Clinical Pharmacology

SEMINAR-2

Objectives

- Define clinical pharmacology
- Get an idea about history of Clinical Pharmacology
- Explain responsibilities of Clinical pharmacologists
- Explain drug Names and Categories
- Describe development of drug
- Describe drug Activity Within the Body

What clinical pharmacology means?

- **Clinical pharmacology** is the science of drugs and their clinical use.

- It has a broad scope, from the **discovery** of new target molecules, to the **effects** of drug usage in whole populations.

- Clinical pharmacology connects the gap between medical **practice** and laboratory **science**.

- The main objective is to **promote the safety** of prescription, **maximize the drug effects** and minimize the **side effects**.

History of Clinical Pharmacology

- Clinical Pharmacology, in theory, has been practiced for centuries through observing the effects of herbal remedies and early drugs on humans.
- scientific advances allowed scientists to combine the study of physiological effects with biological effects.
- the first major breakthrough when scientists used clinical pharmacology to discover insulin.

- discoveries clinical pharmacology has expanded to be a multidisciplinary field and has contributed to the understanding of drug interaction, therapeutic efficacy and safety in humans.

- Over time clinical pharmacologists have been able to make more exact measurements and personalize drug therapies.

Clinical pharmacologists

- have a rigorous **medical** and scientific **training** which enables them to evaluate evidence and produce new data through well designed studies.

- Clinical pharmacologists must have access to enough outpatients for clinical care, teaching and education, and research as well be supervised by medical specialists.

Responsibilities of Clinical pharmacologists

- Their responsibilities to patients include, but are not limited to analyzing adverse drug effects:-
- Therapeutics
- toxicology including reproductive toxicology
- cardiovascular risks
- perioperative drug management
- psychopharmacology.

- In addition, the application of genetic, biochemical, or viral therapeutic techniques has led to a clear appreciation of the mechanisms involved in drug action.

Drug Names and Categories

- *Categories: Chemical; generic; official; trade or brand name
- Several trade names: Use generic name to avoid confusion
- After drug approval FDA assigns categories:
  - Prescription
  - Nonprescription
  - Controlled substance

Drug Classes and Categories

- Drugs are classified by the chemical type of the active ingredient or by the way it is used to treat a particular condition :-

- PRESCRIPTION DRUGS
  - The prescription contains the name of the drug
  - the dosage
  - the method and times of administration
  - Signature of the licensed health care provider

NONPRESCRIPTION DRUGS

- OTC
- ASA may cause GI bleeding and salicylism
- Labeling provides the consumer with info regarding the drug, dosage, contraindications, precautions and adverser reactions
- Consumers are urged to read the directions carefully prior to taking any OTC drugs

Controlled Substances

- The Controlled Substances Act of 1970 established a schedule or classification system for drugs with abuse potential
- Act regulates the manufacture, distribution and dispensing of these drugs

Drug Development-FYI

- Process of drug development: Long and arduous - 7 to 12 years or longer
- FDA: Approves new drugs, monitors current drugs - adverse/toxic reactions
- Development of drug:
  - Pre-FDA phase
  - FDA phase

Drug Development (cont'd)

- Clinical testing: Three phases
  - Phase I: 20 to 100 volunteers involved
  - Phase II: Test performed on people having the disease for which drug might be effective
  - Phase III: Drug given to large numbers of patients in medical research centers that provided information about adverse reactions

Drug Development (cont'd)

- Phase IV: Postmarketing surveillance
  - Ongoing review: Particular attention to adverse reactions
- Healthcare professionals: Help with surveillance; report adverse effects to FDA using MedWatch

Drug Activity Within the Body

- Drugs: Act in various ways in the body
- Oral drugs: Three phases
  - Pharmaceutics: Dissolution of drug occurs; drugs must be soluble to be absorbed
  - Pharmacokinetics: Absorption; distribution; metabolism; excretion
  - Pharmacodynamics

Pharmaceutic Phase

- Liquid and parenteral drugs: Already dissolved - quickly absorbed
- Solid forms of drugs - Tablets or capsules: Disintegrate into small particles; dissolve into body fluids in GI tract
- Enteric-coating tablets: Disintegrates after reaching alkaline environment of small intestine

*Pharmacokinetic Phase

- Pharmacokinetics: Activities within the body after a drug is administered
  - *Absorption
  - *Distribution
  - *Metabolism
  - *Excretion

Absorption

- Drug particles within gastrointestinal tract: Moves into body fluids
- Factors influencing rate of absorption: Route of administration; solubility of drug
- First-pass effect: Drug absorbed by small intestine; liver first metabolizes drug; remaining drug not sufficient to produce therapeutic effect
  - Patient needs higher dosage for desired effect

Distribution

- Systematic circulation: Drug distributed to various body tissues and target sites - interact with specific receptors in body
- Factors affecting distribution: Protein binding (free/bound drugs); blood flow; solubility (lipid-soluble drugs/water-soluble drugs)
- Quick distribution: Heart; liver; kidneys
- Slow distribution: Internal organs; skin; muscle

Metabolism and Excretion

- Metabolism: Body changes drug to a more or less active form for excretion
- Excretion: Elimination of drugs from the body
- Patients with kidney disease: Require dosage reduction and careful monitoring of kidney function
- Older adults: Diminished kidney function - require careful monitoring and lower dosages

