

DIABETES MANAGEMENT: A LITERATURE REVIEW

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ABSTRACT

Aim: Diabetes Mellitus (DM) is becoming of increasing concern worldwide in terms of individual and societal grounds. Half of diabetics don't know they have diabetes and about 4 out of 5 diabetics live in low and middle income countries. DM is boosted by the increase in overweight, obesity and physical inactivity. Our aim was to review the latest trends in diabetes control and management in order to assess which one could be suitable to control this disease in Albania.

Methods: We reviewed the latest documents concerning management of DM. We searched PubMed and the databases of major organizations dealing with DM such as World Health Organization, International Diabetes Federation and American Diabetes Association. Only the relevant articles dealing with DM management and barriers to adhere to guidelines were reviewed.

Results: DM control and management means more than just keeping the plasma glucose level under control. The successful management and control of DM requires a multidisciplinary approach and, besides pharmacotherapy, the patient education regarding self-management behaviors is essential in this regard. In an era of rapid technological development, new approaches toward patient education are encouraged.

Conclusion: The prevention of DM is feasible. In middle income countries patient education can be beneficiary in terms of individual and societal costs reduction. Text messaging or other innovative cheap solutions could work well in Albania, where the prices of these services have decreased substantially.

Keywords: diabetes, management, medication adherence, patient education.

Introduction – Diabetes burden: quick facts and figures

According to the World Health Organization (WHO) there are about 350 million people suffering from diabetes mellitus (DM) and by 2030, diabetes will become the seventh leading cause of death worldwide with diabetes deaths expected to raise by 50% during the next 10 years.

(1). The number of diabetic persons is increasing in every country, 4 out of 5 people with diabetes live in low and middle income countries and half of diabetics don't know they suffer from this disease (2). This global epidemic could be largely attributed to the rapid increase in the rates of overweight, obesity and physical inactivity (1).

There are described two common types of diabetes mellitus: type 1, type 2 and gestational diabetes mellitus, triggered by a complex interaction between environmental and genetic factors and sharing hyperglycemia as a common characteristic (3). Type 1 diabetes results from the complete or near-complete lack of insulin production whereas type 2 diabetes results from insulin resistance, impaired insulin secretion and increased glucose production which could take place in various degrees (3). Gestational diabetes occurs in nearly 4% of pregnancies in United States and, even though in most cases the glucose tolerance is back to normal, these women face an increased risk of developing DM later in life (4). DM is diagnosed by measuring the plasma glucose. The American Diabetes Association suggested the following thresholds of fasting plasma glucose (FPG) for distinguishing between normal, pre-diabetic and diabetic state: up to 100 mg/dL-normal glucose tolerance; 100-125 mg/dL-impaired glucose tolerance (pre-diabetes) and >125 mg/dL-diabetes mellitus, and the following 2-hours plasma glucose (2-h PG) levels: up to 140 mg/dL-normal glucose tolerance; between 140-199 mg/dL- impaired glucose tolerance and more than 200 mg/dL-diabetes mellitus. Type 2 diabetes accounts for 90% of all diabetes cases, but recently its incidence is increasing steadily among children and adolescents (1). Diabetes rate

increases with aging, it varies greatly geographically and among different ethnic populations but no significant sex difference is noticed (5).

Health and economic consequences of diabetes
The disorders attributed to DM cause various pathologic changes in multiple organs thus creating a heavy burden in terms of individual health (3) and societal costs (6). Health consequences of diabetes range from acute complications, like diabetic ketoacidosis, to chronic vascular (such as retinopathy, neuropathy, nephropathy, coronary artery disease, peripheral arterial disease, cerebrovascular disease) and chronic non-vascular complications (gastroparesis, increased vulnerability to infections and skin changes) responsible for the diabetes' associated morbidity and mortality (7). DM is the leading cause of blindness, non-traumatic amputation of lower extremities and kidney failure (1). Diabetic individuals were in greater risk for cardiovascular, renal, neurological and ophthalmic diseases as well as other chronic complications and general medical conditions (6).

The societal costs of diabetes are far from being negligible. For example, in 1997 the costs attributable to diabetes in United States were almost 100 billion dollars, counting for direct and indirect costs (6). Almost 14 million hospital days were attributed to diabetes; treatment of uncomplicated diabetes accounted for 13% of all hospitalizations and health care expenditures attributable to diabetes were around 40 billion dollars in 1997. Working days lost due to diabetes were 5 times more among diabetics than non-diabetics and the later ones experienced fewer limited-activity and bed-disability days compared to their diabetic peers. Finally, the total cost for a diabetic person in US in 1997 was 10071 dollars compared to 2669 dollars for a person without diabetes (6). In 2012, nearly 5 million deaths occurred due to diabetes and almost 500 billion USD were spent on diabetes worldwide (2).

