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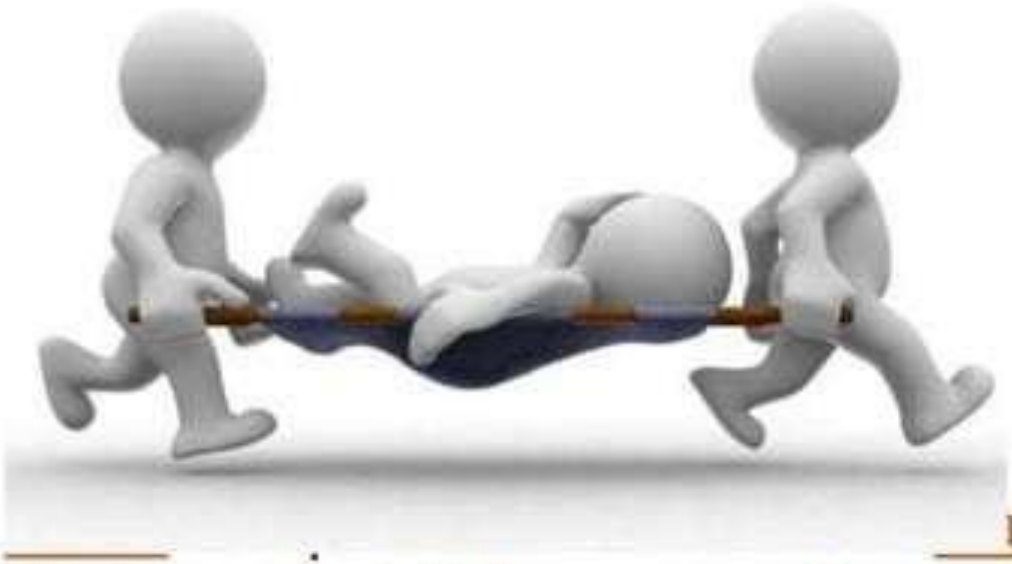
INTRODUCTION

- **Diabetes mellitus** (**DM**), is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period.

- Symptoms of high blood sugar include frequent urination, increased thirst, and increased hunger.

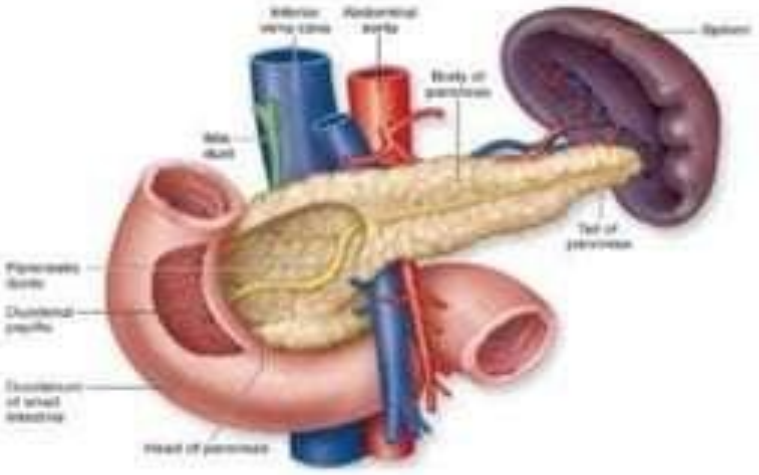
- If left untreated, diabetes can cause many complications.



- _____ ıbetic ketoacidosis, nonketotic hyperosmolar coma, or death.

- Serious long-term complications include heart disease, stroke, chronic kidney failure, foot ulcers, and damage to the eyes.

