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# PATHOPHYSIOLOGY

## UNIT 3

TOPIC :

- **Nervous system** : Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.



# **Nervous system**

## **Epilepsy**

- Epilepsy is a nervous system disorder due to abnormal electrical activity in brain cells, it is also called seizure and convulsant.
- This disorder results contraction , involuntary movement , shaking of the body etc.



### **Classification of seizures**

- Seizure is classified on the basis of behavioural and electrophysiologic pattern of activity as

#### **1. Partial (Focal seizures)**

- ⇒ It mainly appears in only one hemisphere.
- ⇒ That means symptoms only happen in a specific part or on one side of your body. But focal seizures can sometimes spread and become generalized seizures.

- a) Simple partial seizures with motor, sensory, or autonomic symptoms.

- b) Complex partial seizures.
- c) Partial seizures with secondary generalization.

## 2. Generalized seizures

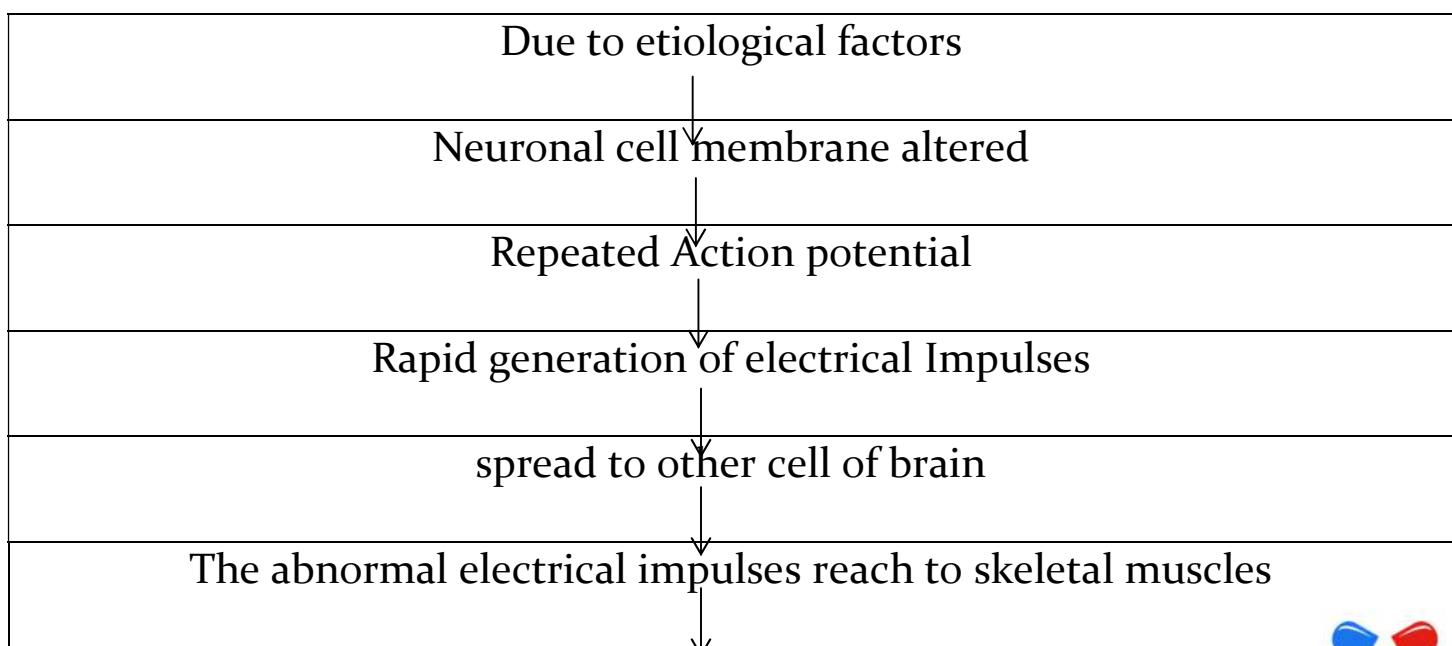
⇒ These are seizures that happen in both hemispheres of your brain side. These seizures tend to cause more severe effects and symptoms.

