CNO Practice Standard: Medication

Safe, effective, and ethical administration

Knowledge, technical skill, and judgement required

Ongoing maintenance of competence

Evaluation

Systematic, ongoing, and dynamic part of the nursing process

Determining status of goals and outcomes of care

Monitoring patient's response to drug therapy (Therapeutic, expected, toxic responses)

Clear, concise documentation

Drug Absorption of Various Oral Preparations

Fastest	Liquids, elixirs, syrups
	Suspension solution
	Powders
	Capsules
	Tablets
	Coated tablets
Slowest	Enteric-coated tablets

Pharmacokinetic Phase: First-pass effect

The metabolism of a drug and its passage from liver into circulation

Oral drugs are absorbed from intestinal lumen into mesenteric blood system, and go to the liver by means of portal vein

Once in the liver, it is metabolized by P450 enzyme system and passed into general circulation

Pharmacokinetic Phase: First-pass effect (cont)

If large amount of drug is metabolized to an inactive form, then less is available in circulation (high first-pass effect)

Means that most drugs have bioavailability of <100%, whereas same drug given IV is 100% bioavailable because it has not been metabolized by the liver

- A drug given via oral route may be extensively metabolized by the liver before reaching systemic circulation (high-pass effect)
- Same drug given IV bypasses liver, preventing the first-pass effect from taking place, and more drug reaches circulation
- ie. Nitro

Drugs and Children

<38 weeks gestation	Premature or preterm infant
<1 month	Neonate or newborn infant
1month - 11months	infant
1 year - 12 years	Child
13 years - 19 years	Adolescent

Important to weigh in kg as doses often weight and/or body surface area based

Drugs and Breastfeeding

Many drugs pass into breast milk

Lower than in maternal circulation

Depends on drug properties (lipid solubility, concentration, etc.)

Must consider the harm-benefit ratio

Pharmacotherapeutics: Nursing responsibility

Assessment:
- Current medication
- Pregnancy
- Breast feeding
- Concurrent illnesses
- Allergies/sensitivities
- *Contraindications:* Make the use of the drug very dangerous

Implementation:
- Intent of the therapy, as well as the psycho-motor skill of administering
- Acute therapy
- Maintenance therapy
- Supplemental therapy
- Palliative therapy
- Prophylactic therapy

Monitoring:
- Client's condition
- Side effects (predictable)
- Adverse effects/reaction (serious)

Pharmacotherapeutics: Nursing responsibility (cont)

- Toxic effects
- Interactions

Evaluation:

Reassessing client's condition and therapeutic effectiveness of pharacotherapy

Interactions - Alteration of drug action by:

- Other prescribed drugs
- Over-the-counter medications
- Herbal therapies
- Food or alcohol interactions

Pharmacodynamics: Mechanism of Action

Receptor Interaction

Drug reacts with a site on the surface of a cell or tissue to elicit/block a physiological response

Receptor agonist

Elicit response from the cell

Receptor antagonist

Do not elicit response (block usual physiological response)

Enzyme interaction

Drug inhibits/alters physiological response of enzyme; fools cell to attach to it VS its targeted cells

Non-specific interaction

Drugs interfere with or chemically alter cellular/metabolic processes

Drugs produce their actions through 1 of 3 primary mechanisms of action: Receptors, enzymes or non-specific interaction

Receptor Interaction: Drugs will have affinity to bind to particular receptor – good fit and strong affinity means greatest response

Pharmacological Principles

Pharmaceutics

Science of preparing and dispensing drugs, including dosage form and design (ie. Tablets, patches, capsules, injections)

Pharmacokinetics

What the body does to the drug (Absorption, distribution, metabolism, excretion)

Pharmacodynamics

What the drug does to the body (biochemical and physiological interactions)

Pharmacotherapeutics

Use of drugs and clinical indications for drugs to prevent and treat disease

Pharmacognosy

Study of natural plant and animal drug sources

Phases of Drug Activity

I. Pharmaceutical Phase

Disintegration of dosage form

II. Pharmacokinetic Phase

Absorption, distribution, metabolism, excretion

III. Pharmacodynamic Phase

Drug-receptor interaction

Pharmaceutical phase - becomes available for absorption once administered
Pharmacokinetic phase - drug is being manipulated by body and becoming available for action
Pharmacodynamic phase - drug having desired effect on target

Pharmaceutical Phase

80% of drugs are PO

Solutions absorbed faster than solids
Absorbed faster in acidic fluids than alkaline fluids
Young and elderly have less gastric acidity - drug absorption is generally slower
Food may increase/decrease absorption

