Pharmacokinetics Class Preparation

Nursing 101

GI SYSTEM*:* The oral medication reaches the systemic circulation through the GI system. As a result, numerous factors can affect the absorption of the pill.

Questions:

1. A client is experiencing diarrhea. How could this effect absorption of an oral drug?

The absorption could be reduced due to increased GI motility, reduced contact time, or incomplete dissolution.

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2. How could the presence of food in the stomach affect the rate of absorption?

Depending on the scenario, presence of food in the stomach could cause a decreased or increased rate of absorption.

Decreased rate due to:

- increased pH with food
- or drug-food binding where food components bind to the drug

Increased rate due to:

- Reduced pH (empty stomach)
- Increased bile secretion (with food): bile salts aid in the dissolution/absorption of lipophilic (water soluble) compounds.

CARDIOVASCULAR SYSTEM: Once the pill is absorbed into the bloodstream, it is carried or delivered to the sites of pharmacologic action where the drug produces its effects.

Question:

- How do you think the distribution of the oral medication affected if a client has less than normal cardiac output?
    - Reduced drug distribution due to insufficient blood flow to the tissues causing the medication to not deliver effectively.

- Impaired initial distribution: typically, distribution into well perfused tissues is rapid, a slower, less efficient blood flow will slow down the drug delivery to those areas.
- Increased drug accumulation: Slower distribution into already poorly perfused tissues (like fat) could lead to possible drug accumulation.

LIVER: Most biotransformation takes place in the liver. Any decrease in the ability of the liver to metabolize medication could lead to an accumulation of the active drug in the bloodstream. This could put the client at risk for toxic effects and adverse reactions.

Questions:

3. How might nutritional status affect metabolism?
    - Malnutrition: if the liver doesn't have enough enzymes to metabolize the drug effectively, this could slow metabolism causing the drugs to accumulate and increase the risk of toxicity.
    - Vitamin/mineral deficiencies: Some vitamins act as cofactors for liver enzymes and a deficiency in them could cause the drug to metabolize less efficiently.
    - Protein poisoning (too much protein): can cause increased liver enzyme activity, leading to a faster metabolism and reduced effectiveness of the drug.
    - Generally poor nutrition weakens overall liver function and reduces the ability for the body to safely process drugs.

4. What factors influence the rate of medication metabolism?
    - Age: infants and older adults have a reduced metabolism
    - Genetics: Genetic based differences are possible and should be considered, certain ethnic groups such as some people of African or Asian decent may be sensitive to toxic effects of antihypertensive and antipsychotic drugs and may require dose adjustments to provide therapeutic effects.
    - Gender: males and females respond in different ways to medications. Females tend to have a higher percentage of body fat while men tend to have a higher percentage of body fluid so females may accumulate lipid soluble drugs over time.
    - Physical characteristics and health status: body surface area, height, and weight are all considered when calculating drug dosages and certain conditions may affect metabolism and other factors like absorption, distribution, and secretion.
    - Nutritional status: malnutrition = slowed metabolism
    - Similar metabolic pathways: if two drugs use the same metabolic pathway, they may compete = slowed metabolism.
    - Liver function: liver disease or damage = decreased metabolism

KIDNEYS: Drug excretion/elimination occurs mainly through the kidneys into the urine. If there is any impairment in kidney function, medications may not be excreted at the anticipated speed. Subsequent medication administration may lead to accumulation and potential toxicity.

Questions:

5. Why would very young and very old clients need to be closely monitored by nurse for signs and symptoms of drug toxicity?
    - Very young clients may have immature/not fully developed kidneys so drugs may be cleared from the body more slowly.
    - Very old clients may have a naturally declined kidney function (due to age) so medications may also clear slower, staying in the body for longer.
    - Both could result in potential accumulation and toxicity.

6. How can the nurse assess kidney function?

- By monitoring fluid intake and urine output: decreased output could signal impaired function
- By checking lab values:
    - Serum creatinine
    - Blood urea nitrogen (BUN)
    - Or estimated glomerular filtration rate (eGFR)
- Also checking urinalysis results:
    - Protein
    - Blood
    - Or other abnormal findings that suggest kidney issues
- Assessing for physical signs such as
    - Edema
    - Fluid retention
    - Hypertension
    - Or changes on mental status (due to toxin build up)