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Comparison of the course of type 2 diabetes in village and town inhabitants in the Lublin region

Porównanie przebiegu cukrzycy typu 2 u mieszkańców wsi i miast regionu lubelskiego

INTRODUCTION

Diabetes type 2 is a chronic metabolic disorder with frequent latent onset, in the course of which chronic vascular complications such as micro- and macroangiopathy develop. The development of microangiopathy leads to disabilities and worse life quality of patients with diabetes. Even though cardiovascular disorders are not typical of diabetes, they occur more often in diabetic patients and frequently contribute to a higher mortality rate. It must be noted that at diagnosis a prominent number of patients chronic complications are mainly connected with the cardiovascular system. This type of diabetes comprises 85–95% of diabetes cases and its occurrence increases systematically and dramatically, which is an important and still unsolved problem of public health [10]. Diabetes type 2, recognized as a cardiovascular disorder, is one of the most frequent causes of death and disabilities of the present day [1]. A total of 5-7% of the world's population suffers from this disease and the number of the sick is rising more quickly than it was expected [6]. It is said that by 2030 the number of people suffering from diabetes will have risen up to 366 million in the world [18].

A lot of data show that the compensation level in most of the diabetes type 2 patients is still insufficient, which considerably contributes to the development of complications and leads to the rise in costs of its treatment. Many clinical trials have provided data which show that decreasing the risk of development and progress of cardiovascular complications of diabetes is possible. To reach this goal, however, multifactorial treatment must be employed not only with the intention to reach a good parameter of carbohydrate metabolism but also to effectively treat hypertension, lipid disorders and obesity [3].

So far there has been little research to compare the course of diabetes type 2 in town and village dwellers. Available literature shows that patients from the countryside are usually worse compensated than those living in towns [17,14].

The aim of the study was to compare the course of diabetes type 2 in village and town inhabitants in the Lublin region hospitalized in the Endocrinology Clinic for 3 years.

MATERIAL AND METHODS

The material of the analysis included 703 patients with diabetes type 2 who were hospitalized in the Endocrinology Clinic of Medical University of Lublin for three years, i.e. from November 2006 to October 2009. At first the patients were divided into two groups depending on their place of abode. Group I included town inhabitants and group II subjects from the countryside. Each patient from the region of over 10,000 inhabitants was admitted to group I, whilst patients living in the country (up to 1,999 inhabitants) and in the suburbs (from 2,000 to 9,999 inhabitants) were included into group II.

Type 2 diabetes was diagnosed in compliance with the WHO standards and the Polish Diabetes Association (PDA) with oral glucose tolerance test (OGTT) or with twice acquired fasting glucose level >126mg% or observed incidental glycemia >200mg% together with typical diabetes type 2 symptoms [13,20]. The date of the test was recognized as the date of diagnosis. If a patient was hospitalized a few times during the trial, only the first visit in the Clinic was taken into consideration.

The method used in the study was the retrospective and comparative evaluation of the results of examination of diabetic patients from town or village areas. Patients' primary data were analyzed in relation to the reason for hospitalization (diabetic cause or other). While analyzing patients' history, the age at which the disease appeared and the present age was assessed, thanks to which accurate disease duration was calculated in years. Next, anthropometric parameters were evaluated and BMI was calculated. Among biochemical parameters the following were assessed: fasting glucose level, metabolic compensation by glycated hemoglobin concentration (HbA1c) and lipidogram. Another step included the comparison of the incidence of microangiopathic complications (retinopathy, nephropathy, polyneuropathy) and macroangiopathic complications (ischemic heart disease, heart failure, hypertension, diabetic foot). Finally, the type of treatment of both the primary disease (oral treatment, insulinotherapy, mixed treatment) as well as the coexisting ones was checked.

Statistical analysis. The results underwent statistical analysis. The values of the analyzed parameters measured in the nominal scale are characterized by size and percentage, whilst quantitative variables are shown as mean values and standard deviations. Mean values of the examined parameters in both groups were compared with Student's t-test for independent variables. The non-parametric Mann-Whitney U test was employed to analyze the results with abnormal distribution compared in the two groups. The observed differences were recognized as statistically significant with $p<0.05$.

