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Diabetes Mellitus: A Review

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Abstract

Diabetes mellitus (DM), or diabetes, is a collection of metabolic illnesses wherein someone has excessive blood sugar, since the body no longer produces sufficient insulin or because cells no longer reply to the insulin it produces. This excessive blood sugar produces the classical signs of polyuria (common urination), polydipsia (expanded thirst), and polyphagia (expanded hunger). There are three types, mainly: Type 1 DM results from the body's failure to provide sufficient insulin. This shape was formerly noted as "insulin-based diabetes mellitus or juvenile diabetes.". The case is unknown. Type 2 DM starts with insulin resistance, a situation wherein cells fail to respond to insulin properly. This shape was formerly mentioned as "noninsulin-structured diabetes mellitus" or "adult-onset diabetics." The number one reason is immoderate frame weight and no longer sufficient exercise. Gestational diabetes is the third main form that occurs when pregnant women without a previous history of diabetes develop a high blood glucose level. Prevention and treatment involve a healthy diet, physical exercise, not using tobacco, and having a normal body weight. Type 1 diabetics ought to be controlled with insulin injections. Type 2 diabetics may be treated with medications with or without insulin. Insulin and some oral medications can cause reduced BP and the proper weight to be maintained. Gestational diabetics usually resolve after the birth of the body.

Keywords: polyuria, polydipsia, polyphagia, ketoacidosis, stroke.

Introduction:

Diabetes is a chronic disease and a group of metabolic disorders characterized by high levels of sugar in the blood (hyperglycemia) [1]. Blurry visions, excess thirst, fatigue, frequent urination, hunger, and weight loss are some of the symptoms commonly seen in diabetic patients [2].

Types of Diabetes:

Type 1 diabetes mellitus(T1DM): is a long-term autoimmune condition linked to the targeted degeneration of pancreatic B-cells that produce insulin [3].

Type 2 diabetes mellitus(T2DM): which is frequently accompanied by increasing beta cell failure. New research emphasizes how oxidative stress, adipose tissue malfunction, and chronic inflammation contribute to the development of beta-cell failure and insulin resistance [4].

Gestational Diabetes: The term "gestational diabetes mellitus" (GDM) refers to a range of degrees of glucose intolerance that first manifests or is diagnosed during pregnancy and may or may not continue after birth [5].

A complex autoimmune disease, type 1 diabetes mellitus is typified by persistently elevated blood sugar levels and the emergence of certain vascular changes. The autoimmune depletion of B-cells by T-cells is the cause of type 1 diabetes, which leads to a severe insulin shortage.[6] Insulin resistance is a hallmark of type 2 diabetes, a chronic condition that raises blood sugar levels too high. By 2030, there will be 366 million people with T2DM, up from 171 million in 2000, perhaps reaching pandemic levels. T2DM is the more common kind, accounting for 90% of cases of diabetes globally [7]. About 7% of pregnancies end in GDM, and the mother, fetus, and subsequent infant are at higher risk of morbidity and death. GDM requires close observation and intensive care. Type 2 diabetes and cardiovascular disease are much more common in women with a history of gestational diabetes mellitus (GDM) in the years following delivery [8].

Factors Causing Diabetes:

The primary cause of T1DM is environmental factors. Obesity is one of the key factors that leads to the development of insulin resistance (T2DM) [9]. Because of the lifestyle changes brought about by urbanization, westernization, and their related nutritional habits, inadequate dietary intake, and poor physical activity, together with obesity and low socioeconomic status, the prevalence of diabetes mellitus is rising [10]. Among the main modifiable risk factors for type 2 diabetes, body weight is significant. Individuals with type 2 diabetes and obesity raise the risk of cardiovascular problems and death. It is an independent risk factor for dyslipidemia, hypertension, and cardiovascular disease [11]. Drug-based therapeutics for type 2 Diabetes mellitus is shown in Figure No. 1.