- a. Absence seizures.
- b. Tonic- clonic seizures.
- c. Other (Myoclonic, tonic, clonic, atonic)

## Etiology

- Brain injury
- High fever
- lack of oxygen to brain
- Brain tumor
- Genetic brain disorder
- Stroke (reduce blood supply to brain )

## Pathogenesis



## Clinical Manifestation

- ✚ Recurrent of seizure
- ✚ Sudden stiffness due to unknown reason
- ✚ Sudden falling due to unknown reason
- ✚ Sudden bouts of chewing due to unspecific reason
- ✚ Repetitive involuntary movement
- ✚ Changes in sense of smell touch and sound

## Non Pharmacological Management

- ❖ Ketogenic diet is useful in children are suffering from seizure .  
ketogenic diet is a high -fat adequate protein , and low carbohydrates diet for example fish , meat , eggs , seafood etc

## Pharmacological managements

- ❖ Benzodiazepines— ex- clonazepam, lorazepam, diazepam.
- ❖ Barbiturates— ex- phenobarbital, desoxyphenobarbital.
- ❖ Deoxy barbiturates— ex- primidone.
- ❖ Hydantoin— ex-phenytoin, ethotoin.
- ❖ Aliphatic carboxylic Acid— ex- valproic acid, magnesium valproate.
- ❖ Oxazolidine derivatives— ex- trimethadione, paramethadione.
- ❖ Cyclic GABA Analogues— ex- gabapentin, pregabalin.
- ❖ Iminostilbene— carbamazepine, oxcarbazepine.
- ❖ Other drugs— ex- levetiracetam, parampanel, brivaracetam, lacosamide

# Parkinson's Disease

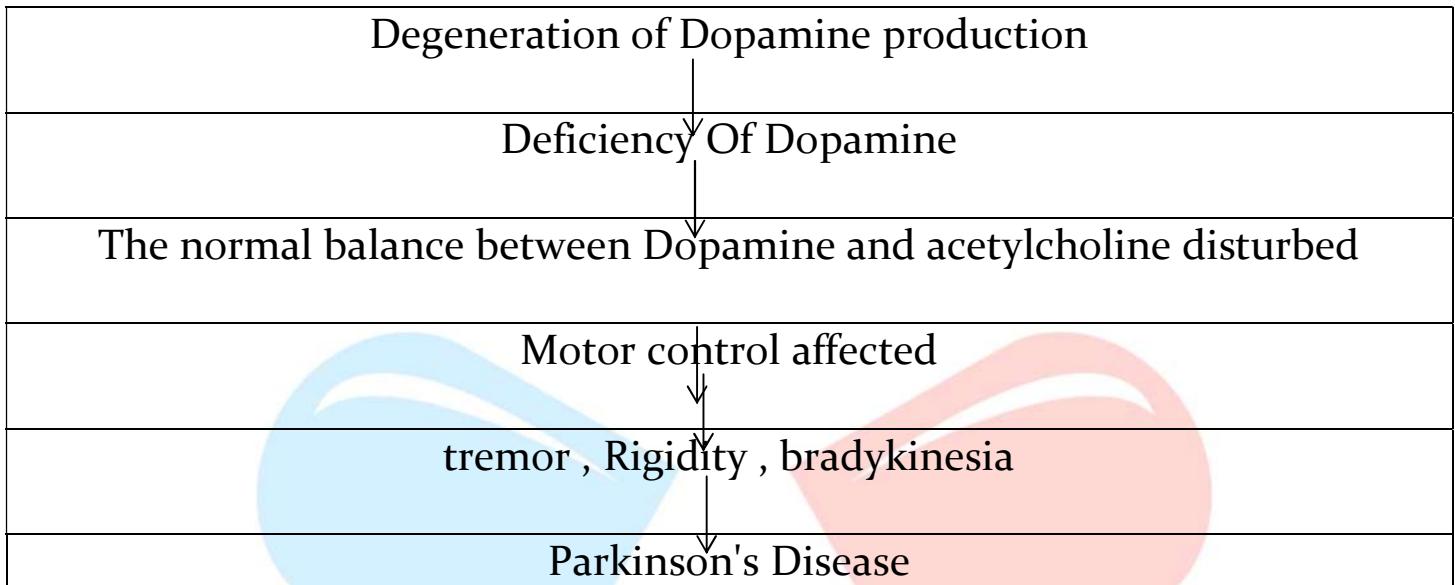
→ It is a chronic, progressive, neurodegeneration disorder. in which slows down the voluntary movement of body parts (bradykinesia) , muscles tone changed ( rigidity) and tremor at rest.



## Etiology

- Genetic factors
- Advancing age : above 60 year mostly seen
- Head injury
- Drugs : like neuroleptics ,antiemetics etc.
- Exposure to toxin.
- Low production of Dopamine

## Pathogenesis of Parkinson 's Disease



### Clinical Manifestation

- ✚ Slow moment
- ✚ Tremor / trembling
- ✚ Low volume of speech
- ✚ Dropping of saliva
- ✚ Constipation
- ✚ Tendency to fall backwards
- ✚ Depression

### Non Pharmacological Management

- ❖ Avoid and discard the all activities which cause/induce the depression, stress, sleep disorders etc.
- ❖ Follow and change the diet plans according to own demand or prescription by any RMP
- ❖ Practice the yoga, meditation, physical exercise regularly. Ventilation is one of the reasons which leads to brain disorders and cardiac disorders also
- ❖ Practice of herbal/natural medicine other than allopathic.

