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Evaluation of metabolic control and chronic complications in a cohort of patients admitted to Braila County Emergency Hospital

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ABSTRACT

In Romanian specialized literature, there is no national/regional registry that highlights the number of people with diabetes as well as the micro and macrovascular complications that affect the quality of life and lead to high economic costs. In this sense, the purpose of this study was to create a database to highlight essential variables according to demographic aspects, anthropometric indicators, glycosylated hemoglobin, chronic complications secondary to diabetes in order to define a profile of the diabetic patient and in the implementation of a early management algorithm in the Braila County Emergency Hospital.

Keywords: diabetes, management, microvascular complications, algorithm

INTRODUCTION

The research approach, which was the basis of this work, started from the hypothesis that a better knowledge of the individual characteristics of people with prediabetes, as well as those with diabetes, will determine the formulation of effective strategic and action guidelines.

Type 2 diabetes consists in a complex interaction between genetics and life style. There are strong evidences that type 2 diabetes has a bigger hereditary character than type 1 diabetes, most of the patients with type 2 diabetes have at least one parent with the same condition [1].

MODY diabetes is another form of non-insulin dependent diabetes, commonly in young patients, under the age of 25, that has no antibodies involved in its onset [2,3].

In this paper we evaluated patients with type 1, type 2, MODY and other forms of diabetes.

AIMS AND GOAL

The purpose of our research consisted in developing a data base that includes the main characteristics of inpatients, their metabolic control evaluation and chronic complications at the first day of hospitalization in the department of diabetes, nutrition and metabolic disorders of Braila County Emergency Hospital in 2017-2019.

OBJECTIVES

The development of prognostic elements, assessment, but also monitoring of patients diagnosed with diabetes, to facilitate the establishment and application of an optimal treatment and of course to improve the quality of life of the patient and decrease the incidence of acute and chronic complications of diabetes.

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Evaluation and definition of a profile of cases of adult patients diagnosed with diabetes based on the average values detected among the monitored variables: average age, environment of origin, sex, metabolic control and chronic complications at the time of admission.

Cross-sectional description of a group of patients diagnosed with type 2 diabetes and type 1 diabetes, patients who showed signs of impairment not only from a clinical point of view, but also from a metabolic point of view, accentuated by the presence of complications.

The chronical complications incidence assesment in the first day of hospitalization.

Evaluation of specific metabolic parameters such as HbA1c, level of glycaemia.

MATERIAL AND METHODS

The present study is an analytical, observational one, carried out on a group composed of a total number of 2587 patients divided as: Group A: consisting of a number of 2493 adult patients aged between a minimum of 18 years and a maximum of 97 years, with a standard deviation of +/- 12.67 years.

All these patients were monitored over a period of three years, January 2017 – December 2019, being subdivided as follows:

371 patients newly diagnosed with diabetes, hospitalized in Braila Emergency County Hospital, representing subgroup I;

2,122 patients with a previously confirmed diagnosis and hospitalized for more than 24 hours in the Diabetes, Nutrition and Metabolic Diseases Department of the Braila County Emergency Hospital between January 2017 and December 2019.

Inclusion criteria:

- Adult, young and elderly patients who have been diagnosed with type 1 and type 2 diabetes;
- Patients who agreed to participate in the study, by signing an informed consent.

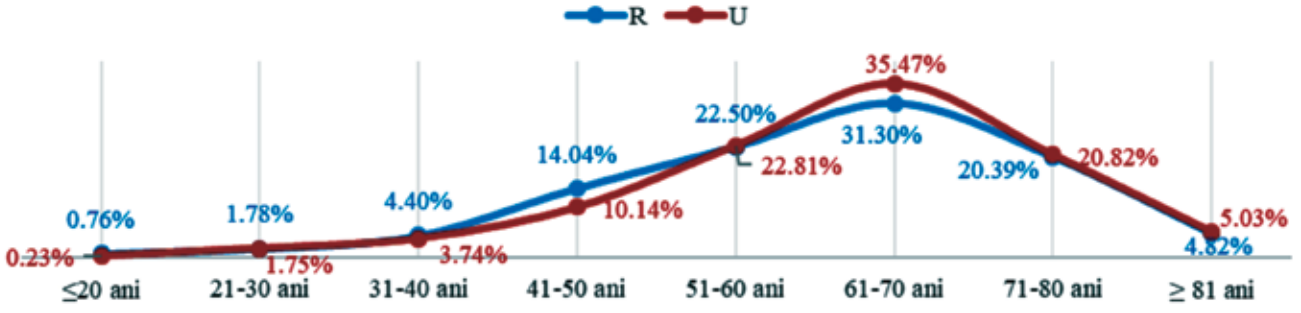

FIGURE 1. Percentage distribution of patients by age groups and places of residence