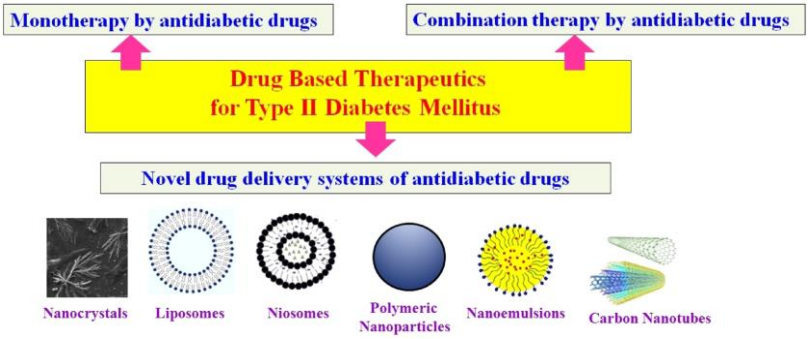

Figure 1: Drug-based therapeutics for type 2 Diabetes mellitus

Epidemiology:

The term "DM" is no longer unfamiliar to people worldwide; it is becoming more and more common in every nation [12]. Growing combinations of the risk factors indicated above have added to the global diabetes epidemic, affecting both type 1 and type 2 diabetes. One of the most prevalent diseases in the world today is type 2 diabetes. Every country has a rising number of patients with type 2 diabetes. It is now estimated that 382 million people worldwide have diabetes, of which 175 million are undiagnosed, with the highest incidence occurring in those aged 40 and 59 [13]. This figure is anticipated to rise to over 592 million by 2035 14. It is projected that 422 million people (8.5%) worldwide suffer from diabetes in 2014 [15]. These figures are significantly higher than earlier projections [16]. One of the main issues and biggest challenges facing the health system is diabetes [17]. Worldwide, the prevalence of diabetes is rising, especially in young people [18]. According to a WHO report, the prevalence of diabetes will rise to 4.4% worldwide in 2030, impacting about 366 million people shift 114% since 2000[19].

Etiology:

The word "aetiologia" is where the English word "aetiology" originates. Thus, the science of determining the causes and origins of a disease is known as aetiology, and it encompasses the following:

1) The juvenile-onset type is thought to have an auto-immune origin currently.

2) Viruses such as Coxsackie B may potentially contribute to the genesis of diabetes.

3) There is debate over the aetiology of diabetes. Perhaps a genetic characteristic increases a person's susceptibility to any of the viruses in the pancreas [19].

Risk Factor:

The development of type 2 diabetes has been linked to several risk factors. Unmodifiable risk factors include advancing population age, family history, and diabetes genetic variables in some ethnic groups. Still, the most common risk factors for the rising diabetes epidemiology, are variables linked to poor food, inactivity, and smoking, which typically result in being overweight, dyslipidemia, high blood pressure, and impaired glucose tolerance. Diabetes development is influenced by environmental factors, including low socioeconomic position, physical living conditions, stress levels, and exposure to mercury and arsenic [20].

Complications:

Type 1 and type 2 diabetes patients have comparable clinical manifestations, while the severity of the clinical characteristics varies. The main symptoms include weight loss, limb pains, impaired vision, constipation, exhaustion, polydipsia, polyphagia and polyuria. The two categories of long-term diabetes issues that are linked to the progressive nature of diabetes over time are macrovascular and microvascular. The latter typically manifests earlier and may include peripheral neuropathy, nephropathy, and retinopathy. The former may result in damage to or loss of vision in the eyes, limbs, and kidneys as well as coronary heart disease, stroke, and peripheral vascular disease [21]. Complications emerging from the diabetes mellitus are shown in Figure No. 2.

