Type 2 Diabetes Mellitus: A Review of Current Trend

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Abstract-Globally, the prevalence of type 2 diabetes mellitus (T2DM), a chronic metabolic disease, has been rising gradually. Obesity and type 2 diabetes are closely related conditions that are becoming a global health concern. The diagnostic standards, etiology, and genetics of several classes of diabetes mellitus, including T1, T2, gestational diabetes, and other forms of the disease, are contrasted. This trend is making it quickly turn into an epidemic in some other parts of the world, where the number of afflicted people is predicted to double in the next ten years due to population growth. This will add to the already heavy burden already placed on healthcare providers, particularly in developing nations with low incomes. This review is predicated on citation lists of pertinent publications and a search of the Cochrane Database of Systemic Reviews. T2 diabetes mellitus, prevalence, current diagnosis, and current therapy are included in the subject heading and key terms. The American Diabetes Association (ADA) and World Health Organization (WHO) guidelines, which take into account both clinical and laboratory characteristics, are still the foundation for screening and diagnosis. Although a cure for the condition has not yet been discovered, treatment options include changing one's lifestyle, managing obesity, taking oral hypoglycaemic medications, and starting metformin—which lowers insulin resistance—as a first line of treatment, particularly for obese patients. Alpha glycosidase inhibitors, insulin, and thiazolidinedione's are a few more medicines that work well.

Keywords: Diabetes, diagnosis, hyperglycaemia, Type 2 diabetes mellitus, novel medications and treatment.

DEFINITION OF DIABETES MELLITUS

A class of metabolic illnesses known as diabetes mellitus (DM) is typified by persistently high blood sugar levels that arise from abnormalities in either insulin secretion, insulin action, or both. The significance of insulin as an anabolic hormone leads to anomalies in the metabolism of proteins, fats, and carbohydrates. Diabetes type 2 is a diverse illness. A combination of environmental and genetic factors are needed for the illness to manifest clinically. In T2 diabetes, hyperglycaemia is caused by either a relative or absolute insulin shortage. Dysregulation of the metabolism of carbohydrates, proteins, and fats is a hallmark of type 2 diabetes mellitus (T2DM), which can be brought on by either reduced insulin production, insulin resistance, or a combination of the two. The kind and duration of the diabetes determine how severe the symptoms are. Certain individuals with diabetes, particularly those diagnosed with type 2 diabetes in their early

INTRODUCTION

One of the oldest diseases that humans have likely ever encountered is diabetes mellitus (DM). Globally, diabetes is a major health issue. About 3000 years ago, the Egyptian manuscripts were first mentioned. It is brought on by persistently high blood glucose levels, which are either the result of the body's cells not using insulin effectively or the inability of the pancreatic beta cells to make enough insulin. T1 diabetes (T1D) and T2 diabetes (T2D) are the two main forms of diabetes, generally speaking. The difference between T1 and T2 DM was established in 1936. In 1988, T2 DM was initially identified as a part of the metabolic syndrome. The most prevalent type of diabetes, known as T2 DM (formerly called non-insulin dependent DM), is characterized by hyperglycaemia, insulin resistance, and relative insulin shortage. The combination of genetic, environmental, and behavioural risk factors leads to T2 DM. Being a chronic illness, diabetes has an adverse effect on many organs, including the kidney, heart, brain, and eyes. It also raises the likelihood of developing a number of additional diseases brought on by macro and micro

vascular damage. Patients with diabetes also have an increased risk of infection. Individuals with type 2 diabetes (T2 DM) are more susceptible to a wide range of short- and long-term consequences, many of which result in an early death. The International Diabetes Federation estimated that 426 million people globally had diabetes in 2016. It is anticipated that both developed and developing nations will see an increase in this figure. It is projected that by 2045, there would be 629.1 million diabetic patients worldwide if adequate care and control are not implemented. Approximately 5.1 million deaths globally in 2017 were attributable to diabetes, and 850 million US dollars were spent on diabetic care. Due to the high cost of care, treatment, and associated problems, infection in patients with diabetes increases the financial burden on the patient.