- ❖ Do such all activities which makes you happy and cheerful.

## Pharmacological Management

- ❖ **Levodopa** : It converts into dopamine when reach to the brain . It is the most effective drug For PD.
- ❖ **Dopamine agonist** : Bromocriptine , ropinirole : They work like dopamine on dopaminergic receptors.
- ❖ **MAOI** : Selegiline , Rasagline.
- ❖ **Anti-cholinergic drugs** : Benztropine , Procyclidine.



# Stroke

- Stroke is a condition in which blood supply to the brain reduced or stops due to blockage or hemorrhage.
- In stroke condition brain function is stopped due to the death of brain cell.
- Stroke is also called brain attack and cerebrovascular accident ( CVA).



## Types

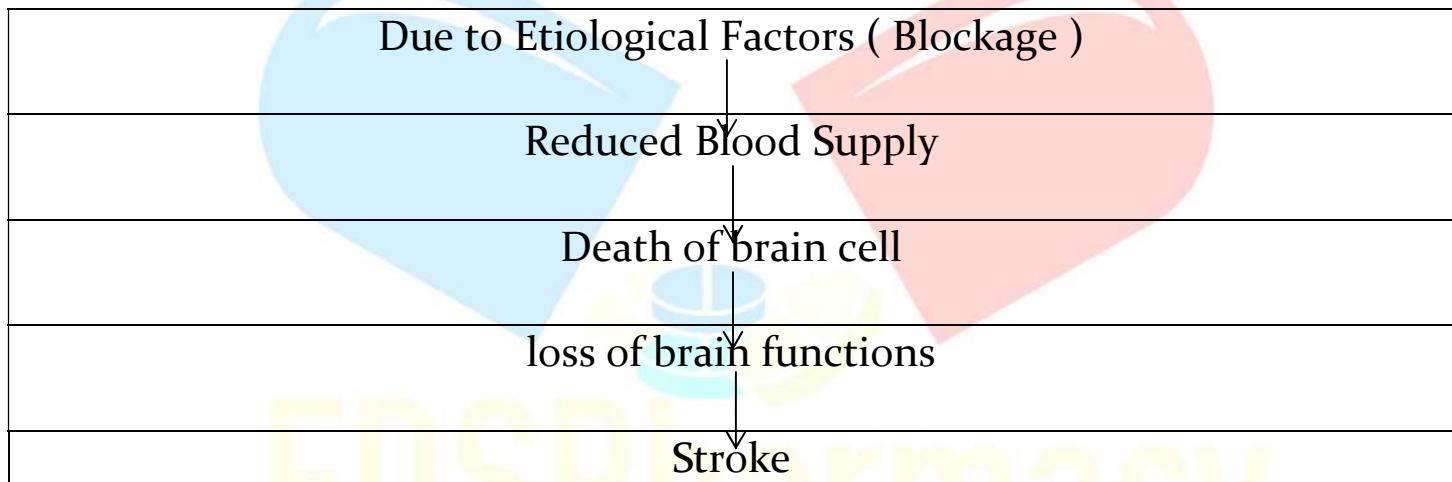
- **Islamic stroke** : Blood flow to the brain reduced due to narrowed or blocked arteries of brain by Thrombus( lipid deposition ) or embolus ( blood clot ).
- **Haemorrhagic stroke** : Blood flow is disturbed due to leakage of blood vessels of brain.

## Etiology

- Blockage in brain arteries
- Leakage in blood vessels
- Diabetes mellitus
- Smoking

- Inactivity
- Obesity
- Alcoholism
- Estrogen use
- Advancing age
- Family history

## Pathogenesis



## Clinical Manifestations

- ✚ Dizziness
- ✚ Loss of control and coordination
- ✚ Difficulty in speaking and understanding
- ✚ Paralysis in face, leg, arms , mostly on one side of the body
- ✚ Blurred vision
- ✚ Severe headache

## Non Pharmacological Management

- ❖ Early Contact to doctor
- ❖ Early Diagnosis

## Pharmacological Management

- ❖ Emergency treatment with medications
- ❖ Alteplase Injection : it is given by vein in arm , it dissolves the blood clot and restore the blood flow
- ❖ Anticoagulant drugs : these drugs prevent further blood clot .Heparin , warfarin.

