A Review on Diabetes Mellitus with it's descriptive information

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Abstract: Over the past thirty years, the number of people with diabetes mellitus has increased four times, making it the ninth leading cause of death worldwide. Currently, about 1 in 11 individuals around the globe has diabetes, with 90% of these cases being diabetes mellitus (DM). Asia plays a crucial role in the worldwide DM crisis, with China and India being the two main centers. A person's risk of developing DM is partly influenced by their genes, but unhealthy eating habits and a lack of physical activity are significant factors contributing to this global issue. Early life factors, such as what happens during pregnancy, can also affect a person's likelihood of developing DM later in life. Many DM cases can be prevented by adopting healthier lifestyle choices, such as maintaining a healthy weight, eating a balanced diet, drinking alcohol in moderation, and engaging in regular exercise. The purpose of this paper is to examine information on type 1 and type 2 diabetes, focusing on how they develop and how to manage them through a review of existing literature. This review updates information on the global occurrence of DM, as well as the dietary, lifestyle, and other risk factors associated with DM and its effects.

INTRODUCTION

Diabetes is a long-lasting condition that occurs when the pancreas doesn't make enough insulin or when the body can't use insulin properly. Insulin is a hormone that helps manage blood sugar levels. If diabetes is not controlled, it leads to hyperglycemia, which means high blood sugar. Over time, this can seriously harm many systems in the body, including the nerves and blood vessels.

In 2014, 8.5 percent of people aged 18 and older had diabetes. In 2019, diabetes caused 1.5 million deaths, with 48 percent of those deaths happening before the age of 70. From 2000 to 2016, diabetes led to a 5% rise in premature death rates (deaths before age 70).

In high-income countries, premature deaths related to diabetes decreased from 2000 to 2010, but then increased again from 2010 to 2016. In lower-middle-income countries, diabetes-related premature deaths rose during both time periods.

Globally, the risk of dying from one of the four major non communicable diseases (which include cardiovascular diseases, cancer, chronic respiratory diseases, or diabetes) between the ages of 30 and 70 dropped by 18% from 2000 to 2016.

Classification of Diabetes Mellitus

- Type 1 diabetes is defined as diabetes caused predominantly by the death of pancreatic beta cells, resulting in insulin insufficiency and the risk of ketoacidosis. This category includes examples where beta cell loss is caused by an autoimmune disease as well as cases where the cause is unknown.

- Type 2 diabetes can range from insulin resistance with relative insulin shortage to insulin resistance with a major secretory dysfunction. Ketosis is a rare occurrence

- Gestational diabetes mellitus is a type of glucose intolerance that develops or is discovered during pregnancy.

Pathophysiology

The pathophysiology of diabetes involves plasm concentrations of glucose signaling the central nervous system to mobilize energy reserves. It is based on cerebral blood flow and tissue integrity, arterial plasma glucose, the speed that plasma glucose concentrations fall, and other available metabolic fuels.hyperglycemia is a risk for diabetic patients. Because multiple causes can typically contribute to the condition, the pathophysiology of DM might be obscure. hyperglycemia can affect pancreatic beta-cell activity and lead to insulin secretion problems. As a result, there is a vicious cycle of hyperglycemia that leads to metabolic impairment. In this setting, blood glucose levels exceeding 180 mg/dL are frequently called hyperglycemia, albeit there is no clear cut off point due to the multiplicity of processes. At greater blood glucose levels, the glucose transporters in the nephron become saturated, causing osmotic diuresis. Serum glucose levels exceeding 250 mg/dL are likely

to elicit polyuria and polydipsia symptoms, while the effect is inconsistent. Excess fatty acids and proinflammatory cytokines cause insulin resistance, which impairs glucose transport and increases fat breakdown. Because the body's response or synthesis of insulin is inadequate, it responds by improperly boosting glucagon, causing to hyperglycemia. While insulin resistance is a part of T2DM, the condition is fully manifested when the patient's insulin production is insufficient to compensate for their insulin resistance. Nonenzymatic glycation of proteins and lipids occurs as a result of chronic hyperglycemia. The glycation haemoglobin (HbA1c) test can be used to determine the amount of this. Damage to small blood vessels in the retina, kidneys, and peripheral nerves is caused by glycation. The process is accelerated by higher glucose levels. The traditional diabetic consequences of diabetic retinopathy, nephropathy, and neuropathy, as well as the avoidable outcomes of blindness, dialysis, and amputation, are all caused by this damage.

