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Evaluation of Fast Glycaemia in Hypertonic Population that Suffer from Diabetes: The Importance of Self-Monitoring of Glycemic Level and the Effects of Interactions, with the Aim of Reducing the Levels of Fast Glycaemia in These Patients

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Abstract

AIM: Identification of glycemic level tendency rates in a hypertonic population that suffers from diabetes mellitus in Health Centre Nr. 1, Tirana, evaluation of self-monitoring and the effects of interactions, with the aim of reducing the levels of fast glycaemia in these patients.

MATERIAL AND METHODS: In the study participated 810 patients of Health Centre Nr 1 in Tirana that suffer from hypertension and diabetes mellitus type 1 and 2. The study was conducted through 10 months' period. The patients that owned glucometer passed through the process of calibration of the devices, the others that had no glucometer had been given one. All the patients had been instructed how to use the device properly. Informative and educative materials regarding hypertension and diabetes were given to them. A standardised table was used to collect all the data. Changes in therapy were done regarding the glycemic levels.

RESULTS: The most of the patient shown an important improvement in glycemic rates during ten months of study. From 810 patients, 617 of them shown an improvement of the glycemic level data (median = 24 mg/dl; IQR: 14 – 50 mg/dl), and the other 193 patients have shown no improvement (n = 11) or aggravation (n = 182). The data showed that the patients that had no improvement during the study have diabetes type one (40%), they that have shown improvement has diabetes type 2 (33%) The difference between 2 those groups were insignificant (p = 0.075). The data of glycemic levels shown a significant decreased of 19% of basal glycemic levels (128 ± 31 vs. 158 ± 55 mg/dl: $p < 0.05$) at the end of the study, and decreased of glycemic levels was visible especially after the first month of the study, in both groups male and females.

CONCLUSION: A total of 205 therapy changes like adding a new or two drugs or an increase of doses of the drugs, are done in some 181 patients that have diabetes, with a frequency of 1.1 changes in therapy per patient.

Introduction

Diabetes mellitus (DM) is a group of metabolic diseases characterised by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Metabolic abnormalities in carbohydrates, lipids, and proteins result from the importance of insulin as an anabolic hormone. Low levels of insulin to achieve adequate response and/or insulin resistance of target tissues, mainly skeletal muscles, adipose tissue, and to a lesser extent, liver, at the level of insulin receptors, signal transduction system, and/or effector enzymes or genes are responsible for these metabolic abnormalities [1]. The severity of symptoms is due to the type and duration of diabetes mellitus.

Some of the diabetes patients are asymptomatic especially those with type 2 diabetes during the early years of the disease, others with marked hyperglycemia and with absolute insulin deficiency may suffer from polyuria, polydipsia, polyphagy, weight loss, and blurred vision. Uncontrolled diabetes may lead to stupor, coma and if not treated death, due to ketoacidosis or rare from nonketotic hyperosmolar syndrome [1][2][3].

Diabetes mellitus is an important health

condition for the ageing population; 26 % of patients over the age of 65 years have diabetes mellitus [1], and this number is expected to grow rapidly in the coming decades [3]. Older individuals with diabetes have higher rates of premature death, functional disability, and coexisting illnesses, such as hypertension, coronary heart disease, and stroke than those without diabetes. Older adults with diabetes mellitus also are at a greater risk than other older adults for several common geriatric syndromes, such as polypharmacy, cognitive impairment, urinary incontinence, injurious falls, and persistent pain. Screening for diabetes mellitus complications in older adults also should be individualised and periodically revisited, since the results of screening tests may impact therapeutic approaches and targets [4].

World Health Organization (WHO) predicts that in 2030 diabetes mellitus will be the 7th cause of death in worldwide [5]. A healthy diet, regular physical activity, normal weight and not smoking can prevent diabetes mellitus type 2 [6]. The prevalence of DM during the 1990-2006 is doubled and is in continuous increasing. Population ageing, urbanisation, increased caloric intake, decreased physical activity are some of the factors that lead to continuous increasing of DM rate in Albania [7]. In 2004 in Albania were 30,000 people with diabetes registered. In 2011 this number reached 55,000, and in 2013 were more than 65,000 patients with diabetes registered regarding ISKSH data [8]. In the world, 15 million people have diabetes mellitus and more than 59.8 million are in Europe region. In 2040 this number is predicted to be 71.1 million [9]. Diabetes mellitus is a chronic and complex disease that requires continuous medical care and a strategy to reduce the risk for this disease. Continuous medical education of the patients is very important in preventing acute complications and in the reduction of risks for long-term complications [10]. Self - monitoring of glycaemia is considered very important key in diabetes mellitus management.