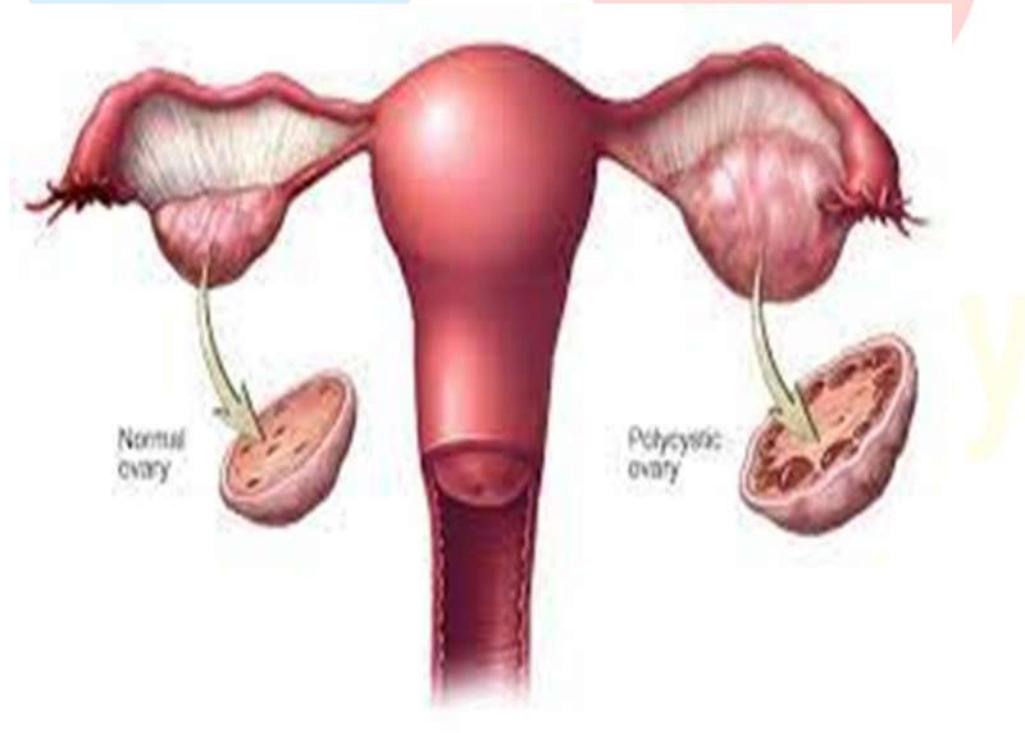
## Emergency Procedure for removal of clot

- 1) Surgical Procedure
- 2) **Mechanical clot removal** : Using a catheter a small device is move into the brain , which removes the clot either by grabbing it or by breaking it .



## Polycystic Ovary Syndrome ( PCOS )

- Polycystic ovarian syndrome (PCOS) is a condition of hormonal imbalance when ovaries (that produce and releases eggs) produce excessive male hormones.
- In PCOS, the ovaries produce abnormally high levels of androgens and cause imbalance in reproductive hormones.
- Thus, PCOS patients experience irregular menstrual cycles, missed periods, and erratic ovulation. Anovulation (lack of ovulation) may lead to the development of small cysts on the ovaries