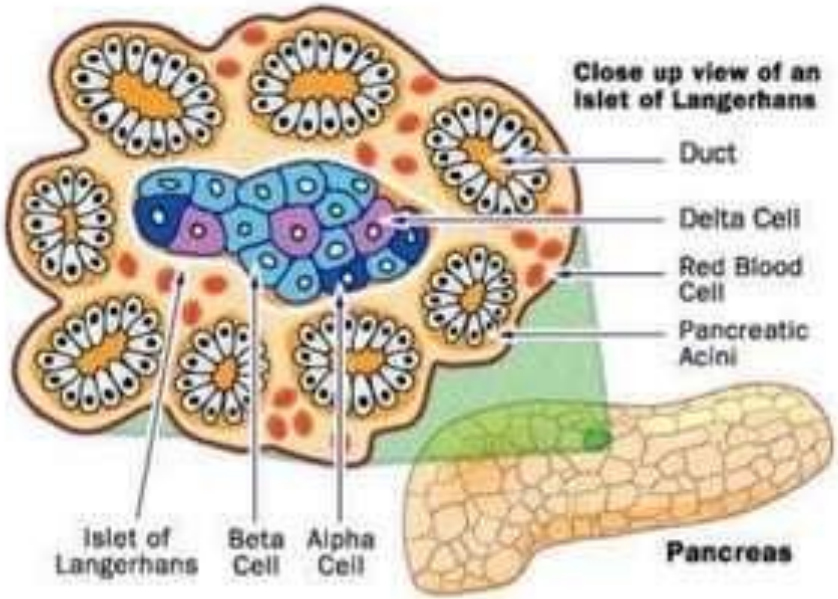
- Diabetes is due to either the pancreas not producing enough insulin or the cells of the body not responding properly to the insulin produced.



- There are three main types of diabetes mellitus:
  - Type 1 DM
  - Type 2 DM
  - Gestational Diabetes

Type 1 DM

- Results from the pancreas's failure to produce enough insulin.



- This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes".

- The cause is unknown.

- Type 2 DM
  - Begins with insulin resistance, a condition in which cells fail to respond to insulin properly.

  - This form was previously referred to as "non insulin-dependent diabetes mellitus" (NIDDM) or "adult-onset diabetes".
  - The primary cause is excessive body weight and not enough exercise.

