

# Role of Physicians in Diagnosis and Management of Diabetes Mellitus in Primary Health Care

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## Abstract

**Background:** Diabetes is a prevalent disease with huge burden on patients and health care system. Therefore, many health organization and guidelines have been developing screening programs for patients and general population as a preemptive to signs and symptoms developing, aiming to have earlier diagnosis, reduced rates of end-organ damage, and modified risk factors that lead to hyperglycemia status. **Objectives:** We aimed to review diabetes in the context of patients referring to primary health care clinics. **Methodology:** PubMed database was searched with the following keywords: diabetes mellitus, and its valuation, and management. **Conclusion:** Diabetes Mellitus is one of the most common comorbidities worldwide. And as a physician, persuading the patient to convert from oral hypoglycemic to insulin injections and following up with the patient are considered as a critical point in management. These steps assure the clinician help in reduction of the complications and providing a better quality of life for these patients.

**Keywords:** Diabetes Mellitus, Diagnosis, Family Physician

## INTRODUCTION

Diabetes mellitus is one of the most common diagnoses ever encountered, modulated and regulated by physicians. Global estimation by 2035, the International Diabetes Federation projections reported that more than 470 million people worldwide would be considered as pre-diabetic patients <sup>[1]</sup>. The classic presentation at the family clinic is of an adult patient coming with frequent urination, thirst, excessive food intake and weight loss. Moreover, some patients may present with complications such as eye problems, nervous system dysfunctions; while, others could come in with festering infections. As a result, the diagnosis and management of such case went through rapid changes in the last 20 years, with more shift toward implementing screening programs in the primary health care centers. In this paper, we will review the literature about this disease with a special focus on the role of family clinicians in screening, diagnosis, and management.

## METHODOLOGY

PubMed database was used for articles' selection using the following keywords: diabetes mellitus, and its evaluation, management, and diagnosis. We included topics as related to diabetes mellitus clinical features, pathophysiology, and

evaluation and management in the family physician context. We excluded all other articles not having the latter criteria as their primary endpoint.

## DISCUSSION

Insulin is an important body hormone that regulates and controls major metabolic reactions in the human body, at both

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the molecular level and general organ-to-organ regulation. Depletion in its level may result from various mechanisms ranging from autoimmune destruction of the pancreatic  $\beta$ -cells to abnormalities that result in a resistance to insulin action. Deficiency in the insulin action on target tissues is the main reason behind the abnormalities in carbohydrate, fat, and protein metabolism seen in diabetes. Sometimes, both problems may occur within the same patients. Diabetes type 2 results from systemic insulin resistance and inadequate pancreatic function. This disrupted pancreatic islet function occurs in both glucagon-secreting alpha cells and insulin-releasing beta cells. Type 1 diabetes is birth-related condition where primary insulin formation is depleted as a result of autoimmune destruction of pancreatic islet cells, requiring long-life replacement and difficult to control. Symptoms of marked hyperglycemia include polydipsia, polyuria, polyphagia, weight loss, and blurred vision. Moreover, impairment of growth and development of certain infections may also accompany longstanding hyperglycemia. Type 1 diabetes is usually diagnosed upon regular checkup or with complications such as diabetic ketoacidosis. Moreover, if left untreated, life-threatening conditions of uncontrolled diabetes can occur which include hyperglycemia with ketoacidosis or nonketotic hyperosmolar syndrome [2]. Lifestyle and pharmacologic interventions along with frequent checkups and feasible attachment to medication are considered as the major point of progression control [3].

### Risk Factors

Socioeconomic status, genetics, and obesity have all been implicated in the development of diabetes. However, raised fasting insulin level combined with decreased pancreatic secretion of insulin remained the strongest predictor of disease development [4, 5]. Diabetes is a well-known disease with the presence of other risk factors such as being in older age, and a positive family history. Moreover, other co-morbid conditions have been linked to diabetes including hypertension, dyslipidemia, gestational diabetes, macrosomic babies, and polycystic ovarian syndrome. Currently, however, the age gap is decreasing as younger people are becoming diagnosed early in their lives. Genetics certainly plays a role, as familial history of diabetes has been established in literature as a major risk factor for illness development. There are many common variants of genetic strands reported as risks for type 2 diabetes, and known genetic abnormalities are only 10% of familial heritability of diabetes type 2 [4]. Dietary habits and sedentary lifestyle are considered as the major factors for rapidly rising incidence of DM among developing countries. High consumption of carbohydrates tends to cause elevated levels of HbA1c; it is reported to be a major risk factor for developing microvascular and macro-vascular complications. Awareness of complication and modifying dietary practice tends to improve overall patient's health and better diabetic control. Practitioners, health-care providers, health facilities, and diabetic agencies should encourage knowledge of diet modification aiming for better quality of life [6]. Another

lifestyle changing strategies include promoting walking, exercising, and promoting adherence to treatment [7].

