PATHOPHYSIOLOGY

IMPORTANT QUESTIONS

UNIT 3

Rx Pharma Education

SOLUTION OF IMPORTANT QUESTIONS OF UNIT 3 PATHOPHYSIOLOGY

① Define Diabetes, Explain short term & long term complications of diabetes mellitus.

Diabetes Melitus is defined as a condition in which body doesn't produce enough insulin or didn't respond to insulin normally that leads to increase in blood-glucose (Blood-Sugar) level abnormally high.

Types

It is of mainly two types

① Type-1 Diabetes
② Type-2 Diabetes

Type-1- Diabetes

- Earlier it was known as Insulin Dependent Diabetes.
- It occurs due to destruction of β cells of pancreas due to autoimmune disorders.
- It leads to deficiency of insulin that leads to increase in Blood-Glucose Level.

Type-2 Diabetes

- Earlier it was known as Non-insulin dependent diabetes.
- It occurs when the cell does not respond to insulin properly.

Etiology / Causes

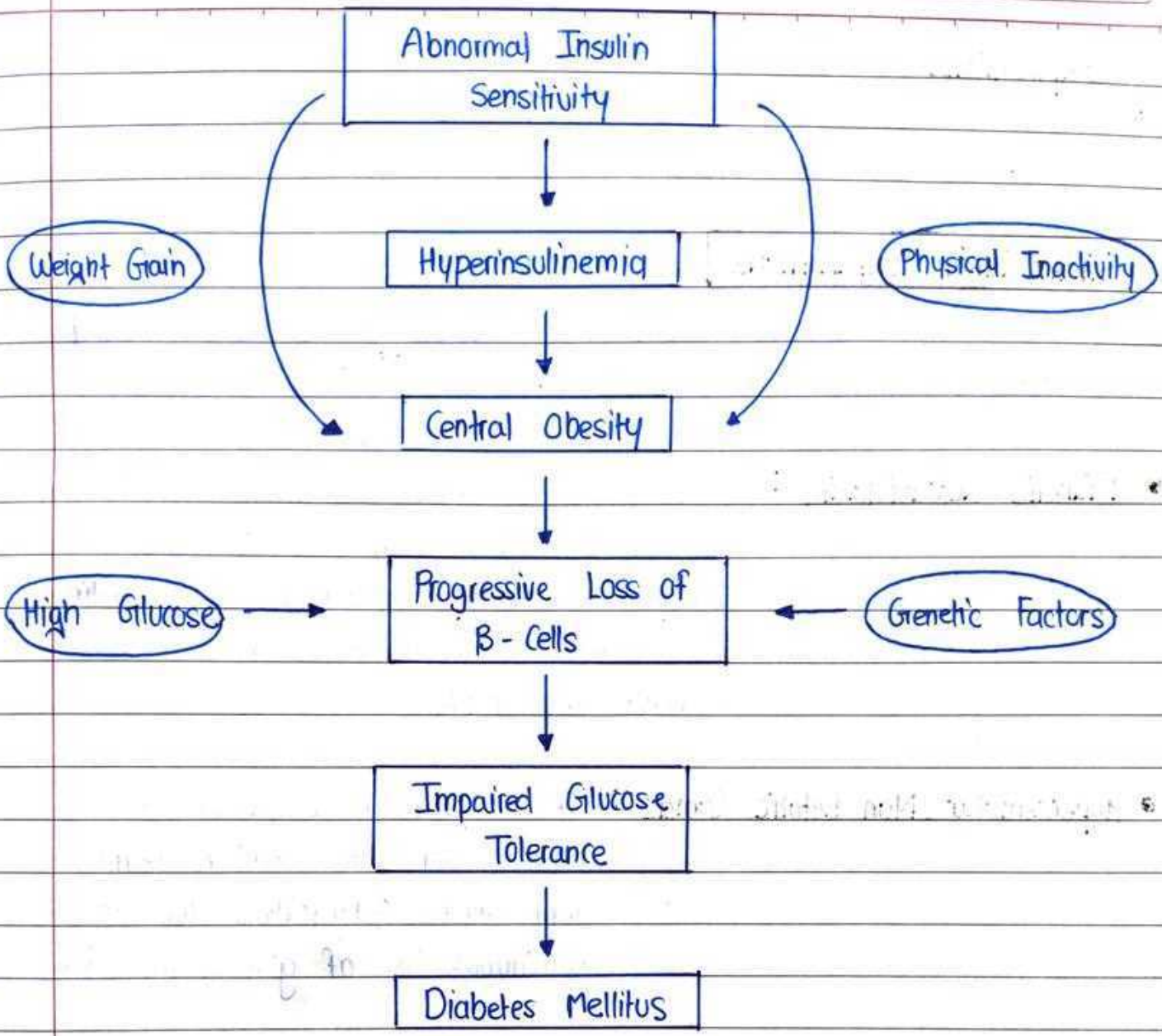
- Family history of type 2 Diabetes Melitus.
- Obesity
- Habitual Physical Inactivity
- Race & Ethnicity
- Hypertension
- Dislipidaemia
- Polycystic Ovary Disease
- History of Vascular Disease

