Focus on diabetes mellitus - A review

Saravanan K* and Manna PK.

Department of pharmacy, Annamalai university, Annamalai Nagar, Tamilnadu, India

*Corresponding Author: E-Mail: sarankcdm@gmail.com

ABSTRACT

Diabetes mellitus is a group of metabolic disorder associated with increased blood sugar. Based on the symptoms and disease progression it is classified into four types are type 1, type 2, gestational diabetes and other specific types. There are two main types are Type 1 diabetes mellitus associated with insufficient insulin secretion in pancreases whereas Type 2 diabetes is associated with a lack of insulin response in the tissue. The pathology of diabetes mellitus is either because the pancreas does not produce enough insulin, or because the cells do not respond to the insulin that is produced. The projected prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The urban population in developing countries is projected to double as compared to rural population. The diabetic prevalence across the world appears to be the increase in the age of 65 years. The higher prevalence diabetes was observed in men than women, but there are more women with diabetes than men. The world health organization places diabetes is one of the major top ten leading causes of death for the decade. Diabetes can be managed with oral hypoglycemic agents and insulin, however, no cure has been found so far. In this review article we mainly focus on the current management of diabetes in clinics. The primary goal of the diabetic management is related to effective control of blood glucose, blood pressure and lipids, to minimize the risk of long-term consequences associated with diabetes. Type-2 can be managed with oral hypoglycemic agents such as sulphnylurea, biguanides and metformin. Whereas Type-1 diabetes need insulin injection to control the complications associated with increased glucose. The recent findings were suggested that drug therapy should be changed for at least every three months based on the blood glucose and HBA1C levels.

Keywords: .....?

1. INTRODUCTION

Diabetes is a metabolic disorder in which human body either does not produce insulin or not properly use insulin. Insulin is a naturally occurring hormone that is required to convert sugar, starch, and other food into energy. diabetes is characterized by constant high levels of blood glucose . The human body has to maintain the blood glucose at a very narrow range, which is the task of insulin and glycogen. Glycogen causes the liver to release glucose from its cells into the blood, for the production of energy when glucose cannot enter into our cells, its built up in the blood, which damage organs including the eyes, kidney and all so cause damage to blood vessels and nerves.

1.1. Epidemiology of diabetes mellitus

Diabetes is considered as one of the most frequent contributors to premature death in developing countries.A recent report indicates that nearly As at 2013, 382 million people have diabetes worldwide. [1] Type 2 makes up about 90% of the cases [2,3]. This is equal to 8.3% of the adult population [3] with equal rates both women and men. In 2014, the International Diabetes Federation (IDF) estimated that diabetes resulted in 4.9 million deaths [4]. The World Health Organization (WHO) estimated that diabetes resulted in 1.5 million deaths in 2012, making it the 8th leading cause of death [5]. The discrepancy between the two estimates is due to the fact that cardiovascular diseases are often the cause of death for individuals with diabetes; the IDF uses

modelling to estimate the amount of deaths that could be attributed to diabetes [6]. More than 80% of diabetic deaths occur in low and middle-income countries [7].

1.2. Prevalence of diabetes mellitus

The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8%in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. The prevalence of diabetes is higher in men than women, but there are more women with diabetes than men. The urban population in developing countries is projected to double between 2000 and 2030. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people >65 years of age.

1.3. Classification of diabetes mellitus

The world health organization classified three main forms of DM on the basis of etiology rather than pharmacological approach to managing it Type1 (insulin deficiency), Type2 (insulin resistance), gestational diabetes (occurring during pregnancy). Expert committee on the diagnosis and classification of diabetes mellitus 1997, has also introduced several other types that do not fit in to typ1 and type2 DM, it include genetic defects in β-cell function, diseases in pancreases (pancreatitis, cystic fibrosis) and other endocrine disorders, drugs and chemical induced DM. in the most common forms of DM has reported type2 (maturity-onset diabetes), rather than type1 (juvenile-onset diabetes) and others [8].