Diagnosis and Management

The therapeutic choices for diabetic individuals have grown as our understanding of the pathophysiology of the disease has grown. Individualizing treatment for both intense lifestyle modification and antidiabetic medications in each patient is therefore critical. Each antidiabetic drug targets a different underlying pathophysiology and comes with its own set of contraindications and adverse effects. When making a shared-decision with patients on an antidiabetic drug, it is critical to evaluate the glycaemic goal, risk of hypoglycaemia, life expectancy, resources, social support, and comorbidities. Obesity management is critical since obesity is a major risk factor for diabetes. To reduce cardiovascular events and death, diabetes treatment must also target other cardiovascular risk factors (such as hypertension and dyslipidaemia). Diabetes tests for type 1 and type 2 diabetes, as well as prediabetes tests Test for glycated haemoglobin (A1C). This non-fasting blood test determines your average blood sugar level over the previous two to three months. It determines how much blood sugar is bound to haemoglobin, the oxygen- carrying protein in red blood cells. The more sugar-attached haemoglobin you have, the higher your blood sugar levels are. You have diabetes if your A1C score is 6.5 percent or greater on two independent tests. Prediabetes is defined as an A1C level of 5.7 to 6.4 percent. A score of less than 5.7 is deemed normal. If the A1C test results are inconsistent, the test isn't accessible, or you have specific factors that can cause the A1C test to be erroneous — such as being pregnant or having diabetes - consult your doctor. If the A1C test results are inconsistent, the test isn't available, or you have certain conditions that could make the A1C test inaccurate — such as being pregnant or having an uncommon form of haemoglobin (known as a haemoglobin variant) — your doctor may use one of the following tests to diagnose diabetes. Blood sugar test at random moment, a blood sample will be obtained. A blood sugar level of 200 milligrams per decilitre (mg/dL) — 11.1 millimoles per litre (mmol/L) or greater, regardless of when you last ate, indicates diabetes. Prediabetes is defined as a fasting blood sugar level ranging from 100 to 125 mg/dL (5.6 to 6.9mmol/L). You have diabetes if your blood sugar level is 126 mg/dL (7 mmol/L) or greater on two separate tests. Test of oral glucose tolerance. This test requires you to fast overnight and measure your fasting blood sugar level. Then you drink a sweet beverage, and your blood sugar levels are monitored for the next two hours. Normal blood sugar is less than 140 mg/dL (7.8 mmol/L). After two hours, a result of more than 200 mg/dL (11.1 mmol/L) indicates diabetes. Prediabetes is defined as a blood sugar level of 140 to 199 mg/dL (7.8 mmol/L to 11.0 mmol/L). If you have type 1 diabetes, your urine will be checked for a by-product formed when muscle and fat tissue are used for energy since the body doesn't have enough insulin to use the glucose that is present (ketones). Your doctor will most likely do a test to discover if you have autoantibodies, which are damaging immune system cells linked to type 1 diabetes. Physical activity is an essential component of your diabetes control strategy. Your muscles use sugar (glucose) for energy when you work out. Regular physical activity also aids in the efficient utilisation of insulin by the body. These elements work synergistically to reduce blood sugar levels.

4 Ways to manage diabetes

1. Even if you are feeling well, take your diabetic and other medical medications.

2. Cuts, blisters, red areas, and swelling should all be checked on a daily basis.

3. To keep your mouth, teeth, and gums healthy, brush and floss every day.

4. Please don't smoke.

5. Monitor your blood sugar levels.

Management

Through lifestyle and diet modification. Studies have shown that there was significant reduction in the incidence of type 2 DM with a combination of maintenance of body mass index of 25 kg/m2, eating high fibre and unsaturated fat and diet low in saturated and trans-fats and glycemic index, regular exercise, abstinence from smoking and moderate consumption of alcohol.5,16,35-37 Suggesting that majority of type 2 DM can be prevented by lifestyle modification. Patients with type 2 DM should receive a medical nutrition evaluation; lifestyle recommendations should be tailored according to physical and functional ability.38

Pharmacological Agents

Biguanides

Biguanides, of which metformin is the most commonly used in overweight and obese patients, suppresses hepatic glucose production, increases insulin sensitivity, enhances glucose uptake by phosphorylating GLUT-enhancer factor, increases fatty acid oxidation, and decreases the absorption of glucose from the gastrointestinal tract.39 Research published in 2008 shows further mechanism of action of metformin as activation of AMP-activated

protein kinase, an enzyme that plays a role in the expression of hepatic gluconeogenic genes.40 Due to the concern of development of lactic acidosis, metformin should be used with caution in elderly diabetic individuals with renal impairment. It has a low incidence of hypoglycemia compared to sulfonylureas.39

