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Review on Assessment of Risk and Complications of Diabetes Mellitus

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Abstract: ***The numbers of diabetic patients are increasing in India. The early onsets of diabetes at younger ages will affect the economy and health status of nation. It could be more distinct to classify based on clinical characteristics, demographics and progression of complications in individuals. Diabetes mellitus (DM) is associated with hyperglycemia and risk for developing other complications like hypertension, neuropathy, nephropathy and retinopathy etc. Many pathophysiological pathways for diabetes are driven by various environmental and genetic factors. These factors may affect the function of β- cells. The loss of mass and function of β-cells are key factors for all forms of diabetes. Early identification, proper diagnosis and lifestyle management will help to reduce the onset of diabetes and maintain a healthy nation. Now, research may reduce the potentially increase in diabetes at regional and national levels.***

Keywords: β-cell, complications, risk factors

1. Introduction

India leads as "the diabetes capital of the world" with the largest number of diabetic patients [1].The number of diabetic patients in India may be rise up to 69.9 million by 2025 unless proper prevention and it is published in the Diabetes Atlas, 2006 of the International Diabetes Federation.Recently, the most problematic fact is the onset of diabetes at younger ages [2]. The rate of morbidity and mortality due to diabetes create significant burdens on both families and society [3]. Pre-DM is associated with hyperlipidemia, obesity and other risk factors. Many pathophysiological pathways are driven by various genetic and environmental factors for DM. Early identification, proper diagnosis and lifestyle management would help to reduce the onset of diabetes and maintains a healthy nation. Now, there is the need for investigation at regional and national levels to reduce the potentially increase in diabetes. People with hyperglycemia are at risk for developing the complications [4, 5].

1.1 Prognosis

Pathophysiology of diabetes is unifying the characteristic like hyperglycemia of different diabetes resulting from dysfunction of β-cell. While Type 1 DM (T1 DM) results from immune-mediated destruction of β-cells and Type 2 DM (T2 DM) is primarily associated with defects in glucose-specific insulin secretion. In both cases of diabetes, the stress response induced by hyperglycemia may play a role in β-cell apoptosis [6]. Declining in numbers of functional β-cells are key factor for hyperglycemia and related diabetic complications. After 30 years of T1DM, there is decrease in C-peptide level in many diabetic patients. Metabolic markers could be utilized to predict the onset of diabetes in suspecting individuals [7,8]. Insulin secretion and sensitivity varies to maintain normal glucose levels. The ratio of proinsulin to insulin is high in type 2 diabetes [9]. There many studies have shown that treatment with appropriate lifestyle and medication can reduce the progression from prediabetes to diabetes [10,11]. It is also observed that clinical benefit of early therapy has reduced in complications like retinopathy and cardiovascular mortality [12].

1.2 Pathophysiology of Diabetes

T1 DM and T2 DM distinctively influence on age, race, ethnicity, geography, and socioeconomic status of a population in a state or nation. The rate of incidence and prevalence of T1DM vary dramatically across the globe. The prevalence of diabetes is increasing approximately at a rate of 3% per year globally. Though the diagnosis of T1DM frequently occurs in childhood, 84% of people living with T1DM are adults. T1DM affects males and females equally and decreases expectancy of life by an estimated 13 years [13, 14]. In the U.S., an estimated 95% of the nearly 30 million people living with T2DM and others are at risk for developing T2DM. The prevalence of T2DM is higher for males than females in U.S.. There is a regional variability of prevalence of T2DM. South-East Asia and Australia have more diabetic patients than other region of the world. The risk of incidence of T2DM is associated with low socioeconomic status. Low educational level increases risk by 41%, low occupation level by 31%, and low income level by 40% [15].

2. Material and methods

The information related to diabetes, types of DM, risk factors and complication related to diabetes were collected from .the scientific literature databases including PubMed and Google Scholar, books and proceedings. These risk factors are compiled and the related complications sited here.

3. Results and Discussion

This literature survey revealed the risk factors associated with diabetes and the complications like microvascular and macrovascular disorder. Proper management of lifestyle against DM also discussed here.