### Screening

It is recommended that screening of DM with a sugar level checkup is done for every patient, especially in adults 40 to 70 years of age who are overweight or obese. Moreover, in children who are overweight or obese, with additional risk factors, screening shall be done at 10-year old or at the onset of puberty. Identifying glucose level is usually done via a blood sample, and measuring fasting FPG, postprandial 2 h-PG and glycated hemoglobin HbA1c. Another major test that helps in screening and diagnosis is oral glucose tolerance test (OGTT) which is carried out with 75g of glucose. Furthermore, random blood glucose test has a limited role in the screening of patients. These tests helps the family physician in recognizing the pre-diabetic population, diabetic patients and the development chance of future complications. When these tests are normal, the physician can repeat testing at a minimum of 3 years intervals or in any cardiovascular event or developing of new (diabetes related) symptoms [8].

### Diagnosis

The diagnostic criteria for diabetes and pre-diabetes classifies patients according to the signs and symptoms along with the glucose markers in the blood sample (Table 1). To diagnose diabetes, an unequivocal hyperglycemia shall be present; otherwise, two abnormal test results in two separate samples or from the same sample (twice) are diagnostic. This applies to all tests, except random glucose testing where diagnosis of diabetes is only applicable if the patient has classic hyperglycemic symptoms or has a hyperglycemic crisis [9].

**Table 1: The Criteria for Screening and Diagnosis of Diabetes**

Test	Prediabetic Values	Diabetic Values
<b>Hb A1C</b>	Between 5.7 and 6.4%	Equal to or more than 6.5%
<b>Fasting Plasma Glucose</b>	Between 100 and 125 mg/dL (5.6–6.9 mmol/L)	Equal to or more than 126 mg/dL (7.0 mmol/L)
<b>75-g Oral Glucose Tolerance Test</b>	Between 140 and 199 mg/dL (7.8–11.0 mmol/L)	Equal to or more than 200 mg/dL (11.1 mmol/L)
<b>Random Plasma Glucose</b>		Equal to or more than 200 mg/dL (11.1 mmol/L)

Thus, the primary care providers should have a high prediction cut off point in his patients in order to avoid occurrence of complications. The high mortality and morbidity is a result of deterioration despite proper management protocol of DM. Micro-vascular, macro-vascular, and end-organ injury are involved with metabolic derangement that may have resulted from uncontrolled hyperglycemia. These complications put the vulnerable

patients at risk of further injury —as they affect important body parts that are manifested as blindness, limb amputation, kidney failure, and vascular and heart disease<sup>[2,10]</sup>.

## Management

### • Oral Hypoglycemic

In the clinical settings, the pharmacological management is usually started as soon as a diagnosis is confirmed. The starting drug of choice in most cases is metformin, which is available widely and very cost effective. The other cases where A1C is more than 10%, fasting plasma glucose is more than 300 mg/dL, and/or patient complaining of severe hyperglycemic symptoms, insulin is initiated. Furthermore, a widely-used approach is to use the combination of long acting insulin once daily and pairing it with an oral anti-diabetic in some cases. Sometimes, the clinician faces difficulties from the patient when switching from oral therapy into insulin, and the compliance maybe poor as a result. As a family physician, persuading the patient into this option and following up with the patient are a critical point in management and helps in reducing the complications and better life quality for the patients. It is not recommended in the guidelines to put the patient on two or more different kinds of oral anti-diabetic drugs; however, family physician may see people taking this regimen on daily basis. Unfortunately, this regimen can lead easily to hypoglycemia, and thus knowledge of the drugs used by the patient (with a basic idea of their mechanism of action) is needed for the family physician, especially in diabetes. Generally, if the clinician is not confident in prescribing and switching the patient into insulin, he shall refer the patient immediately. This is due to the fact that delaying the proper management may fasten the complications rate. Moreover, it has been reported that 1% decrease in A1C will result in 21% drop in complications rate, decrease mortality and morbidity rates in diabetic patients. Insulin prescription shall be combined with education of the treatment technique, sites and overall diabetic care, this is preferably done by a physician<sup>[11]</sup>.

Biguanides, specifically metformin, is the recommended non-insulin therapy for diabetes, especially when combined with exercise and diet control. Caution should be taken with biguanides and patients should have their base creatinine level taken on a regular interval. Creatinine at 1.4 mg/dL, or an eGFR >60 mL/minute is crucial to note and should guide the clinician into discontinuation of metformin prescription. It is a good practice to initiate doses from one-quarter of the desired dosage for a week and increment steadily; taking the drug 2 hours postprandial is the best to avoid undesirable gastrointestinal disturbances<sup>[11]</sup>. Metformin has many beneficial effects in diabetes including decreasing weight gain, and decreasing incidences of hypoglycemic episodes relatively (compared to insulin and sulphonylureas). Metformin is recommended as the first line in overweight diabetic patients<sup>[12]</sup>.