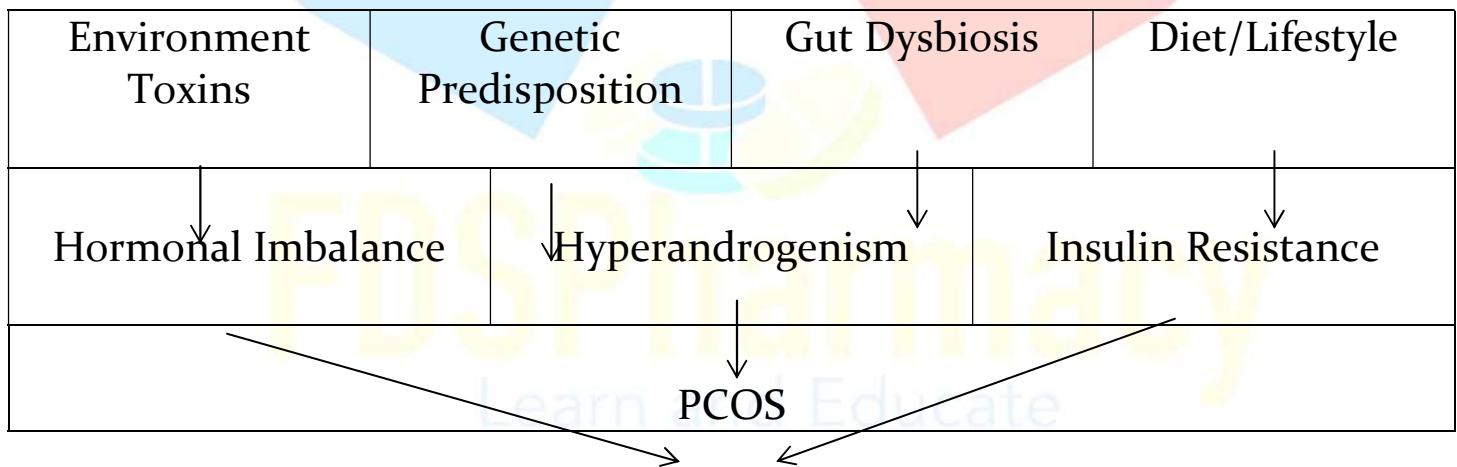


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## Etiology

- Genetic
- Environmental factor( climate , diet , pollution , smoking, alcoholism etc)
- High level of androgens ( Male hormone : testosterone) it leads to irregular MC and prevent evolution and this can lead to development of cyst .
- Insulin resistance : high level of insulin causes excess production of androgens which cause PCOS .

## Pathogenesis



## Clinical Manifestation

- Irregular Periods
- Abnormal hair growth
- Acne
- Obesity
- Cyst
- Thinning of hair
- Infertility

## Non Pharmacological Managements

- ❖ Weight loss
- ❖ Low calorie diet
- ❖ Moderate exercise
- ❖ Enough sleep
- ❖ Stress reduction

## Pharmacological Managements

- ❖ **Oral contraceptives** : Birth control pills containing a combination of estrogen and progestin can regulate menstrual cycles and reduce androgen levels, which can improve symptoms of PCOS.
- ❖ **Anti-androgens** : Drugs like spironolactone and flutamide : can block the effects of androgens (male hormones) in the body, which can reduce symptoms such as acne and excess hair growth.
- ❖ **Metformin** : This medication is typically used to treat type 2 diabetes, but it can also be helpful for women with PCOS who have insulin resistance. Metformin can help regulate menstrual cycles and lower androgen levels.
- ❖ **Gonadotropins** : Women with PCOS who are trying to conceive may benefit from injections of gonadotropins, which can stimulate ovulation.
- ❖ **Clomiphene citrate** : This medication is an oral fertility drug that can help women with PCOS ovulate and conceive.
- ❖ **Letrozole** : This medication is also used to stimulate ovulation in women with PCOS who are trying to conceive

# Amenorrhea

Amenorrhea is a condition characterized by the **absence of menstruation** in females of reproductive age.

It is not a disease itself but a symptom of various underlying physiological or pathological conditions.

## Types of Amenorrhea

- **Primary Amenorrhea** : When a girl has not started menstruating by age 15 (with normal secondary sexual features) or by age 13 (without secondary sexual features).
- **Secondary Amenorrhea** : When a woman who has previously had regular periods experiences absence of menstruation for 3 months or more.

## Etiology (Causes)

### Primary Amenorrhea

- Genetic Disorders: Turner syndrome (45, XO)
- Hypothalamic dysfunction
- Müllerian agenesis (absence of uterus/vagina)
- Androgen Insensitivity Syndrome
- Pituitary disorders

### Secondary Amenorrhea

- Pregnancy (most common cause)
- Polycystic Ovary Syndrome (PCOS)
- Hypothyroidism
- Hyperprolactinemia
- Stress, anorexia, excessive exercise
- Premature ovarian failure (early menopause)

- Asherman's syndrome (intrauterine adhesions)

## Pathogenesis

Normal menstrual cycle depends on the hypothalamic-pituitary-ovarian-uterine axis:

Hypothalamus → GnRH → Pituitary → FSH & LH → Ovaries → Estrogen & Progesterone → Menstruation

**In Amenorrhea:**

**Disruption at any level →**

**No hormone production or improper hormone response →  
Absence of menstruation**

## Clinical Manifestations

- Absence of menstruation
- Infertility
- Delayed puberty (in primary)
- Headache, visual disturbances (if pituitary tumor present)
- Galactorrhea (milky nipple discharge due to high prolactin)
- Acne or hirsutism (in PCOS)
- Hot flashes and vaginal dryness (in ovarian failure)

## Non-Pharmacological Management

- Lifestyle correction: balanced diet, stress reduction, moderate exercise
- Nutritional support (for anorexia or underweight patients)
- Counseling: psychological support in adolescents or infertility cases
- Monitor menstrual history and sexual development

## Pharmacological Management

Cause	Drug/Treatment
<b>PCOS</b>	Oral contraceptive pills (to regularize periods), Metformin
<b>Hyperprolactinemia</b>	Dopamine agonists: <i>Bromocriptine, Cabergoline</i>
<b>Hypothyroidism</b>	Levothyroxine
<b>Premature ovarian failure</b>	Hormone replacement therapy (HRT)
<b>Pituitary tumor</b>	Surgery or dopamine agonists
<b>Asherman's syndrome</b>	Surgical removal of adhesions (hysteroscopy)

# Psychiatric disorders

## Depression

- Depression is a common mood disorder characterized by a persistent feeling of sadness, hopelessness, and loss of interest in daily activities.
- It affects a person's thoughts, behavior, emotions, and physical health, often interfering with personal and social functioning.