Drugs and the Older adult

65 years or older

Polypharmacy

Consumes 20-40% of Rx drugs, 40% OTC drugs

Risk of drug interactions

Refer to table 4.4 p. 68-69 for problematic drugs

Drugs and Pregnancy

First trimester generally period of greatest danger

Transfer to fetus primarily by diffusion across placenta and some active transport

Factors that contribute to safety include *drug properties, gestational age, and maternal factors*

Prescription Drugs

Food and Drug Regulations (Schedule F)

Lists drugs that must be sold by prescription

Pharmacokinetics Phase: Elimination

Elimination of drugs from body

Excrete through kidney (main organ)

Other routes: liver, bile feces, lungs, saliva, sweat, breast milk

Whether active or inactive metabolites, all the waste products have to be eliminated

Pharmacokinetics Phase: Metabolism

Biotransformation: Primarily Liver (also skeletal muscle, kidney, plasma, lungs)

> Process of transforming a drug into inactive metabolite (more soluble compound)

Cytochrome P-450 enzymes most responsible for biotransformation

Hepatic biotransformation varies (genetics, diseases, other drugs, etc.)

Delayed drug metabolism results in accumulation of drugs in system - prolonged action time

Pharmacokinetic Phase: Distribution

Distribution

> Drugs are distributed throughout body by blood stream

Distribution influenced by:
- Blood flow
- Affinity to tissues
- Protein-binding (if drug binds to protein, they're less likely to be able to leave circulatory system, therefore not reach target tissue. Higher protein-binding of drug = slower its action will be. Albumin is most common blood protein drugs bind to. Portion of drug that is unbound and active is the "free" drug. Free drug increases risk of toxicity)
- Volume of drug distribution

Pharmacokinetic Phase: Absorption

Absorption

> Process of drug leaving the site of administration and becoming *available*

bioavailability speaks to extent of drug that is actually absorbed in blood stream

Factors that affect absorption:
Most oral drugs absorbed in small intestine
- Administration route of drug
- Food or fluids administered with drug
- Dosage formulation
- Status of absorptive surface
- Rate of blood flow to small intestines
- Acidity of stomach
- Status of GI motility

10 Rights of Medications

Right drug

Right dose

Right time

Right route

Right patient

Right reason

Right documentation

Right evaluation

Right patient education

Right to refuse

Drug Names

Chemical Name

> Drug's chemical composition and molecular structure

Generic Name

> Name given by Health Canada under FDA and FDR

Trade name

> Drug has registered trademark; use of name restricted by drug's patent owner

Pharmacokinetic Phase: bypassing the liver

Sublingual

Buccal

Rectal

Intravenous

Intranasal

Transdermal

Vaginal

Intramuscular

Subcutaneous

Inhalation

- Routes do not require absorption within GI tract, therefore bypassing the liver and do not experience effect of "first-pass effect:
- Rectal route undergoes higher degree of first-pass effects than other routes listed

Pharmacokinetics: Half-life of a Drug

Time it takes for one half of the original amount of a drug to be eliminated from the body

Metabolism and elimination affect the half-life of a drug

Useful for determining 'steady state'

After ~5 half-lives, most drugs are considered to be removed from the body (97%)

Pharmacokinetics: Steady-State

Amount of drug eliminated is equal to amount absorbed at each administration

Steady-state is desired to achieve a therapeutic effect over time

Longer half-life = longer it takes to reach steady state

Pharmacokinetics: Onset, peak, duration

Onset

> Time it takes to reach minimum effective concentration

Peak

> Occurs when drug reaches highest blood or plasma concentration

Duration

> Length of time drug has a pharmacologic effect

Other Drug-Related Effects

Teratogenic

> Disturb fetal/embryo development

Mutagenic

> Changes genetic material

Carcinogenic

> Cancer-causing

Drug Legislation

Food and Drugs Act	- Protect consumer from drugs that are contaminated, adulterated, or unsafe for use. - Addresses drugs taht are labeled falsely and those with misleading/deceptive labels
Controlled Drugs and Substances Act	- Addresses possession, sale, manufacture, disposal, production, import, export, and distribution of certain drugs

Over-the-Counter Drugs (OTC)

Restricted Access Drug

> - Must ask pharmacist (insulin, loperamide)

Pharmacy Only

> ie. Antihistamines, ulcer meds

General Retail

> ie. Acetaminophen, nicotine gum

Criteria for OTC Status

> - Consumer must easily diagnose condition and monitor effectiveness
> - Drug should have: favourable adverse affect, profile, limited drug interaction profile, low misuse potentional
> - Drug should be easy to use and easy to monitor