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Review Paper for Diabetes Mellitus

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Abstract

Diabetes mellitus (DM), a chronic metabolic disorder characterized by hyper-glycemia, has its roots in ancient times. Originating from the Greek words "diabetes" (siphon) and "mellitus" (sweet), DM has plagued humanity for millennia. The condition is marked by the body's inability to produce or effectively use insulin, leading to elevated blood sugar levels.

The global prevalence of DM is alarming, with an estimated 463 million individuals affected worldwide in 2019. Type 2 diabetes accounts for the majority of cases, and the disease is a significant contributor to mortality and morbidity. DM imposes a substantial economic burden on healthcare systems globally, with billions of dollars spent annually on treatment and management.

The long-term complications of DM are severe and can include cardiovascular disease, kidney disease, nerve damage, and eye problems. Effective management of DM is crucial to prevent these complications and improve quality of life.

Keywords: Diabetes Mellitus, Insulin, Sulfonylureas, Radioimmunoassay (RIA)

1. Introduction

The Greek language is where "Diabetes" and "Mellitus" originate. Mellitus means "sweet," while diabetes means "passer-by: A siphon" [1]. (DM) is a subset of insulin resistance syndrome that is typified by persistently elevated blood sugar levels. Three thousand years ago, the ancient Egyptians explained [2]. It is commonly referred to as diabetes or sugar sickness in the local community. The illness is not contagious [3]. Severe long-term issues such as foot ulcers, chronic nephropathy, stroke, and cardiovascular disease, among others. It has nothing to do with kidney-related fluid retention issues known as "Diabetes Insipidus."

Around 463 million people worldwide suffer from diabetes as of 2019. About 8.8% of adults have diabetes mellitus, with type 2 diabetes mellitus accounting for 90% of cases. An estimated 4.2 million deaths in 2019 were attributed to diabetes mellitus. In the United States, the price of diabetes mellitus was approximately USD 327 billion in 2017. An estimated 727 billion US dollars were spent on diabetes mellitus-related medical expenses worldwide in 2017. Of the population, 25–30% are normal diabetics. Every year, about 1 in 90 people in North America suffer from diabetes. Develop 1 in 80 cases of macular oedema and proliferative retinal disease.

2. History

Diabetes mellitus history the pathogenesis of diabetes was primarily clarified in the 20th century, even though remedies for the condition have existed since the Middle Ages. In 1889, Joseph Von Mering and Oskar Minkowski identified the pancreas' involvement in diabetes. Sir Edward Albert Sharpey-Schafer proposed in 1910 that people with diabetes lacked a specific substance that the pancreas ordinarily produces; this substance was subsequently dubbed insulin (Himsworth, 1936) [6]. At the University of Toronto in Canada, Frederick Grant Banting and Charles Herbert Best separated insulin from cow pancreas in 1921. Type I and type II diabetes were later distinguished by Sir Harold Percival (Himsworth, 1936) [6]. Other notable findings in this area include the 1942 discovery of sulfonylureas and the radioimmunoassay.

Reaven's 1988 discovery of the metabolic syndrome, Rosalyn Yallow and Solomon Berson's discovery of insulin, and the 1990s discovery of thiazolidinediones in the treatment of diabetes.

3. Classification of Diabetes Mellitus

Type 1 Diabetes

Type 1 diabetes is detectable long before abnormal insulin production starts, with a steady decline starting at least two years before diagnosis. Around the same period, β-cells become less sensitive to glucose. A compensating mechanism may be at play when the first insulin response decreases and the last insulin response rises. In the early post-diagnosis period, the decline in insulin responsiveness keeps getting faster. In the early years after diagnosis, there has been a biphasic reduction in insulin secretion, with the first year being steeper than the second. Due to the decrease in insulin secretion following a diagnosis, insulin production may be minimal or nonexistent for years. High blood sugar levels are a sign.

Even when blood glucose levels are within the normal range, elevated levels indicate type 1 diabetes. There are notable changes in glucose when type 1 diabetes develops. Metabolic markers like these could help predict the onset of diabetes in these individuals more precisely. To further enhance prediction, risk ratings can make use of changes in glucose and C-peptide levels.

There have been reports of a rare form of type 1 diabetes called "idiopathic diabetes," which is less severe than autoimmune type 1 diabetes and not brought on by autoimmunity. Insulin insufficiency and episodic ketoacidosis are possible symptoms of idiopathic diabetes. Those with Asian or African ancestry are more likely to have this variation.

This particular type of type 1 diabetes was first recognized in 2000. It is not immune-mediated, which is one of its shared traits with idiopathic type 1 diabetes. Serum C-peptide levels, a sign of the endogenous production of insulin, are undetectable when blood glucose levels are high (288 mg/dL), and ketoacidosis develops soon after hyperglycemia begins. Acute-onset type 1 diabetes, which has primarily been described in East Asian countries, affects about 20% of Japanese individuals (5000–7000 cases). It results in β-cell death that is extremely rapid and nearly total, leaving virtually no insulin output left behind. The primary causes of this illness are thought to be genetic and environmental. Using an augmented immune response that targets pancreatic β-cells without observable autoantibody production, an antiviral immune.

