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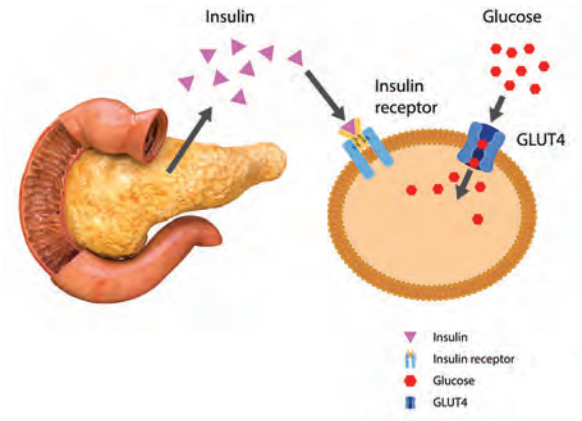
Learning Series - #16

Making sense of Diabetes

Diabetes Mellitus is a chronic endocrine disease, capable of acute manifestations. It is hallmarked by abnormal fat, protein and carbohydrate metabolism due to inadequate production or utilization of insulin, or both.

Anatomy and physiology

- The pancreas serves as two glands in one: a digestive exocrine gland and a hormone-producing endocrine gland.
- The hormone-producing cells of the pancreas called islets of Langerhans (pancreatic islets) contain alpha cells that produce glucagon and beta cells that produce insulin.
- All cells in our bodies requires energy to function. This energy is derived from the food we eat. During the digestive process, food is broken down in a series of processes into molecules of simple sugar, or glucose, which can be absorbed by cells. The glucose is transported to the cells through the blood stream but cannot pass from the blood into the cell through the cell membrane on its own. This process requires insulin to "unlock" the cell to allow the glucose to enter. Brain, liver and kidney cells however are not dependent on insulin for glucose intake.
- The stimulus for insulin secretion is a high blood glucose (hyperglycemia). This state occurs after eating.



Types of diabetes mellitus

There are several types of diabetes that differ in their cause, treatment, typical age of onset, and prevalence: **Type 1**, **Type 2**, **Gestational Diabetes**.

Type 1 and type 2 diabetes are the most common forms and are both metabolic diseases that cause the blood sugar to increase and inhibit the production of insulin. Both forms generally crossover symptomatically, but they surface at different stages in life and have a few key differences that set them apart.

Type 1 diabetes (insulin dependent diabetes mellitus-IDDM or juvenile diabetes)
- Characterized by destruction of beta cells of the pancreatic islets and complete lack of insulin.
- Onset is usually abrupt.
- The destruction of beta cells is an autoimmune response believed to be mediated by viral infection.
- The disease generally manifests at a young age and lasts a lifetime.

Type 2 diabetes (non-insulin dependent diabetes mellitus-NIDDM or adult-onset diabetes)
- Insulin is produced but cannot exert its function on cells because of loss of insulin receptors.
- Onset is usually gradual.
- Is closely linked to family history and lifestyle choices.

Gestational DM (GDM)
- Elevated blood sugars occurring during pregnancy.
- Is associated with complications to both mother and child.
- Usually resolves after pregnancy but affected women and their children are at increased risk of developing type 2 diabetes later in life.

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Making sense of Diabetes (cont'd)

Diagnosis of diabetes

1) Diagnosed when it is manifested clinically by ***polyuria*** (increased voiding), ***polydipsia*** (increased thirst), ***polyphagia*** (increased appetite), ***weight loss***, ***pruritus*** (itching), ***frequent skin infections***, ***peripheral neuritis***, ***and weakness and fatigue***.

2) Laboratory assays
Lab studies show sugar (glucose) in the urine (glycosuria), elevated blood sugar (hyperglycemia) and often elevated blood lipids (cholesterol, phospholipids, triglycerides).
Accurate diagnosis requires a determination of the blood sugar level as well as measurement of the Hemoglobin A1c (Hb A1c).
- **Hb A1c**: measures the amount of glycosylation of hemoglobin that occurs in the blood and is an excellent measure of diabetic control over the ***preceding three months***.

