positive relationship was revealed (r=0.82, r=0.75, r=0.70 respectively, by systems; p≤0.05). The analysis also established a strong significant positive relationship between the body mass indices determined during the first visit and mean CI values using Charlson system (r=0.78; p≤0.05). The same strong significant positive correlation was found between the waist size in the patient at the time of the first visit and mean CI values using Charlson system (r=0.74, p≤0.05). The data obtained allow us to conclude that the studied components of the metabolic syndrome directly affect the prevalence of comorbid pathology in patients with type 2 DM.

At the next stage the influence of the duration of type 2 diabetes on the comorbidity level was analyzed. Mean duration of the disease in the studied patients was 9.8+5.6 years. There was a significant strong positive relationship between the duration of the disease and CI using all systems (r=0.91, r=0.79, r=0.78 respectively, by systems; p≤0.05), a significant positive relationship of moderate strength between the duration of the disease and the risk of mortality within the next year (r=0.65; p≤0.05); a significant negative relationship of moderate strength between the duration of the disease and the 10-year survival of patients(r=-0.61; p≤, 05). The data obtained allow us to conclude that the duration of the disease directly affects the comorbidity rate and prognosis of patients with type 2 diabetes.

Conclusions

1. In the general structure of comorbidity in patients with type 2 diabetes mellitus, diseases of the central and peripheral nervous system, cardiovascular and genitourinary systems prevail; in the structure of comorbid pathology in men, pathology of the cardiovascular system prevails; in women, pathology of the nervous system prevails, and the proportion of endocrine pathology not detected in men is also high; with aging in men and women, the overall structure of comorbid pathology remains the same, and in men over 60 years, the pathology of the nervous system also comes to the fore.
2. With aging, patients with type 2 diabetes mellitus have an increase in the mean CI score determined by CIRS, Kaplan-Feinstein, Charlson systems and accordingly an increase in comorbidity rate.
3. In 76% of the studied patients there are unfavorable prognostic indicators of death risk within the next year and 10-year survival which were detected in 100% of cases in age groups older than 60 years.
4. Components of the metabolic syndrome have a direct impact on the rate of comorbid pathology in patients with type 2 diabetes.
5. With an increase in disease duration there is an increase in mean CI values using CIRS, Kaplan-Feinstein, Charlson systems; and the percentage of death risk increases and 10-year survival decreases.

Conflict of interests

The authors declare no conflict of interests.

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