Sulphonylureas and even insulin could be used to control hyperglycaemia and would have the advantageous and life-quality preserving effect of preventing micro-vascular injury

in type 2 diabetes<sup>[13]</sup>. Unfortunately, the protective effect does not carry on to macro-vascular complications. Other hypoglycemic medications work by stimulating insulin release (or whatever amount is remaining in the pancreas) and these are known as insulin secretagogues. This class includes sulphonylureas (e.g. gliclazide). Moreover, hypoglycemia which is the major adverse effect, if developed, it may last more than a day. These sulphonylureas are, by intuition, preferable in adult patients, with normal weight (thin and lean), and had been recently diagnosed within the last 5 years<sup>[11]</sup>.

$\alpha$ -Glucosidase inhibitors (acarbose) work on glucose absorption from the intestines. Logically, it has adverse effects on the gastrointestinal tract ranging from flatulence to diarrhea. These drugs are preferable in the elder patients, as there is the risk of hypoglycemia, unlike in the former groups. DPP-4 inhibitors e.g. sitagliptin, are insulin-like oral drugs which selectively and reversibly block degradation of GLP-1 (glucose like peptidase-1) and other incretins. They induce insulin sensitivity and enhance the overall pancreatic  $\beta$ -cell function<sup>[11]</sup>.

### • Insulin therapy

Insulin is usually divided either by duration of action (long, short and intermediate) or the base component be it human or analogue. Long acting insulin include NPH insulin, Glargine insulin and detemir insulin. NPH and glargine are given once daily but detemir can be given twice a day and the usual basal effect of this class lasts over 24 hours. The time of injection is preferably in the morning in order to avoid possible hypoglycemia while sleeping in the morning. If long acting insulin is used for regular patients, short acting insulin on the other hand is mainly used for intensive insulin therapy. This group includes regular insulin, insulin lispro, insulin aspart, insulin glulisine, and prompt insulin zinc and lower plasma glucose often within 15 min with short duration of action of less than 4 hours. The administration of these drugs is usually in basis of three times a day just before each meal. For intermediate insulin, the usage is less in clinical settings and main examples of this group is Isophane insulin, neutral protamine Hagedorn (commonly known as NPH), and Insulin zinc.

Injections are not the only way of administration, and lately insulin pumps have been providing a great alternative for patients. Lispro, aspart, and regular insulin can be given via the pump, and the main advantage of this method is continuous administration based on the plasma glucose levels automatically, this provides unparalleled flexibility for the patients' daily life. The main drawbacks for this method are high cost, possible mechanical failures, and inconvenience of the (external) device. Furthermore, frequent self-monitoring and checking the pump function are required to assure effective and safe usage of the pump<sup>[11,14]</sup>.

The usual starting regimen for insulin therapy is to start with basal insulin with a dose of 0.2 units per day. Dividing this dosage goes by two thirds in the morning (before breakfast) and one third in evening if premixed human short acting and long acting insulin was used. However, if a mixture of analog

insulins was used, then half or 60% of the dose can be given in the morning (before breakfast) and the rest before dinner. Human insulin is preferably injected 15 to 30 minutes before the meal, but the insulin analogs can be administered 5 to 15 minutes prior to it. The concentration of these mixtures is widely different, the most common formula is 30/70 insulin mix that is composed of 30% short acting and 70% long acting insulin. Other formulas like 20/80 is used in the elderly, and 50/50 is used in patients doing heavy work and/or individuals who have poor dietary habits and is injected three times a day<sup>[15]</sup>.

Patients should self-monitor their glucose levels (preferably postprandial) if they can and these results shall be shared with their physician with 3 days interval in order to follow up and later on optimize the insulin dosage. Some events may require an increase in insulin dosage, such as stroke and retinopathy, and the A1C follow up is vital but the target differ between patients (adults have lower target than elderly or children). Family physicians must teach the patient how to inject (using needle or the pen), the locations of injection, and how to switch between them. Another important point to convey to the patient is how to store insulin in refrigerator and not freeze it. Clinician shall confirm that the patient has understood by making him write the steps or doing them in presence of the physician before starting the management. Another point the family physician should work on before initiating the treatment is teaching the patient about hypoglycemia and its symptoms such as cold sweating, tachycardia, blurred vision and changes in consciousness, and this will help in early recognition and even management of this complication. Providing extra care to patients facing family or compliance issues, and involving the family and even the public (e.g. school) as well as another issues that the primary health care physician shall address are considered important<sup>[11]</sup>.

## CONCLUSION

Diabetes Mellitus nowadays is one of the most common comorbidities worldwide. As a physician, the rule of screening the general population and thus early diagnosis of affected people are a vital part in the community health overall. Moreover, even after diagnosis the physician can face challenges such as converting the patient from oral hypoglycemic into insulin injections and consistent follow up with the patient. These issues, once solved by the clinician, can assure a great help in reduction of the complications and providing a better quality of life for these patients. New modalities in therapy are being studied and a lot of drugs are being developed in order to provide a more convenient and effective modalities of treatment to these patients.

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