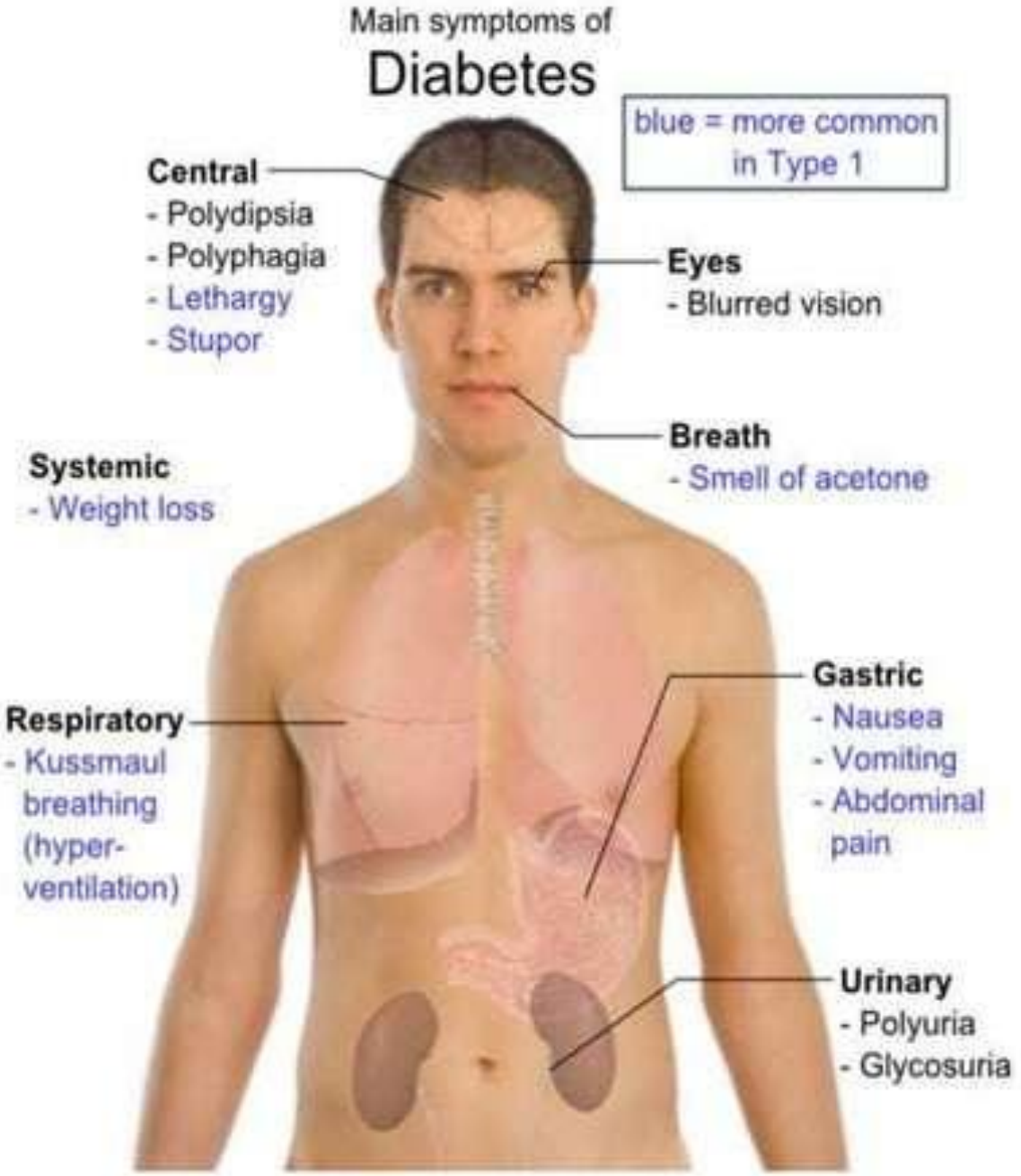
Gestational Diabetes

Is the third main form and occurs in pregnant women without a previous history of diabetes

Comparison of type 1 and 2 diabetes

Feature	Type 1 diabetes	Type 2 diabetes
Onset	Sudden	Gradual
Age at onset	Mostly in children	Mostly in adults
Body size	Thin or normal	Often obese
Ketoacidosis	Common	Rare
Autoantibodies	Usually present	Absent
Endogenous insulin	Low or absent	Normal, decreased or increased
Concordance in identical twins	50%	90%
Prevalence	~10%	~90%

SIGNS AND SYMPTOMS



Signs and symptoms

- The classic symptoms of untreated diabetes are
  - weight loss
  - polyuria (increased urination)
  - polydipsia (increased thirst) and
  - polyphagia (increased hunger).

- Symptoms may develop rapidly (weeks or months) in type 1 DM, while they usually develop much more slowly and may be subtle or absent in type 2 DM.

Signs and symptoms

In addition they also include:

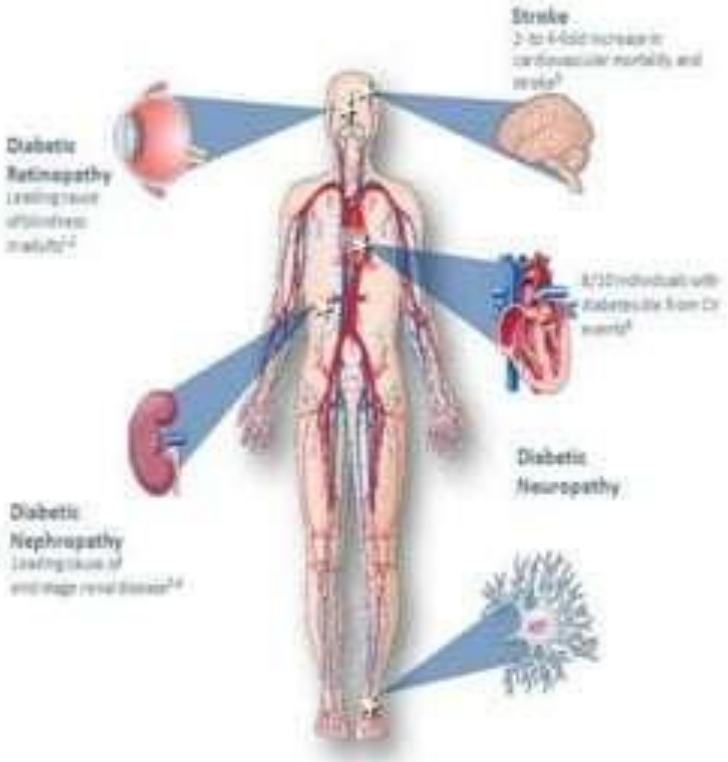
- Blurry vision
- Headache
- Fatigue
- Slow healing of cuts and
- Itchy skin.

- Prolonged high blood glucose can cause glucose absorption in the lens of the eye, which leads to changes in its shape, resulting in vision changes.

- A number of skin rashes that can occur in diabetes are collectively known as diabetic dermadromes

Complications

- All forms of diabetes increase the risk of long-term complications. These typically develop after many years (10–20)
  - The major long-term complications relate to damage to blood vessels.
    - Diabetes doubles the risk of cardiovascular disease
- About 75% of deaths in diabetics are due to coronary artery disease.
  - Other "macrovascular" diseases (stroke)
  - peripheral vascular disease.



COMPLICATIONS

- The primary complications of diabetes due to damage in small blood vessels include damage to the eyes, kidneys, and nerves.