The study aims to evaluate the collaboration between patient and doctor, self-monitoring of glycemia and the impact of these two actions in the decrease of glycemic levels. The study was based on the hypotheses that the treatment of diabetes is effective when the patient is active in monitoring his glycemic blood levels and collaborates with medical staff.

Patients and Methods

Patients

Health Center No 1 in Tirana has a total number of 82,500 patients. Twelve percent (12%) of them, 10,190 patients have chronic diseases, especially cardiovascular disease and diabetes mellitus. 89% of these chronic patients suffer from hypertension (9,120 patients), and 27% suffer from diabetes mellitus type 1 and type 2 (796 patients). In the study contributed 810 patients with hypertension and diabetes mellitus. The confidentiality and anonymity were secured for all the patients since the first clinical visit. Demographic data were collected retrospectively from the individual data registered in Health Center No 1 in Tirana database. Other data are collected prospectively during the time of the study. The criteria for patient selection are I: the patient must have been diagnosed with DM and hypertension from almost one year; II: the patient must be in continuous medical treatment for the last six months; and III: the patient must show a desire to be part of the study and collaborate with the doctor. All the data are registered in our database.

Methodology

Self - monitoring of levels of glycemia is considered as a very important part of diabetes mellitus management. In the study participated 810 patients of Health Center No 1 in Tirana that suffers from hypertension and diabetes mellitus type 1 and 2. The study was conducted through 10 months' period. The patients that owned glucometer passed through the process of calibration of the devices, the others that had no glucometer had been given one. Glucometers (one touch select) 270 pieces and strip tests were given to the patients. The patients were instructed regarding the exact monitoring of glycaemia (Table1), and instructions regarding diet were secured to them also (Table 2).

Table 1: Step – by - step patient instruction on blood glucose home monitoring

1	Wash hands with soap and warm water. Dry hands
2	Prepare the lancing device by inserting a fresh lancet. Lancets that are used more than once are not as sharp as a new lancet and can cause more pain and injury to the skin
3	Prepare the blood glucose meter and test strip
4	Use the lancing device to obtain a small drop of blood from your fingertip
5	If you have difficulty getting a good drop of blood from the fingertip, try rinsing your fingers with warm water, shaking the hand below the waist, or squeezing the fingertip
6	Apply the blood drop to the test strip in the blood glucose meter. The results will be displayed on the meter after several seconds
7	Dispose of the used lancet in a puncture-resistant sharps container

Regular physical activity is very important in the management of diabetes mellitus and hypertension, but also healthy balanced diet and medical therapy are necessary to control these diseases. The patients were suggested to maintain an active physical status by walking for 30 - 60 min per day.

Table 2: Diet instructions

1. Drink 6-8 glasses of water every day.
2. Eat five fruits and vegetables per day.
3. Eat whole grain bread or cereals.
4. Do not eat refined sugar foods, and with high fat.
5. Eat small portions.
6. Eat fish, white meat and drink milk with low fat.
7. Reduce salt intake, sugar, alcohol as much as possible.
8. Limit soft drinks and sweet foods.

Results

Demographics

More than half of the study patients were females (n = 435 vs. n = 375; p = 0.001; Table 3). Mean age at study initiation was 68 ± 10 years. Eight hundred ten patients had DM.

Table 3: Patient baseline demographics by gender

	Females (n = 435)	Males (n = 375)	*p*-value
Age	67 ± 9	68 ± 10	
Diabetes Mellitus (DM)			
Type I	160 (37%)	122 (33%)	0.133
Type II	275 (63%)	253 (67%)	0.235
Median time with DM	8 (4, 12)	8 (4, 11)	0.247
Baseline blood glucose			
Median (IQR)		145 (121-169)	0.762
Mean ± Std		158 ± 59	0.860

IQR-interquartile range (25th and 75th percentiles); Std-standard deviation.

There were significantly more patients with type II DM (65% [*n* = 528] type II DM *vs*. 35% [*n* = 282] type I DM; *p* < 0.001). The median time of patients with DM was 8 (interquartile range [IQR]: 4 - years. Mean blood glucose level at baseline was 158 ± 55 mg/dl and median 145 mg/dl (IQR: 125 - 170) (Table 4).