> Fasting plasma glucose level at or above 126 mg/dL (7.0mmol/l).

> Plasma glucose at or above 200 mg/dL or 11.1 mmol/l two hours after a 75 g oral glucose load as in a glucose tolerance test.

> Random plasma glucose at or above 200 mg/dL or 11.1 mmol/l. [1]

> Hemoglobin A1C, also called as HBA1C measured periodically every 2-3 months people with well controlled diabetes HBA1C levels should be below 7%

Most physicians prefer measuring a fasting glucose level because of the ease of measurement and the considerable time commitment of formal glucose tolerance testing, which can take two hours to complete. By current definition, two fasting glucose measurements above 126 mg/DL or 7.0 mmol/ I is considered diagnostic for diabetes mellitus [1] .Patients with fasting sugars between 6.1 and 7.0 mmol/l (iE, 110 and 125 mg/DL) are considered to have

"impaired fasting glucose" and patients with plasma glucose at or above 140mg/dL or 7.8 mmol/l two hours after a 75 g oral glucose load are considered to have "impaired glucose tolerance". "Prediabetes" is either impaired fasting glucose or impaired glucose tolerance; the latter in particular is a major risk factor for progression to full-blown diabetes mellitus as well as cardiovascular disease.

While not used for diagnosis, an elevated level of glucose irreversibly bound to hemoglobin (termed glycosylated hemoglobin or HbA1c) of 6.0% or higher (the 2003 revised U.S. standard) is considered abnormal by most labs; HbA1c is primarily used as a treatment-tracking test reflecting average blood glucose levels over the preceding 90 days (approximately). However, some physicians may order this test at the time of diagnosis to track changes over time. The current recommended goal for HbA1c in patients with diabetes is <7.0%, which as defined as "good glycemic control", although some guidelines are stricter (<6.5%). People with diabetes who have HbA1c levels within this range have a significantly lower incidence of complications from diabetes, including retinopathy and diabetic nephropathy.[6]

1.4. Type 1 or insulin dependent diabetes melitus (IDDM)

Type 1 diabetes mellitus—formerly known as insulin-dependent diabetes (IDDM), childhood diabetes, is characterized by loss of the insulin-producing beta cells of the islets of Langerhans of the pancreas leading to a deficiency of insulin, Insulin is a hormone that helps glucose enter cells (Figure 1). It should be noted that there is no known preventative measure that can be taken against type 1 diabetes. Diet and exercise cannot reverse or prevent type 1 diabetes. Sensitivity and responsiveness to insulin are usually normal, especially in the early stages. This type of diabetes can affect children or adults, but was traditionally termed "juvenile diabetes" because it represents a majority of cases of diabetes affecting children.

The most common cause of beta cell loss leading to type 1 diabetes is autoimmune destruction, accompanied by antibodies directed against insulin and islet cell proteins. The principal treatment of type 1 diabetes, even from the earliest stages, is replacement of insulin. Without insulin, ketosis and diabetic ketoacidosis can develop and coma or death will result. Currently, type1 diabetes can be treated only with insulin, with careful monitoring of blood glucose levels using blood testing monitors. Emphasis is also placed on lifestyle adjustments (diet and exercise). Apart from the common subcutaneous

injections, it is also possible to deliver insulin by a pump, which allows continuous infusion of insulin 24 hours a day at preset levels and the ability to program doses (a bolus) of insulin as needed at meal times. It is also possible to deliver insulin with an inhaled powder.