Statistical analysis was carried out with "Statistica 8" software.

RESULTS

A total of 703 patients with diabetes type 2 were examined with 499 village inhabitants aged 63.3±12.2 years and 204 town inhabitants aged 62.3 ±12.3 years. Clinical and biochemical

characteristics are shown in Table 1. Analyzing the patients' history we calculated the disease duration which was 11.2 years (±8.6) in town dwellers and did not differ from the country dwellers 10.4 years (±8.2). Next, anthropometric parameters were taken (weight, height) and BMI was assessed. Significant differences were found in BMI of town inhabitants as compared to the country ones: weight 83.6±16.2kg vs. 87.3±17.8kg, $p<0.05$, respectively; BMI 30.7±10.7kg/m^2 vs. 34.3±19.6kg/m^2, $p<0.05$, respectively. The analysis of the diabetes metabolic compensation started with fasting glucose level which differed between the groups considerably. Mean fasting glucose levels were notably higher in group I than in group II, i.e. 141.8±42.7mg/dL vs 134.2±26.0 mg/dL, $p<0.05$, respectively, which is shown in Table 1. However, glycemia <110mg/dL was reached by a comparable number of patients from town and village inhabitants, i.e. 19.4% and 19.6%, respectively. Another biochemical parameter that was analyzed was HbA1c concentration which was almost identical in both groups (Table 1), and the HbA1c percentage <7% was equally frequent in both groups i.e. 42.1% and 44.1%, respectively.

Table 1. Clinical and biochemical characteristics

Examined parameter	Whole group (N=703)		Town (N=499)		Village (N=204)		p
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	
Patient's age (years)	62.9	12.2	63.3	12.2	62.3	12.3	0.41
Age of diabetes (years)	11.0	8.5	11.3	8.6	10.4	8.5	0.35
Weight (kg)	84.7	16.7	83.6	16.2	87.3	17.8	<0.05
Height (m)	1.6	11.2	2.7	13.4	1.6	0.2	0.11
BMI (kg/m^2)	31.8	14.1	30.7	10.7	34.3	19.6	<0.05
$HbA_{1c\,(\%)}$	8.1	2.1	8.2	2.1	8.1	1.9	0.66
Fasting glucose level (mg/dL)	139.6	38.7	141.8	42.7	134.2	26.0	<0.05
Total cholesterol (mg/dL)	181.6	48.5	180.5	48.5	184.4	49.2	0.09
HDL(mg/dL)	48.3	18.7	48.2	19.4	48.8	17.1	0.35
LDL(mg/dL)	105.4	37.8	103.1	37.4	111.0	38.2	<0.05
Triglycerides (mg/dL)	165.0	115.9	165.5	117.1	163.9	113.4	0.75
Creatinine (mg/dL)	0.9	0.5	1.0	0.5	0.9	0.3	0.55
Systolic (mmHg)	133.2	15.1	132.7	14.6	134.3	16.1	0.08
Diastolic (mmHg)	82.6	8.6	82.4	8.9	83.2	7.9	0.26
Microalbuminuria (mg/24 hrs)	72.47	248.2	84.5	284.5	38.8	78.8	0.28

Parameters of lipid metabolism compensation were also analyzed, where total cholesterol and its fraction in plasma were assessed. Mean LDL cholesterol fraction concentrations were significantly lower in town inhabitants as compared to those living in the country, i.e. 103.1±37.4mg/dL vs. 111.0±38.2mg/dL, $p<0.05$, respectively, without any difference in other lipid fractions. Metabolic compensation criterion <175mg/dL was present in 52.7% of village dwellers and 12.2% in town ones, which is a significant value (Fig. 1). Table 2 shows the incidence of diabetes complications and the type of treatment of the examined patients. The frequency of microangiopathic complications

(retinopathy, nephropathy and diabetic polyneuropathy) was not significant. Retinopathy was diagnosed in 7.3% of patients in group I and 5.6% of patients in group II. Diabetic polyneuropathy was present with comparable frequency in both group I and II, 9.7% and 7.5%, respectively.