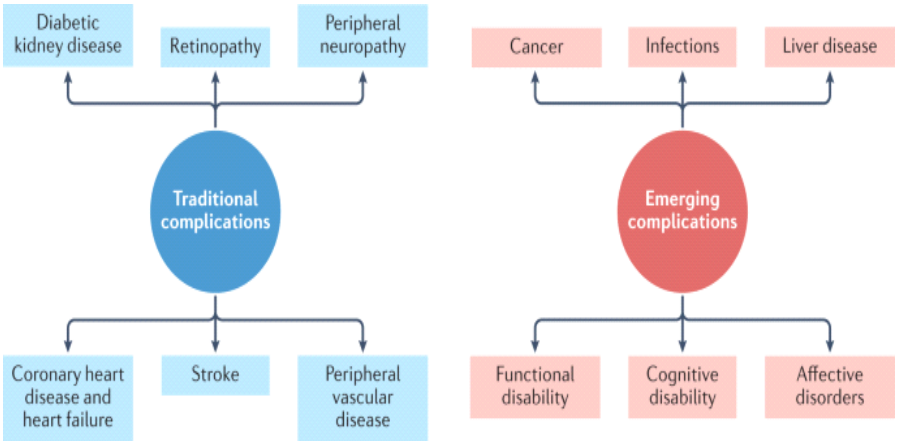

Figure 2: Complications emerging from the diabetes mellitus

Diabetes Management:

Over 10% of the National Health Service's (NHS's) yearly expenditure goes into managing its patient population with diabetes, with over half of that amount going toward treating people who have severe consequences from the disease [22]. If treatment costs are not drastically lowered, the growing number of people with diabetes in the UK will have a substantial effect on NHS spending and may compromise patient care 23. The burden of treating and preventing diabetes and its consequences will increase with a considerable rise in the disease's prevalence, and this will have a major financial impact on healthcare. Adopting national guidelines into standard clinical practice has been linked to increased medication prescribing and technology use [24]. Increased usage of anti-hyperglycemic drugs and improved glycemic management to the HbA1c recommended level [25]. Patient empowerment and education are crucial for the successful implementation of such strategies [26] in addition to the diverse specialized team's care system [27].

Treatment:

Insulin and hypoglycemic drugs:

The goal of insulin therapy should be to emulate nature, which has remarkable efficacy in preventing hypoglycemia in between meals and minimizing postprandial hypoglycemia [28]. Insulin injection sites can be intramuscular and intravenous; both are crucial for the optimal and safe functioning of the drug. There are various insulin formulations available, including cattle, pork, and human insulin. There are drawbacks and dangers to insulin therapy. The two most significant side effects of taking an incorrect dose of insulin and timing meals and insulin injections are weight gain and hypoglycemia [29]. Gaining weight due to increased muscle mass and truncal fat is an inevitable side effect of beginning insulin therapy for uncontrolled diabetes. Additionally, less energy is lost because of glycosuria [30]. Voltage-gated channels are then opened as a result, permitting the entry of calcium ions and the consequent release of granules. Initial research revealed that the hypoglycemic effects of sulfonylureas required a functioning pancreas [31]. Metformin is an example of a biguanide that is antihyperglycemic rather than hypoglycemic [32]. Even at high dosages, it does not cause hypoglycemia or the pancreas to secrete insulin [33]. When taken orally, but not intravenously, it has been demonstrated to enhance peripheral glucose absorption and decrease hepatic glucose production by about 20–30%. Another proposed mechanism of action is impaired intestinal absorption of glucose [34].

Herbal Treatment of Diabetes:

With the expanded research in the field of traditional medicine over the past few decades, plant-based medications that are eco-friendly, bio-friendly, affordable, and generally safe have made a transition from the fringe to the mainstream. Numerous literature studies have been written regarding antidiabetic herbal compounds by various authors; however, the review of Atta-ar-Rahman, who has recorded over 300 plant species approved for their hypoglycemic activities is most informative. The plants in this review have been categorized based on their botanic name, place of origin, parts utilized, and type of active agent. Momordica Charnita, a member of the Cucurbitaceae family, is one such plant [35]. The World Health Organization has compiled a list of 21,000 plants that are used medically worldwide. Of these 2500 species, 150 are used on a reasonably considerable scale in commercial settings in India. India is known as the world's largest producer of medicinal plants [36].

Pathophysiology

The complex interactions between genetics, environmental factors, and lifestyle decisions are part of the pathophysiology of diabetes mellitus. Absolute insulin insufficiency is the outcome of the autoimmune loss of pancreatic beta cells that characterizes type 2 diabetes, which is frequently accompanied by increasing beta cell failure [37]. Pathophysiology of diabetes mellitus is shown in Figure No. 3.