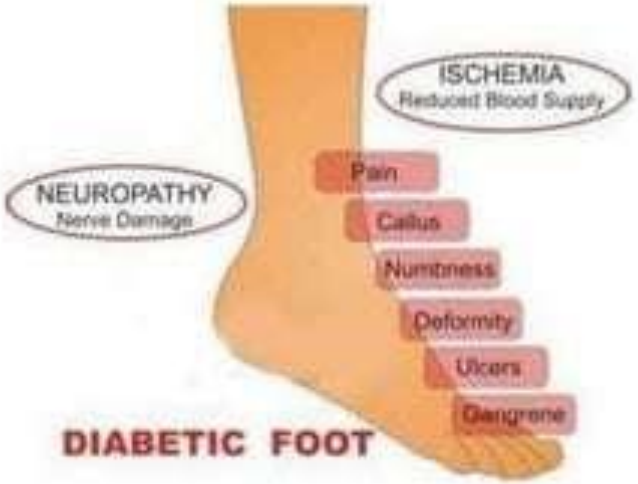
- Damage to the eyes, known as diabetic retinopathy, is caused by damage to the blood vessels in the retina of the eye, and can result in gradual vision loss and blindness.

- Damage to the kidneys, known as diabetic nephropathy, can lead to tissue scarring, urine protein loss, and eventually chronic kidney disease, sometimes requiring dialysis or kidney transplant.

- Damage to the nerves of the body, known as diabetic neuropathy, is the most common complication of diabetes.

COMPLICATIONS

- The symptoms can include numbness, tingling, pain, and altered pain sensation, which can lead to damage to the skin.

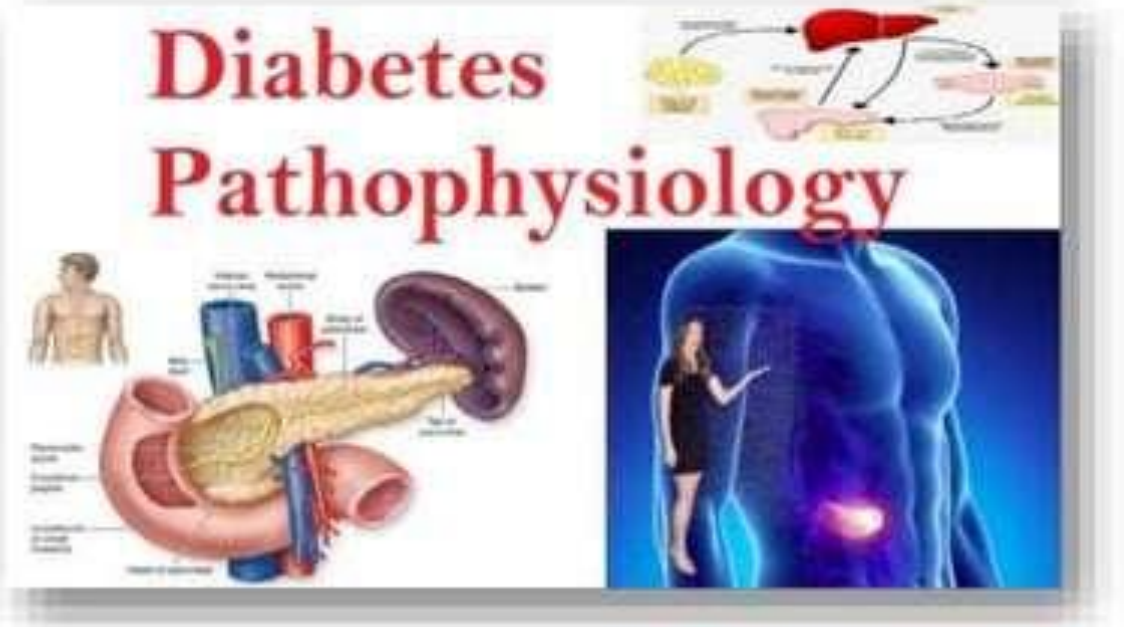


- Diabetes-related foot problems (such as diabetic foot ulcers) may occur, and can be difficult to treat, occasionally requiring amputation.

- Additionally, proximal diabetic neuropathy causes painful muscle wasting and weakness – Diabetic Amyotrophy.