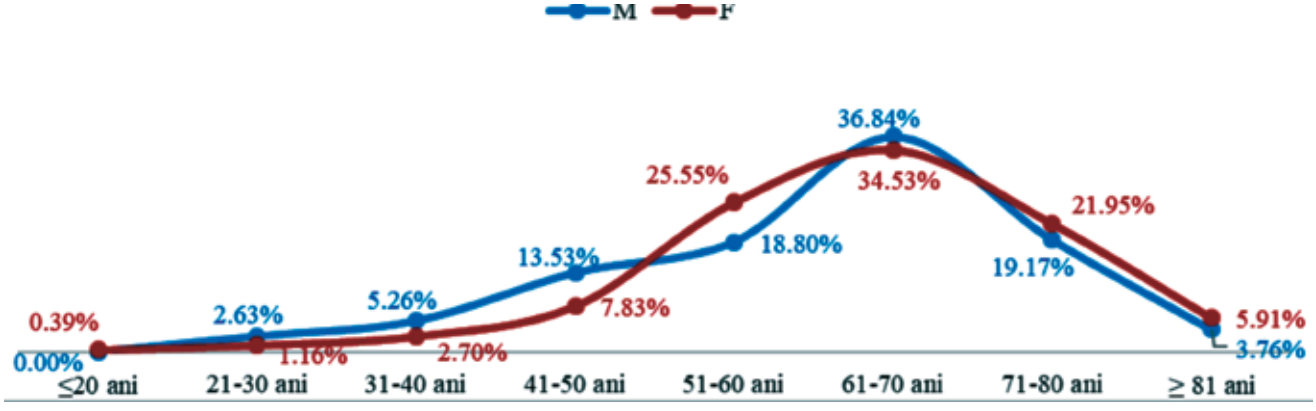

FIGURE 1A. Percentage distribution of patients by age groups, sexes and places of residence

FIGURE 1B. Percentage distribution of patients by age groups, sexes and places of residence

Exclusion criteria:

- Patients who did not want to sign the informed consent to be included in the study;
- Patients in whose case the diagnosis of diabetes mellitus was disaffirmed;
- Patients residing outside Braila county.

RESULTS

Discriminating the patients according to the place of residence, it was observed that both in the group of those coming from the rural and urban environment, the highest proportion is female patients (61.42% and 59.42%, respectively) and that in both categories the highest number of cases was registered in the 61-70 age group (Figure 1).

Correlating the variables related to age, sex and place of residence, a percentage distribution that deviates from the general norm is highlighted in the case of male patients from rural areas, where the highest proportion of cases was registered in the 51-60 age group years (Figures 1a and 1b).

Analyzing the entire study group, the highest proportion of BMI of 29.52% was observed in male patients in the age groups 51-60 years, respectively, 61-70 years, where as in females, the highest weight of BMI was for the age groups 41-50 years and 51-60 years, being represented by a value of 31.73%. Females presented first degree obesity (Table 1).

TABLE 1. Mean values of the body mass index according to the age and sex of the patients

Age	Study lot	Male patients	Female patients
< 20 ani	23.46±3.83	21.14±0.54	25.12±5.62
21-30 ani	24.02±3.08	24.22±2.62	23.79±3.64
31-40 ani	26.76±4.89	26.90±4.49	26.52±5.57
41-50 ani	29.12±5.24	27.58±4.89	31.02±5.16
51-60 ani	30.83±4.85	29.52±4.33	31.73±5.00
61-70 ani	29.85±4.14	29.39±4.02	30.11±4.16
71-80 ani	28.42±3.84	27.46±3.51	28.85±3.89
≥ 81 ani	27.05±3.57	28.18±3.54	26.61±3.53

As it is seen in Figure 2, in our lot of patients the majority had values of HbA1c >7%, 15.76% had a value between 7.01 and 8%, 15.52% had values between 8.01 and 9%, 15.52% had values between 9.01 and 10%. Only 9.03% of the patients had a value under 6.5% of HbA1c and 7.26% had a good metabolic control shown by a value between 6.5 and 7.01%.

The same lack of metabolic control is reflected in Table 2, where it is shown that mean value of HbA1c for the entire lot of patients is 9.73%±1.97 % for type 1 diabetes and 9.35±1.93 % for type 2 diabetes; both this value are outside the targets that we usually recommend to our patients. Furthermore we can see a difference also in the values upon gender, the values for males are lower (9.50±1.43 %) than the ones for females (9.87±1.72 %) in type 1 diabetes, but are similar in type 2 diabetes, males had 9.35±1.93 % and females had 9.35±1.96%.

