PARACLINICAL MANAGEMENT REGARDING THE METABOLIC STATUS OF PATIENTS DIAGNOSED WITH TYPE 1 AND 2 DIABETES MELLITUS

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INTRODUCTION
Diabetes mellitus is a major metabolic imbalance that appears with a more raising incidence amongst the population, especially type 2 diabetes [1]. Also more and more cases of metabolic syndrome occur [2]. Obesity is an important risk factor for development of diabetic disease and in general of metabolic syndrome [3]. Inflammatory processes usually appear in patients suffering from obesity and diabetes mellitus, inflammation reduction can be considered as aim of the therapy [4]. Amongst common markers of inflammatory process are included increased erythrocyte sedimentation rate (ESR), raised leucocyte count, high levels of fibrinogen and elevated C reactive protein [5]. Mineral imbalance can appear in diabetic patients in the context of polyuria by osmotic mechanism, of polydipsia, of insulin dysmetabolism, etc. [6]. Numerous studies have reported decreased values of serum sodium and potassium levels, respectively increased calcium and chlorine levels in diabetic patients [7]. The most frequent pathological urine compounds in diabetes mellitus are glucose, ketone bodies, proteins; considering the increased predisposition to urinary infections, leucocytes and erythrocytes could be present, with nitrate positivity test, which indicates the presence of bacteriuria, which can be confirmed by analysis of urinary sediment. A close relationship exists between glycosuria and uric acid elimination through urine [8].

The purpose of treatment is to avoid metabolic and electrolyte imbalances, prevention of acute and chronic complications [6]. The therapy is different depending on the type of diabetes, in case of type 1 diabetes injectable administration of insulin is required, and in type 2 diabetes the intervention could consist of diet and physical activity, in case of failure oral antidiabetic treatment or insulin are used [9], [10]. The patients need to be monitored carefully regarding laboratory parameters, glycated hemoglobin being the principal analysis on which therapeutical decision is based [11].

AIM
The purpose of our study was the evaluation of common inflammatory markers, electrolyte status and the presence of pathological urine compounds in diabetic patients included in the in- and outpatients group.

MATERIALS AND METHODS
Data were obtained based on the patients’ medical records from the Compartment of Diabetology, Nutrition and Metabolic Diseases of Mureș County Emergency Hospital and on the database of the Civil Medical Society Prolacta outpatient unit from Tîrgu-Mureș, during the first half of the year 2017. The study group included type 1 and type 2 diabetic patients.

Biochemistry laboratory analyses were processed on the Konelab20XTi analyzer for the outpatients, the equipment of Prolacta Laboratory, and for the inpatients from Diabetology Clinic of Mureș County Emergency Clinical Hospital on the device Cobas 6000 that belongs to the Central Laboratory within this unit. Blood
count was performed on Sysmex XS800i analyzer of Procardia Laboratory for the outpatients and on hematology device Celldyn 3700 within the Central Laboratory of Mureș County Emergency Clinical Hospital for the inpatients. Westergreen method was used to determine the erythrocyte sedimentation rate. The device for urine analyses was HandURReader for the outpatients and Labumat equipment for inpatients.

Statistical analysis was conducted using Excel and GraphPad InStat software. Statistical significance threshold of \( p \) was set under 0.05.

**RESULTS**

The average age of patients was 61.94 years +/- 13.16 (SD), and 64.61% were from urban environment. Regarding the gender distribution, 45.91% of the patients were male and 54.09% were female.

Average of leucocyte concentration was significantly higher in the hospitalized patients compared to those from the outpatient unit (\( p=0.0001 \)), \( 9.8 \times 10^3 /\mu l +/- 7.41 \) (SD) versus \( 6.69 \times 10^3 /\mu l +/- 1.78 \) (SD), respectively, and 26.31% of the hospitalized patients presented higher values against only 4.21% in case of outpatients.

Average ESR of inpatients was 26.74 mm/h +/- 28.08 (SD) and 20.93 mm/h +/- 16.31 (SD) in case of the outpatients’ group. 24.24% of the inpatients and 10.30% of outpatients presented higher values. Fibrinogen concentration was determined in a few outpatients and in none of the inpatients, the obtained average of outpatients being 378 mg/dl +/- 98.99 (SD).