### Types of Depression

- **Major Depressive Disorder (MDD)** – Classic clinical depression
- **Persistent Depressive Disorder (Dysthymia)** – Long-term, low-grade depression
- **Bipolar Depression** – Depression as a phase of Bipolar Disorder
- **Postpartum Depression** – After childbirth
- **Seasonal Affective Disorder (SAD)** – Occurs during specific seasons (usually winter)
- **Psychotic Depression** – Includes depressive symptoms with psychosis (delusions/hallucinations)

### Etiology (Causes)

#### Biological Causes

- Imbalance of neurotransmitters: ↓ serotonin, dopamine, norepinephrine

- Genetic predisposition (family history)
- Hormonal imbalances (e.g., cortisol, thyroid hormones)

## Psychosocial Causes

- Chronic stress or trauma (abuse, loss of loved ones)
- Unemployment, relationship issues
- Low self-esteem or pessimistic thinking

## Medical & Drug-related Causes

- Chronic illnesses: diabetes, cancer, heart disease
- Neurological disorders: stroke, Parkinson's, dementia
- Substance abuse: alcohol, drugs
- Side effects of medications (e.g., steroids, beta blockers)

## Pathogenesis

- Stress or other triggers lead to neurotransmitter imbalance ( $\downarrow$  serotonin/dopamine)
- Affects brain regions: prefrontal cortex, hippocampus, amygdala
- Leads to emotional and behavioral symptoms of depression
- Chronic cases alter brain structure and hormone regulation ( $\uparrow$  cortisol)

## Clinical Manifestations (Symptoms)

- Persistent sad or empty mood
- Loss of interest or pleasure in most activities (anhedonia)
- Fatigue or decreased energy
- Sleep disturbances (insomnia or hypersomnia)
- Appetite or weight changes
- Feelings of worthlessness, guilt, or helplessness
- Difficulty in thinking, concentrating, or making decisions
- Psychomotor changes (agitation or retardation)
- Suicidal thoughts or attempts

## Non-Pharmacological Management

- **Psychotherapy** (Talk therapy)
  - *Cognitive Behavioral Therapy (CBT)* – most effective
  - *Interpersonal Therapy (IPT)*
- **Lifestyle modifications:**
  - Regular exercise
  - Adequate sleep and nutrition
  - Avoid alcohol and drugs
  - Social support from family and friends
- **Electroconvulsive Therapy (ECT)** – for severe, treatment-resistant depression
- Mindfulness meditation and stress reduction techniques

## Pharmacological Management

Drug Class	Examples	Mechanism
<b>SSRIs (Selective Serotonin Reuptake Inhibitors)</b>	Fluoxetine, Sertraline, Citalopram	↑ Serotonin levels in brain
<b>SNRIs (Serotonin-Norepinephrine Reuptake Inhibitors)</b>	Venlafaxine, Duloxetine	↑ Serotonin and norepinephrine
<b>TCAs (Tricyclic Antidepressants)</b>	Amitriptyline, Imipramine	Block reuptake of serotonin and norepinephrine
<b>MAOIs (Monoamine Oxidase Inhibitors)</b>	Phenelzine, Tranylcypromine	Inhibit breakdown of neurotransmitters
<b>Atypical antidepressants</b>	Bupropion, Mirtazapine	Varying mechanisms
<b>Mood stabilizers or antipsychotics</b>	In severe or bipolar depression	Used adjunctively with antidepressants

# Schizophrenia

- Schizophrenia is a chronic and severe psychiatric disorder that affects a person's thinking, feeling, perception, and behavior.
- It is characterized by delusions, hallucinations, disorganized speech, and impaired social functioning.
- The onset is usually in late adolescence or early adulthood.