Pathophysiology - General

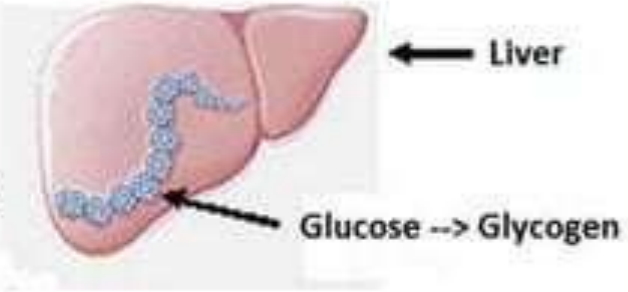
- Insulin is the principal hormone that regulates the uptake of glucose from the blood into cells of the body, especially liver, adipose tissue and muscle, except smooth muscle, in which insulin acts via the IGF-1 (Insulin-like growth factor - 1).



- Therefore, deficiency of insulin or the insensitivity of its receptors plays a central role in all forms of diabetes mellitus.

PATHOPHYSIOLOGY

- The body obtains glucose from three main places:
  - The intestinal absorption of food
  - The breakdown of glycogen, the storage form of glucose found in the liver
  - Gluconeogenesis, the generation of glucose from non-carbohydrate substrates in the body.

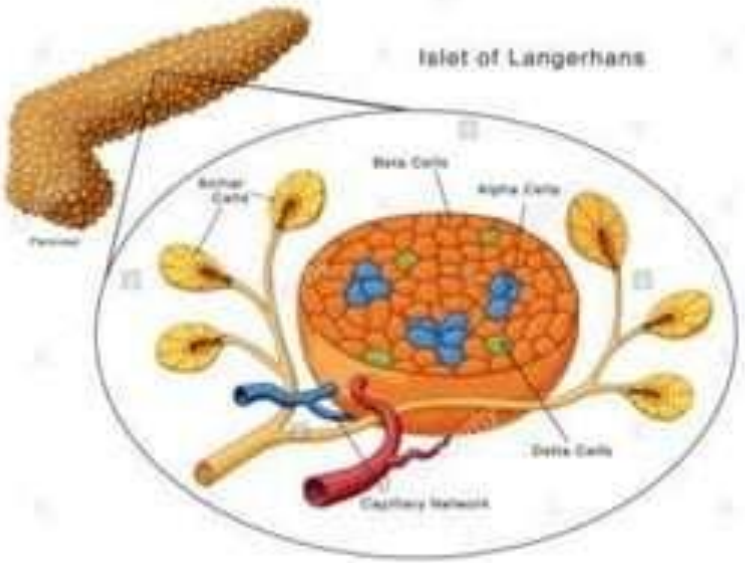


PATHOPHYSIOLOGY

- Insulin plays a critical role in balancing glucose levels in the body:
  - It can inhibit the breakdown of glycogen or the process of gluconeogenesis.
  - It can stimulate the transport of glucose into fat and muscle cells.
  - It can stimulate the storage of glucose in the form of glycogen.

PATHOPHYSIOLOGY

- Insulin is released into the blood by beta cells (β-cells), found in the islets of Langerhans in the pancreas, in response to rising levels of blood glucose, typically after eating.



- Lower glucose levels result in decreased insulin release from the beta cells and results in the breakdown of glycogen to glucose.

- This process is mainly controlled by the hormone glucagon, which acts in the opposite manner to insulin.

PATHOPHYSIOLOGY

- If the amount of insulin available is insufficient
- If cells respond poorly to the effects of insulin
- If the insulin itself is defective

↓

- Then glucose will not be absorbed properly by the body cells

↓

- The net effect is persistently high levels of blood glucose, poor protein synthesis, and break down of fat storage

↓

- Acidosis.

PATHOPHYSIOLOGY

- When the glucose concentration in the blood remains high over time, the kidneys will reach a threshold of reabsorption → Glycosuria.