TYPE 2 DIABETES

Due to both inadequate insulin action (insulin resistance) and reduced insulin synthesis by islet β cells in the pancreas, about 90% of all cases of diabetes are Type 2 D. This group includes more than 90%–94% of diabetic patients, the majority of whom are adults. In the United States, 0.45 out of 1000 people under the age of 20 had type 2 diabetes in 2009; this represents about 20% of all juvenile cases of the disease. Type 2 diabetes mellitus is linked to obesity, sedentary lifestyles, and aging. The primary cause of insulin resistance, which is the primary cause of type 2 diabetes, is obesity. The American Diabetes Association advises screening for T2 diabetes in overweight children and adolescents.

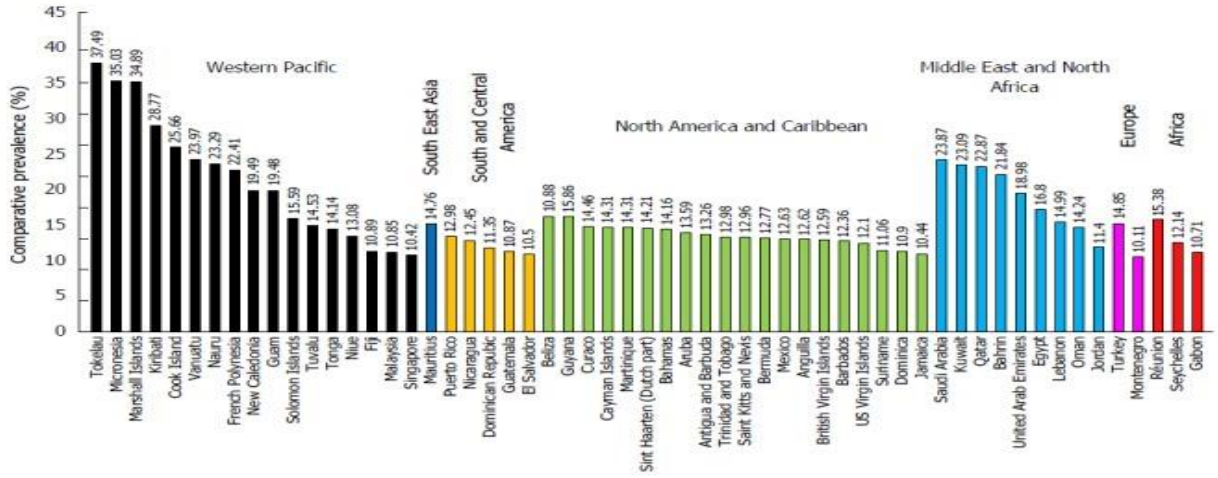


Fig.1. Comparative prevalence of diabetes in adults (20-78 years) in countries with high prevalence (≥ 10%).

This group includes more than 90–95% of diabetes patients, the majority of whom are adults. In the United States, 0.46 per 1000 children under 20 had type 2 diabetes in 2009. This represents about 20% of all juvenile cases of the disease. Insulin-target tissues require more insulin in T2 diabetes patients due to insulin resistance. In addition to insulin resistance, the pancreatic β cells' malfunctions prevented them from meeting the increasing demand for insulin.

Type 2 diabetes was mistakenly diagnosed as type 1 diabetes due to the occurrence of ketoacidosis in certain paediatric patients with T2 diabetes, the occurrence of severe dehydration on occasion, and the existence of type 2 diabetes in children and adolescents who are not obese. 7.1% of 62-year-old European patients with type 2 diabetes tested positive for GAD auto antibodies, while patients with diabetes who were diagnosed at a younger age had a greater frequency of LADA. Most of them are between the ages of 40 and 59, and by 2035, there will be more than 592 million of them worldwide, accounting for 10.1% of the population. Over half of a billion individuals worldwide are afflicted with diabetes, of which 176 million cases are still undiagnosed. 22 million more women are identified as having hyperglycaemia during pregnancy. The Western Pacific region has 138.2 million adults with a diagnosis of diabetes, and its countries also have the largest incidence of the disease. The Middle East and North Africa region has the highest prevalence of diabetes (10.9%). Eighteen percent of the cases are in low- and middle-income nations, "where the epidemic is gathering pace at alarming rates." In those with type 2 diabetes, long-term chronic insulin resistance has a number of

negative effects, including micro vascular problems like retinopathy, neuropathy, and nephropathy as well as macro vascular problems like atherosclerosis.