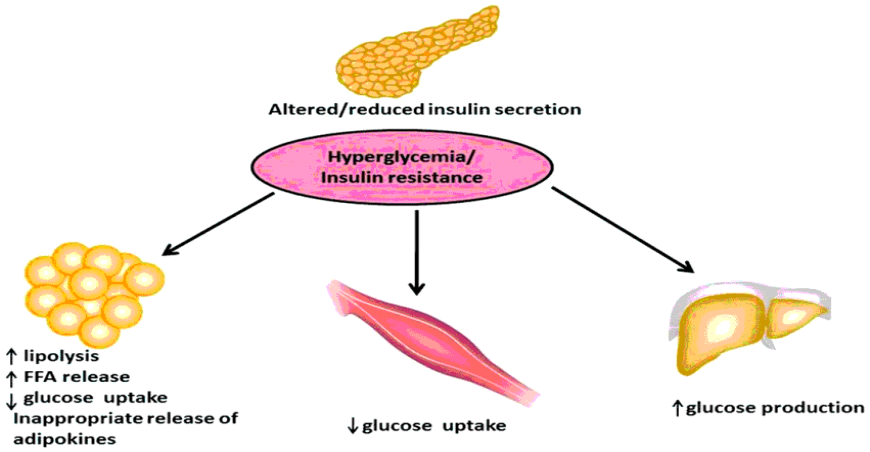

Figure 3: Pathophysiology of diabetes mellitus

Diagnosis:

Either HbA1c or the estimation of plasma glucose {Fasting plasma concentration(FGP) or Oral Glucose Tolerance Test (OGTT)} is used to diagnose diabetes mellitus. Based on the correlation between FPG or HbA1c and retinopathy, the cutoff values for glucose and HbA1c are estimated. Diagnosing diabetes mellitus involves measuring plasma glucose levels of at least 126 mg/dl {7.0 mmol/L} during fasting, 200 mg {11.1 mmol/L} after a 2-hour OGTT, HbA1c of at least 6.5%, or a random plasma glucose level of at least 200ml (about 6.76 oz) \dl along with hyperglycemia symptoms [38] and approved by the American Diabetes Assocation [39]. The WHO and the Endocrine Society [40] and several scientists worldwide, along with associated organizations. Sacks et al., have analysed the benefits and drawbacks of the various tests used to diagnose diabetes [41]. To confirm a single seemingly diagnostic result in asymptomatic patients, it is advised to repeat the HbA1c test after two weeks[42].

SIGNS AND SYMPTOMS:

When cells in diabetes mellitus are unable to metabolize glucose in a normal way, they essentially starve [43]. Diabetes mellitus long-term effects include the progressive development of certain complications such as retinopathy, which results in blindness, nephropathy which can cause renal failure, neuropathy, Charcot joints, and symptoms of autoimmune and sexual dysfunction [44]. Additional symptoms include muscle atrophy, tissue disintegration, and elevated blood glucose levels as a result of

1) Gluconeogenesis from amino acids and body protein

2) The breakdown of body fat, which releases some of its energy and produces an excessive amount of ketone bodies [45].

Quality of Life in Diabetes:

A Quality of life in diabetes assessment was conducted in 29 studies including T2D population. Four studies examined T1D patient's quality of life [46]. Quality of life evaluations among women with gestational diabetes was reported in a single study [47]. The reported mean DAWN Quality of life scores for T1D patients were 35 [48].

Conclusion:

Diabetes mellitus is the pandemic of the century, and it will only increase if early diagnosis techniques are not developed. The many forms of diabetes, as well as the best diagnostic techniques and standards for identifying 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. Accurately pinpointing the genetic causes of diabetes may offer a crucial tool for better diagnosis, treatment, and more successful genetic counseling. Moreover, our increased understanding of the link between medical genetics and the long-term consequences of diabetes will offer a further benefit to postpone or eliminate these extremely stressful consequences.

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