1.5. Type 2 or Non insulin dependent diabetes melitus (NIDDM)

Type 2 diabetes mellitus is known as adult-onset diabetes, maturity-onset diabetes, or non-insulin-dependent diabetes mellitus (NIDDM) is due to a combination of defective insulin secretion and insulin resistance or reduced insulin sensitivity (defective responsiveness of tissues to insulin), which almost certainly involves the insulin receptor in cell membranes. In the early stage the predominant abnormality is reduced insulin sensitivity, characterized by elevated levels of insulin in the blood. There are numerous theories as to the exact cause and mechanism for this resistance, but central obesity is known to predispose for insulin resistance, possibly due to its secretion of adipokines (a group of hormones) that impair glucose tolerance. Abdominal fat is especially active hormonally. Obesity is found in approximately 90% of developed world patients diagnosed with type2 diabetes. Other factors include aging and family history which also predispose to diabetes.
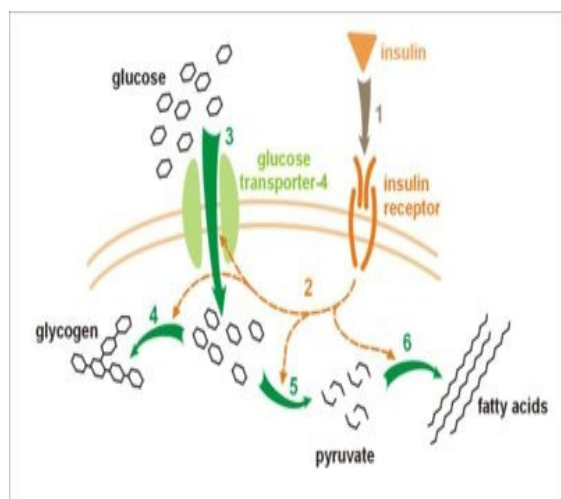

Figure - 1: Mechanism of insulin release in normal pancreatic beta cells.

Type 2 \diabetes may go unnoticed for years in a patient before diagnosis, as visible symptoms are typically mild or non-existent, without ketoacidotic episodes, and can be sporadic as well. However, severe long-term complications can result from unnoticed type 2 diabetes, including renal failure, vascular disease (including coronary artery disease), vision damage, etc.

It is usually first treated by attempts to change physical activity (usually increase), diet (generally decrease carbohydrate intake), and weight loss. These can restore insulin sensitivity, even when the weight loss is modest, for example, around 5 kg (10 to 15 lb), most especially when it is in abdominal fat deposits. Some Type 2 diabetics can achieve satisfactory glucose control, sometimes for years, as a result. However, the underlying tendency to insulin resistance is not lost, and so attention to diet, exercise, and weight must continue. The usual next step, if necessary, is treatment with oral antidiabetic drugs. As insulin production is initially unimpaired in Type 2s, oral medication (often used in various combinations) can still be used to improve insulin production (e.g., sulfonylureas), to regulate inappropriate release of glucose by the liver (and attenuate insulin resistance to some extent (e.g., metformin), and to substantially attenuate insulin resistance (e.g., thiazolidinediones). If these fail insulin therapy will be necessary to maintain normal or near normal glucose levels. A disciplined regimen of blood glucose checks is recommended in most cases, most particularly and necessarily when taking medications.

1.6. Gestational diabetes

It also involves a combination of inadequate insulin secretion and responsiveness, resembling type 2 diabetes in several respects. It develops during pregnancy and may persist or disappear after delivery. Even though it may be transient, gestational diabetes may damage the health of the fetus or mother, and about 20%–50% of women with gestational diabetes develop type2 diabetes later in life. GDM occurs in about 2%–5% of all pregnancies. It is temporary and fully treatable but, if untreated, may cause problems with the pregnancy, including macrosomia (high birth weight), fetal malformation and congenital heart disease. It requires careful medical supervision during the pregnancy. Fetal/neonatal risks associated with GDM include congenital anomalies such as cardiac, central nervous system, and skeletal muscle malformations. Increased fetal insulin may inhibit fetal surfactant production and cause respiratory distress syndrome. Hyperbilirubinemia may result from red blood cell destruction. In severe cases, prenatal death may occur, most commonly as a result of poor placental profusion due to vascular impairment. As a result of the decreased placental function, there is marked fetal distress or an increased risk of injury associated with macrosomia, such as shoulder dystocia.