↓

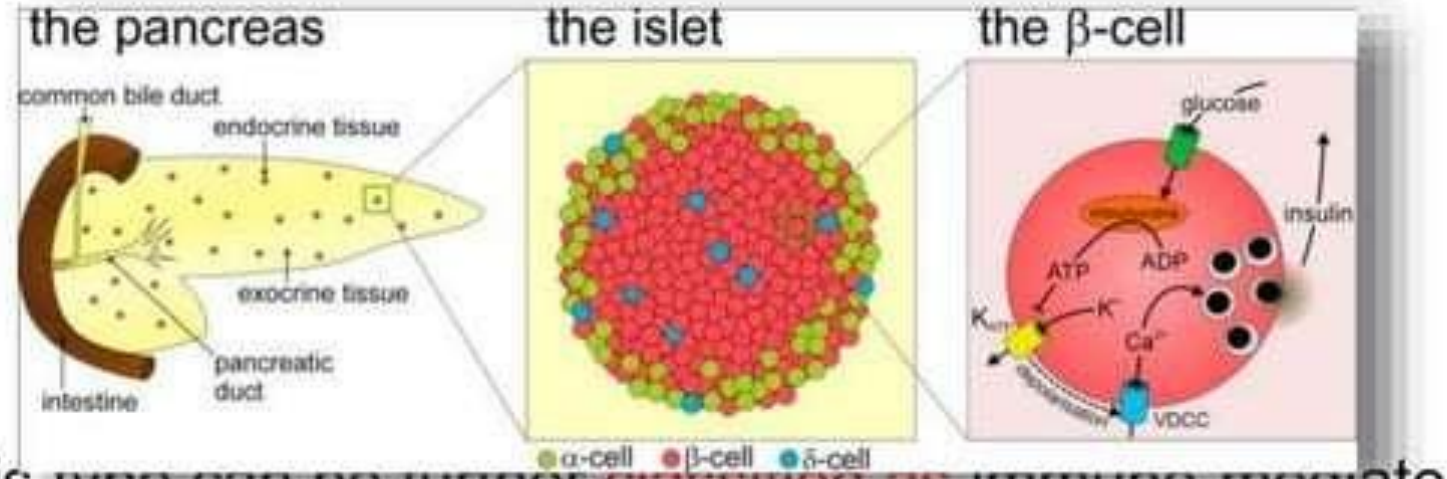
- This increases the osmotic pressure of the urine → polyuria → increased fluid loss

↓

- Lost blood volume will be replaced osmotically from water held in body cells and other body compartments → dehydration → polydipsia

PATHOPHYSIOLOGY - TYPE 1

- Type 1 diabetes mellitus is characterized by loss of the insulin-producing beta cells of the islets of Langerhans in the pancreas, leading to insulin deficiency.



- This type can be further classified as immune-mediated or idiopathic.
  - The majority of type 1 diabetes is of the immune-mediated nature, in which a T-cell-mediated autoimmune attack leads to the loss of beta cells and thus insulin.

Pathophysiology - Type 1

- Most affected people are otherwise healthy and of a healthy weight when onset occurs.

- Sensitivity and responsiveness to insulin are usually normal, especially in the early stages.

- Type 1 diabetes can affect children or adults, but was traditionally termed "juvenile diabetes" because a majority of these diabetes cases were in children.

Pathophysiology - Type 1

- Type 1 diabetes is partly inherited, with multiple genes, including certain HLA genotypes, known to influence the risk of diabetes.

- In genetically susceptible people, the onset of diabetes can be triggered by one or more environmental factors, such as a viral infection or diet.
  - Among dietary factors, gluten may lead to type 1 diabetes, but the mechanism is not fully understood

PATHOPHYSIOLOGY - TYPE 2

- Type 2 DM is characterized by insulin resistance.
- The defective responsiveness of body tissues to insulin is believed to involve the insulin receptor.
  - In the early stage of type 2, the predominant abnormality is reduced insulin sensitivity.
- Type 2 DM is due primarily to lifestyle factors and genetics.

PATHOPHYSIOLOGY - TYPE 2

- A number of lifestyle factors are known to be important to the development of type 2 DM, including
  - Obesity
  - lack of physical activity
  - poor diet
  - Stress

- Dietary factors also influence the risk of developing type 2 DM such as
  - sugar-sweetened drinks
  - Type of fats in diet
    - saturated fats and trans fatty acids **increasing** the risk
    - polyunsaturated and monounsaturated fat **decreasing** the risk
  - Eating lots of white rice also may increase the risk of diabetes.
  - A lack of exercise is believed to cause 7% of cases

PATHOPHYSIOLOGY - GESTATIONAL DIABETES

- Gestational diabetes mellitus (GDM) resembles type 2 DM in several aspects.
  - Involves a combination of relatively inadequate insulin secretion and responsiveness.
    - It occurs in about 2–10% of all pregnancies and may improve or disappear after delivery.

Pathophysiology - Gestational diabetes

- However, after pregnancy approximately 5–10% of women with gestational diabetes are found to have diabetes mellitus, most commonly type 2.

- Gestational diabetes is fully treatable, but requires careful medical supervision throughout the pregnancy.