Diabetes management

Diabetes is a chronic condition the control of which demands the combining efforts of the patients and a group of specialized care providers. The patient's participation, motivation and enthusiasm are critical for achieving optimal control of the disease. The successful management of diabetes requires more than just controlling the plasma glucose levels. It requires a multidisciplinary approach. (8- 9). Giving the fact that most patients will have developed one or more complications of diabetes at the time they show up at the health care provider and the diagnosis is set, then the case management will focus on two directions:

a) history and physical examination, in order to check for any signs and symptoms of acute hyperglycemia, and b) screening for long-term or chronic complications related to DM. According

to the International Diabetes Federation (IDF) the idea behind diabetes management is that, although monitoring and controlling the level of plasma glucose is essential, the optimal management of diabetes requires also the investigation of potential DM complications and their management, accompanied by efforts to modify the risk factors for different diabetes-related conditions. Diabetes care and management might also be dependent on a certain number of other factors such as societal and economic factors. Cultural factors and employment factors are also very important as they relate to life-style, including smoking, drinking, physical activity, the patterns of feeding, stress and a whole range of other activities which could serve as risk factors for triggering diabetes. The recommendation of IDF for a comprehensive management of diabetes mellitus is summarized in Table 1.

Table 1. Management of diabetes mellitus (multidisciplinary team)*

Short-term management of diabetes	
History	Data about weight, family history for DM, history of C-V diseases, smoking, drinking, exercise.
Physical examination	Weight, retinal examination, blood pressure, foot examination, insulin injection sites, peripheral pulse, reflexes checking
Classification of the individual patient	Type 1 DM: onset of disease before age 30; slim body; insulin taking; prone to ketoacidosis and to other autoimmune disorders. Type 2 DM: usually after age 30; obese; may not require insulin since the beginning; might have hypertension, CV disease, and dyslipidemia.
Laboratory assessment	FPG and 2-h PG; screening for conditions related to DM: microalbuminuria, dyslipidemia etc., or cardiac stress testing in high risk CV disease individuals.
Long-term treatment	
<i>Overall goals of the therapy</i>	
Eliminate symptoms related to hyperglycemia	The target level of glycemic control should be set. Provide all the <i>education</i> and <i>pharmacological</i> treatment necessary to reach and maintain this level
Reduce the long-term vascular complications	
Allow the patients to a normal lifestyle	
<i>The management multi-disciplinary team</i>	
Primary care provider, or diabetologist/endocrinologist	
Diabetes educator (nurse, dietician or pharmacist)	Education topics include: self-monitoring of blood glucose; urine ketone monitoring (type 1 DM); insulin administration; diabetes management during illness; management of hypoglycemia; skin and foot care; management of diabetes before, during and after exercise etc.
Nutritionist	Aims to balance calories' intake with other aspects of DM such as insulin intake, exercise and weight loss. Weight reduction is recommended. Balance of calories intake from different sources: to 35% of calories from fat, up to 65% from carbohydrates and up 35% from proteins. Exercises are beneficial to diabetes control as it lowers plasma glucose, lowers CV diseases risk, reduces blood pressure, and enhances weight loss. ADA recommends 150 minutes of physical activity per week. However, exercise should be performed with caution, as there is risk of hypoglycemia.
Specialist according to the type of complication (neurologist, nephrologist, cardiologist, ophthalmologists etc)	When these complications are present, then the respective specialized care provider will enter into play

* Adapted from the International Diabetes Federation and American Diabetes Association.

The International Diabetes Federation recommends the self-monitoring of blood glucose as often as necessary, testing for HbA1c several times per year, education of patients with refreshment once per year, examination of eye and foot once or twice a year, blood pressure measurement, lipid profile once a year and vaccinations against influenza as good approaches toward the ongoing management of diabetes.