## Types of Schizophrenia

1. **Paranoid Type:** Dominated by delusions and hallucinations
2. **Disorganized Type:** Speech and behavior are disorganized; inappropriate affect
3. **Catatonic Type:** Abnormal motor activity (rigid posture, mutism)
4. **Undifferentiated Type:** Symptoms don't fit a specific subtype
5. **Residual Type:** Absence of prominent positive symptoms but continued negative symptoms

## Etiology (Causes)

### Biological Factors

- **Genetic predisposition** (family history of schizophrenia)
- **Neurochemical imbalance:**
  - ↑ **Dopamine** (main neurotransmitter involved)

- Also involves serotonin, glutamate, and GABA
- **Brain structure abnormalities:**
  - Enlarged ventricles
  - Decreased gray matter volume

## Psychosocial Factors

- Childhood trauma
- Stressful life events
- Poor family environment

## Drug-Induced Triggers

- Cannabis
- Amphetamines
- LSD
- Cocaine

## Pathogenesis

- Genetic/environmental trigger
- Leads to dopaminergic hyperactivity in certain brain pathways (especially mesolimbic)
- Causes positive symptoms (hallucinations, delusions)
- Hypoactivity in other pathways (e.g., prefrontal cortex) leads to negative symptoms (apathy, social withdrawal)

## Clinical Manifestations (Symptoms)

### Positive Symptoms (*excess/distortion of normal functions*):

- **Delusions** (false, fixed beliefs – e.g., persecution, grandeur)
- **Hallucinations** (usually auditory – hearing voices)
- **Disorganized speech** (e.g., incoherence, word salad)
- **Disorganized or catatonic behavior**

## **Negative Symptoms (*loss of normal functions*):**

- **Affective flattening** (reduced emotional expression)
- **Alogia** (poverty of speech)
- **Avolition** (lack of motivation)
- **Social withdrawal**

## **Cognitive Symptoms:**

- Poor attention
- Impaired working memory
- Difficulty in executive functions

## **Non-Pharmacological Management**

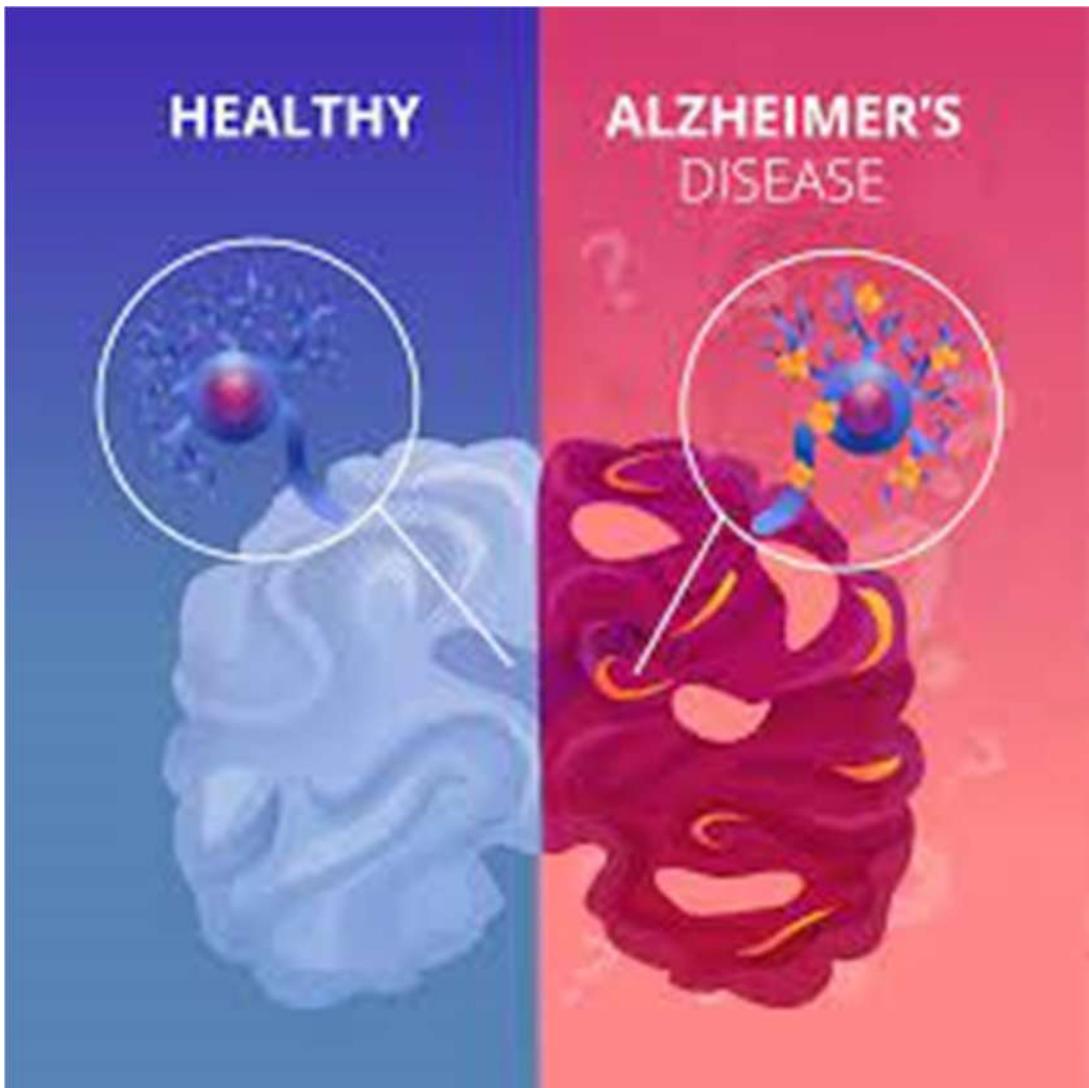
- **Psychosocial interventions:**
  - Family therapy
  - Cognitive Behavioral Therapy (CBT)
  - Social skills training
  - Supported employment/rehabilitation
- **Electroconvulsive Therapy (ECT):** In severe or treatment-resistant cases