Pathogenesis

- Insulin is the principal harmone that regulates the uptake of glucose from the blood into most cells of body especially liver, muscle & adipose tissue.
- Now, deficiency of insulin or inselectivity of its receptors plays a central role in all forms of diabetes mellitus.
- The body obtains glucose from three main places :

(i) the intestinal absorbtion of food
(ii) the breakdown of glycogen
(iii) Gluconeogenesis

- Insulin plays a critical role in balancing glucose levels in body.
- Insulin is released into the blood by β-cells found in islets of Langerhans in the pancreas
- Insulin is used by about two thirds of body's cells to absorb glucose from the blood for use as fuel.
- If the amount of insulin available is insufficient or if cells respond poorly to the effect of insulin, then glucose will not be absorbed properly by body cells.
- The net effect is persistently high levels of blood glucose, poor protein synthesis, metabolic acidosis etc.



Sign & Symptoms

- Increased Thirst
- Increased Urination
- Abnormal weight loss
- Tiredness & Weakness
- Irritability
- Blurred Vision
- Slow Healing
- Infections

Complications

Diabetes Mellitus may develop complications that are broadly divided into 2 major types

① SHORT TERM COMPLICATIONS

These are the metabolic complications develop in a short period of time & include :

- **Diabetic ketoacidosis** : ketoacidosis is defined as high concentration of ketone bodies in blood. Clinically this condition is characterized by nausea, vomiting fast, mental confusion & coma that is however recoverable

- **Hyperosmolar Non ketotic Coma** : It is generally a complication of type 2 DM, this condition results from severe dehydration due to continuous loss of glucose in urine.

- **Hypoglycaemia** : It may develop in patients of type 1 DM. It may result from excessive administration of insulin, missing a meal or due to stress.

② LONG TERM COMPLICATIONS

These are the complications develop over a long period of time :

- **Atherosclerosis** : both type 1 & type 2 DM accelerates the development of atherosclerosis.

- **Diabetic Nephropathy** : This includes involvement of kidneys and may result in kidney failure.

- **Diabetic Neuropathy** : Diabetic neuropathy may affect all parts of nervous system.

- **Infections** : Diabetics have enhanced suspectibility to various infections such as tuberculosis, pyelonephritis, otitis, diabetic ulcers etc.

Treatment

① Non Pharmacological Approach
- Weigh control
- Avoiding excessive salt
- Avoid sugar
- Balanced Diet

② Pharmacological Approach
- Insulin Therapy
- Hypoglycaemic Therapy

② Define Alzheimer's Disease.

- Alzheimer disease first introduced by Alois Alzheimer in 1907. It is an irreversible, progressive, neurodegenerative disease that is characterized by impairment of memory & eventually by disturbances in reasoning, planning, language & perception.
- It commonly occurs in old age (over age of 65 years).
- Alzheimer's disease results from an inhancement in the production or accumulation of specific protein called **beta- amyloid** in the brain that leads to nerve cell death.
- Patients slowly lose their memory, thinking ability & eventually the ability to carry easiest tasks.

Types

Based on stages, Alzheimer's disease can be divided into three types:

① Stage I (Mild Type)
② Stage II (Moderate Type)
③ Stage III (Severe Type)

STAGE I

It is the initial stage & lasts from 2-4 years.
The patient feels less energetic & other symptoms are:

- Minor memory loss
- Mood swings
- Slow learning & reaction
- Difficulty in performing routine tasks
- Avoiding people & new places
- Difficulty in planning
- Difficulty in Communication
- Confusion

STAGE - II

It is the longest stage & last for 2-10 years
The patient suffers from following symptoms

- Becomes disabled
- Forget recent events & their personal history
- Becomes disconnected from reality
- Trouble in recognising familiar people.
- Difficulty in understanding current situation, date & time.
- Difficulty in speech, reading & writing.