May result in the death of β cells in the pancreas. Pregnancy and this kind of diabetes have also been reported.

Type 2 Diabetes

Diabetes type 2 Defective insulin production is a major factor in the pathophysiology of type 2 diabetes (T2D). To maintain appropriate glucose levels, insulin sensitivity causes a wide range of variations in insulin output. An indicator of the curvilinear relationship between insulin secretion and sensitivity is the disposition index. Additionally, people with type 2 diabetes cannot effectively increase their insulin production to fight insulin resistance since they have a low disposition index. Given the severity of their insulin resistance, insulin-resistant obese type 2 diabetes patients' absolute insulin levels are still unacceptably low, even if they are greater than those of insulin-sensitive lean control individuals. Glucose stimulation causes a considerable reduction in or elimination of insulin production (initial phase).

The ratio of proinsulin to insulin (C-peptide) is elevated in type 2 diabetes patients. Significantly reduced are the maximum insulin production and the potentiation of insulin responses to non-glucose stimuli brought on by hyperglycemia. Over time, hyperglycemia usually gets worse and is harder to treat. Another characteristic of type 2 diabetes progression is the ongoing reduction in β-cell function.

Gestational diabetes

Diabetes during pregnancy Hyperglycemia during pregnancy raises the likelihood of negative consequences for the mother, foetus, and unborn child. Whether the hyperglycemia takes on the form identified before or during pregnancy, this risk exists. There is a higher chance of adult diabetes for newborns whose moms had gestational diabetes. The higher prevalence of pregnancy-related issues, including macrosomia, large-for-gestational-age newborns, and premature birth.

A hybrid form of diabetes

Diabetes hybrids Slowly evolving immunomediated diabetes. The emergence of pancreatic autoantibodies associated with autoimmune diabetes is a characteristic of LADA or slowly progressing immune-mediated diabetes. LADA and type 2 diabetes are comparable in clinical settings. First, LADA patients can be treated with oral medications and lifestyle modifications, just like those with type 2 diabetes. However, they frequently progress to the point where they require insulin therapy more quickly than those with traditional type 2 diabetes. LADA is more prevalent than type 1 diabetes with rapid onset in some places. It has been discovered that children and adolescents with pancreatic autoantibodies and clinical type 2 diabetes have a related subtype known as latent autoimmune diabetes in youth. Diabetes hybrids Slowly evolving immunomediated diabetes. A hallmark of latent autoimmune diabetes in adults, also known as slowly progressing immune-mediated diabetes, is the emergence of pancreatic autoantibodies associated with autoimmune diabetes. Type 2 diabetes and LADA are comparable in clinical settings. First, oral medications and lifestyle modifications can be used to treat LADA, just like they are for type 2 diabetes. They frequently reach the stage where they require insulin therapy sooner than those with traditional type 2 diabetes, though. Type 1 diabetes with a rapid onset is less common than LADA in some places. A similar subgroup known as latent autoimmune diabetes in youth has been identified in children and adolescents with pancreatic autoantibodies and clinical type 2 diabetes.

Positive glutamic acid decarboxylase autoantibodies, being older than 35 at diagnosis, and not requiring insulin therapy right away during the first six to twelve months of diagnosis are the usual criteria used to diagnose LADA. Between 5% and 14% of people with type 2 diabetes who have been clinically diagnosed have GAD autoantibodies, depending on their ethnicity and geographic location.

Ketosis-prone type 2 diabetes

Type 2 diabetes that is prone to ketosis. A distinct clinical syndrome known as ketosis-prone type 2 diabetes is mostly observed in young African Americans and communities in

sub-Saharan Africa. When type 1 diabetes or diabetic ketoacidosis first manifests, it is typified by periods of ketosis and acute insulin insufficiency. Nevertheless, people with this illness eventually experience remission and are no longer in need of insulin therapy. However, within ten years, almost 90% of these people go through more ketosis episodes. Although it is less prevalent in populations of European ancestry, ketosis-prone type 2 diabetes can be seen in a variety of ethnic groups. No genetic evidence or autoimmune indicators have been found, and the precise underlying cause is still unclear. It is thought that glucose poisoning could be involved.

In this scenario, β-cells fail both acutely and physically. Interestingly, β-cell insulin secretory function significantly and sustainably improves with insulin therapy and the return of normal blood glucose levels.

Other special types of Diabetes Mellitus

Several types of diabetes mellitus. Defects in beta-cell genetics. Adolescents with diabetes develop with adulthood. Abnormal β-cell activity that is monogenetic is associated with this type of diabetes. Usually appearing before the age of 25, it is characterized by reduced insulin production and minimal to no abnormalities in insulin action. Autosomal dominant inheritance means that just one copy of the defective gene from each parent can produce the illness. Mutations in several genes have been identified as the cause of maturity-onset diabetes, including glucokinase, HNF-4, HNF-1α, IPF-1, Neuro D1, hepatic transcription factor HNF-1, and others.