## **Pharmacological Management**

Drug Class	Examples	Effects
<b>Typical Antipsychotics</b>	Haloperidol, Chlorpromazine	Mainly control positive symptoms, risk of extrapyramidal side effects (EPS)
<b>Atypical Antipsychotics</b>	Risperidone, Olanzapine, Clozapine, Aripiprazole	Control both positive and negative symptoms, fewer EPS
<b>Depot injections</b>	Fluphenazine decanoate, Risperidone LAI	Long-acting, used for non-compliant patients

## Alzheimer's Disease

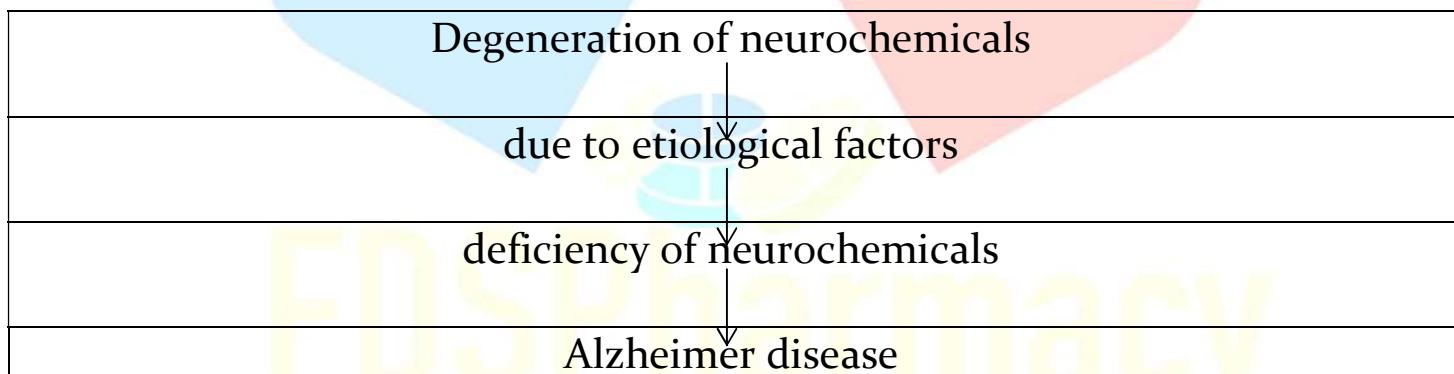
→ Alzheimer's disease is a chronic irreversible neurodegeneration disease which gradually destroy the ability to think, remember, and learn ,and involves memory loss.



## Etiology

- Neurochemical factor
- Genetic factors
- Environmental factors
- Head injury
- Smoking
- Advancing age ( above 65 years ).

## Pathogenesis



## Clinical Manifestation

- ✚ Loss of memory
- ✚ Placing object at unusual place
- ✚ Confusion about events, time and place
- ✚ Asking the same question repeatedly
- ✚ Problem to perform familiar work
- ✚ Getting lost of or wandering
- ✚ Problem in sleeping
- ✚ Behaviour changes like agitation , anxiety
- ✚ Poor thinking or understanding
- ✚ Difficulty in recognising family members or friends
- ✚ Difficulty in speaking during choosing the right words.

## Non Pharmacological Management

- ❖ Avoid and discard the all activities which cause/induce the depression, stress, sleep disorders etc.
- ❖ Follow and change the diet plans according to own demand or prescription by any RMP
- ❖ Practice the yoga, meditation, physical exercise regularly. Ventilation is one of the reasons which leads to brain disorders and cardiac disorders also
- ❖ Practice of herbal/natural medicine other than allopathic.
- ❖ Do such all activities which makes you happy and cheerful.

## Pharmacological Management

- ❖ **Cholinesterase Inhibitors** : Donepezil , galantamine.
- ❖ **Glutamatergic Drugs** : Gabapentin , Lamotrigine

