

An overview of diabetes types and treatment

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ABSTRACT:

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels resulting from defects in insulin secretion, insulin action, or both. It is a global health concern affecting millions of individuals worldwide. This abstract aims to provide a brief overview of diabetes mellitus, including its types, risk factors, symptoms, complications, and management strategies.

There are two main types of diabetes mellitus: type 1 and type 2. Type 1 diabetes is an autoimmune condition in which the body's immune system mistakenly attacks and destroys the insulin-producing cells in the pancreas. Type 2 diabetes, on the other hand, is primarily associated with insulin resistance, where the body's cells become less responsive to the effects of insulin.

KEYWORDS: Diabetes mellitus, Insulin, Glucose.

I. INTRODUCTION:

Diabetes is a disease that occurs when your blood glucose, also called blood sugar, is too high. Glucose is your body's main source of energy. Your body can make glucose, but glucose also comes from the food you eat.

Insulin is a hormone made by the pancreas that helps glucose get into your cells to be used for energy. If you have diabetes, your body doesn't make enough—or any—insulin, or doesn't use insulin properly. Glucose then stays in your blood and doesn't reach your cells.

Diabetes raises the risk for damage to the eyes, kidneys, nerves, and heart. Diabetes is also linked to some types of cancer. Taking steps to prevent or manage diabetes may lower your risk of developing diabetes health problems.

TYPES OF DIABETES:

Diabetes is divided into two types. There are diabetes mellitus and insipidus. In diabetes mellitus blood glucose is too high and kidneys try to remove the extra glucose by passing it in urine. As in case of diabetes insipidus glucose levels are normal, but you can't properly concentrate urine. Diabetes mellitus is divided into four types. They are type 1 diabetes, type 2 diabetes, prediabetes, gestational diabetes.

TYPE 1 DIABETES:

A chronic condition in which the pancreas produces little or no insulin. It typically appears in adolescence. It can also occur in children and adolescents depending on how many B-cells of the pancreas are non-functioning. The onset of symptoms corresponds to an 80% reduction in beta cell mass.

TYPE 2 DIABETES:

Type 2 diabetes is the most common type of diabetes, is a disease that occurs when your blood glucose, also called blood sugar, is too high. Blood glucose is your main source of energy and comes mainly from the foods you eat. Insulin, a hormone made by the pancreas helps glucose get into your cells to be used for energy.

PREDIABETES:

Prediabetes is a condition whereby people have higher than normal blood glucose [sugar] levels, but not yet high enough to be diagnosed as diabetes. Prediabetes is a precursor of type 2 diabetes, as well as a risk factor for heart disease and stroke.

GESTATIONAL DIABETES:

It's a condition that affects some pregnant women. It happens when the body can't produce enough insulin to manage the increased blood sugar

levels during pregnancy. It's important to work closely with your healthcare provider to manage it. They can provide guidance on diet, exercise, and medication if needed.

ETIOLOGY:

Diabetes involves a combination of genetic, environmental, and lifestyle factors. There are different types of diabetes, including type 1 diabetes, type 2 diabetes, and gestational diabetes, each with its own specific etiological factors.

Type 1 diabetes is believed to be an autoimmune disease in which the immune system mistakenly attacks and destroys the insulin-producing cells in pancreas. The exact cause is unknown, but it is thought to involve a combination of genetic susceptibility and environmental triggers, such as viral infections.

Type 2 diabetes is primarily caused by a combination of genetic factors and lifestyle choices, such as poor diet, lack of physical activity, and obesity. Genetic predisposition plays a significant role in the development of type 2 diabetes, but lifestyle factors can also greatly influence its onset and progression.

Gestational diabetes occurs during pregnancy and is thought to be primarily caused by hormonal changes that affect insulin action. Women who are overweight, have a family history of diabetes, or have had gestational diabetes in previous pregnancies are at higher risk.

EPIDEMIOLOGY:

Diabetes Mellitus is a chronic metabolic disorder characterized by high blood glucose levels. It is a major global health concern, and its prevalence has been steadily increasing over the years. According to the International Diabetes Federation, in 2023, approximately 463 million adults (20-79 years old) were living with diabetes worldwide. This number is projected to rise to 700 million by 2045 if current trends continue.

The prevalence of diabetes varies across different countries and regions. Low- and middle-income countries are disproportionately affected, accounting for around 80% of all cases. In terms of age, diabetes is more commonly diagnosed in older adults, but there has been a concerning rise in the number of younger individuals being diagnosed with the condition.

Type 2 diabetes is the most common form, accounting for about 90% of all cases. It is closely linked to obesity, physical inactivity, and unhealthy diets. Type 1 diabetes, although less prevalent, usually develops in childhood or adolescence and is

caused by the immune system attacking the insulin-producing cells in the pancreas.

Efforts to prevent and manage diabetes involve promoting healthy lifestyles, regular physical activity, balanced diets, and access to quality healthcare services. Early detection, diagnosis, and appropriate management are crucial in reducing the burden of diabetes and its complications on individuals and society as a whole.

