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INFORMATION ON DIABETES MELLITUS

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Abstract: -

Diabetes mellitus **is a disorder of carbohydrate metabolism** characterized by the impaired ability of the body to produce or respond to insulin and thereby maintain proper levels of sugar (glucose) in the blood. Diabetes is a major cause of morbidity and mortality, though these outcomes are not due to the immediate effects of the disorder. Glucose is not regular sugar that is available in stores and supermarkets. Glucose is a natural carbohydrate that our bodies use as a source of energy. The kind of sugar sold in supermarkets is called sucrose and is much different from glucose. High concentrations of glucose can be found in soft drinks and fruits. The glucose level in the blood is controlled by several hormones. Hormones are chemicals in the body that send messages from cells to other cells. Insulin is a hormone made by the pancreas. When you eat, the pancreas makes insulin to send a message to other cells in the body. This insulin tells the cells to take up glucose from the blood. Glucose is used by cells for energy. Extra glucose that is not needed right away is stored in some cells as glycogen. When you are not eating, cells break down the stored glycogen into glucose to use as energy.[1]

Types of Diabetes

Type 1 Diabetes

Diabetes 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 food you eat. Insulin, a hormone made by the pancreas, helps the glucose in your blood get into your cells to be used for energy. Another hormone, glucagon, works with insulin to control blood glucose levels.

In most people with type 1 diabetes, the body's immune system, which normally fights infection, attacks and destroys the cells in the pancreas that make insulin. As a result, your pancreas stops making insulin. Without insulin, glucose can't get into your cells and your blood glucose rises above normal. People with type 1 diabetes need to take insulin every day to stay alive.\

What are the symptoms of type 1 diabetes?

Symptoms of type 1 diabetes are serious and usually happen quickly, over a few days to weeks. Symptoms can include

- increased thirst and urination
- increased hunger
- blurred vision
- fatigue
- unexplained weight loss

Sometimes the first symptoms of type 1 diabetes are signs of a life-threatening condition called diabetic ketoacidosis (DKA) *NIH external link*. Some symptoms of DKA include

- breath that smells fruity
- dry or flushed skin
- nausea or vomiting
- stomach pain
- trouble breathing
- trouble paying attention or feeling confused

DKA is serious and dangerous. If you or your child have symptoms of DKA, contact your healthcare professional right away, or go to the nearest hospital emergency room.

problems can people with type 1 diabetes develop?

Over time, high blood glucose leads to problems such as

- heart disease
- stroke
- kidney disease
- eye problems
- dental disease
- nerve damage
- foot problems
- depression
- sleep apnea

If you have type 1 diabetes, you can help prevent or delay the health problems of diabetes by managing your blood glucose, blood pressure, and cholesterol, and following your self-care plan.[2]

Diagnosis:

Tests used to diagnose diabetes insipidus include:

- **Water deprivation test:**

  While being monitored by a doctor and health care team, you'll be asked to stop drinking fluids for several hours. To prevent dehydration while fluids are restricted, ADH allows your kidneys to decrease the amount of fluid lost in the urine.

  While fluids are being withheld, your doctor will measure changes in your body weight, urine output, and the concentration of your urine and blood. Your doctor may also measure blood levels of ADH or give you synthetic ADH during this test. This will determine if your body is producing enough ADH and if your kidneys can respond as expected to ADH.

- **Magnetic resonance imaging (MRI):**

  An MRI can look for abnormalities in or near the pituitary gland. This test is noninvasive. It uses a powerful magnetic field and radio waves to construct detailed pictures of brain tissues.

- **Genetic screening;**

  If others in your family have had problems with excess urination, your doctor may suggest genetic screening.