Table 2. Complications of diabetes and types of treatment in both groups

Examined parameter	Town (N=499)		Village (N=204)		p
	Yes	No	Yes	No	
Reason for hospitalization - diabetes	85.3%	14.7%	78.8%	21.2%	p<0.05
Hypertension	82.8%	17.2%	86.4%	13.6%	NS
Dyslipidemia	66.5%	33.5%	67.7%	32.2%	NS
Obesity	54.7%	45.3%	72.0%	28.0%	p<0.001
Ischemic heart disease	26.2%	73.8%	29.3%	70.7%	NS
Retinopathy	7.3%	92.7%	5.6%	94.4%	NS
Polyneuropathy	9.7%	90.3%	7.5%	92.5%	NS
Diabetic foot	4.4%	95.6%	4.0%	96.0%	NS
Insulinotherapy	61.5%	38.5%	53.3%	46.7%	p<0.05
Intensive insulinotherapy	20.5%	79.5%	17.6%	82.4%	NS
Conventional insulinotherapy	35.8%	64.2%	33.7%	66.3%	NS
NPH insulin at night	5.9%	94.1%	3.0%	97.0%	NS
Metphormin	50.3%	49.7%	56.8%	43.2%	NS
Sulphonylurea	24.8%	75.2%	28.1%	71.9%	NS
Acarbose	7.3%	92.7%	5.5%	94.5%	NS
Converting inhibitors	66.4%	33.6%	66.3%	33.7%	NS
Beta blokers	44.9%	55.1%	44.3%	55.7%	NS
Statins	53.9%	46.1%	56.8%	43.2%	NS
ASA	50.2%	49.8%	57.8%	42.2%	NS

Hypertension was among the most frequently reported macroangiopathic complications in both groups; taking into consideration higher values of systolic pressure (<130mmHg) – the percentage of patients in group I (51.5%, mean 132.75mmHg ± 14.6) as compared to group II (134.29mmHg ± 16.1) was not significant. Analyzing diastolic pressure (>80mmHg); no significant differences were noted between the two groups (town 44.3%, mean 82.4mmHg ± 8.9, village 49.1%, mean 83.2mmHg ± 7.9).

The next step concerned the type of treatment, pointing towards insulinotherapy, 61.5% and 53.3% group I and group II, respectively. No significant difference was noted as regards the oral pharmacological treatment. Over 50% of patients in both groups were treated with metphormin, a small number with sulphonylurea, and the fewest number of patients with acarbose.

Pharmacotherapy of coexisting diseases was also evaluated, i.e., hypertension and dyslipidemia. The fact worth noticing is the frequency of using antihypertensives from group of angiotensin-converting enzyme inhibitors as compared to beta blockers or calcium channel inhibitors which was similar in both groups. Hypoglycemic type of treatment was used in a similar number of patients in both groups.

As for taking acetylsalicylic acid derivatives (ASA), generally a low percentage of patients with type 2 diabetes in our study group (52.4%) was treated with this medicine as a preventive measure against cardiovascular diseases. The respective percentage of patients taking ASA in group I was 57.8% and group II 50.2%. In both groups, the primary cause of hospitalization in the Endocrinology Clinic was insufficient metabolic compensation, which was present in 85.3% of patients in group I and 78.8% in group II; however, subjects from the latter group were hospitalized more often because of other causes, 21.2% vs. 14.7%, $p<0.05$.

DISCUSSION

In current literature on diabetology the fact worth noting is that there has been little research about the degree of metabolic compensation in diabetic patients living outside cities, i.e. in towns and in the country. Szurkowska et al. in their analysis show that compensation of diabetes in village inhabitants was worse than in their town equivalents [17]. Malec et al. reached similar conclusions, indicating that patients with type 2 diabetes living in the country had insufficient metabolic compensation which seemed worse than of patients living in towns. The possible reason behind it may be the higher level of obesity and overweight of village dwellers together with worse access to specialized medical care [8]. Undoubtedly, this aspect should be investigated further with cross-sectional research of both populations.