Sulfonylureas

These generally well tolerated but because they stimulate endogenous insulin secretion, they carry a risk of hypoglycemia.38

Elderly patients, with DM who are treated with sulfonylureas have a 36% increased risk of hypoglycemia compared to younger patients.41 Glyburide is associated with higher rates of hypoglycemia compared to glipizide.42 Some of the risk factors for hypoglycemia are age-related impaired renal function, simultaneous use of insulin or insulin sensitizers, age greater than 60 years, recent hospital discharge, alcohol abuse, caloric restriction, multiple medications or medications that potentiate sulfonylurea actions.43 Use of long acting sulfonylurea such as glyburide should be avoided in elderly patients with DM and use of short-acting glipizide should be preferred.38

Meglitinides

Repaglinide and nateglinide are non-sulfonylurea secretagogues which act on the ATP-dependent K-channel in the pancreatic beta cells thereby stimulating the release of insulin from the beta cells, similar to sulfonylurea, though the binding site is different.44

Meglitinides have a rapid onset and a short duration of action (4-6 hrs) and thus lower risk of hypoglycemia. Meglitinides are given before meals for postprandial blood glucose control. Pre-prandial administration allows flexibility in case a meal is missed without increased risk of hypoglycemia.45 Repaglinide is mainly metabolized in the liver with very minimal amounts excreted via the kidneys and thus dose adjustment is not necessary in patients with renal insufficiency except those with end-stage renal disease.44

Thiazolidinediones

Thiazolidinedione is an insulin sensitizer, selective ligands transcription factor peroxisomes proliferator-activated gamma.

They are the first drugs to address the basic problem of insulin resistance in type 2 DM patients,46 whose class now includes mainly pioglitazone after the restricted use of rosiglitazone recommended by Food and Drug Administration (FDA) recently due to increased cardiovascular events reported with rosiglitazone.36 Pioglitazone use is not associated with hypoglycemia and can be used in cases of renal impairment and thus well tolerated in older adults. On the other hand, due to concerns regarding peripheral edema, fluid retention and fracture risk in women, its use can be limited in older adults with DM. Pioglitazone should be avoided in elderly patients with congestive heart failure and is contraindicated in patients with class III-IV heart failure.47

Alpha-Glucosidase Inhibitors

Acarbose, Voglibose and Miglitol have not widely been used to treat type 2 DM individuals but are likely to be safe and effective.

These agents are most effective for postprandial hyperglycemia and should be avoided in patients with significant renal impairment.

Their use is usually limited due to high rates of side-effects such as diarrhoea and flatulence.38 Voglibose, which is the newest of the drugs, has been shown in a study to significantly improve glucose tolerance, in terms of delayed disease progression and in the number of patients who achieved normoglycemia.48

Incretin-Based Therapies

Glucagon-like peptide 1 (GLP-1) analogues are the foundation of incretin-based therapies which are to target this previously unrecognized feature of DM pathophysiology resulting in sustained improvements in glycemic control and improved body weight control.49 They are available for use as monotherapy, as an adjunct to diet and exercise or in combination with oral hypoglycemic agents in adults with type 2 DM. Examples are Exenatide, an incretin mimetic, and Liraglutide.38

There is no risk of hypoglycemia with the use of GLP-1 therapies (unless combined with insulin secretagogues). In addition, emerging evidence suggests incretin-based therapies may have a positive impact on inflammation, cardiovascular and hepatic health, sleep, and the central nervous system

CONCLUSION

Diabetes is a slow-killing disease with no known cure.

Its complications, on the other hand, can be reduced with good awareness and prompt treatment. Blindness, kidney damage, and heart attack are three serious consequences.

To avoid complications, it is critical to keep patients' blood glucose levels under careful supervision. One of the challenges with strict glucose regulation in the blood is that it might lead to hypoglycaemia, which can cause far more serious complications than a rise in blood glucose. Researchers are currently looking for new ways to treat diabetes. The purpose of this study is to provide an overview of current diabetes research.

REFERENCES

[1] Jevas chibuike ozougwu et al, The pathogenesis and pathophysiology of type 1 and type2 diabetes mellitus

[2] K.T.Tan et al, Pathogenesis of type1 and type2 dm.

