

HENRY FORD HEALTH
Inpatient Nursing
Pharmacology Study Guide



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Inpatient Nursing Pharmacology Examination Guidelines

Policy

All faculty from affiliated schools will successfully complete a written pharmacology examination prior to being on any business unit with nursing students.

Participants will be required to pass the pharmacology examination with a score of at least **80% on part one—calculations and a score of at least 80% on part two—drug knowledge**. Participants will be allowed a total of two attempts in order to successfully meet the pharmacology requirements.

If not successful, the faculty will not be allowed in the clinical setting with students.

Implementation

A Pharmacology Study Guide is available to all faculty required to take the Pharmacology Calculation and Pharmacology Drug Knowledge exams. The examinations assess the following areas of competency: knowledge of common drugs, the mechanics of administration, calculations, HFHS medication policies, and reduction of medication errors.

Faculty will be allowed 60 minutes to complete the pharmacology examination. Use of calculators is permitted.

After the exam, results will be e-mailed within one business day.

If a second exam is required, it is taken after 24 hours and within seven days.

This is scheduled before start of the clinical date with students.

Faculty will successfully complete the pharmacology exam before starting clinical.

Six Rights of Medication Administration

When administering medications with students, the faculty must know the following.

1. Right Drug

Proper identification of the ordered drug is required. Check medication against the physician's order form. As a Registered Nurse, you have the responsibility before administering any medication, to ensure that the dose and drug is appropriate for the patient. You also have the responsibility to clarify orders, which are unclear or seem inappropriate for the clinical condition of the patient.

2. Right Dose

The RN is responsible for checking the dosage of the drug, doing the appropriate calculations or conversions, and knowing the usual dosage.

3. Right Patient

Proper identification of the patient is required before medication is administered. HFHS's acceptable method for confirming identification consists of checking the patient's first and last name and medical record number (MRN) on the identification band with the name and MRN on the Medication Administration Record (MAR).

4. Right Route

Route of administration should be part of the physician's order. The RN is responsible for preparing and administering medications correctly by consulting the accompanying instructions from the pharmacy or drug company.

5. Right Time

The RN is responsible for administering medications according to scheduled times if that is how the order is written. Instructing patients on the timing of self-administered drugs at home is also an important function for nurses. Instruct using exact times such as "take at 8:00 in the morning with food and 5:00 in the evening with food" rather than "take at meal times" since meal times can vary with different cultural groups.

6. Right Documentation

The RN is responsible for documenting the administration of the prescribed medication with the information required in the appropriate location such as the Medication Administration Record (MAR) within the Electronic Health Record.

In addition to the Six Rights, additional information is needed.

Drug Information

Know each drug your students administer. There are several new drugs introduced each year. Use resources (e.g., drug books, pharmacists, on-line resources) to obtain information on new drugs. You can access information for both patient and staff education.

Patient Information

Know key information such as age, weight, clinical status, drug allergies and use of other medications such as vitamins, herbs, and supplements.

Distractions

A busy unit with telephones ringing and multiple interruptions can result in a loss of concentration during medication preparation and administration. Keep distractions to a minimum while preparing and administering medications.

Communication

Problems can result from mispronouncing a drug's name (many drugs have similar names). Use generic names instead of trade names. Using incorrect abbreviations or using abbreviations that can be confused such as qd and QID can lead to medication errors.

Abbreviations that should NOT be used. Do not use these dangerous abbreviations or dose designations

Abbreviation/ Dose Expression	Intended Meaning	Misinterpretation	Correct Usage
cc	Cubic centimeter	Mistaken for U (units) when poorly written	Write "mL" for milliliters
Q.D.	Once daily	Mistaken for Q.O.D.	Write "daily"
Q.O.D.	Every other day		Spell out "every other day"
S.C. or S.Q.	For subcutaneous	Mistaken as SL for sublingual or "5 every"	Write "Sub-Q", "subQ", or "subcutaneously"
Trailing zero (X.0 mg), lack of leading zero (.X mg)		Decimal point is missed	Never write a zero by itself after a decimal point (X mg), and always use a zero before a decimal point (0.X mg)
U	Units	Mistaken for a zero, resulting in a ten-fold dosing overdose	Spell out "units"
Ug	Microgram	Mistaken for mg (milligrams) resulting in one thousand-fold dosing overdose	Spell out "microgram" or "mcg"
&	And		Spell out "and"
IU	International Unit	Mistaken as IV (Intravenous) Or 10 (ten)	Write out "international unit"

Drug Names			
No abbreviated drug names are allowed i.e. HCTZ, MOM	All drug names		Spell out complete drug name
MS or MS04	Morphine sulfate		Write out "morphine sulfate"
MgSO4	Magnesium sulfate		Write "magnesium sulfate"

*Approved by the HFHS Pharmacy and Therapeutics Committee 12/03

Patient Education

Patients need to know:

- The names of medications and how to pronounce them
- What the medications do
- What they look like
- How and when medications should be taken
- Possible side effects and food/drug interactions

Patients should be encouraged to always carry a list of their medications with doses and schedule with them. Patients may have difficulty following the medication treatment plan due to language barriers, low literacy, poor eyesight, memory problems, cultural beliefs, and/ or inability to afford the cost of medications. Patients should be screened for the presence of these barriers during the admission process and they should be considered in the discharge plan.

Medications Requiring Special Care (High Alert Medications)

High alert medications are drugs that bear a higher risk of causing significant patient harm when they are used in error. Some examples of these medications include potassium chloride, heparin, warfarin, insulin, calcium, chemotherapy drugs, opioids, and lidocaine. These high alert medications may require special safeguards to reduce the risk of errors, including double checks, limiting access and standardization. Identify the medications requiring special care during the time you are on your unit.

Verbal Orders for Medications

Students and faculty are not to receive verbal orders.

Range Orders

Orders that specify a range for **frequency** of administration are **NOT** to be implemented (e.g. morphine sulfate 2-6 mg IV push every 4 hours prn pain). When frequency is expressed as a range, the order must be re-entered.

Prescribing

The range order needs to specify the indication for which the medication is to be administered (i.e. pain, agitation) and guidelines for dose selection when appropriate.