PATHOPHYSIOLOGY:

Diabetes mellitus is a chronic metabolic disorder characterized by high blood glucose levels (hyperglycemia) due to either insufficient insulin production or impaired insulin action.

The pathophysiology of diabetes mellitus involves multiple factors and mechanisms. Here is a simplified explanation:

1. **Insulin production:** In type 1 diabetes, the immune system mistakenly attacks and destroys the insulin-producing beta cells in the pancreas. This results in little to no production of insulin. In type 2 diabetes, the pancreas initially produces insulin, but the body becomes resistant to its effects over time, leading to decreased insulin production.
2. **Insulin action:** Insulin plays a crucial role in regulating glucose metabolism. It helps glucose enter cells from the bloodstream, where it can be utilized for energy production or stored for future use. In diabetes, there is either insufficient insulin or resistance to its action, leading to impaired glucose uptake by cells.
3. **Glucose metabolism:** Without sufficient insulin or effective insulin action, glucose accumulates in the bloodstream instead of being taken up by cells. This leads to elevated blood glucose levels, which can cause various complications if left uncontrolled.
4. **Glycogen storage and breakdown:** In normal circumstances, excess glucose is converted into glycogen and stored in the liver and muscles. When energy is needed, glycogen is broken down into glucose and released into the bloodstream. In diabetes, the deficiency or resistance to insulin impairs this glycogen storage and breakdown process, further contributing to persistent hyperglycemia.
5. **Gluconeogenesis:** In the absence of sufficient glucose supply, the body can produce glucose through a process called gluconeogenesis. This usually occurs in the liver. In diabetes, there is an abnormal increase in gluconeogenesis,

leading to additional elevation of blood glucose levels.

6. **Complications:** Prolonged hyperglycemia can lead to various complications affecting multiple organ systems. These complications include cardiovascular disease, kidney damage, nerve damage (neuropathy), eye problems (retinopathy), and impaired wound healing.

It's important to note that the pathophysiology of diabetes mellitus is complex and can vary between individuals. Proper management, including lifestyle modifications, medication, and regular monitoring, is essential to control blood glucose levels and prevent complications.

Causes and Risk Factors:

The exact causes of diabetes mellitus are not fully understood, but several factors contribute to its development:

- **Genetic predisposition:** Having a family history of diabetes increases the risk.
- **Obesity:** Excess body weight, particularly abdominal obesity is a significant risk factor for type 2 diabetes.
- **Sedentary lifestyle:** Lack of physical activity and a sedentary lifestyle increase the risk.
- **Unhealthy diet:** Consuming a diet high in processed foods, sugary beverages, and unhealthy fats increases the risk of developing diabetes.
- **Age:** The risk of type 2 diabetes increases with age, particularly after the age of 45.
- **Ethnicity:** Certain ethnic groups, such as African Americans, Hispanics, and Asians, have a higher prevalence of diabetes.

Symptoms:

Common symptoms of diabetes mellitus include:

- Frequent urination (polyuria)
- Excessive thirst (polydipsia)
- Unexplained weight loss
- Fatigue
- Blurred vision
- Slow wound healing
- Recurrent infections, such as urinary tract infections

Complications:

If diabetes is left uncontrolled, it can lead to several long-term complications, including:

- Cardiovascular diseases (heart attack, stroke)
- Kidney damage (diabetic nephropathy)
- Nerve damage (neuropathy)
- Eye problems (diabetic retinopathy)

- Foot problems, including ulcers and infections
- Increased risk of infections
- Sexual dysfunction
- Mental health issues, such as depression

MANAGEMENT:

The management of diabetes mellitus involves several key aspects:

1. **Blood sugar monitoring:** Regular monitoring of blood sugar levels is essential to keep them within the target range. This can be done using a blood glucose meter or continuous glucose monitoring (CGM) devices.
2. **Medications:** Depending on the type and severity of diabetes, medications may be prescribed to help control blood sugar levels. This can include insulin injections, oral medications like metformin, or other medications that help regulate blood sugar.
3. **Healthy eating:** A balanced and nutritious diet plays a crucial role in managing diabetes. This includes consuming a variety of fruits, vegetables, whole grains, lean proteins, and healthy fats, while limiting the intake of sugary and processed foods.
4. **Regular exercise:** Physical activity is beneficial for managing diabetes as it helps lower blood sugar levels, improves insulin sensitivity, and promotes weight management. Aim for at least 150 minutes of moderate-intensity aerobic exercise per week, along with strength training exercises.
5. **Weight management:** Maintaining a healthy weight or losing excess weight can significantly improve blood sugar control. This can be achieved through a combination of healthy eating and regular physical activity.
6. **Stress management:** Chronic stress can affect blood sugar levels. Finding healthy ways to manage stress, such as through relaxation techniques, exercise, or engaging in hobbies, can be helpful in diabetes management.
7. **Regular check-ups:** Regular visits to healthcare professionals are important for monitoring blood sugar levels, adjusting medications if needed, and addressing any concerns or complications associated with diabetes.