Pharmacological therapy. For patients on long-term lithium therapy, amiloride prevents the uptake of lithium in the collecting duct epithelial cells and thus the inhibitory effects of intracellular lithium on water transport [3]. Hydrochlorothiazide has been shown to reduce urine output in both central and nephrogenic DI [4][5] Thiazides decrease salt reabsorption by inhibiting the thiazide-sensitive co- transporter SLC12A3 in the distal
tubule. The sodium loss reduces plasma volume so that less water is presented to the collecting duct and lost in the urine. Also, hydrochlorothiazide administration reduced urine volume with lithium-induced nephrogenic DI, suggesting an a-independent mechanism of thiazide-mediated reduction in urine output [6]. Furthermore, inhibition of carbonic anhydrase by hydrochlorothiazide in the proximal tubule might reduce proximal sodium uptake and, via tubule-glomerular feedback, reduce glomerular filtration. The carbonic anhydrase inhibitor acetazolamide reduces inulin clearance and cortical expression of sodium/hydrogen exchanger 3 and attenuates

the increased urinary PGE2 levels observed in mice with lithium-induced nephrogenic DIand is effective in humans with lithium-induced nephrogenic DI. Polyuria in these patients is usually moderate (<6 l/day) and can be decreased by a strict clamping of the plasma lithium concentration at 0.8 mEq/l, a low-sodium diet, and amiloride administration. Central DI Patients with central DI should be treated to reduce polyuria and polydipsia to levels that allow the maintenance of a normal lifestyle. As the goal of therapy is improved symptomatology, the prescribed regimen should be individually tailored to individual patients to address their needs. The safety of the therapeutic regimen and avoidance of detrimental effects of overtreatment are primary considerations, as in most patients, central DI has a fairly benign course.

Fluid administration. Patients with central DI will develop thirst when the plasma osmolality increases by 2–3% unless the hypothalamic osmoreceptors are also affected by the primary lesion that causes adipic DI. Consequently, severe hyperosmolality is not a risk□in patients who are alert, ambulatory, and able to drink in response to perceived thirst. Although inconvenient and lifestyle-disrupting, polyuria and polydipsia

are not life-threatening. However, hyponatremia does not cause specific symptoms initially and can quickly progress to more symptomatic levels if fluid intake continues during continuous antidiuresis. Therefore, treatment of central DI should be designed to minimize polyuria and polydipsia without causing undue risk of hyponatremia as a result of overtreatment.

Pharmacological therapy

Although different agents have been used in the past (for example, chlorpropamide and Pitressin tannate), desmopressin is the current standard of care for patients with central DI [7], owing to its long half-life, selectivity for AVPR2 and the availability of multiple preparations. The optimal dose and dosing intervals should be determined for each patient. Oral preparations provide greater convenience and are usually preferred by patients. However, starting with a nasal spray initially is preferable because of greater consistency of absorption and physiological effect, after which the patient can be switched to an oral preparation. After trying both preparations, patients can then choose which they prefer for long-term treatment. The duration of action of individual doses should be ascertained in each patient owing to variability in responses between patients [8]. A satisfactory schedule can generally be determined using modest doses of desmopressin. The maximum dose of desmopressin required rarely exceeds 0.2 mg orally, 120 µg sublingually, or 10 µg (one nasal spray) two or three times daily. These doses usually produce plasma desmopressin levels higher than those required to cause maximum antidiuresis but reduce the need for more frequent treatment [9].