Average sodium concentration of patients was 139.64 mEq/l +/- 3.99 (SD). 11% of the patients presented hypernatremia, and 18% of them hyponatremia. Average potassium concentration of patients was 4.75 mEq/l +/- 0.58 (SD). In 2.97% of the cases hypopotassiumemia could be observed and 34.65% of the patients presented hypopotassiumemia. The majority of these values belong to inpatient subjects. Average values of other electrolytes were 2.17 mmol/l +/- 0.13 (SD) for calcium, and 0.81 mmol/l +/- 0.08 (SD) in case of serum magnesium, the latter were determined especially in outpatients.

Regarding the urinary pathological compounds, glycosuria was present in 15.62% of outpatients and 65.65% of inpatients, the difference being statistically significant (\( p<0.0001 \)). Proteinuria was observed with a higher frequency in case of inpatients (29.29%) compared to the outpatients (17.52%), the difference is not statistically significant. Inpatients presented an average urine pH of 5.46 +/- 0.71 (SD) and a urine density of 1.017 +/- 0.006 (SD), in case of outpatients we found similar values, average urine pH of 5.50 +/- 0.81 (SD) and urine density of 1.008 +/- 0.095 (SD). Also other pathological urine compounds were observed, percentage distribution of these is represented on Figure 1.

The frequency of leucocyturia in hospitalized patients was significantly higher compared to the outpatients’ group (\( p<0.0001 \)), hematuria was more frequent in outpatients, the difference is not statistically significant. Microalbuminuria was present in 21.64% of the inpatients. *E. coli* and *Candida albicans* infection were present, each of them in one case, and bacteriuria was observed in case of a few patients.

81.81% of the inpatients were diagnosed with type 2 diabetes mellitus, the rest of 18.19% suffering from type 1 diabetes mellitus. 89.58% of outpatients were type 2 diabetics and 10.42% suffers from type 1 diabetic mellitus. 10.30% of the inpatients are under treatment with oral antidiabetics, 88.65% receive insulin treatment and one case is only on diet.

85% of the outpatients is on oral antidiabetic treatment, especially with metformin. According to collected data a percentage of 20.61% of patients use dietary supplements, the most often used product being Milgamma®.

**DISCUSSION**

Diabetic patients use to get hospitalized generally following the complications of the underlying disease, most frequently of cardiovascular nature [12]. During hospitalization patients undergo a complex investigation regarding their hydromineral balance, explaining the fact that in case of inpatients we know the serum potassium and sodium values. A close relationship exists between the acid-base and mineral balance of diabetic subjects, therefore these values must be followed-up in dynamics [13].

Among pathological aspects, glycosuria is in close relationship with glycemia, the value of 180 mg/dl being
considered renal threshold. The high percentage of subjects with glycosuria shows the hyperglycemic states before collecting the urine samples.

Microalbuminuria is an important parameter in early recognition of diabetic nephropathy [14], this analysis is missing in outpatients, because it requires collection of urine for 24 hours, easier to be performed in hospital conditions.

Regarding the treatment, in case of acute complications even patients receiving oral antidiabetics or special diet can use insulin to obtain a good metabolic balance [15]. This aspect could contribute to the very high percentage of inpatients who received injectable treatment with insulin in the study period.

CONCLUSIONS

According to our results it can be observed that over a quarter of the evaluated diabetic patients had laboratory analyses showing an inflammatory process.

In two third of diabetic inpatients glycosuria could be detected, which marks a raised glycaemia in the period of hospitalization. In this aspect we could observe the highest differences between the groups of hospitalized subjects and outpatients. The presence of a diabetic nephropathy could be detected based on microalbuminuria in nearly a quarter of inpatients.

Hyperpotassemia was the most frequent disorder regarding mineral balance, especially in hospitalized patients.

The majority of diabetic inpatients were on treatment with injectable insulin, meanwhile in the outpatient group oral antidiabetic therapy predominated, the difference being significant between the distribution of patients on different treatment. Among orally administrated products metformin is used with the highest frequency.

A more complex evaluation of metabolic and mineral status, early detection of microvascular damage in diabetes mellitus could be beneficial in providing optimal therapy for these patients in order to obtain metabolic balance and to prevent complications.

References

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