In both examined groups of patients with diabetes type 2, the parameters of carbohydrate metabolism were insufficient according to the PDA guidelines regardless to the place of abode [20]. Fasting glucose level was significantly higher in town subjects as compared to the village ones, however, there was no differentiation in HbA1c values. Target fasting glucose <110mg/dL was reached by a small, but similar in both groups, percentage of subjects, i.e. 19.4% in towns and 19.6% in villages, which seems to result from patients inconsistency in following diabetic recommendations. Another evaluated biochemical parameter was the HbA1c concentration which was a lot above the recommendations of the PDA, whilst its mean value was almost identical in both groups i.e. group I – 8.1% and group II – 8.2%, which indicates that mean glycemia was >154mg% (8.6 mol/L) [20,11]. This parameter was higher than the mean value of the Polish national study "DINAMIC 2": in 2488 patients it was 7.37% [16]. Unfortunately, it was also a lot higher than the mean of the Lublin Province which was 7.27% shown in this study [4]. The most probable explanation for this is the fact that the patients examined in our study were not randomized but they were hospitalized because of the lack of metabolic compensation. However, the percentage of patients that reached the HbA1c threshold <7% was distributed equally in both groups of our study, 42.1%; and 44.1% respectively as well as in the "DINAMIC 2" study. As compared to the results of another national study evaluating the degree of carbohydrate metabolism called "PolDiab", our findings were the same. Mean HbA1c in this study was 8.07%, but the percentage of patients which reached HbA1c <7% was twice as low (23.3%) as the percentage found in our study [15].

Body weight control in patients with diabetes type 2 is one of the criteria of the compensation of the disease according to the PDA and the ADA [7,20]. Unfortunately, most of our patients did not meet this criterion since obesity was present in 54.7% of subjects in group I and in as many as

72.0% in group II. However, this fact did not explicitly affect the remaining parameters of metabolic compensation, which is consistent with our previous study [9]. However, among more obese village population the compensation criterion for total cholesterol <175mg/dL was reached only by 12.2% of diabetic patients as compared to 52.7% of town population. Undoubtedly, it is connected with a different lifestyle of those patients who live on a high-calorie diet and undertake hard physical work. It should be noted that obesity and dyslipidemia are independent cardiovascular risk factors, therefore, a corrective therapy (reduction of body weight and lipid disorders) should be an integral part of the multifactorial treatment of diabetes [12].

With no regard to the place of abode, the primary treatment in our study was insulinotherapy which was used in >50% of the patients with preferential treatment of conventional insulinotherapy. Taking into consideration disease duration, which for the whole studied population was 11 years, it was probably the result of acquired drug resistance to oral medications for glycemic control. According to the PDA; insulinotherapy should be provided when the HbA1c percentage exceeds 7% while using the maximum dosage of oral drugs (if removable causes of hiperglycemia have been excluded and there are no recommendations for an earlier use of insulin) [20]. Insulinotherapy as treatment for diabetes type 2 should not be provided too early because of the potential weight gain and a possibility of iatrogenic metabolic syndrome, and probably an increased risk of colorectal cancer; however, it should not be provided too late either as glucotoxicity, adverse effects of proinsulin and chronic hyperglycemia lead to vascular complications [2,5].

CONCLUSIONS

In the population of patients with type 2 diabetes in the Lublin region, the place of abode does not affect the course of diabetes type 2, though BMI was significantly higher in village than in town inhabitants. Despite higher fasting glucose levels in patients from towns, no significant HbA1c values were noted as compared to those of the country dwellers. Both groups did not meet the metabolic compensation criteria of the PDA to a similar extent and required absolute intensification treatment.