Type 1 diabetes and type 2 diabetes can be associated with microangiopathic and macroangiopathic complications, as shown in Figure 3.

Large clinical trials have demonstrated that optimal metabolic control in patients with type 1 diabetes reduces the occurrence of microvascular complications and control of risk factors (dyslipidemia and hypertension) reduces the risk of macrovascular complications and cardiovascular mortality. Macrovascular events are 10 times more frequent than microvascular complications in patients with changes in carbohydrate metabolism, before the emerge of type 2 diabetes [4].

In our study, the predominant microangiopathic complication in the entire group (patients with type 1 diabetes and type 2 diabetes) was represented by distal symmetric sensitive diabetic polyneuropathy in a percentage of 84%, with small differences between patients with type 1 DM 91.3% and those with DZ type 2.83%.

A statistically significant correlation is observed in the case of nephropathy and chronic kidney disease in patients with type 1 diabetes compared to patients with type 2 diabetes.

In patients with type 1 diabetes, nephropathy was found in 22.54%, while in those with type 2 diabetes it was found in 8.8%. Chronic kidney disease was present in 14.34% of patients with type 1 diabetes and in 13.83% of those with type 2 diabetes.

Regarding heart failure, a major difference can be noticed between patients with type 1 diabetes and type 2 diabetes. Patients with type 2 diabetes were diagnosed with heart failure in a percentage of 16.99% compared to a percentage of 3.28% in those with type 1 diabetes.

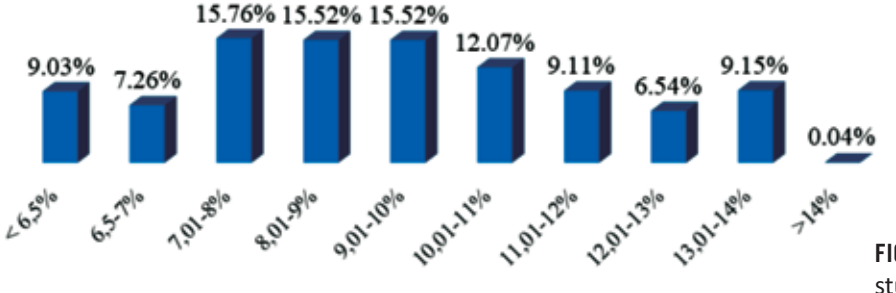

FIGURE 2. Distribution of patients in the study group according to HbA1c value

TABLE 2. Distribution of HBA1c in patients with type 1 DM and type 2 DM according to age groups and duration of diabetes

	DM type 1		DM type 2	
	Mean value HbA1c (%)	Mean value Hb (g/dL)	Mean value HbA1c (%)	Mean value Hb (g/dL)
Entire study lot	9.73±1.97	13.44±1.42	9.35±1.93	13.39±1.36
Male patients	9.50±1.43	13.71±1.35	9.35±1.88	13.75±1.44
„Age				
≤ 20 years	9.24±1.16	14.95±0.50	14.00*	17.20*
21-30 years	10.18±1.73	14.42±0.85	10.24±2.03	12.70±0.93
31-40 years	10.34±1.26	13.49±1.71	9.22±1.38	14.37±1.38
41-50 years	10.22±1.39	13.77±1.21	10.03±1.60	14.31±1.18
51-60 years	9.01±1.35	13.67±1.20	9.40±1.73	13.91±1.41
61-70 years	9.48±0.88	12.63±1.28	9.19±1.84	13.87±1.40
71-80 years	10.35±0.49	13.60±1.90	9.18±3.13	13.03±1.60
≥ 81 years	9.80*	11.50*	8.85±2.44	12.86±1.34
Correlations	r = 0.06	r = -0.85	r = -0.73	r = -0.62
Period of DM				
≤ 9 years	10.16±1.49	13.82±1.19	9.53±1.98	13.97±1.34
10-19 years	10.00±1.20	13.65±1.48	9.01±1.73	13.39±1.54
≥ 20 years	9.64±1.41	13.66±1.30	8.90±1.29	13.43±1.61
Neprecizată	-	-	11.39±1.48	14.14±1.68
Correlations	r = -0.98	r = -0.84	r = -0.96	r = -0.83
Female patients	9.87±1.72	12.94±1.44	9.35±1.96	13.17±1.28
Age of patients				
≤ 20 years	10.96±2.24	12.75±1.93	13.39*	12.10*
21-30 years	11.27±1.79	13.25±1.14	9.65±2.90	13.32±0.66
31-40 years	9.29±1.00	12.49±1.29	9.85±1.90	14.05±0.97
41-50 years	9.25±1.91	13.13±1.31	9.69±1.98	13.69±1.15
51-60 years	10.22±1.72	13.16±1.81	9.68±1.88	13.26±1.21
61-70 years	8.95±0.90	13.63±1.29	9.37±1.96	13.18±1.27
71-80 years	8,48±0.28	12.50±1.50	9.01±1.89	12.97±1.32
≥ 81 years	7.80*	12.10*	8.90±2.12	12.80±1.37
Correlations	r = -0.88	r = -0.28	r = -0.73	r = 0
Period of DM				
≤ 9 years	10.40±2.00	13.65±1.41	9.52±2.14	13.38±1.24
10-19 years	9.94±1.55	12.76±1.38	9.27±1.74	12.92±1.27
≥ 20 years	8.62±1.00	11.82±0.88	8.68±1.40	12.78±1.37
Neprecizată	-	-	10.09±1.40	13.84±1.05
Correlations	r = -0.94	r = -0.99	r = -0.98	r = -0.96