STAGE - III

This is the last stage & severe conditions are observed :

- Patient may lose the ability to feed themselves.
- Severely impaired speech
- Loss of ability to recognise people
- Uncontrolled body functions.

Etiology / Causes

- Abnormal builup of protein around brain cells
- One of the protein is called amyloid & other protein is called Tau.
- Genetic Factors
- Environmental Factors
- Age
- Inherited Genes
- Long exposure to metals like manganese or aluminium
- Obesity
- Smoking.

Pathogenesis

Due to Various Etiological Factors

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Changes occur in the protein of the nerve cells of the cerebral cortex

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Accumulation of neurofibrillary tangles and plaque

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Granulo Vascular Degeneration

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Loss of Cholinergic nerve cells

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Loss of memory, function and cognition

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Alzheimer's Disease

Sign & Symptoms

- Forgetfulness or Absent mindset
- Confusion with Time & Location
- Memory Loss
- Irritability
- Depression
- Anxiety
- Aggresiveness
- Difficulty with words
- Unnecessary Arguing

Complications

- Aspiration
- Pneumonia
- Falls
- Fractures
- Bedsores
- Malnutrition
- Dehydration

Plan of Treatment

Alzeheimer's disease is almost irreversible but following precautions can be applied to control the AD.

- Medications such as alcohol, sedatives, antihistamines should be removed or switched to alternative medicines as early as possible.
- Cholinesterase Inhibitors
- Glutamatergic Agents

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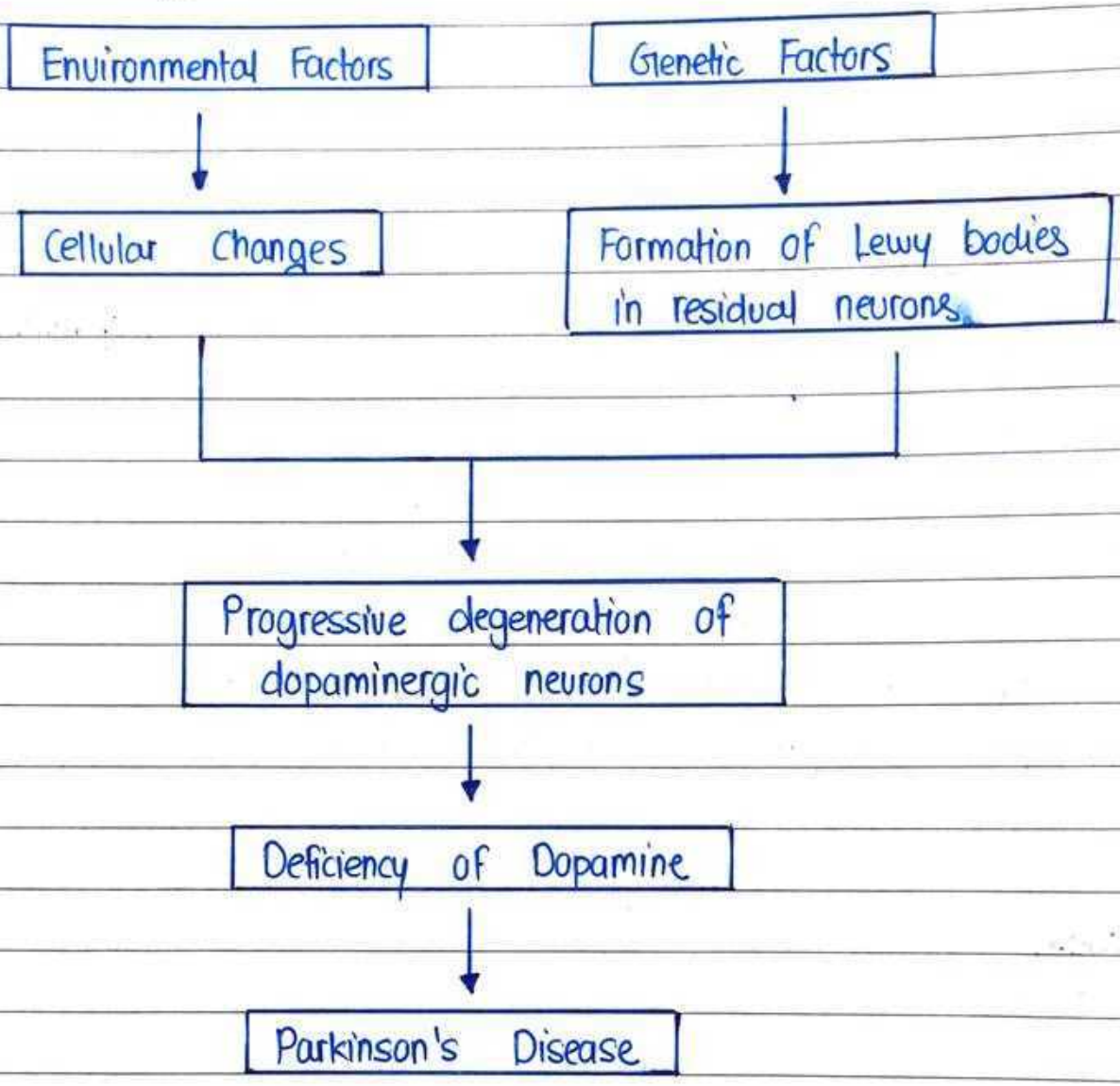
③ Define Parkinson's Disease.