*Half-life

- Time required for the body to eliminate 50% of the drug
  - Plan the frequency of dosing
- Drugs with short half-life: Administered frequently
- Drugs with long half-life: Require less frequent dosing
- *Difficulty in drug excretion: Increases half-life and risk of toxicity

Onset, Peak, and Duration

- Onset of action: Time between drug administration and beginning of therapeutic effect
- Peak concentration: Absorption rate equals elimination rate
- Duration of action: Time for drug to produce therapeutic effect

Pharmacodynamic Phase

- Pharmacodynamics: Study of drug mechanisms producing biochemical/physiologic changes in body
- Primary effect of drug: Desired or therapeutic effect
- Secondary effect of drug: Other desirable or undesirable effects
- Drugs exert action - two mechanisms: Alteration in cellular form/environment

Receptor-mediated Drug Action

- Drug interacts with receptor; function of a cell alters; drug molecule joins with reactive site (receptor) on surface of cell
- Agonist: Binds with and stimulates receptor - therapeutic response
- Antagonist: Joins with but does not stimulate receptors; prevents drug response; competitive/noncompetitive
- Effects of number of available receptor sites; potent drugs

Drug Use and Pregnancy

- Drugs administered during the first trimester: May cause teratogenic effects
- Most drugs: Contraindicated unless benefits outweighs risk
- Pregnant women: Use drugs/herbal supplements only after consultation
- Risks of smoking and drinking: Low birth weight; premature birth; fetal alcohol syndrome
- Addictive drugs: Children born with addiction
  - Such as cocaine or heroin

Various Drug Reactions

- Allergic drug reactions
- Drug idiosyncrasy
- Drug tolerance
- Cumulative drug effect
- Toxic reactions
- Pharmacogenetic reactions

Allergic Drug Reactions (Hypersensitivity Reactions)

- *Usually begins after more than one dose of the drug is given; body views drug as antigen
- Signs and symptoms: Itching; skin rashes; hives; wheezing; cyanosis; sudden loss of consciousness; swelling of eyes, lips, or tongue
- Anaphylactic shock; hypotension and shock; *angioedema, dyspnea, urticaria
  - Angioedema most often occurs around the eyes, lips, mouth and throat

Drug Idiosyncrasy

- Unusual, abnormal reaction to drug; different from expected reaction
- Cause: Believed to be due to genetic deficiency

Drug Tolerance

- *Decreased response to a drug: Requires increased dosage for desired effect
- Example: Narcotics or tranquilizers taken for a long time

Cumulative Drug Effect

- Patients with liver and kidney disease: Body is unable to metabolize and excrete one dose of drug before next dose is given
- Dose lowered to prevent toxic drug reaction

Toxic Reactions

- *Drug is administered in large dosages; blood concentration levels exceed therapeutic levels
- Reverse drug toxicity: Administer another drug as antidote; monitor drugs with low safety margin

Drug Interactions

- One drug interacts and interferes with the action of another drug
  - Oral anticoagulants; oral hypoglycemics; anti-infectives; antiarrhythmics; cardiac glycosides; alcohol
- Effects: Additive; synergistic; antagonistic

Additive Drug Reaction

Combined effect of two drugs is equal to sum of each drug given alone (1 + 1 = 2)

Synergistic Drug Reaction

- *Drug synergism: Drugs interact with each other and produce a sum greater than the sum of their separate actions (1 + 1 = 4)

Antagonistic Drug Reaction

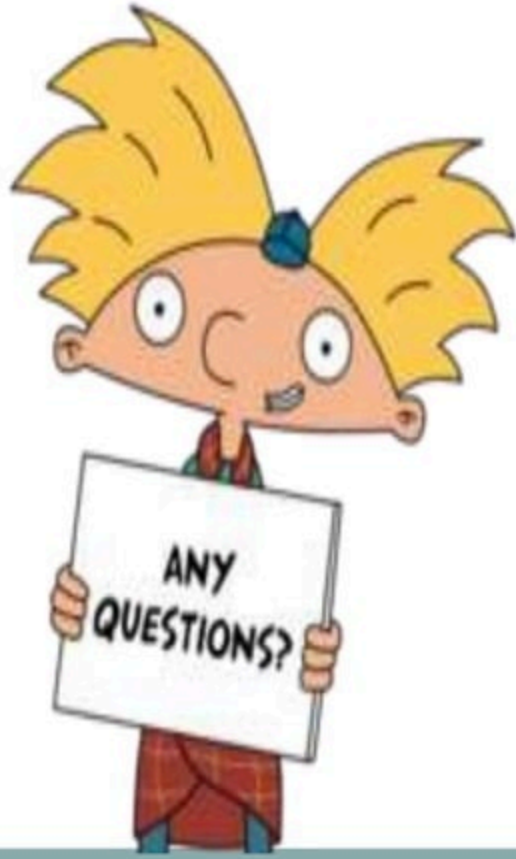
- One drug interferes with action of another: Neutralization/decrease in effect of one drug

Drug-food Interactions

- Food may impair or enhance its absorption
  - Drug taken on empty stomach (captopril)
  - Drugs that irritate stomach; cause nausea; vomiting; epigastric distress: Given with meals (anti-inflammatory drugs; salicylates)
  - Drug–food mixture: Drugs combine with a drug forming an insoluble food (tetracycline administered with dairy products)

*Factors Influencing Drug Response

- Age
- Weight
- Gender
- Disease
- Route of administration


ANY
QUESTIONS?

Thank you very much for your attention