If the A1C test results aren't consistent, the test isn't available, or the patient has certain conditions that can make the A1C test inaccurate (i.e current pregnancy or having an uncommon form of hemoglobin -known as a hemoglobin variant) — the physician may use the following tests to diagnose diabetes:

- **Fasting Blood Sugar Test**: measures the blood sugar after an overnight fast
- **Oral Glucose Tolerance Test**: measures the amount of glucose that remains in the bloodstream after fasting and then before & after drinking a sugary drink
- **Random blood sugar test**: a blood sample will be taken at a random time (fasting is not required)

Results	A1c test	Fasting blood sugar test	Glucose tolerance test	Random blood sugar test
Diabetes	≥ 6.5%	≥ 126 mg/dl	≥ 200 mg/dl	≥ 200mg/dL
Prediabetes	5-7-6.4%	100-125 mg/dL	140-199 mg/dL	n/a
Normal	<5.7%	≤99 mg/dL	≤ 140 mg/dL	n/a

Treatment

1) Diet & exercise are important for all diabetics and for some with Type 2 diabetes, this can be the only treatment required.
2) However, for the majority of Type 2 diabetics, medication is needed to maintain the blood glucose level within an acceptable range.
Multiple classes of pharmacological agents exist, and each class works in different ways to lower blood sugar. There is also a vast array of blood glucose monitoring devices, from flash to continuous, essential to the day-to-day management of diabetes.
3) ***Some*** Type 2 diabetics, and ***all*** Type 1 diabetics, require insulin

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Making sense of Diabetes (cont'd)

Complications

Long-term complications of untreated hyperglycemia can include

1) ***Vascular changes***: the capillary walls thicken and the exchanges in gas and nutrients diminish. The most damaging effects are seen in the skin (especially of the feet); the retina (diabetic retinopathy;) and the kidneys (nephropathy). Poorly controlled diabetes can lead to dry gangrene, blindness and severe kidney damage

2) ***Atherosclerosis*** is common because faulty triglyceride metabolism is linked to faulty glucose metabolism. Diabetics must control their blood pressure and cholesterol level to prevent heart attacks and strokes.

3) ***Neuropathy*** (nerve damage) leads to impaired cutaneous sensation and difficulty with fine movements (i.e buttoning a shirt)

4) ***Ketoacidosis***: a potentially life-threatening complication of diabetes , most common with type 1 diabetes. When glucose cannot be used for energy, our body turns to fats and proteins, which are converted by the liver in ketones (organic acids that lower the pH of the blood as they accumulate).

Underwriting considerations

1) Type of diabetes

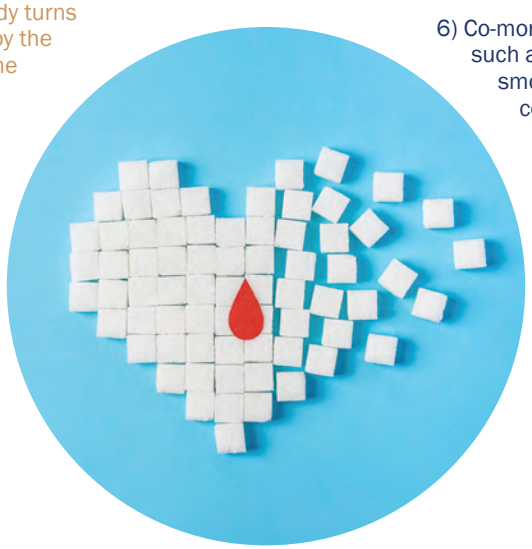
2) Treatment

3) Degree of blood sugar control
It's preferable to review the average blood sugar level over a period of several years. The better the blood sugar control, the less damage results from hyperglycemia at both the cellular and organ level, and fewer complications develop. Increased sugar at cellular level creates an adverse milieu at the vascular wall interface, kidneys, etc. Compliance with medical treatment is vital to achieving good blood sugar control and avoiding complications. Self-monitoring of blood glucose levels and regular follow up with a physician are good indicators of compliance.

4) Duration of the disease – Longer durations generally result in higher risk, as the effects of the disease accumulate over time.

5) Presence of diabetic complications.

6) Co-morbidities – the presence of other impairments such as obesity, hypertension, hyperlipidemia, and smoking, tend to accelerate the progression of complications, thus the mortality/morbidity risks increase.



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