Discussion

Diabetes is a slow and hideous disease. A person can live for years with the glycemic dys-regulation without noticing anything. Chronic complications are positively linked to the level and duration of hyperglycemia. They usually appear in the second decade of hyperglycemia and that is why most of patients present with complications at the time of DM diagnosis (10). In these conditions, screening for type 2 DM using the fasting plasma glucose (FPG) test is of imperative importance and could offer a substantial help for relieving individual and societal costs, because: a) the overwhelming majority of individuals with abnormal glucose levels are asymptomatic and unaware of the disorder. In fact, half of diabetics don't know they have it (2); b) evidence suggests that the gap between disease installment and diagnosis is about one decade; c) half of type 2 DM patients have one or more diabetic complications at the time of diagnosis; and, d) early treatment of type 2 DM may favorably change the natural history of this. The American Diabetes Association recommends that all individuals 45 years old or older should be screened every three years and overweight persons with any additional diabetes risk factors should be screened at an earlier age disease (5). However, cultural and ethnic factors could hinder or enhance the adherence to screening or preventive measures, even though these services are universally available. For example, a study found that black population were less likely to utilize the preventive services, less likely to self-monitor their diet compared to white and the level of self-management behaviors

was low in all ethnic groups people (11). This points out to the importance of education in diabetes management. Besides pharmacotherapies, patient education is central toward the successful management of diabetes (12 -13). It guarantees not only the maintaining of glycemic control and monitoring of other DM related conditions, but it is imperative for the optimal application of the appropriate pharmacotherapy treatment as well. In this regards, diabetic patient education is an ongoing process, which should reinforced once or twice annually and which could not be completed by a single visit to the doctor or nurse. Different education approaches could be used: individual or group education. There is evidence that individual education is more effective in controlling HbA1c concentration level compared to group education or usual care approach (14 - 15). Other studies have highlighted the effectiveness of diabetes case management and education in terms of costs saving and clinical outputs, especially for low-income populations (16).

Despite the fact that diabetes mellitus is becoming of increasing concern to the health systems globally and diabetes management guidelines have been circulating since decades from now, the pace of implementation of such guidelines by health care providers has not been the same as the pace of the disease growth. For example, various obstacles to adhere and implement the guidelines have been reported: the doctor's attitude to consider their scientific knowledge as the "golden standard" and to overlook the patient's perceptions can lead to communication gaps and lack of success (17 -18). Moreover, certain beliefs and perceptions about the gravity and seriousness of the disease as well as the reluctance in the willingness of patients to change their lifestyle can contribute toward non adherence as well (15,19). For example, a study reported that only half of DM patients regarded the disease as serious, one third did not understand the disease, three quarters were not clear about symptoms and very few followed instructions on recommended physical activity (15). Another potential barrier toward the

successful management of diabetes could be the fear of hypoglycemia (FoH) among diabetic persons. Hypoglycemia is the most frequent adverse effect resulting from insulin treatment in diabetics, which can occur suddenly with signs and symptoms ranging from sweating to unconsciousness. Tight control of glycosylated hemoglobin (HbA1c) increases by three-folds the number of hypoglycemic events. Because of this fear, diabetic patients may reduce the intake of insulin or can apply other measures to avoid hypoglycemic episodes. This results in poorer control of plasma glucose, thus worse diabetic management, which could be alleviated by blood glucose awareness trainings and cognitive behavioral therapies (20). The fragmentation of the care delivery system could be another barrier toward effective management of diabetes (9). The management of diabetes should be delivered by multi-disciplinary teams because of the complexity of diabetes control requirements. Evidence has shown that diabetes management programs are able to improve glycemic control and increase foot and retinopathy screening rates (21). Reminding health care providers and patients about diabetes can also improve the diabetes management. For example, reminding doctors about different aspects of diabetic patient's care resulted in better diabetes care (22). On the other hand, in an era of fast technological developments and globalization, reminding and informing patient via cellular phones by text messaging results very beneficiary in terms of adherence to diabetes control strategies and disease self-management behaviors (23-24). Therefore, this could be recommended even for a country such

as Albania, which is estimated to have around 65.000 thousand diabetic persons (2), and where the prices of cellular telephony have been reduced significantly and thus being more affordable to be used by various stakeholders for promoting health and preventing undesirable health consequences.

In summary, the key point for a successful diabetes management in our country should be the focusing on education of patients. This is especially important in a country with limited health system resources as education campaigns can reach considerable population numbers at refrained costs. Patient education toward prevention of the disease and self-management of the condition is becoming increasingly crucial among Albanian citizens who are becoming more and more exposed toward diabetes risk factors. According to Demographic and Health Survey 2008-2009 in Albania, among persons aged 15-49 years, the prevalence of smoking was 4% among women and 43% among men, with fast increasing rates among urban well-educated women. One-third of women and two-thirds of men had ever used alcohol, 20% of women and 30% of men are living with hypertension and more than 80% of both sexes had at least one problem accessing health care. (25). Moreover, obesity, a well-recognized risk factor for diabetes, is an alarming emerging concern among the Albanians citizens, especially among the new generations. All these facts and figures lead to troublesome forecasts regarding the burden of diabetes in the future. Therefore, the preventing of this disease should start as early as possible, and the education is a cost-effective way to do this.

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