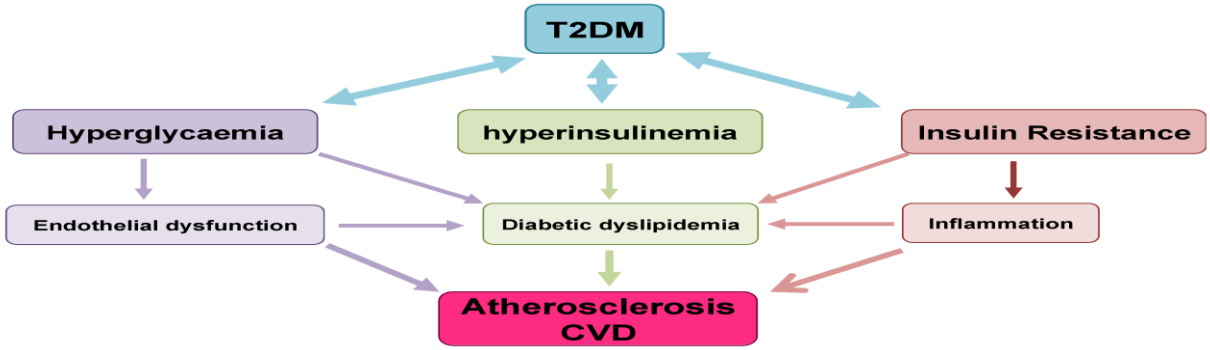
Epidemiology

Type 2 diabetes is now a serious global public health issue. According to estimates from the International Diabetes Federation, 382 million persons globally between the ages of 20 and 70 had type 2 diabetes in 2013. Of those affected, 80% lived in low- and middle-income nations. By 2030, there will have been 552 million cases of diabetes mellitus worldwide, from an anticipated 366 million cases in 2012. Every country is seeing a rise in the number of T2DM patients, with low- and middle-income nations housing 80% of the global T2DM population. In 2011, 4.6 million people died from DM. By 2030, 439.1 million people are predicted to develop type 2 diabetes. Our comprehension of the behavioural lifestyle and biological risk factors for type 2 diabetes has improved as a result of epidemiological investigations. The single biggest risk factor for type 2 diabetes is increasing adiposity, which is shown by rising BMI values. Additionally, certain dietary elements are linked, independent of body weight, to a lower risk of Type 2 DM. These elements include moderate alcohol consumption, a lower intake of refined grains, red and processed meat, and sugar-sweetened beverages, and a higher intake of coffee, nuts, and green leafy vegetables. Even though genetics has a significant role in the development of type 2 diabetes, the current diabetes epidemic is primarily explained by the obesity epidemic rather than by novel genetic abnormalities. According to predictions, within the next 20 years, there will be a significant increase in the incidence of adult diabetes mellitus, of which type 2 diabetes is becoming more common. Most of these cases are expected to occur in developing nations, where the majority of patients are between the ages of 44 and 65. The current trend of diseases shifting from communicable to non-communicable is expected to result in a twofold burden in emerging countries, with the latter expected to equal or even surpass the former.

Pathophysiology

Insulin insensitivity based on by insulin resistance, a decrease in insulin production, and ultimately pancreatic beta-cell loss are the hallmarks of type 2 diabetes mellitus. As a result, there is less glucose ($C_6H_{12}O_6$) transported into the adipose, muscle, and liver tissues. This malfunction prevents the rise in hepatic glucose and glucagon levels that occur during fasting from being controlled by meals. Hyperglycaemia is the outcome of low or insufficient insulin levels combined with elevated insulin resistance. Important gastrointestinal mediators of insulin release and, in the case of GLP-1, glucagon suppression, are the incretions.