Type 2 Diabetes

Insulin resistance and β-cell dysfunction are the 2 major hallmarks of type 2 diabetes mellitus (T2DM) that appear as the result of disturbed homeostasis. Failure of β-cells (~80% of their β-cell function) and insulin resistance in muscles and the liver is a vicious triumvirate responsible for the core physiological defects. However, T2DM is classically viewed as a disorder of insulin deficiency and resistance, and further insights into the pathophysiology of T2DM suggest the role of other key players in insulin deficiency and its functional inability. Pancreatic islets are composed of insulin-releasing β-cells (48–59%), glucagon releasing α-cells (33–46%), somatostatin (SsT)-releasing δ-cells, and F cells that release polypeptides (PPs) in similar proportion. Moreover, paracrine interactions occur in the sequence from β-cell to α-cells followed by δ-cells and PP-cells/F-cells. While the β-cell interactions are emphasized at present, the interaction of other cells in the pancreas is of crucial importance that needs to be explored further to understand their roles in glucose homeostasis [10]. Also, the development of glucose resistance in T2DM is largely influenced by fat cells (accelerated lipolysis), gastrointestinal tract (incretin deficiency/resistance), α-cells (hyperglucagonemia), kidneys (increased glucose reabsorption) and brain (insulin resistance), and complex interactions that occur between these factors and T2DM associated genes [11]. Changes in the lifestyle of T2DM patients are crucial along with pharmacological interventions to improve the overall health status of the patient. The present review discusses our current understanding of the pathogenesis of T2DM and attempts to emphasize on generally unfocused aspects of T2DM pathogenesis and treatment that may contribute significantly to treatment approaches and patient-related outcomes.

Types of Therapy Involved in Diabetes Mellitus

1. **Stem cell therapy:**

Researchers have shown that monocytes/ macrophages may be the main players which contribute to these chronic inflammations and insulin resistance in T2DM patients [12]. Stem cell educator therapy, a novel technology, is designed to control or reverse immune dysfunctions [13]. The procedure includes a collection of patients' blood circulating through a closed-loop system, purification of lymphocytes from the whole blood, co-culture of them with adherent cord blood-derived multi-potent stem cells (CB-SCs) in vitro, and administration of the educated lymphocytes (but not the CB-SCs) to the patient's circulation [13]. The Pharma Innovation Journal

2. Antioxidant therapy:

A variety of antioxidants, such as vitamins, supplements, plant-derived active substances, and drugs with antioxidant effects, have been used for oxidative stress treatment in T2DM patients. Vitamin C, vitamin

E, and β carotene are ideal supplements against oxidative stress and its complications. [14] Antioxidants play an important role in lowering the risk of developing diabetes and its complications.

3. Anti-inflammatory treatment:

The changes indicate that inflammation plays a pivotal role in the pathogenesis of T2DM and its complications [15, 16]. In T2DM, especially in adipose tissue, pancreatic islets, the liver, the vasculature, and circulating leukocytes, [17] which include altered levels of specific cytokines and chemokines, the number and activation state of different leukocyte populations, increased apoptosis and tissue fibrosis. [17, 18] Immunomodulatory drugs are provided.

4. Dietary Management Adequate caloric value Dietary management should be taken properly by both diabetic and non-diabetic patients such as:

- Balanced regarding protein, carbohydrates, and fats, in all cases it is necessary to restrict carbohydrate intake.
- Should conform as closely as possible to normal
- Food intake should be divided into regularly spaced meals of similar size
- Reduce total calorie intake by decreasing both fat and carbohydrate
- Patient must be advised to be constant in his dietary habits from day to day.

5. Newer Insulin Delivery Devices:

Several innovations have been made to improve the ease and accuracy of insulin administration as well as to achieve tight glycaemic control. These are insulin syringes, pen devices, inhaled insulin, insulin pumps, implantable pumps, and other routes of insulin delivery.

6. Oral Hypoglycaemic or Antidiabetic Agents:

Clinically useful biguanide phenformin was produced parallel to sulfonylureas in 1957. Newer approaches have constantly been explored and have lately yielded thiazolidinediones, meglitinide analogs, α-glucosidase inhibitors, and the latest are dipeptidyl peptidase-4(DPP-4) inhibitors [19]. Important Features of Oral Hypoglycaemic Agents Diabetes mellitus can be considered a disease of the modern world with a great impact on morbidity, morality, and the quality of the type of the affected individual. Diabetes mellitus is a frequent complication of Cushing syndrome which is caused by chronic exposure to Glucocorticoids by several clinical symptoms such as central obesity, proximal muscles weakness, hirsutism, neurophysiological disturbance, macro-vascular complication autonomic neuropathy, digestive problems, dental problems, etc. [19]

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