3.1 Genetic Factors

The lifetime risk of developing T2DM is 40% if parent has T2DM and higher if the mother has the disease . The risk for T1DM is 5% if parent has T1DM and higher if the father has the disease [16]. Mutations in relevant genes can cause Maturity-onset diabetes of the young (MODY). Nearly about 50 additional genes individually contribute their effects [17,18]. These factors influence on environmental signals and endocrine function. These gene variant shows 80% of T1DM heritability. Genome-wide association studies have identified more than 130 genetic variants associated with T2DM and explain less than 15% of disease heritability. There are many approaches for defining the heritability, disease heterogeneity, gene–gene interactions, and epigenetics in diabetes population. Most of the type 2 variants are in noncoding genomic regions. Mothers carrying KCNQ1 can able to secret insufficient insulin and this is due to born with a less functional β-cell. The rapid development of molecular genetics and decreasing costs for next-generation sequencing should give path to genetics of diabetes [19-21].

3.2 Environmental Influences

Environmental factors also play major role in increasing the prevalence of both types of diabetes.Common environmental factors including nutritional factors, environmental polluters and intestinal microbiome composition are associated with both T1 DM and T2 DM [22]. Obesity and insulin resistance may be enhancing the two types of diabetes respectively. It is suggested that environmental factors interact with genetic factors and enhance autoimmunity and cause progression of T1DM. These factors may be entero-viral and other infectious agents like intestinal microbes. The exposure of these factors may influence autoimmunity of β-cells. Low concentrations of vitamin D in serum and obesity are also associated with T1DM and T2DM. Insulin resistance develops with ectopic fat deposition in the liver and muscle. Fat deposition in the pancreas may cause for decline in secretion of insulin. Sleeping disorder like reduced and increased in sleep time are associated with obesity and diabetes [23].

3.3 Complications in Diabetes

Intensive glycemic control can reduce diabetes complications in diabetic patients. Recently it is studied that in this decade the rates of diabetic complication in microvascular and macrovascular, also deaths from hyperglycaemic have substantially decreased. Research efforts are carried out to identify the presence and progression of complications in diabetes [24]. It may lead to a better understanding of risk and reduce the impact of diabetes.

Many people with obesity and T1DM have begun to exhibit metabolic syndrome. Kidney disease predicts the cardiovascular disease in people with T1DM and is associated with development of additional microvascular and macrovascular complications over time [25]. It is studied that absorption of cholesterol is higher in diabetes and abnormal metabolism of lipoproteins are seen in diabetic nephropathy. Cardiovascular disease risk increases substantially when decrease in glomerular filtration rate. Diabetic nephropathy cannot be detected by only microalbuminuria, but it is a marker for inflammation that indicates vascular leakage and cardiovascular risk. For three decades albuminuria has been used as a marker for diabetic nephropathy[26]. Gestational diabetes mellitus is associated with perinatal complications like increased foetal adiposity, the risk of obesity, T2DM and metabolic syndrome in adulthood [27,28].

Rubler et al., 1972 first time used the term “diabetic cardiomyopathy” describing the myocardial dysfunction in diabetic patients . Hypertrophy of the diabetic heart is cause for the deposition of myocardial triglyceride, collagen and fibrosis. Deposition of end product constitutes factors for microvascular complications. This microvascular problem is responsible for myocardial collagen deposition and cardiomyocyte stiffness [29-30].

Both hypertension and DM are common and their co-existence is extremely prevalent in an individual [31]. Both are considered as risk factors for coronary artery disease, cerebrovascular disease, renal failure and congestive heart failure. So, the treatments of both conditions are essential. Certain diabetic individuals are recommended to set a goal of BP less than <140/90 mm Hg by standard guidelines . Recently introduced drug classes for the treatment of DM have also been found to lower BP, thus making the interaction between BP and DM even more complex. In addition to lowering BP it is very important to control all other risk factors in diabetic patients[32].

4. Conclusions

Diabetes is currently broadly classified as type 1, type 2, gestational, and a group of “other specific syndromes.” Characterization of disease progression is much more developed for T1DM and T2DM. Clinical and genetic information could be more refined to classify based on clinical characteristics, demographics, and novel biomarkers for disease risk, progression, and complications in discreet populations. The loss of β-cells and its function are key factors for all forms of diabetes and its related complications. Understanding the pathways of dysregulation may reduce the incidence and complication of diabetes. In urban areas, it is seen that the rapid rise of diabetes during last few decades. Hence, the early identification, weight reduction, changes in dietary habits and increased physical activity could greatly help to prevent, or delay the onset of diabetes. It will decrease the burden of non communicable diseases in India.

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