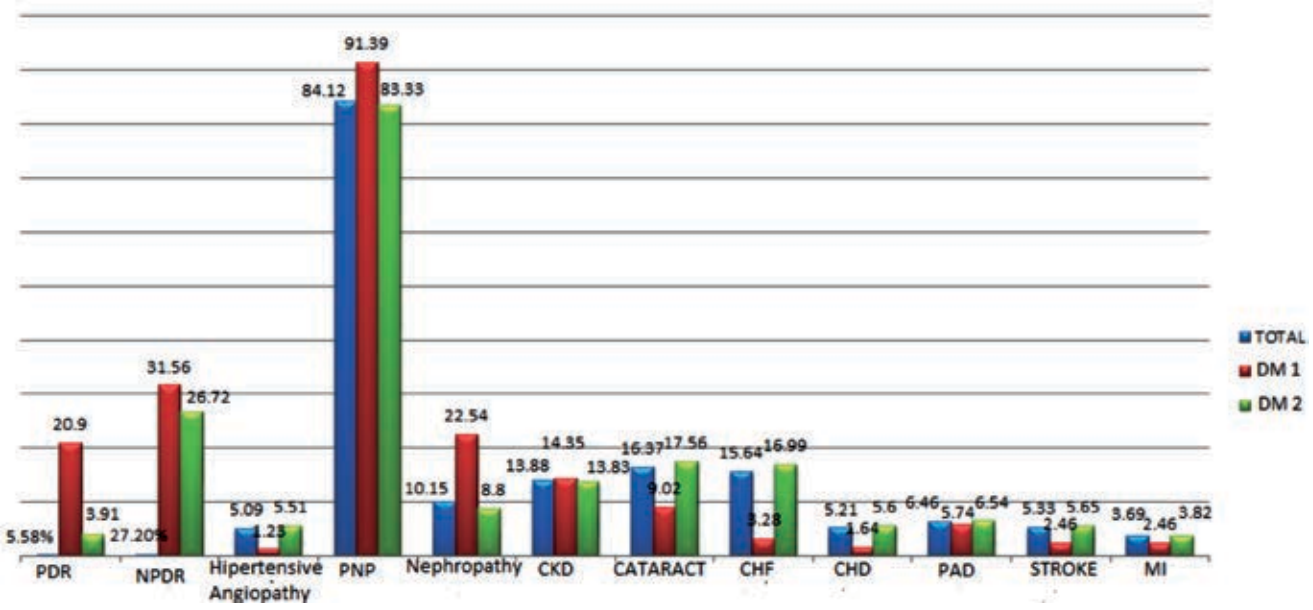

FIGURE 3. Evaluation of chronic complications in patients with type 1 and type 2 diabetes during hospitalization

ABREVIATIONS: PDR-proliferative diabetic retinopathy; NDPR-non proliferative diabetic retinopathy; PNP-peripheral neuropathy; CKD-chronic kidney disease; CHF-congestive heart failure; CHD-coronary heart disease; PAD-peripheral artery disease; MI-myocardial infarction

The highest rate of heart failure was found in patients with type 2 diabetes with a duration of the evolution of the disease in the range of 10-19 years, with a percentage of 18.84%. Also there is an increased prevalence in our study of patients with peripheral arterial disease, stroke, myocardial infarction, also in accordance with the increase in the duration of diabetes, these being included in the class of high cardiovascular risk and mortality from cardiovascular causes.