Table 4: Patient baseline demographics

	Total	*the*
Age	68 ± 10	
Gender		
Females	435 (54%)	
Males	375 (46%)	0.001*
Diabetes Mellitus (DM)		
Type I	282 (35%)	
Type II	538 (65%)	<0.001*
Median time with DM (years)	8 (4-11)	
Baseline blood glucose (mg/dl)		
Median (IQR)	145 (125-170)	
Mean ± Std	158 ± 55	

IQR-interquartile range (25th and 75th percentiles); Std-standard deviation.

The majority of the patients demonstrated improvement of DM after ten months of being in the study. Of the 810 patients, 617 patients demonstrated an improvement of their blood sugar (median = 24mg/dl; IQR: 14 – 50 mg/dl). The remaining 193 patients had no improvement (n = 11) or worsening of their DM (n = 182). There were more patients with type I DM that did not improve compared to patients with type 2 (40% vs 33%), although not significant (*p* = 0.075; Table 5).

Table 5: Patient baseline demographics by groups

DM	Group 1 (n = 617)	Group 2 (n = 193)	*p*-value
Age	67±9	68±11	0.26
Gender			
Female	333 (54%)	102 (53%)	0.80
Male	284 (46%)	91 (47%)	
Time/year with DM,	8 (4, 11)	8 (5, 12)	0.38
DM type I	204 (33%)	78 (40%)	0.075
DM type II	413 (67%)	115 (60%)	

Group 1 - showed improvement; group 2 - did not have any effect on improvement or worsening DM = diabetes mellitus.

We observed a steady decline in mean fasting glucose levels in all patients, females and males. This decline became statistically significant starting at one month after baseline readings. A 19.5% decline in blood glucose level was observed at the end of study follow - up (10 - months) when compared to baseline (128 ± 31 vs 158 ± 55 mg/dl; *p* < 0.05).

We also investigated whether the decline in blood glucose level was age-dependent we divided our study population into three groups (Table 6). The decline in blood glucose levels ranges from 18% (group 2) to 20% (group 1). Chi-square test showed that the decline was not statistically different between the age groups (*p* > 0.05).

Table 6: Age-dependent decline in blood glucose level

	BM	10-Months	Decline	BM	10-Months	Decline	BM	10-Month	Decline
DM	160 ± 60	128 ± 29	20%	156 ± 51	128 ± 35	18%	159 ± 56	128 ± 30	19.5%

DM = diabetes mellitus; BM=baseline measurements; Decline = represents the decline values in blood glucose level at the end of study follow-up (10-months) when compared with baseline measurements.

To confirm these results we ran a Cox regression analysis against gender and age, with age as a continuous variable (i.e. patients were not divided into age groups). This analysis also Cox regression analysis showed that this decline was independent of patient gender (i.e. the decline was found to be similar and significant in both males and females; *p* > 0.05).

A total of 205 interventions related to DM, were performed during the ten months of follow - up to 181 patients for a rate of 1.1 interventions/patient. Interventions included therapy changes.

Discussion

Self - monitoring of glycemia is the collection of detailed information of glycemic levels during the day, and with the aim of finding the appropriate drug doses for them, to improve diabetes mellitus and prevent complications [11].

Self-monitoring of glycemic levels can be improved with these steps:

I: finding the appropriate frequency for the tests.

II: education and the capability of the patients. III: capability and the education of medical staff.

IV: use of simple medical devices for glycemic measurements [12].

These steps help in limitation of overuse of glycemic tests at home, helping so in reducing the cost of the glycemic control [13]. The studies have concluded that the management of chronic diseases resulted in improvement of patient health and decreased of costs as result of the reduction. Our

study concluded that diabetes could be improved when doctor-patient relationship is well - established, and the patient is educated and instructed how to monitor his glycemia. But there were also some patients that regarding all the instructions and education have not shown any improvement in their health condition. Some of the factors that may have contributed in this result for the mentioned group may be incapability for following instructions, monitoring at home blood glycemic level, other existent diseases, eating not carefully regarding diets and having a sedentary lifestyle. To sum it up, our study has shown that it was a really clear improvement in our group study of the glycemic levels, not related to age or sex of the patients. This achievement it is believed to be as a result of continuous and carefully education of the patients for self-monitoring of glycaemia at home, and also different drug therapy changes that are specific for every patient. We also believe that the relationship doctor-patient is very important in the impact of the study result, making patent more comfortable to follow doctor's advice. We must admit that the time of the study was not long, and the possibility to follow the patients for a long time was not possible.

In conclusion, self - monitoring improve Diabetes Mellitus the final point, which may reduce Diabetes Mellitus complication, and the study has verified what we already know that relationship doctor-patient is important in diabetes mellitus improvement.

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