- In 1817, British Physician Dr. James Parkinson publishe a case series describing a progressive neurologic disorder called Parkinsonism (loss of control of movement).
- Parkinson's occurs when certain nerve cells in a part of brain die or become impaired.
- Normally these cells produce a vital chemical called Dopamine that allows smooth movement of muscles.
- When approx 70% of dopamine producing cells get damaged, the symptoms of parkinson disease appear.
- It is one of the most common neurologic disorder affecting approx 1% of individuals older than 60 years.
- It usually begins in late 50s & 60s
- Age is the most important risk factor for parkinson's disease.

Causes

- Mutations in Genes
- Age
- Dietary habits
- Infections
- Heavy Metals
- Environmental Factors
- Head Trauma
- Neoplasm
- Atherosclerosis
- Drugs like Anti-emetics & Hypertensives

Pathophysiology



Sign & Symptoms

- Tremors (shaking or oscillating movement)
- Slowed movement
- Rigid muscle
- Impaired posture & balance
- Loss of automatic movements
- Speech changes
- Writing Changes
- Constipation
- Fatigue
- Pain

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Complications

- Uncontrolled sweating
- Hypertension
- Depression
- Anxiety
- Urinary Retention
- Memory Defect
- Dementia
- Sleep Disorders

Treatment

- Partial Weight Supported Treadmill Gait Training (PWSTT)
- Dopamine Precursor
- Decarboxylase Inhibitors
- COMT Inhibitors
- Antihistaminics

④ Explain the pathophysiology of Peptic Ulcer.

- Peptic ulcer is defined as a condition in which open sores or wounds are developes in the inside lining of esophagus, stomach or duodenum due to increased amount of gastric HCl.
- It results in burning stomach pain.

Types Of Peptic Ulcer

Peptic ulcer is mainly classified into three types:

① Gastric Ulcer
② Duodenal Ulcer
③ Esophageal Ulcer

Gastric Ulcer

- This ulcer occurs mainly in the stomach lining & may be acute or chronic
- Gastric ulcer is characterized by pain in the stomach with in a short period of time after food consumption.

Duodenal Ulcer

- This type of ulcer affect the upper part of small intestine & may be acute or chronic.
- In this pain usually occur after several hour of food consumption.

Esophageal Ulcer

- This type of ulcer affect the esophagus & may be either acute or chronic.
- It generally occurs by gastric reflux.

Etiology

- H. pylori infecting stomach
- Inflammation
- NSAIDs like Aspirin, ibuprofen etc.
- Smoking
- Radiotherapy
- Alcoholism
- Cancer of stomach

Pathogenesis

Decrease in defensive factors like Bicarbonate, Mucous Layer, Prostaglandin, Mucosal blood flow

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Increase in aggresive factors like H. Pylori, NSAIDs, Bile acid Pepsins, Smoking etc.

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Excessive secretion of HCl

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Decrease mucous secretion

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Breakdown of mucous membrane

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Acid enters into gastric mucosa

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Gastric Ulcers

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Sign & Symptoms

- Bloating
- Heartburn
- Nausea
- Vomiting
- Dark / Black stool
- Weight Loss
- Severe pain in abdomen
- Fatigue

Complications

- Haemorrhage
- Obstructions
- Malignant Transformation
- Perforation

Treatment

- Avoid acidic food
- Avoid NSAIDs
- Antibiotics
- Antacids
- Anti-secretory Agents

⑤ Describe the pathophysiology of different types of anaemia i.e., iron deficiency anaemia, megaloblastic anaemia, sickle cell anaemia.