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SUMMARY

Diabetes type 2, a chronic metabolic disorder and frequent lifestyle disease is, according to WHO, the biggest unsolved problem of public health. The aim of the study was to compare the course of diabetes type 2 in village and town inhabitants in the Lublin region hospitalized in the Endocrinology Clinic for 3 years. The analysis was based on retrospective evaluation of medical history of 703

patients with diabetes type 2 hospitalized in the Endocrinology Clinic November 2006–October 2009, including 204 country dwellers (29%) and 499 town dwellers (71%) with mean disease duration 11±8.5 years. The following parameters were analyzed: reasons of hospitalization, disease duration, anthropometric features, metabolic compensation criteria, presence of chronic complications and types of hypoglycemic treatment. In both groups, the main reason of hospitalization was the lack of metabolic compensation. Mean fasting glucose levels were considerably higher in patients from towns than those of from villages, though, this fact was not significantly reflected in HbA1c values. No significant difference between the groups was found with regard to the patients' age, disease duration, total cholesterol, HDL cholesterol, triglycerides, creatinine, microalbuminuria, blood pressure or the presence and types of chronic vascular complications. Mean BMI was considerably higher for inhabitants of the country than in the town, respectively: 34.3±19.6 vs. 30.7±10.7, $p<0.001$. The tested groups did not meet the metabolic compensation criteria of the PDA to a similar extent. Both groups were treated mainly with insulinotherapy. In the population of patients with type 2 diabetes in the Lublin region, the place of abode does not affect the course of diabetes type 2, though BMI was higher in village than in town inhabitants. Despite higher fasting glucose levels in patients from towns, no significant HbA1c values were noted as compared to those of the country dwellers.

Keywords: diabetes type 2, villages, town, metabolic compensation, obesity

STRESZCZENIE

Cukrzyca typu 2, przewlekła choroba metaboliczna i jedna z głównych chorób cywilizacyjnych, stanowi obecnie wg WHO największy nierozwiązany problem zdrowia publicznego. Celem pracy było porównanie przebiegu cukrzycy typu 2 u mieszkańców wsi i miast regionu lubelskiego, hospitalizowanych w Klinice Endokrynologii w okresie 3-letnim. Analizę przeprowadzono w oparciu o retrospektywną ocenę dokumentacji medycznej 703 chorych z cukrzycą t. 2 hospitalizowanych w Klinice Endokrynologii od listopada 2006 r. do października 2009 r., w tym 204 chorych (29%) zamieszkujących obszary wiejskie i 499 pacjentów (71%) z miasta, o średnim czasie trwania choroby 11±8,5 roku. Analizie poddano następujące parametry: przyczyny hospitalizacji, czas trwania cukrzycy, cechy antropometryczne, kryteria wyrównania metabolicznego, obecność przewlekłych powikłań choroby, rodzaj leczenia hipoglikemizującego. Zarówno wśród mieszkańców miast, jak i wsi głównym powodem hospitalizacji był brak wyrównania metabolicznego choroby. Średnie wartości glikemii na czczo były istotnie wyższe u pacjentów w populacji miejskiej w porównaniu z populacją wiejską, chociaż nie odzwierciedlało się to istotnie w wartości HbA1c.Nie obserwowano istotnych różnic w zakresie wieku chorych, czasu trwania choroby, cholesterolu całkowitego, frakcji HDL, triglicerydów, kreatyniny, mikroalbuminurii, wartości ciśnienia tętniczego, jak również obecności i rodzaju przewlekłych powikłań naczyniowych w zależności od miejsca zamieszkania. Średnie wartości BMI były istotnie wyższe u pacjentów z rejonów wiejskich w porównaniu z mieszkańcami miast, odpowiednio: 34,3±19,6 vs 30,7±10,7, $p<0,001$. Badane grupy pacjentów nie spełniały kryteriów wyrównania metabolicznego PTD w porównywalnym stopniu. W obydwu grupach pacjentów dominującym sposobem leczenia była insulinoterapia. W populacji pacjentów z cukrzycą typu 2 regionu lubelskiego miejsce zamieszkania nie wpływało na przebieg cukrzycy

typu 2, chociaż wartości BMI były istotnie wyższe u pacjentów z rejonów wiejskich niż u pacjentów z miasta. Pomimo istotnie wyższej glikemii na czczo u pacjentów z rejonów miejskich nie obserwowano istotnego zwiększenia wartości HbA1c w porównaniu z pacjentami ze wsi. Badane grupy pacjentów nie spełniały kryteriów wyrównania metabolicznego PTD w porównywalnym stopniu.

Słowa kluczowe: cukrzyca typu 2, tereny wiejskie, miasto, wyrównanie metaboliczne, otyłość