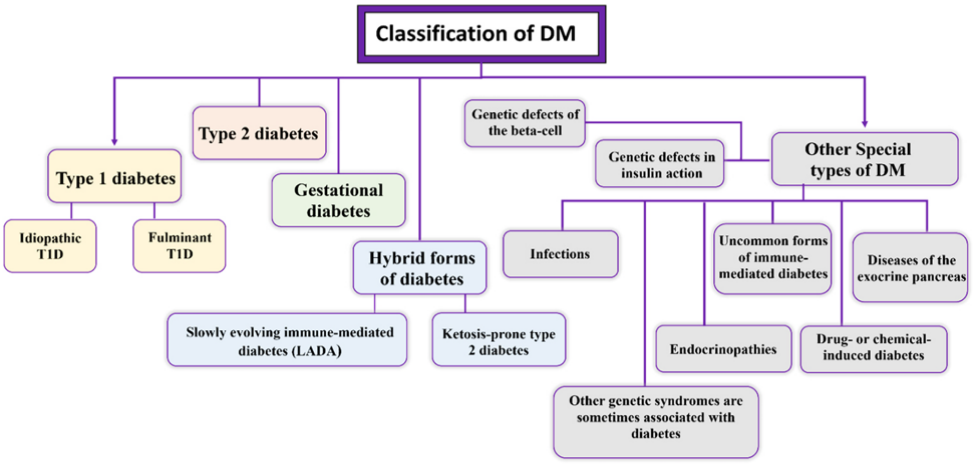

Fig 1: Classification of Diabetes Meletus

4. Sign and Symptoms of Diabetes Mellitus

Sign	Symptoms
Extreme Hunger (Polyphagia)	Dry Skin &Mouth
Excessive Thirst (Polydipsia)	Foot Pain
Frequent Urination (Polyuria)	Yeast Infection
Slow Wound Healing	Genital & Skin Infection
Acanthosis Nigricans	Fatigue
Weight Loss	Nausea
Dehydration	Pain in Stomach
Headache	Vomiting
Flushed Face	Blurry Vision

5. Patent

S. No	Author	Title	Patent No.	Submission	Publication
1.	Kjeld Hermansensoren, Gregerseniper Bendix Jeppesen	Medicament for treatment for non-insulin-dependent diabetes mellitus, hypertension or metabolic syndrome	US9636314B2	13-06-2013	02-05-2017
2.	Zenichi Ikeda, Keiko Kakegawa, Minoru Sasaki	Heterocyclic compounds useful in the treatment of diabetes and obesity	EP3150228B1	12-02-2015	2018-09-26
3.	Wayman Wondell Cheutham Anders, Hasager Boss	Superior control of Blood glucose in diabetes treatment	US20200138912A1	07-01-2020	07-05-2020
4.	Sang Gyu Park, Kyuong Soo Park, Sunghoon Kim	Diagnostic masker for type -1 diabetes mellitus	US8563327B2	05-08-2011	22-10-2013
5.	Avadhesha Surolia, Sarika Gupta, Mahendra Pal Singh	Method for treating metabolic disorders including type-1 and type-2 diabetes mellitus	US8940691B2	18-03-2013	27-01-2015
6.	In young choi, Sand youn Hwang, Sang Youb Jung, Seung Sukim	Composition for treating diabetes mellitus comprising insulin & GTP-1, glucogen dual agonist	AU202077290B2	27-11-2020	30-05-2024
7.	Sephy Philip	Compositions and Methods for Lowering Triglycerides in a Subject with Reduced Kidney Function and Diabetes Mellitus	US20230248741A1	2022-09-20	2023-08-10
8.	Richard L. Watson	Compositions and methods for treating insulin	US9011922B2	2014-08-25	2015-04-21

	Anthony B. Wood Gregory J. Archambeau	resistance and diabetes mellitus			
9.	Kjeld Hermansen Soren Gregersen Per Bendix Jeppesen	Medicament for treatment of non-insulin-dependent diabetes mellitus, hypertension and/or metabolic syndrome	US9636314B2	2013-06-13	2017-05-02
10.	Pankaj Pasricha Liansheng Liu	Treatments for Diabetes Mellitus and Obesity	US20240207208A1	2024-03-08	2024-06-27

6. Conclusion

Community-based unstructured care is linked to inferior glycaemic control, higher mortality, and worse follow-up than hospital treatment. With prompting for patients and their family physicians, computerized central recall can, at least temporarily, meet or surpass hospital outpatient care requirements. The research shows that, with the right organization in place, it is possible to provide regular prompted recall and review of individuals with diabetes by willing general practitioners.

Restoring normal carbohydrate metabolism is the primary objective of diabetes care. Individuals with a complete insulin shortage need insulin replacement medication, which takes the form of injectables or tablets, to accomplish this goal. On the other hand, insulin resistance can be resolved with exercise and dietary changes. Preventing or treating the numerous problems that result from diabetes and ensuring that its treatment is safe are additional objectives of diabetes management. A patient with diabetes can lead a happy life as long as their blood sugar is kept under control.

7. Conflict of Interest

Authors do not have any conflict of interest.

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