[3] Lancet et al, Pathophysiology and treatment of type2 diabetes:prespectives on the past,present and future

[4] Nishita singh et al, review on type2 diabetes mellitus.

[5] Mohammed H Abutaleb et al, Daibetes mellitus:an overview.

[6] Konstantinos paptheodorou et al,Complications of diabetes.

[7] Anjali D Desphande et al, Epideomology of diabetes and diabetes related complications.

[8] Gupta, A., Gupta, R., Lal, B. "Effect of Trigonella foenum-graecum (fenugreek) seeds on glycaemic control and insulin resistance in type 2 diabetes mellitus: A double-blind placebo-controlled study." Journal of the Association of Physicians of India, 2001. 49, 1057-1061.

[9] Gokhale SB Kokate CK Purochit AP, Text book of Pharmacognosy 40TH ed , 9.97-9.98

[10] Baskaran, K., Ahamath, B. K., Shanmugasundaram, K. R., &Shanmugasundaram, E. R. "Antidiabetic effect of a leaf extract from Gymnemasylvestre in non-insulin-dependent diabetes mellitus patients." J of Ethnopharmacology,1990 ,30(3), 295-305.

[11] Shanmugasundaram, E. R., Rajeswari, G., Baskaran, K., Rajesh Kumar, B. R., RadhaShanmugasundaram, K., &KizarAhmath, B"Use of Gymnemasylvestre leaf extract in the control of blood glucose in Chevallier, Andrew. Encyclopedia of Medicinal Plants. London: Dorling Kindersley, 1996.

[12] PDR for Herbal Medicines. Montvale, N. J.: Medical Economics Company, 1999.

[13] Peirce, Andrea. The American Pharmaceutical Association Practical Guide to Natural Medicines New York: William Morrow and Company, 1999.

[14] Hwang, Y. H., et al. Archives of Environmental Health 57, 2002: 78-84.

[15] Racchi, M., et al. Journal of Agricultural and Food Chemistry 50 (February 2002): 1272-1277.

[16] Onion. Review of Natural Products. Available from Wolters Kluwer Health, Inc. Accessed April 17, 2007.

[17] Hedrick. U. P. Sturtevant's Edible Plants of the World. Dover Publications 1972 ISBN 0-486-20459-6.
[18] Kelkar, S. M., Kakly and Bapat V. A. (2002). Determination of antidiabetic activity in Allium cepa (oniona bulb) tissue cultures. Indian journal of Biochemistry and Biophysics. 38:277-279
[19] Nazar,S.Hypoglycemic (2006). Activity of Nineteen Sudanese medicinal plants with emphasis on Allium cepaL(Red onion).Thesis for
[20] Medical pharmacology, faculty of Pharmacy, University of Gezira, Sudan.(PubMed).
[21] Harborne, J. B. (1973). "Textbook of Phytochemical Methods". New edition Chapman and Hall Ltd. London. Pp: 110-113.
[22] Sofowara, A. (1993). "Medicinal Plant and Traditional Medicine in Africa. 2nd ed. Spectrum Books Ltd. Ibadan, Nigeria pp: 289
[23] Lorke D (1983). A New Approach to Practical Acute Toxicity Testing. Archives of toxicology ; 54:275-87(PubMed)
[24] Saidu, Y.,Nwachukwu, F.C., Bilbis, L.S., Faruk,U.Z, and Abbas, A.Y. (2011).Hypoglycaemic and hypolipidemic effects of root extracts of Albizziachevalieri in alloxan induced diabetic Rats.International Journal of Basic and Applied Sciences 18(1):72-78.
[25] Beach, E. F. and Turner J. J. (1958). An enzymatic method for glucose determination in body fluids. Clinical Chemistry, 4 (6):462-75.
[26] Rheney, C.C, and Kirk KK (2000). Performance of three blood glucose meters.Pharmacother. 2000. DOI:10.1345/aph.19187
[27] Sood, R. (1999). Medical laboratory methods and interpretations. 5th edition. Jaypee Brothers medical Publishers Limited. New Delhi, India. 45-57
[28] Gazuwa,S.Y.(2013). The photochemical composition of Allium cepa/Allium sativum. Asian Journal of experimatal biology.
[29] Abdel-Hassan I. A., Abdel-Barry J. A., and T. S. Mohammed. (2002) The hypoglycaemic and antihyperglycaecemic effect of citrulluscolocynthis Fruit Aqueous Extract in Normal and Alloxan Induced Diabetic Rabbits. Journal of Ethnopharmacology, 71:325-330