- Management may include dietary changes, blood glucose monitoring, and in some cases, insulin may be required.

Pathophysiology - Gestational diabetes

- Though it may be transient, untreated gestational diabetes can damage the health of the fetus or mother.

- Risks to the baby include:
  - Macrosomia (high birth weight)
  - Congenital Heart Defects
  - Central Nervous System Abnormalities
  - Skeletal Muscle Malformations.

Pathophysiology - Gestational diabetes

- Increased levels of insulin in a fetus's blood may inhibit fetal surfactant production and cause respiratory distress syndrome.

- A high blood bilirubin level may result from red blood cell destruction.

PATHOPHYSIOLOGY - GESTATIONAL DIABETES

- In severe cases, perinatal death may occur, most commonly as a result of poor placental perfusion due to vascular impairment.

- Labor induction may be indicated with decreased placental function.

- A Caesarean section may be performed if there is marked fetal distress or an increased risk of injury associated with macrosomia, such as shoulder dystocia.

ORAL MANIFESTATIONS AND COMPLICATIONS

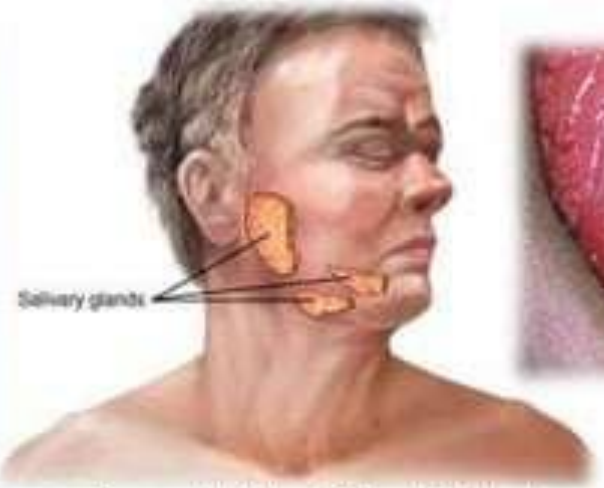
No specific oral lesions associated with diabetes. However, there are a number of problems by presence of hyperglycemia.

- **Periodontal disease:**
  - Microangiopathy alters antigenic challenge.
  - Altered cell-mediated immune response and impaired of neutrophil chemotaxis.
  - Increased Ca^{+} and glucose lead to plaque formation.
  - Increased collagen breakdown.

- Periodontal changes in seen in Diabetes Mellitus

ORAL MANIFESTATIONS AND COMPLICATIONS

- Salivary glands
  - Xerostomia is common, but reason is unclear.
  - Tenderness, pain and burning sensation of tongue.
  - May cause secondary enlargement of parotid glands with sialosis.



- Dental caries
  - Increase caries prevalence in adult with diabetes. (xerostomia, increase saliva glucose)
  - Hyperglycemia state shows a positive association with dental caries.

SIALOSIS

CARIOUS LESION ON TEETH WITH XEROSTOMIA

ORAL MANIFESTATIONS AND COMPLICATIONS

- **Increased risk of infection**
  - Reasons unknown, but macrophage metabolism altered with inhibition of phagocytosis.
  - Peripheral neuropathy and poor peripheral circulation
  - Immunological deficiency
  - High sugar medium
  - Decrease production of Antibodies
  - Candidal infection are more common and adding effects with xerostomia

ORAL MANIFESTATIONS AND COMPLICATIONS

- **Delayed healing of wounds**
  - Due to microangiopathy and ultilisation of protein for energy, may retard the repair of tissues.
  - Increase prevalence of dry socket.

- **Miscellaneous conditions**
  - Pulpitis : degeneration of vascular.
  - Neuropathies : may affect cranial nerves. (facial)
  - Drug side-effects : lichenoid reaction may be associated with sulphonylureas (chlopropamide)
  - Ulcers

Dental management considerations

To minimize the risk of an intraoperative emergency, clinicians need to consider some issues before initiating dental treatment.

- Medical history:
  - Glucose levels
  - Frequency of hypoglycemic episodes
  - Medication, dosage and times.
  - Consultation

Dental management considerations

- Scheduling of visits
  - Morning appointment
  - Do not coincide with peak activity.
- Diet
  - Ensure that the patient has eaten normally and taken medications as usual.
- Blood glucose monitoring
  - Measured before beginning. (<70 mg/dL)
- Prophylactic antibiotics
  - Established infection
  - Pre-operation contamination wound
  - Major surgery

Dental management considerations

- During treatment
  - The most complication of DM occur is hypoglycemia episode.
  - Hyperglycemia
- After treatment
  - Infection control
  - Dietary intake
  - Medications : salicylates increase insulin secretion and sensitivity➔ avoid aspirin.