DISCUSSIONS

Tomasso et al. study revelead that 27.9% of diabetic patients with poor metabolic control, with an HbA1c higher than 6.5%, showed signs of diabetic retinopathy. In the mentioned study, the duration of diabetes was correlated with an increased prevalence of diabetic retinopathy, 40% had retinopathy correlated with the increased evolution of diabetes [5], whereas in our research, within the studied patients, a positive correlation was found between the increased value of glycated hemoglobin with the presence of diabetic retinopathy, and for proliferative diabetic retinopathy, the positive correlation reached a glycated hemoglobin of 9.53%+-1.69, while for non-proliferative retinopathy reached a value of HbA1c9.48%+-1.67.

Regarding the increased prevalence of retinopathy correlated with the long duration of diabetes, similar results were obtained as in Tomasso's study, the results being in agreement.

Analyzing the results of our study related to the renal profile of the patients in comparison with other studies in the specialized literature, we can state that our results show a high proportion of diabetic kidney disease. In the study by Gheith and colleagues it was described that over 40% of diabetic patients develop the disease chronic kidney disease.

In our study, we had 26.4% of patients with CKD stage IIIa, CKD stage IIIb 26.7%, CKD stage IV and 1.3% CKD stage V, in total 62.2% of patients had kidney damage. This indicates that this group of patients is representative of the general population, because they presented an increased weight of more than 60% of renal damage that requires early intervention in metabolic therapy and in the reduction of risk factors for renal progression [6].

In a study conducted by Bramante et al., which aimed to treat obesity in patients with diabetes, a percentage of over 90% of patients with a BMI over 25kg/m^2 was described [7]. The proportion of overweight and obese patients in group A, was 79.38% with an average BMI of 29.23% and also a tendency to obesity was observed in women aged 51-60.

We could say that one of the causes of this increased weight of obesity could be the presence of insulin resistance, a proven role in the pathophysiology of obesity-induced diabetes [8].

Comparing the results with those of the study led by Bramante et al., we can say that the weight of obesity was lower in the group analyzed from the Braila County Emergency Hospital. The patients in the hospital had chronic metabolic imbalance characterized by a hypercatabolic state produced by chronic hyperglycemia, and weight loss being its consequence.

Another clinical evidence stated by Stone is the correlation between glycated hemoglobin values and low BMI [9].

Among the patients with metabolic pathology in Braila county, a right-shifted distribution of the body mass index values was observed, the average value of the body mass index being 29.23 kg/m^2. Among the patients hospitalized for metabolic pathology, only 20.62% were normal or underweight, 79.38% were overweight or obese.

The share of overweight and obesity in patients with diabetes from Braila County was significantly higher from a clinical point of view compared to the prevalence of overweight and obesity in the general population, thus demonstrating that among these patients, overweight and obesity are a main pathogenic resource of metabolic imbalances.

Female patients consistently had a higher body mass index than matched cohorts of male patients. From the point of view of age, a symmetrical distribution of the body mass index was observed, reaching a peak value within the age group of 51-60 years, with a symmetrical decrease in the value towards the extremes of age.

The HbA1c value had a Gaussian distribution, with a frequency maximum near the 9%-10% interval and with an average of 9.4% in conditions of a median of 9.15%, values that argue for the causality between metabolic imbalance and hospitalization, 83.71 % of patients with glycemic control considered inadequate in terms of an HbA1c value over 7%.

Regarding the distribution of HbA1c values, an important discrepancy was noticed between the sexes: male patients had a Gaussian-type distribution of values, while among female patients a bimodal distribution was observed, the two modes being positioned at the extremes, towards the ends of the range.

In all patients with type 1 DM, the tendency to improve glycemic control was observed as the duration of the evolution of type 1 DM increased, an aspect that can be explained by the incremental learning of management skills of type 1 DM throughout life.

Among patients with type 2 DM, both male and female, an improvement in glycemic control was observed as the age group progressed.

At the same time, a surprising tendency to improve the quality of glycemic control was noted as the duration of type 2 DM evolution increased.

CONCLUSIONS

The management algorithm proposed for the patient with diabetes following this study includes:

- information and awareness campaigns for the population regarding the potential risks of undiagnosed diabetes, as well as the acute and chronic complications of this pathology;
- prevention strategies of DM and prediabetes through screening campaigns extended throughout the county by means of family doctors but also with the help of other specialist colleagues;
- standardization, at the level of the entire county, of the diagnostic methods of diabetes and prediabetes in accordance with the current guidelines (ADA, EASD, Guide of the Romanian Diabetes Society);

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