- Anaemia is defined as reduced haemoglobin concentration in blood below the lower limit of normal range.
- Haemoglobin value plays the major role for determining whether the anaemia is present or not.

Types Of Anaemia

Anaemia can be of various types:

① Iron Deficiency Anaemia
② Megaloblastic Anaemia
③ Sickle Cell Anaemia
④ Thalasemia
⑤ Hereditary acquired Anaemia
⑥ Hemophilia

IRON DEFICIENCY ANAEMIA

- Iron deficiency anaemia is a condition where lack of iron in the body leads to a reduction in the number of red blood cells.
- Iron is used to produce red blood cells that helps to store & carry oxygen in the blood.
- Iron deficiency anaemia is the most common type of anaemia.

Etiology / Causes

- Blood Loss
- Lack of iron in diet
- Pregnancy & Lactation
- Inability to absorb iron
- Excessive menstruation

Pathogenesis

- Iron deficiency anaemia develops when the supply of iron is inadequate for the requirment of haemoglobin synthesis.
- Initially, negative iron balance is covered by mobilization from the tissues stores to maintain haemoglobin synthesis
- When the tissue stores of iron are exhausted, the supply of iron to the bone marrow becomes insufficient for haemoglobin formation & thus a state of iron deficiency anaemia develops.
- The development of iron deficiency depends upon one or more following factors :

① Increased blood loss
② Increased requirments.
③ Inadequate dietary intake
④ Decreased intestinal absorbtion

Sign & Symptoms

- Weakness
- Fatigue
- Irregular Heartbeat
- Chest Pain
- Headaches
- Pale skin
- Shortness of breath
- Cold hands & feet

Complications

- Heart Problems
- Increased risk of infections
- Developmental delay in children
- Pregnancy complications
- Depression

Treatment

- Oral formulation of iron
- Combination of iron with ascorbic acid
- Infusion of supplemental iron etc.

MEGALOBLASTIC ANAEMIA

- It is a condition in which bone marrow forms large, structurally abnormal and immature RBCs.
- Such RBCs are termed as megaloblasts.
- Megaloblastic anaemia occurs mainly due to deficiencies of Vitamin B_{12} & Folic acid. that are essentially important for formation of RBCs.

Etiology

① Vitamin B_{12} Deficiency : It occurs due to disturbance in the absorbtion of vitamin B_{12} & leads to development of pernicious anaemia

② Folic Acid Deficiency : Alcohol interfares with folic acid absorbtion & leads to Megaloblastic Anaemia.

Pathogenesis

Gastric Atrophy

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Reduced Intrinsic factor Secretion

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Failure of absorbtion of dietary vitamin B_{12}

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Deficiency of Vitamin B_{12}

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Megaloblastic Anaemia

Sign & Symptoms

- Weakness
- Shortness of breath
- Pale skin
- Irregular Heartbeat
- Diarrhoea
- Nausea
- Loss of apetite

Complications

- Vision problems
- Memory Loss
- Infertility
- Cardiovascular Disease
- Cancers

SICKLE CELL ANAEMIA

- Sickle cell anaemia is a genetic disease of the red blood cells (RBCs)
- Normally, RBCs are of disc shaped, which gives them the flexibility to travel through blood vessels.
- In sickle cell anaemia, RBCs attain a sickle-like shape, now this makes them sticky & rigid to get trapped in small vessels that ultimately blocks blood from reaching different parts of body.
- This cause pain & tissue damage.

Etiology / Causes

- Defect in gene is the major cause of sickle cell anaemia.
- A person will be born with sickle cell disease only if two genes are inherited : one from mother, another from father.
- A person who inherits just one gene is healthy & said to be a carrier of the disease.

Pathogenesis

- Sickle cell disease is caused by a mutation in the gene that encodes the beta-globin chain of haemoglobin molecule.
- The mutation results in the formation of sickle haemoglobin
- Because of a single base-pair point mutation in the beta-globin chain, the amino acid glutamic acid is replaced by valine at position 6 of beta globin molecule, resulting in the formation of Hbs
- Hbs polymerization causes erythrocyte sickling leading to vaso occlusion, ischemia etc.

Sign & Symptoms

- Excessive Fatigue
- Irritability
- Jaundice
- Swelling
- Pain

Complications

- Brain Stroke
- Acute Chest Syndrome
- Hypertension
- Blindness
- Leg blisters
- Gallstones
- Sexual Dysfunction