TREATMENT:

TYPE 1 DIABETES:

People with type 1 diabetes require synthetic insulin several times each day to live a healthy life. The three main components of type 1

diabetes management include insulin, blood sugar monitoring, and carbohydrate counting.

TYPE 2 DIABETES:

Type 2 diabetes influences about two hundred million human beings worldwide, together with extra than 1 / 4 of the aged in evolved countries. Diet and exercise, together with oral antidiabetic drugs, are first-line treatments to gain the aim of enhancing glycemic control. When glycemic control is not established or if HbA1C increases to 6.5% after 2-3 months of lifestyle modification, pharmacological treatment for T2DM should be started. There are eight pathophysiological pathways underlying in type 2 diabetes. These include - Reduced insulin secretion from pancreatic beta-cells, increased glucagon secretion from pancreatic alpha-cells, increased glucose production in the liver, increased lipolysis, increased renal glucose reabsorption, decreased incretin effect in the small intestine, and impaired or diminished glucose uptake in peripheral tissues like skeletal muscle, liver, and adipose tissue are just a few of the effects.

Neurotransmitter dysfunction and insulin resistance are also among them. Currently accessible treatments to reduce blood sugar focus on one or more of these important routes. Biguanides, sulfonylureas, meglitinide, thiazolidinedione (TZD), dipeptidyl peptidase 4 (DPP-4) inhibitors, sodium-glucose cotransporter (SGLT2) inhibitors, and -glucosidase inhibitors are the main groups of oral antidiabetic drugs.

BIGUANIDES:

The primary first-line oral medication of preference for the treatment of T2DM across all age categories is the biguanide metformin. Through intricate interactions with the mitochondrial enzymes, metformin activates the liver's adenosine monophosphate-activated protein kinase, causing hepatic absorption of glucose and blocking gluconeogenesis.

GLP-1 RECEPTOR AGONISTS:

Exenatide and liraglutide are the two GLP-1 receptor agonists that are currently on the market. These medicines have a higher resistance to DPP4's enzymatic destruction. Consider treating young individuals with GLP-1 analogues, which would help with weight loss and ameliorate metabolic dysfunction, if they have recently been diagnosed with T2DM, central obesity, and an aberrant metabolic profile. GLP-1 analogues should not be used in cases of renal failure.

DPP4-INHIBITORS:

Sitagliptin, saxagliptin, vidagliptin, linagliptin, and alogliptin are dipeptidyl peptidase 4 inhibitors. These drugs can be taken alone or in combination with TZD, metformin, or sulfonylurea. This medication is comparable to other oral diabetes medications. There is no evidence that gliptins increase the frequency of hypoglycemia incidents as compared to controls. Inhibitors of dipeptidyl peptidase 4 affect postprandial lipid levels. In T2DM patients who have never taken these drugs before, vidagliptin treatment for four weeks reduces postprandial plasma triglyceride and apolipoprotein B-48-containing triglyceride-rich lipoprotein particle metabolism following a fatty meal.

SGLT2 INHIBITORS:

Canagliflozin, dapagliflozin, and empagliflozin are new kinds of glucosuric medications called sodium-glucose cotransporter inhibitors. By preventing glucose reabsorption in the proximal renal tubule by inhibiting SGLT2, SGLT2 inhibitors lower blood sugar without the use of insulin. Due to their glucose-independent mechanisms of action, these medications may be useful in T2DM that has progressed to the point where pancreatic beta-cell reserves have been irreparably depleted. These medications help reduce blood pressure and modestly reduce body weight. SGLT2 inhibitors may cause vaginal mycosis, urosepsis, and pyelonephritis in addition to urinary tract

PARAMETERS	HIGHER LEVELS PREFERENCES	MANAGEMENT OF DIABETES											
		FIRST LINE THERAPY	Second line therapy	Combination therapy									
HbA1C	<9%	Monotherapy with Metformin	Continue and monitor metformin	-									
	>9%	-	-	Consider Dual OHA agents									
	Asymptomatic			<table border="1"> <thead> <tr> <th>FIRST CHOICE</th> <th>SECOND CHOICE</th> </tr> </thead> <tbody> <tr> <td>1.SU</td> <td>1.AGI</td> </tr> <tr> <td>2.DPP-4 inhibitors</td> <td>2.Glinides</td> </tr> <tr> <td>3.SGLT2 inhibitors</td> <td>3.TZD</td> </tr> <tr> <td></td> <td>4.GLP 1RA</td> </tr> </tbody> </table>	FIRST CHOICE	SECOND CHOICE	1.SU	1.AGI	2.DPP-4 inhibitors	2.Glinides	3.SGLT2 inhibitors	3.TZD	
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II. CONCLUSION:

Diabetes is a chronic metabolic disease, divided into four types called type 1 diabetes, type 2 diabetes, prediabetes and gestational diabetes. The normal range of HbA1C is 7%. Diabetes can be managed by oral hypoglycaemics as monotherapy when the HbA1C rises to above 7% while diet control and life style modifications fails to give glycaemic control. And if the HbA1C climbs up to 7.5 and above while the patient is on oral hypoglycemics combinational therapy with insulin as second line therapy is used.

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