1.7. Other types

There are several rare causes of diabetes mellitus that do not fit into Type 1, Type 2, or gestational diabetes:

> Genetic defects in beta cells (autosomal or mitochondrial)

> Genetically-related insulin resistance, with or without lipodystrophy (abnormal body fat deposition)

> Diseases of the pancreas (e.g. Chronic pancreatitis, cystic fibrosis)

> Hormonal defects

> Chemicals or drugs

The tenth version of the International Statistical Classification of Diseases (ICD-10) contained a diagnostic entity named "malnutrition-related diabetes mellitus". A subsequent WHO 1999 working group recommended that MRDM be deprecated, and proposed a new taxonomy for alternative forms of diabetes [8]. Classifications of non-type 1, non-type 2, non-gestational diabetes remains controversial.

1.8. Genetic and modifiable risk factors

The population based studies suggest that type 2 diabetes has a strong genetic component gene seems to be strongly infused by environmental and behavioral factors. These are large number of genes that are responsible for diabetes. PPAR- gama (Peroxisome proliferator-activated receptor gamma)mostly found in adipose tissue and its mechanism of action insulin resistance [9]. The modifiable risk factors operate in different combination in different part of the world majority of the age > 40 years gender, socioeconomic group, anthropometric parameters like body weight, inactivity, family history, race, age, gestational diabetes, especially in women mostly affected polycystic ovary syndrome, high blood pressure, abnormal cholesterol and triglyceride levels, like other important environmental factors are smoking, alcohol consumption, psychological stress. The summation of these socio-demographic and lifestyle factors is accelerating the diabetes epidemic sweeping India and other developing countries [10].

1.9. Medication for diabetic mellitus

The overall goal of treating of diabetes is to reduce diabetes -associated morbidity and mortality. The selection of specific drug therapy is based on evidence that demonstrates risk reduction, non pharmacological therapy includes modification in life style, diabetic diet, physical activity, like exercise, and meditation. Pharmacological therapy is based on the different classes 0f oral hypoglycemic agents, anti-diabetic drugs Biguanide. (Metformin), sulfonylureas. (Glimepiride) Thiazolidinedione. (pioglitazone) Alpha-glucosidase inhibitor, (Acarbose) Non-sulfonylurea insulin secretogogues (Repaglinide) mainly prescribed this medicine as low risk of hypoglycemia, no significant drug interaction. Injectable ggents for glycemic control in Patients with diabetes. Rapid -acting insulin, short acting, long acting, intermediate and short acting mixture

1.10. Preventive care for diabetes

The most common type of diabetes, prevention is a big deal. It's especially important to make diabetes prevention a priority if you're at increased risk of diabetes, for example, if you're overweight or have a family history of the disease

> Get more physical activity There are many benefits to regular physical activity. Exercise can help you (a) Lose weight (b) Lower your blood sugar (c) Boost your sensitivity to insulin-which helps keep your blood sugar within a normal range.

> Get plenty of fiber it may help you (a) reduce the risk of diabetes, improving blood sugar level normal(b) Lower risk of heart diseases(c) Promoting weight loss food high fiber includes fruits, vegetables ,beans, whole grains, nuts and seeds.

> The goal of treating diabetes is to reduce the risk of serious complications, including heart diseases,retinopathy, diabetic foot ulcers. Neuropathy(nerve damage) nephropathy (kidney damage) etc.

2. CONCLUSION

Epidemiological studies to assess the prevalence of diabetes are urgently needed in developing countries like India to bring these populations into preventive care and reduce the mortality risk associated with diabetes and associated with disorders. Studies are needed in rural areas to have a baseline data about the prevalence of diabetes and its association with the risk factors and regular monitoring and proper counselling only to prevent the diseases.

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