Genetic and environmental factors are two of the many variables that contribute to type 2 diabetes. The pathophysiological alterations are typified by chronic inflammation, insulin resistance, and β-cell dysfunction, among other things. These factors gradually impair blood glucose regulation and give rise to micro- and macro vascular problems. At least eight different pathophysiological anomalies lead to poor glucose homeostasis in relation to hyperglycaemia, and these factors are already well-established early in the natural history of Type 2 DM. Two other pathophysiological defects that contribute to strong insulin resistance can be added to the "ominous octet": defective insulin-mediated vasodilation and the activation of inflammatory pathways.



DIAGNOSTIC CRITERIA FOR DIABETES MELLITUS

The American Diabetes Association (ADA) has established the following diagnostic criteria: A 2-hour plasma glucose level of 200 mg/dL (11.1 mmol/L) or higher after a 75-g oral glucose tolerance test (OGTT), or a fasting plasma glucose (FPG) level of 126 mg/dL (7.0 mmol/L) or higher.

	No Diabetes	Prediabetes	Type 2 Diabetes
HbA1c	4 - 5.6%	5.7 - 6.4%	6.5+%
Fasting Blood Glucose	<100 mg/dL	100–125 mg/dL	126+ mg/dL
OGTT	< 140mg/dL	141–199 mg/dL	200+ mg/dL

One of two methods is used to diagnose diabetes mellitus: HbA1c or plasma glucose estimation. Based on the correlation between FPG or HbA1c and retinopathy, the cut off values for glucose and HbA1c are estimated. Diabetes mellitus can be diagnosed by plasma glucose levels of 126 mg/dL or above when fasting, 200 mg/dL following a 2-hour OGTT, 6.5% HbA1c (48 mmol/mol), or 200 mg/dL random plasma glucose with hyperglycaemia symptoms.

Pharmacological Agents

Biguanides suppress hepatic glucose production, increase insulin sensitivity, enhance glucose uptake by phosphorylating GLUT-enhancer factor, increase fatty acid oxidation, and decrease the absorption of glucose from the gastrointestinal tract. Metformin is the most widely used biguanide in patients who are overweight or obese. A 2009 study reveals that another mode of action of metformin is the stimulation of AMP-activated protein kinase, an enzyme involved in the production of gluconeogenic genes in the liver. Metformin usage in senior diabetes patients with renal impairment should be cautious due to the possibility of developing lactic acidosis. Comparing it to sulfonylureas, the incidence of hypoglycaemia is lower.

Compared to younger individuals, elderly patients with Diabetes Mellitus on sulfonylureas treatment have a 37% higher risk of hypoglycaemia. Inhibitors of Alpha-Glycosidase although they are not commonly used, metformin and Acarbose have the potential to be safe and effective treatments for type 2 diabetes. In patients with severe renal impairment, these medications should be avoided as they are most useful for treating postprandial hyperglycaemia. Due to their strong side effects, which include flatulence and diarrhoea, their use is typically restricted. In a research, the new medication called vosibose was found to dramatically enhance the body's ability to tolerate glucose, as seen by a delay in the advancement of the disease and an increase in the proportion of patients who achieved normoglycemia.

Exenatide, liraglutide, dulaglutide, albiglutide, and semaglutide are a few examples. Dosing options for these formulations include twice daily, once daily, and weekly. All GLP-1 agonists are administered subcutaneously, and an oral version of semaglutide is also available. For type 2 diabetes, metformin (Fortamet, Glumetza) is typically the first medication recommended. It primarily functions by reducing the amount of glucose produced in the liver and raising insulin sensitivity, which increases the body's ability to use insulin more efficiently. Some individuals may require supplements due to a B-12 deficiency.

CONCLUSION

Metabolic diseases like Type 2 Diabetes Mellitus can be avoided by changing one's diet, controlling weight, and avoiding obesity. The goal of management for people with type 2 diabetes mellitus should be to enhance their quality of life. The forms of diabetes, as

well as the best techniques and standards for diagnosing people with diabetes and prediabetes, are the main topics of this review. It appears that diabetes is a complicated condition with many different genes contributing to its onset. The accurate identification of the genetic causes of diabetes may offer a crucial tool for better treatment, diagnosis, and genetic counselling.

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