EMERGENCY MANAGEMENT

- **Hypo**glycemia
  - Initial signs : mood changes, decreased spontaneity, hunger and weakness.
  - Followed by sweating, incoherence, tachycardia.
  - Results in unconsciousness, hypotension, hypothermia, seizures, coma, even death.

Emergency management

- 15 grams of fast-acting oral carbohydrate.
- Measured blood sugar.
- Loss of consciousness: 25-30ml 50% dextrose solution iv. over 3 min period.
- Glucagon 1mg.

Emergency management

- Severe **hyper**glycemia
  - A prolonged onset
  - Ketoacidosis may develop with nausea, vomiting, abdominal pain and acetone odor.
  - Difficult to different hypoglycemia or hyperglycemia.

LOW BLOOD SUGAR
*Hypo*glycemia

Signs and Symptoms


SWEATING


TREMBLING


DIZZINESS


MOOD CHANGES


HUNGER

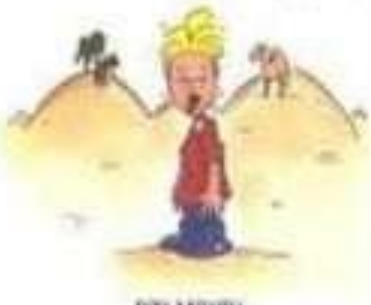

HEADACHES


BLURRED VISION


EXTREME TIREDNESS AND PALENESS

HIGH BLOOD SUGAR
*Hyper*glycemia

Signs and Symptoms:


DRY MOUTH


EXTREME THIRST


FREQUENT URGE TO URINATE


DROWSINESS


FREQUENT BED WETTING


STOMACH PAIN

Emergency management

- Hyperglycemia needs medical intervention and insulin administration.
- While emergency, give glucose first !
- Small amount is unlikely to cause significant harm.

Diagnosis

- Can be diagnosed by demonstrating any one of the following:
  - Fasting plasma glucose level ≥ 7.0 mmol/l (126 mg/dl)
  - Plasma glucose ≥ 11.1 mmol/l (200 mg/dl) two hours after a 75 g oral glucose load as in a glucose tolerance test.
  - Symptoms of high blood sugar and casual plasma glucose ≥ 11.1 mmol/l (200 mg/dl)
  - Glycated hemoglobin (HbA_{1C}) ≥ 48 mmol/mol (≥ 6.5 DCCT %)

Diagnosis

- **Oral Glucose Tolerance Test (OGTT)**
  - Measures the body's ability to metobolise glucose
  - Most commonly done to check for gestational diabetes.
  - The patient is asked to take a glucose drink and their blood glucose level is measured before and at intervals after the sugary drink is taken.
  - For the standard glucose tolerance test, we should drink 75 grams or 100 grams.


1. Fasting for 8 - 12 hours
1
3
3. Glucose drink
2
4
4. Blood samples are drawn for three times with the time interval of one hour
2. Blood is withdrawn to test fasting blood glucose level
© www.medindia.net

OGTT Result's :

- **People without diabetes**
  - **Fasting value (before test):** under 6 mmol/L
  - **At 2 hours:** under 7.8 mmol/L
- **People with impaired glucose tolerance (IGT)**
  - **Fasting value (before test):** 6.0 to 7.0 mmol/L
  - **At 2 hours:** 7.9 to 11.0 mmol/L
- **Diabetic levels**
  - **Fasting value (before test):** over 7.0 mmol/L
  - **At 2 hours:** over 11.0 mmol/L

WHO DIABETES DIAGNOSTIC CRITERIA

Condition	2 Hour Glucose	Fasting Glucose	HbA_{1c}	
Unit	mmol/l (mg/dl)	mmol/l (mg/dl)	mmol/mol	DCCT %
Normal	<7.8 (<140)	<6.1 (<110)	<42	<6.0
Diabetes mellitus	≥11.1 (≥200)	≥7.0 (≥126)	≥48	≥6.5

Management

- **Lifestyle**
  - Good nutrition
  - Regular exercise
  - Diet control to maintain blood pressure.
- **Medications**
- **Surgery**
  - Pancreas transplant
  - kidney transplantation
  - Weight loss surgery

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