Only the following categories of medications are acceptable as range orders:

- Opioids and other analgesics
- Antitussive
- Antiemetic
- Antihypertensive
- Antihistamine
- Anxiolytics

Orders written with a dosage range shall be administered at the lowest prescribed dose

- The RN determines through clinical assessment and history if the higher dose is necessary to promote the optimal management of the patient's condition.

The maximum prescribed doses within the range should not be greater than four times the minimum dose.

The dose and dosing interval should be appropriate for the drug and route of administration, taking into account the usual absorption and distribution characteristics, time to onset, time to peak effect, and duration of action.

Medication Administration

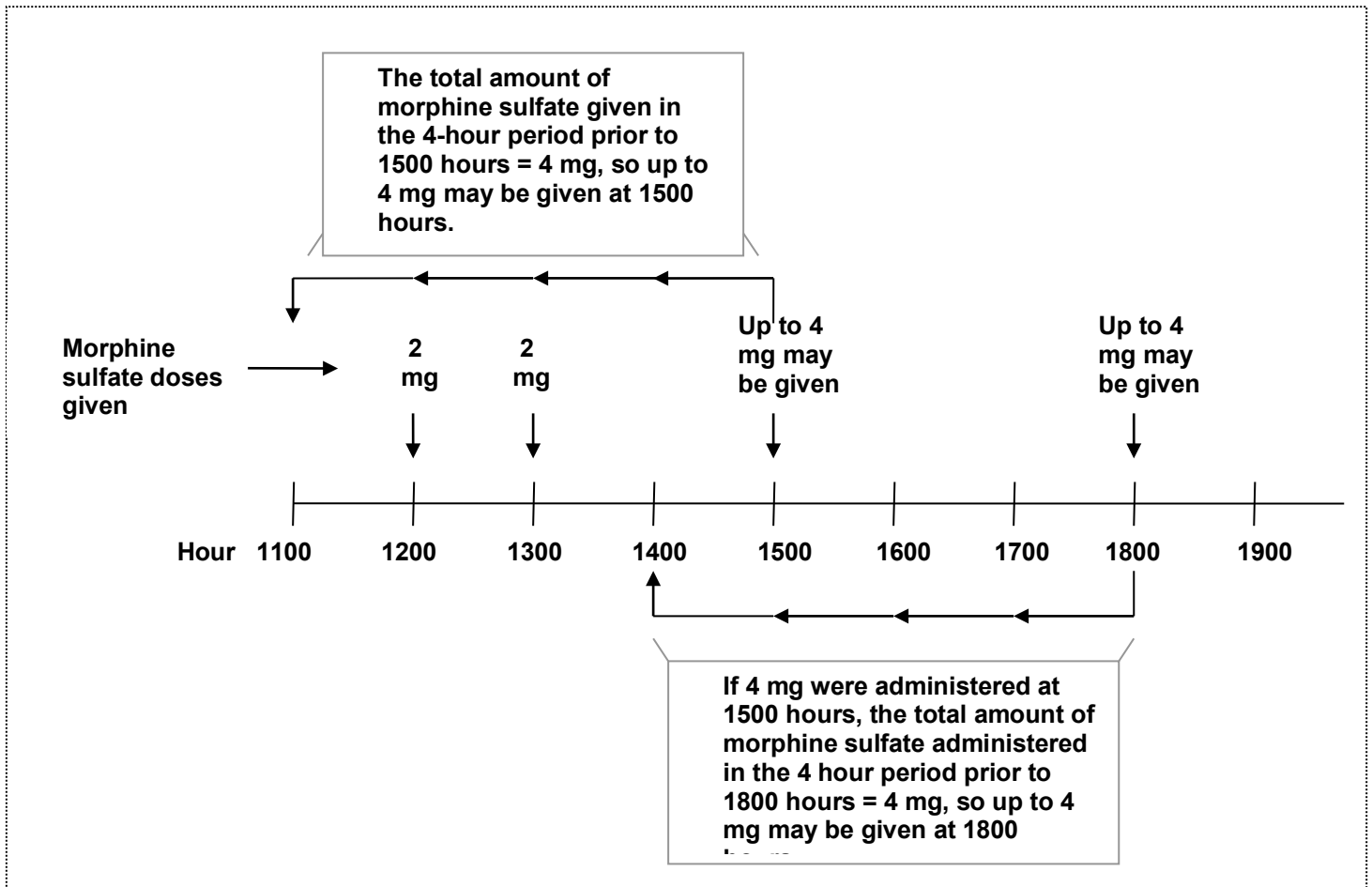
When determining the dose to be administered, take the following into consideration:

- Symptom severity
- The patient's response to previous doses of the medication
- Concomitant use of other medications that potentiate the action of the medication
- Patient age
- Patient weight
- Resolution or worsening of the underlying cause of the symptom(s) being treated
- Patient's self-reported pain score

If supplemental symptom relief is needed prior to the next approved frequency (e.g. before 4 hours) in the "every 4 hours" frequency and side-effects are tolerable, an additional dose may be given prior to the next dosing interval time, provided the total dose does not exceed the maximum prescribed dose.

For example: Order reads, "Morphine sulfate 2-8mg IV push every 4 hours"

Morphine 2 mg is given at 1200, without relief and without side effects. At 1300, an additional 2mg IVP is given for a total of 4mg. A supplemental dose is required at 1500. Since only 4mg has been given, 4mg more may be given at this time for a total of 8mg within the 4-hour limit. At 1800, the patient requires another dose of morphine. The total received within the last 4 hours (1400-1800) is 4mg. Therefore, the nurse may consider administering up to 4mg of morphine at this time. Any larger dose will exceed 8mg within the 4-hour limit.



Cultural Care Considerations

Patients may hold different views on:

- The definition of “family”
- The meaning of birth and death
- The cause of their illness
- Acceptable communication such as eye contact & touch
- The acceptability of asking direct questions of healthcare personnel
- The use of “Healers” and when to seek professional medical help
- The use of traditional remedies versus prescribed medication
- The meaning of pain and the accepted response to pain
- Immunizations and other preventive health measures
- Eating certain foods
- The importance of religion and religious practices
- The accepted response to loss and grieving

Cultural differences can affect the acceptance of the medication plan by the patient/family, especially these highlighted beliefs.

Nursing Assessment & Intervention

- Talk with the patients/families about their beliefs and practices as they relate to taking medications
- Assess their use of traditional remedies and views on prescribed medications
- Discuss with the physician and the pharmacist if issues are identified
- Develop an education plan in collaboration with the physician and the pharmacist

Age-Based Considerations when Administering Medications

Identify population(s) you will be caring for:

- ★ Neonates/ Infant (0-12 months) ★ Pediatrics (1-12 yr.) ★ Adolescent (13-17 yr.)
 ★ Adult (18-64 yr.) ★ Older Adult (65+ yr.)

Age Specific Communication: Newborn to 17 years

AGE	COMMUNICATION
Infant Birth to Age 1	Speak to the child in soft, calm voice. Do not rush. Explain procedures to caregiver. Offer age appropriate toys. Keep child with parent if possible. Encourage questions. Discuss concerns with parent.
Toddler Age 1- 3	Same as Birth to One. Can understand simple commands. Talk to child at eye level. Allow to touch equipment.
Preschool 3-5 years	Explain procedures and unfamiliar objects in words child understands. Allow to touch equipment. Use short & simple explanations. Allow choices if possible. Use distraction. Tell child how they can “help” during procedure. Encourage use of comforting objects. Offer age appropriate toys. Keep child with parent if possible. Offer a “badge of courage” (stickers) after painful procedures such as injections. Reassure that procedures (e.g., injections) are not punishment. Choose a positive behavior and praise.
School Age 6-12 years	Protect privacy. Explain procedures and how they can “help”. Allow choices when possible. Explain if procedure will hurt and why it is necessary. Use correct terminology and concrete information. Watch for nonverbal signs of need for support. Praise for good behavior.

Age Specific Communication: Adult

AGE	COMMUNICATION
Young Adult 18-39 years	Treat with respect. Encourage involvement in decision-making. Explain information carefully and provide rationale. Encourage questions. Discuss concerns about normal changes.
Middle Adult 40-64 years	Same as 19-39 yr. Address by last name unless given permission to use first name.
Older Adult 65 –79 years	Address by last name unless given permission to use first name. Involve patient in decision-making. Encourage self-care. Functioning varies greatly within age group. Adapt care to meet functional needs.
80 + years	Same as 65-79 years.

Drug Dosage Calculations

Metric Equivalents:

1 kilogram = 1000 grams

1 milligram = 1000 mcg

1 gram = 1000 mg

1 liter = 1000 ml

Conversions within the metric system:

Hint: Big to small: Multiply <u>Gm to mg</u> Multiply by 1000 or move decimal point 3 places to the right. Bigger to smaller unit → go right	Small to Big: Divide <u>mg to Gm</u> Divide by 1000 or move decimal point 3 places to the left Smaller to bigger unit– go left ←
<u>L to ml</u> Multiply by 1000	<u>L to ml</u> Divide by 1000
<u>mg to mcg</u> Multiply by 1000	<u>mcg to mg</u> Divide by 1000

Conversions from one system of measurement to another:

1 kilogram = 2.2 lb

1 tbsp = 15 ml

1 ounce = 30 ml

$$\frac{\text{New equivalent (what you want)}}{\text{Old equivalent (what you have)}} \times \text{Known Unit} = \text{conversion}$$

Examples

Convert 143 pounds to kilogram: $\frac{1 \text{ kg}}{2.2 \text{ lb}} \times 143 = 65 \text{ kg}$

Convert 50 kilograms to pounds: $\frac{2.2 \text{ lb}}{1 \text{ kg}} \times 50 = 110 \text{ lb}$

Convert 800 grams to kilograms: $\frac{1 \text{ kg}}{1000 \text{ gm}} \times 800 = 0.8 \text{ kg}$

Convert 120 milliliters to teaspoons: $\frac{1 \text{ tsp}}{5 \text{ ml}} \times 120 = 24 \text{ tsp}$

Convert 6 ounces to milliliters: $\frac{30 \text{ ml}}{1 \text{ ounce}} \times 6 = 180 \text{ ml}$

Convert 930 milliliters to ounces: $\frac{1 \text{ ounce}}{30 \text{ ml}} \times 930 = 31 \text{ ounces}$

Convert 0.7 grams to milligrams: $\frac{1000 \text{ mg}}{1 \text{ gram}} \times 0.7 = 700 \text{ mg}$

Convert 2 milligram to micrograms: $\frac{1000 \text{ mcg}}{1 \text{ mg}} \times 2 = 2000 \text{ mcg}$

Convert 3 tsp to ounces: $\frac{1 \text{ ounce}}{6 \text{ tsp}} \times 3 = 0.5 \text{ ounces}$

Drug Calculations for Dosage Problems Dealing with Tablets, Capsules, and Suppositories

$$\frac{D(\text{esire})}{H(\text{ave})} \times V(\text{ehicle}) = \text{Quantity to be given}$$

Vehicle = tablet, etc.

Example: Order reads: "Aspirin 650 mg po q 4h prn for headaches". Aspirin is available in tablets containing 325 mg.

$$\frac{D}{H} = \frac{650 \text{ mg}}{325 \text{ mg}} \times 1 \text{ tablet} = 2 \text{ tablets}$$

For dosage problems dealing with liquid medications, either oral or injection, either formula works:

Formula #1	$\frac{D(\text{esire})}{H(\text{ave})} \times V(\text{ehicle}) = \text{Quantity to be given}$
Formula #2	$\frac{\text{Desire}}{\text{Mg : ml}} = \frac{\text{Have}}{\text{mg : ml}}$ Means times the extremes

Example: Order reads: "Dilantin Suspension 100 mg po tid." Dilantin liquid is available 125 mg/5ml.

Formula #1: $\frac{100}{125} \times 5 \text{ ml} = 4 \text{ ml}$

Formula #2

$$\frac{D}{H} = \frac{H}{D}$$

$$\frac{100 \text{ mg} : X \text{ ml}}{125 \text{ mg} : 5 \text{ ml}} = \frac{125 \text{ mg} : 5 \text{ ml}}{100 \text{ mg} : X \text{ ml}}$$
$$125 X = 500$$

$$X = \frac{500}{125}$$

$$X = 4 \text{ ml}$$

Formulas for IV Rate Calculation

In order to calculate the continuous drip rate for an IV infusion the following information is necessary:

- a. amount of solution to be infused
- b. amount of time during which the solution is to be infused
- c. drop factor for the tubing used (found on tubing package)

$$\frac{\text{total volume to be infused}}{\text{total hours for infusion}} \times \frac{\text{drop factor (gtts/ml)}}{60 \text{ min/hr}} = \text{gtt/min}$$

Example: Infuse 1000 ml D5W/0.45 NaCl over 8 hours using tubing with a drop factor of 10 gtts/min.

$$\frac{1000 \text{ ml}}{8 \text{ hr}} \times \frac{10 \text{ gtts}}{60 \text{ min}} = \frac{1000}{48} = 20.8 \text{ or } 21 \text{ gtts/min}$$

For intermittent infusions such as antibiotic piggybacks, use the following formula:

$$\frac{\text{Total volume to be infused} \times \text{drop factor}}{\text{Total minutes}} = \text{gtts/min}$$

Example: Administer 3 gm Zosyn in 100 ml D5W over 45 minutes using tubing with a drop factor of 15 gtts/min

$$\frac{100 \text{ mL}}{45 \text{ min}} \times 15 = 33.5 \text{ gtts/min}$$

Medication Worksheet: Practice Problems:

Equivalents

- | | |
|-----------------------|--------------------------|
| 1. 0.25 Gm = _____ mg | 7. 250 ml = _____ L |
| 2. 100 lb = _____ kg | 8. 2 L = _____ ml |
| 3. 2 L = _____ ml | 9. 0.4 mg = _____ mcg |
| 4. 2 Gm = _____ mg | 10. 0.125 mg = _____ mcg |
| 5. 125 mg = _____ Gm | 11. 200 mcg = _____ mg |
| 6. 90 kg = _____ lb | 12. 250 mcg = _____ mg |

Dosage Problems:

- Order: Acetaminophen liquid 180 mg PO now
Label: Acetaminophen liquid 120 mg per 5 ml
Administer: _____

- Order: Cephalexin 375 mg PO now
Label: Cephalexin suspension 125 mg per 5 ml
Administer: _____

- Order: Clonidine 0.2 mg PO now
Label: Clonidine 100 mcg tablets
Administer: _____

- Order: Erythrocin Stearate 0.75 Gm PO now
Label: Erythrocin Stearate 250 mg tablets
Administer: _____

- Order: S-R Penicillin 1,000,000 units IM now
Label: S-R Penicillin 600,000 units per 1 ml.
Administer: _____

6. Order: Pneumococcal vaccine 25 mcg IM now
Label: Pneumococcal vaccine 50 mcg in 1 ml
Administer: _____

7. Order: Pen Vee K 500,000 units PO now
Label: Pen Vee K 400,000 units per 5 ml
Administer: _____

8. Order: Lupron 7.5 mg IM now
Label: Lupron 5 mg per ml
Administer: _____

9. Order: Betamethasone 12 mg IM now
Label: Betamethasone 6 mg per ml
Administer: _____

10. Order: KCL Elixir 15 mEq PO now
Label: KCL Elixir 20 mEq per 10 ml
Administer: _____

11. Order reads: Prochloroperazine 10 mg IM stat".
Available: 2 ml pre-filled syringe, 5 mg/ml. How much will you administer?
Administer: _____

12. Order reads: Indomethacin 100 mg PO
Available: Indomethacin 25 mg tablets
Administer: _____

13. Meperidine HCL 35 mg IM q 4h prn for severe pain.
Available: The pre-filled cartridge- Meperidine 50 mg/ml.
Administer: _____

14. Order reads: Dexamethasone 1.5 mg PO every 8 hours.
Available: 750 mcg scored tablets.
Administer: _____

15. Order reads: Digoxin elixir 0.125 mg PO every morning.

Available: Digoxin elixir 50 mcg (0.05 mg) per ml.

Administer: _____

16. A medication is available as a powder to be reconstituted with 8.6 ml of diluent resulting in a concentration of 100 mg/ml. If 375 mg is ordered how many milliliters of the reconstituted solution should a nurse administer?

Administer: _____

IV Calculations and IV Medications

1. Order reads: 1000 ml D5W with 20 mEq KCL q 12h. Calculate the drops/minute using macro drip tubing (10 gtts/ml).

Answer: _____

2. Order reads: 1000 ml D5W q 24h at a KVO (keep open rate). Calculate the drop rate using micro drip tubing (60 gtts/ml) is used. Hint: KVO = 42 ml/hr

Answer: _____

3. Order reads: 500 ml D5 and 0.33 Sodium Chloride, with 1 ampule of MVI q 24 h. Calculate the drop rate per minute using micro drip tubing (60 gtts/ml).

Answer: _____

4. Order reads: Ampicillin 500 mg IVPB q 6 hrs in 100 ml D5W. Drop factor for the secondary administration set is 10 gtts/ml. Calculate the drop rate per minute administering the medication over 30 minutes.

1. Answer: _____

Now, calculate the drop rate per minute administering the medication over 45 minutes.

2. Answer: _____

5. The piggyback has a total volume of 50 mLs. The medication is ordered to be infused over 30 minutes (drip factor = 10 gtts/ml). How many drops per minute would you infuse?

Answer: _____

6. A heparin drip is ordered. The heparin bag is 25,000 units in a 250 ml bag of D5W. What is the concentration of heparin per mLs?

Answer: _____

7. Order reads: 1000 mL of Normal Saline to infuse over 10 hours. If the RN starts the infusion at 0800, how many milliliters are left to count in the bag at 1300?

Answer: _____

8. The physician orders 1 unit of packed cells to infuse over 2 hours. The unit is marked to contain 300 ml. Calculate the flow rate in ml/hr.

Answer: _____

Answer Key

EQUIVALENTS:

1. 250 mg
2. 45.5 kg
3. 2000 mg
4. 0.125 Gm
5. 0.75 Gm
6. 198 lb
7. 0.25 L
8. 2000 ml
9. 400 mcg
10. 125 mcg
11. 0.2 mg
12. 0.25 mg

DOSAGE:

1. 7.5 ml
2. 15 ml
3. 2 tablets
4. 3 tablets
5. 1.7 ml
6. 0.5 ml
7. 6.25 ml
8. 1.5 ml
9. 2 ml
10. 7.5 ml
11. 2 ml
12. 4 tablets
13. 0.7 ml
14. 2 tablets
15. 2.5 ml
16. 3.75 ml

IV CALCULATIONS:

1. 14 gtts/min
2. 42 gtts/min
3. 21 gtts/min
4. a. 33 gtts/min
b. 22 gtts/min
5. 17 gtts/min
6. 100 units/ml
7. 500 ml
8. 150 ml/hr

Medication Administration Test Study Guide

Medications will be presented in groups or classifications instead of individual drugs to help organize the study process.

1. Anti-infective drugs
 - Antibiotics
 - Antimicrobials
 - Antituberculars
 - Antivirals
2. Cardiovascular system drugs
3. Central nervous system drugs
4. Respiratory tract drugs
5. Gastrointestinal drugs
6. Hormonal agents
7. Agents for fluid and electrolyte balance
8. Herbal Supplements / Alternative Therapy

Anti-infective Drugs

General Information

- Culture & sensitivity tests must be done before administering first dose
- Verify allergy status – the most common drug allergy is to penicillin
- IM or IV- inject or infuse slowly to minimize local irritation & phlebitis
- Dehydration decreases excretion of drug and may raise drug levels to toxicity
- Assess therapeutic response: Reduction in fever, increased appetite, increased sense of well-being, decreased WBC's, wound healing, etc.
- Assess for superinfections, particularly of fungal origin (Candida most common), characterized by “furry tongue”, nausea and/or diarrhea, abdominal cramps, creamy vaginal discharge, severe perineal itching, stomatitis, glossitis
- Teach patients to complete entire prescribed therapy even if they feel cured. Incomplete therapy increases potential for relapse, or drug resistance may develop
- The most common antibiotics given at HFH include: Piperacillin/tazobactam, ciprofloxacin, levofloxacin, ceftazidime, vancomycin, cefepime, gentamicin, tobramycin, ceftiofur, clindamycin and azithromycin

A. Penicillins (PCN): Amoxicillin, Ampicillin, Augmentin, Nafcillin Sodium, Piperacillin sodium, Penicillin G (aqueous), Penicillin VK, Trimox, Unasyn

1. Indications: Penicillins are antibiotics used to treat many different types of infections, such as tonsillitis, pneumonia, ear infections, bronchitis, urinary tract infections, gonorrhea, and infections of the skin, just to name a few.

2. Serious Adverse Reactions:

- Anaphylaxis
- Neutropenia
- Leukopenia
- Thrombocytopenia
- Hepatotoxicity

3. Nursing Considerations:

- Give with full glass of water on empty stomach
- Do not give with acidic fruit juice - it decomposes PCN

4. Patient Education:

- Seek emergency medical treatment if they experience signs and symptoms of an allergic reaction such as: shortness of breath, hives, swelling of the lips, face or tongue, rash, or fainting
- Contact physician if they experience severe or bloody diarrhea and abdominal cramping if being discharged on penicillin
- Penicillin may decrease the effectiveness of birth control pills and a second method of birth control while taking penicillin may be necessary to ensure protection from unintended pregnancy

B. Tetracycline: Doxycycline (Vibramycin), Minocycline, and Tetracycline

1. Indications: Tetracycline is used for different types of bacterial infections including urinary tract infections, acne, gonorrhea, and chlamydia

2. Serious Adverse Reactions:

- Neutropenia
- Thrombocytopenia
- Hepatotoxicity
- Superinfection
- Hemolytic anemia
- Anaphylaxis

3. Nursing Considerations:

- Effectiveness reduced with antacids, iron salts, & foods high in calcium
- Give 1 hour before meals or 2 hours after meals
- Give with a full glass of water. Adequate water should be taken with each dose to prevent irritation of the esophagus

4. Patient Education:

- Warn to stay out of the sun, photosensitivity manifested by exaggerated sunburn
- Do not use tetracycline during tooth development, i.e., last trimester of pregnancy, neonatal period, and childhood until age 8 - may cause permanent discoloration of teeth & may inhibit fetal skeletal growth
- Do not take dairy products, iron supplements, multivitamins, calcium supplements, antacids or laxatives within 2 hours of taking tetracycline. These products may reduce the effectiveness of tetracycline
- Throw away any unused tetracycline when it expires or when it is no longer needed. Do not take any tetracycline after the expiration date printed on the label. Expired tetracycline can cause a dangerous syndrome resulting in damage to the kidneys
- Stop taking the tetracycline and seek emergency medical attention if the patient experiences serious side effects such as an allergic reaction, severe headache, vision changes or confusion, liver damage, bleeding or bruising, or severe fatigue
- Inform doctor if any less serious side effects occur including nausea, vomiting, increased sensitivity of the skin to sunlight, swollen tongue, or yeast infection

C. Aminoglycosides: Amikacin, Gentamycin (Garamycin), Streptomycin, Tobramycin

1. Indications: Aminoglycosides are antibiotics used to treat many different infections including serious infections. Infections such as cirrhosis, gonorrhea, pneumonia, septicemia, and urinary tract infections may be treated with aminoglycosides

2. Serious Adverse Reactions:

- Nephrotoxicity
- Ototoxicity
- Agranulocytosis
- Thrombocytopenia
- Neurotoxicity

3. Nursing Considerations:

- Nephrotoxicity is a serious side effect of aminoglycosides. If these side effects are present, the physician must be contacted before administering this medication. Risk increases in patient with poor renal function and the elderly. Monitor patient's BUN, creatinine, increase/decrease in frequency of urination, and increased thirst for signs of nephrotoxicity. Nephrotoxicity is limited if given for less than 5 days.
- Monitor patient for signs of ototoxicity. This may include tinnitus, hearing impairment, and vestibular symptoms such as dizziness, nystagmus, vertigo, and ataxia.

4. Patient Education:

- Do not take aminoglycosides without first talking to your doctor if you have:
 - Sulfite sensitivity
 - Kidney disease
 - Hearing loss or loss of balance due to ear problems
 - Parkinson's disease or a neuromuscular disorder such as myasthenia gravis
- Do not use aminoglycosides without first talking to your doctor if you are pregnant or could become pregnant during treatment
- Aminoglycosides may cause damage to the kidneys and/or nerves. Kidney function and drug levels in the blood may be monitored with blood tests during treatment
- Tell your doctor if you experience hearing loss, dizziness, numbness, skin tingling, muscle twitching, or seizures, which may be signs of nerve damage

D. Quinolones: Ciprofloxacin (Cipro), Levofloxacin (Levoquin)

1. Indications: Quinolones are used to treat many different types of infections such as bronchitis, community acquired pneumonia, chronic bacterial prostatitis, UTI, and sinusitis

2. Serious Adverse Reactions:

- Anaphylaxis
- Hypersensitivity reaction
- Phototoxicity
- Superinfection
- Increased ICP
- Seizures

3. Nursing Considerations:

- Use with caution in renal or liver failure, geriatrics and with seizure disorders
- Administer 2 hours before or after antacids, iron supplements, and multivitamins
- Encourage plenty of fluids to minimize risk of crystalluria
- Pediatric use not recommended
- Avoid using with drugs used to treat heart rhythm disturbances (irregular heartbeats) with drugs such as quinidine (Cardioquin, Quinidex, Quinaglute, others), procainamide (Pronestyl, Procan SR, others), amiodarone (Cordarone, Pacerone, others), sotalol (Betapace), and others. Combination of quinolones and these drugs may prolong the QT interval and lethal dysrhythmias may result

4. Patient Education:

- Before taking levofloxacin, tell your doctor if you:
 - have kidney disease
 - have a seizure disorder
 - have a heart condition known as prolongation of the QT interval
 - have a slow heart rate that is considered a medical condition
 - have low levels of potassium in your blood are being treated for heart rhythm disturbances (irregular heartbeats) with drugs such as quinidine (Cardioquin, Quinidex, Quinaglute, others), procainamide (Pronestyl, Procan SR, others), amiodarone (Cordarone, Pacerone, others), sotalol (Betapace), and others
- Levofloxacin is in the FDA pregnancy category C. This means that it is not known whether levofloxacin will be harmful to an unborn baby. Do not take this medication without first talking to your doctor if you are pregnant or could become pregnant during treatment.
- It is not known whether levofloxacin passes into breast milk. Similar drugs are known to affect bone development. Do not take levofloxacin without first talking to your doctor if you are breast-feeding a baby.
- Take each dose with a full glass of water (8 ounces). Drink several extra glasses of fluid each day to prevent the formation of crystals in the urine.
- Do not take antacids that contain magnesium or aluminum (e.g., Tums or Rolaids), the ulcer medicine sucralfate (Carafate), or vitamin or mineral supplements that contain iron or zinc for a minimum of 2 hours before or 2 hours after a dose. Taking antacids, sucralfate, or vitamin or mineral supplements too close to a dose can greatly decrease the effects of the antibiotic.

E. Cephalosporins

First Generation: cefazolin (Ancef, Kefzol), cefadroxil (Duricef), cephalixin (Keflex)

Second Generation: cefamandole (Mandol), cefuroxime (Zinacef), cefoxitin (Mefoxin), cefotetan (Cefotan), cefuroxime (Ceftin), cefonicid (Monocid), cefmetazol (Zefazone)

Third Generation: ceftizoxime (Cefizox), cefoperazone (Cefobid), cefprozil (Cefzil), cefotaxime (Claforan), ceftazidime (Fortaz), ceftriaxone (Rocephin), cefixime (Suprax), cefpodoxime (Vantin)

Fourth Generation: cefepime (Maxipime)

1. Indications: Cephalosporins may be used to treat different types of bacterial infections such as bronchitis, pneumonia, blood infections, bone and joint infections, meningitis, abdominal infections, skin infections, ear infections, gonorrhea, pelvic inflammatory disease, and urinary tract infections.

2. Serious Adverse Reactions:

- Anaphylaxis
- Severe nausea, vomiting or diarrhea
- Mucous or blood in the stool
- Unusual bleeding or bruising

3. Nursing Considerations:

- Broad spectrum antibiotic structurally related to PCN. Ask about PCN allergies
- If allergic to PCN, third generation may be tolerated. Use with caution
- Cephalosporins are rapidly absorbed PO, IM, and IV
- They all have similar sounding & similarly spelled names. Use care when transcribing orders and request clarification as needed
- Persistent temperature elevations may be indicative of drug-induced fever
- Prolonged serum half-life (15 hours) and reduced total clearance in the elderly

4. Patient Education:

- Before using cephalosporins, tell your doctor if you have had:
 - Kidney disease
 - Liver disease
 - Bleeding or blood clotting problems
 - Gastrointestinal disease such as colitis or gallbladder problems
- May decrease effectiveness of birth control pills and a second method of birth control while taking penicillin may be necessary to ensure protection from unintended pregnancy
- Do not use cephalosporins if you have ever had an allergic reaction to penicillin without first consulting physician
- Seek emergency medical treatment if patient experiences signs and symptoms of an allergic reaction such as: shortness of breath, hives, swelling of the lips, face or tongue, rash, or fainting

F. Macrolides

Erythromycin, azithromycin (Zithromax), clarithromycin (Biaxin), erythromycin/sulfisoxazole

1. Indications: Macrolides are used to treat many different types of bacterial infections, such as tonsillitis, bronchitis, pneumonia, whooping cough, Legionnaire's disease, chlamydia, gonorrhea, skin infections, and others

2. Serious Adverse Reactions:

- Anaphylaxis
- Hepatotoxicity
- Thrombophlebitis
- Ventricular arrhythmias
- Bradycardia
- Hypotension

3. Nursing Considerations:

- Monitor the patient for an allergic reaction with the combination erythromycin and sulfisoxazole if the patient has ever had an allergic reaction to diuretics, a sunscreen containing PABA, or a sulfonamide
- Monitor for signs of overdose that may include: decreased appetite, nausea, vomiting, diarrhea, dizziness, headache, abdominal discomfort, drowsiness, fever, and unconsciousness
- Give medication with a full glass of water and encourage increased fluid intake daily unless contraindicated
- Monitor patient for irregular pulse or arrhythmias if on a cardiac monitor
- If on a monitor, be sure to measure the QT interval and notify physician if the interval is prolonged

4. Patient Education:

- Take the medication exactly as ordered by the physician
- Do not take if pregnant without consulting your physician
- Do not take with Seldane, Hismanal, Propulsid or Orap. These medications may interact resulting in dangerous or life-threatening irregular heartbeats.
- Avoid prolonged exposure to sunlight. The medication may increase the sensitivity of the skin to sunlight. Use a sunscreen and wear protective clothing when exposure to the sun is unavoidable.

G. Sulfonamides: Trimethoprim/sulfamethoxazole (Bactrim DS, Bactrim SS, Septra DS)

1. Indications: Sulfonamides are used to treat infections such as urinary tract infections, bronchitis, ear infections (otitis), traveler's diarrhea, and Pneumocystic carinii pneumonia

2. Serious Adverse Reactions:

- Hypersensitivity reactions, such as Stevens-Johnson syndrome
- Hematopoietic disorders, such as acute hemolytic anemia
- Urinary tract abnormalities such as the deposit of sulfonamide crystals within the tissue of the urinary tract
- Hepatitis rarely; focal or diffuse necrosis of the liver

3. Nursing Considerations: Monitor for overdose symptoms which may include nausea, vomiting, decreased appetite, diarrhea, headache, yellowing of the skin or eyes, decreased urine production, bloody urine, and coma.

4. Patient Education:

- This medication affects folic acid in your body, which is necessary for the normal development of a baby. Do not take sulfamethoxazole and trimethoprim without first talking to your doctor if you are pregnant.
- Sulfamethoxazole and trimethoprim passes into breast milk and may harm a nursing baby. Do not take this medication without first talking to your doctor if you are breast-feeding a baby.
- Sulfamethoxazole and trimethoprim is not approved for use in children younger than 2 months of age
- Take each dose with a full glass of water
- Avoid prolonged exposure to sunlight. Sulfamethoxazole and trimethoprim may increase the sensitivity of your skin to sunlight. Use a sunscreen and wear protective clothing when exposure to the sun is unavoidable.
- Stop taking sulfamethoxazole and trimethoprim and seek emergency medical attention if you experience any of the following serious side effects: an allergic reaction (difficulty breathing; closing of your throat; swelling of your lips, tongue, or face; or hives); unusual bleeding or bruising, or yellow skin or eyes

H. Antituberculars: Isoniazide (INH), Rifampin (Rifadin), Mycobutin (Rifabutin)

1. Indications: Rifampin and INH are antibiotics. They prevent bacteria from multiplying and are used to treat and to prevent tuberculosis (TB). Rifabutin is used to prevent mycobacterium avium complex in people with advanced Human Immunodeficiency Virus (HIV) infection. Rifabutin will not effectively treat active tuberculosis, and it may cause the infection to become resistant to treatment. Long-term treatment with drug combinations is needed (can be as long as two years).

2. Adverse Reactions:

INH includes:

- Peripheral neuropathy
- Nausea, vomiting
- Elevated AST, ALT levels
- May impart a harmless red-orange color to body secretions including urine, saliva, sputum, sweat, and tears

Rifampin includes:

- Headache
- Fatigue
- Heartburn
- Elevations of liver enzymes

Rifabutin includes:

- Anorexia
- Nausea
- Thrombocytopenia
- Transient leukopenia

3. Nursing Considerations:

- These drugs are used with caution in patients with renal or liver impairment, or gastric ulcers
- Inform patients taking rifampin that drug may impart a harmless red-orange color to body secretions (urine, saliva, sputum, sweat, and tears)
- Give on an empty stomach, one hour before and two hours after meals. If GI upset is severe, may take with food.
- Monitor patient for fever, chills, muscle or bone pain, blurred vision, eye pain or redness, excessive tiredness or weakness, a sore throat, unusual bleeding or bruising, or yellow skin or eyes and notify the physician

4. Patient Education:

- Symptoms of overdose might include nausea, vomiting, tiredness, abdominal pain, yellow skin or eyes, and unconsciousness
- Do not wear contact lenses while taking Rifabutin or Rifampin. The medication may turn the tears, sweat, saliva, urine, feces, and contact lenses a red-orange color. This effect may be permanent on contact lenses.
- Medication may decrease effectiveness of oral contraceptives and another form of birth control may be needed to prevent pregnancy during treatment
- Treatment is long term from 6 months to 2 years.

I. Antiviral Agents

Anti-Virals: CMV – Ganciclovir (Cytovene), Foscavir (Foscarnet), Valganciclovir (Valcyte), Cidofovir (Vistide)

Anti-Virals: HIV - Zidovudine (Retrovir), Lamivudine/Zidovudine (Combivir)

Anti-Virals: Hepatitis – Lamivudine (Epivir HBV), Interferon alfa 2b (Intron A)

Anti-Virals: Herpes – Famciclovir (Famvir), Acyclovir (Zovirax)

1. Indications:

- Anti-Virals: CMV - Used to treat and prevent infections caused by cytomegalovirus. This infection usually occurs in patients who have suppressed immune systems, such as patients with AIDS and organ transplant patients
- Anti-Virals: HIV - Used to treat the human immunodeficiency virus (HIV), which causes the acquired immunodeficiency syndrome (AIDS). These medications are called reverse transcriptase inhibitors. They inhibit the reproduction of HIV.
- Anti-Virals: Hepatitis - Used to treat chronic Hepatitis B
- Anti-Virals: Herpes - Used to treat infections caused by herpes viruses. Illnesses caused by herpes viruses include genital herpes, cold sores, shingles, and chicken pox.

2. Serious Adverse Reactions:

- Thrombocytopenia
- Neutropenia
- Pancytopenia
- Sepsis
- Nephrotoxicity

3. Drug Interactions:

Anti-viral medications can react with many drugs including over-the-counter and herbal medications. Contact the pharmacy for specific drug interactions.

4. Nursing Considerations:

- Lactic acidosis and severe liver problems including fatal cases have been reported with anti-virals. Report to the physician if the patient experiences nausea, vomiting, shortness of breath, weakness in arms and legs, jaundice of skin, eyes or palate, or pain in the upper right-hand quadrant of the abdomen.
- Monitor patient for signs and symptoms of pancreatitis
- Monitor patient for signs and symptoms of bone marrow suppression

5. Patient Education:

- Viral infections are contagious and can infect others, even during treatment. Avoid letting infected areas or body fluids come into contact with others. Frequent handwashing will help to prevent transmission.
- Avoid high-risk activities such as the sharing of needles and unprotected sexual activity
- Avoid alcohol intake with these medications. Alcohol may increase the risk of liver or pancreatic damage.

J. Antifungal Agents: Amphotericin B, Nystatin (Mycostatin), Fluconazole (Diflucan)

1. Indications: Anti-fungal medications are used to treat fungal infections of the mouth, throat, esophagus, vagina, urinary tract, blood, and pneumonia. They are also used to prevent fungal infections from occurring in people with suppressed immune systems such as chemotherapy patients, organ transplant patients, and AIDS patients.

2. Serious Adverse Reactions:

Nystatin

Hypersensitivity (rare)

Amphotericin B

Electrolyte imbalance (severe hypokalemia)

Nephrotoxicity

Renal failure

Anaphylaxis

Fluconazole

Hepatotoxicity

Stevens-Johnson Syndrome

Angioedema

Seizures

Leukopenia

3. Nursing Considerations:

Nystatin

- Used for treatment of cutaneous & mucocutaneous infections caused by *Candida albicans*
- Available in cream, ointment, powder, vaginal tablets and oral tablets
- Immunosuppressed patients are sometimes instructed to suck on oral tablets because this provides prolonged contact with oral mucosa
- Contact the pharmacist for other drug interactions including over-the-counter and herbal medications

Amphotericin B

- Indicated for treatment of any type of progressive fungal infection that does not respond to conventional treatment
- Monitor kidney function for toxicity, i.e., creatinine
- If line must be flushed, do not use heparin or saline (use D5W)

Cardiovascular Drugs

A. Angiotensin Converting Enzyme Inhibitors (ACE Inhibitors)

Benazepril, Captopril (Capoten), Enalapril (Vasotec), Lisinopril (Prinivil),

1. Indications: Treatment of hypertension, either alone or in combination with other antihypertensive agents; adjunctive therapy in treatment of CHF; treatment of left ventricular dysfunction after myocardial infarction

2. Serious Adverse Reactions:

- Angioedema
- Severe hypotension
- Acute renal failure
- Severe hyperkalemia

3. Nursing Considerations:

- Monitor for angioedema (swelling of lips, tongue or glottis). If patient has any of these symptoms, hold the dose and notify the physician immediately.
- Monitor for hypotension within one to three hours of first dose or new increased dose
- Patients placed on ACE inhibitors will have a lowering of the blood pressure. If the patient remains warm and dry and can “read a newspaper”, he or she is fine regardless of what his or her blood pressure is. However, if the patient becomes restless, cool, ashen and/or clammy, these findings need to be reported to the MD and the ACE inhibitor may be temporarily stopped or the dose reduced.
- If the patient on an ACE inhibitor is complaining of feeling dizzy or lightheaded when standing from a sitting or lying position, orthostatic blood pressures should be done to assess for orthostatic hypotension
- Monitor renal function (BUN, creatinine) and potassium levels
- Discuss the development of a dry, tickly and often bothersome cough

4. Patient Teaching

- Take directly as ordered and do not discontinue without consulting physician
- Take first dose at bedtime
- Do not use with NSAIDS such as Motrin, Indocin or Naproxen
- Avoid potassium supplements and foods high in potassium
- May cause dizziness when rising from lying or sitting position or climbing stairs
- May experience dry mouth or transient loss of appetite
- Report chest pain, palpitations, mouth sores, fever, or unusual cough
- Avoid salt substitutes which are high in potassium

B. Angiotensin II Receptor Blockers (ARBs)

Losartan (Cozaar)

1. Indications: The ARBs are especially useful in providing an alternative therapy in those patients who have intractable cough in response to ACE Inhibitors or who have angioedema from ACE Inhibitors. Losartan blocks the vasoconstrictor and aldosterone secreting effects of angiotensin II.

2. Serious Adverse Reactions:

- Angioedema
- Severe hypotension
- Hepatotoxicity
- Leukopenia
- Neutropenia
- Hyperkalemia

3. Nursing Considerations:

- Observe for symptomatic hypotension and tachycardia, especially in patients with CHF
- Assess for hyponatremia or severe volume depletion
- Assess orthostatic blood pressures for complaints of dizziness when going from a lying or sitting to a standing position
- Monitor creatinine and BUN

4. Patient Education:

- Take exactly as directed and do not discontinue without consulting physician
- Take first dose at bedtime
- Consult physician before using NSAIDS
- May cause dizziness, fainting, and/or lightheadedness
- Report chest pain or palpitations, unrelenting headache, swelling of extremities, face or tongue, difficulty in breathing, or unusual cough

C. Cardiac Glycosides (digitalis preparations)

Digoxin (Lanoxin)

1. Indications: Digoxin is used for the treatment of CHF and to slow the ventricular rate in a tachyarrhythmia such as atrial fibrillation, atrial flutter and supraventricular tachycardia

2. Serious Adverse Reactions:

- AV block
- Bradycardia
- Ventricular arrhythmia
- Thrombocytopenia (rare)
- Delirium
- Hallucinations

3. Nursing Considerations:

- Observe patients for non-cardiac signs of toxicity such as anorexia, vision changes (blurred, yellow halos), confusion, depression, anorexia, and fatigue
- Monitor for changes in pulse rate, or rhythm & BP. Take apical pulse before administering. