Learning Objectives – Pharmacology

Define pharmacology and understand the history of pharmacology:

Pharmacology: the study of drugs (incl. their actions and effects on a living system). Pharmacological agents have controlled, prevented, cured, diagnosed and in some cases eradicated disease = improved quality of life

History:

- 1618 = first text book on drug prep published (Pharmacopoeia)
- 16th-17th century = opium, cocaine, ipeac, anti-scurvy drugs
- 18th century = smallpox vaccine invented
- 19th century = anaesthetics invented
- 20th century = discovery of insulin (1922), discovery of penicillin (1930-40), TB cured (1940-50), the "pill" invented (1950s), polio vaccine (1955-1961), etc.

Describe the sources of drugs and their nomenclature:

Drug = chemical that affects living tissue, either endogenous (made by the body) or exogenous (from outside body) to the body

- Microorganisms (Eg. fungi as a source of antibiotics)
- Plants (Eg. caffeine, cocaine, morphine, nicotine)
- Humans and other animals (Eg. insulin)
- Minerals and mineral products (Eg. iron, lithium)
- Laboratories (Eg. antidepressants)

Describe the classification system for drugs (Schedules 1-9):

Scheduling = way of classifying chemicals (incl. poisons and drugs) to ID the amount of control over their availability to the public. National classification system that controls how meds and poisons are made available to the public.

Schedule 1 Poisons (not currently in use)	Possibly complementary and alternative meds (CAM)
Schedule 2 Poisons (pharmacy meds)	Over the counter (OTC) meds
Schedule 3 Poisons (pharmacist only meds)	"stronger" meds BUT no prescription necessary
Schedule 4 Poisons (prescription only meds)	Need prescription from legal source, dispensed by pharmacist (stored in dispensary). Incl. many prescribed drugs (antibiotics, antidepressants, CNS and cardiovascular drugs)
Schedule 5 Poisons (caution)	Household poisons, low potential for causing harm
Schedule 6 Poisons (poison)	More dangerous than S5 (eg. household and garden pesticides)
Schedule 7 Poisons (dangerous poison)	High potential for causing harm at low doses (arsenic). These classifications used for industrial and agricultural chemicals
Schedule 8 Poisons (controlled drug)	Availability is restricted, due to likelihood of dependence in patients, prescription is definitely required (morphine)
Schedule 9 Poisons (prohibited substance)	Such as illicit/illegal drugs (heroin)

Describe the different formulations of drugs available on the market, clinical situations for their use and the advantages and disadvantages of these formulations:

Tablets	Used for the administration of solids Compression of granulated powder in machine Incl. the active ingredient, filler, excipient, binding agent, lubricant May be sugar/film coated to disguise bad-tasting drugs Chewable tablets available
Oral liquid preparations	For patients that can't swallow tablets or have difficulty swallowing (eg. children) Flavours added for palatability Linctus, elixirs, emulsions
Drops	Eye drops = oily and aqueous (isotonic) Nose drops = aqueous only (isotonic) Ear drops = oily solutions
Other formulations	Creams, ointments, pastes, gels, lotions, sprays
Solutions for injection	Injection = invasive procedure Solutions need to be sterile, filtered, particle free and preferably isotonic and buffered

- *Other types of TABLETS:*
    - Capsules
    - Enteric coated tablets
        - Formulation that allows disintegration in the intestines rather than stomach
        - Shouldn't be crushed otherwise disintegration will occur in the stomach rather than the intestines and drug will not be effective
    - Sustained-release tablets (SR)
        - For drugs that have short duration of action (half life, t ½)
        - Shown to increase compliance – taking the drug at the right dose at the right time, effects last longer as drug is release slowly
    - Controlled-release tablets (CR)
        - Designed to produce slow, uniform absorption of drug for 8hrs +
        - Invented to overcome variability present w. SR tablets

Describe the different routes of administration, clinical situations for their use and discuss the advantages and disadvantages of these methods:

Enteral (via the intestines) = enters the body by way of the GIT system

Parenteral (anything you don't swallow) = pathway other than through the GIT system, may allow the drug to be delivered directly to target tissue

Enteral Administration	Oral Administration = Swallowing Advantages = - easy/convenient - likely to increase compliance - easy to eliminate in overdose - most economical Disadvantages = - decreased bioavailability (<100%) - unreliable absorption - irritation to gastric mucosa rate of absorption in the small intestine is controlled by the ability of drug molecules to dissolve in lipids = lipid solubility
Parenteral Drug Administration	Enter venous circulation – avoid first-pass metabolism (liver) = paraenteral - Sublingual = under tongue - Buccal = in cheek Subcutaneous = - Blood supply poor → absorption of drug v. slow - Can implant drugs here → slow absorption over a period of wks/months - Can only be used for drugs that are not irritating to issue, otherwise v. painful Intramuscular = - Allows for greater vol. of injection - Not always given for quick action (depot injection) - Exercise will increase absorption of drug (blood supply rich to skeletal muscle) - Main danger is nerve and blood vessel damage - Injection common in deltoid/vastuc lateralis rather than gluteus maximus Intravenous = - Injection directly into veins → rapid onset of action - 100% bioavailability - Method of choice in an emergency - Aseptic technique vital Intrathecal =

	- Injection of drug into spinal subarachnoid space → directly into CSF - Method of administering drug directly into nervous system (avoids BBB) Epidural = - Deposited above dura mater in lumbar spine (not in CSF) - Local anaesthetic given this way to block transmission to higher CNS from pelvic region and below Inhalational = - Administration of drug to lower respiratory passages - Only small molecules can cross the alveoli and enter blood
Topical Drug Administration	Application of drug via skin/mucous membranes, for local and/or systemic delivery Skin = - Dermal administration (cream, patches, powder/spray, tinctures) Eye = - Ocular administration - Requires absorption of drug through the cornea - Corneal infection/trauma may result in more rapid absorption Ear (otic) and nose (nasal) administration = Rectal and vaginal drug administration = - Suppositories/pessaries - Can be sued when oral ingestion is precluded (eg. patient unconscious/vomiting)

TABLE 3–3 Routes of administration, bioavailability, and general characteristics.

Route	Bioavailability (%)	Characteristics
Intravenous (IV)	100 (by definition)	Most rapid onset
Intramuscular (IM)	75 to ≤ 100	Large volumes often feasible; may be painful
Subcutaneous (SC)	75 to ≤ 100	Smaller volumes than IM; may be painful
Oral (PO)	5 to < 100	Most convenient; first-pass effect may be significant
Rectal (PR)	30 to < 100	Less first-pass effect than oral
Inhalation	5 to < 100	Often very rapid onset
Transdermal	80 to ≤ 100	Usually very slow absorption; used for lack of first-pass effect; prolonged duration of action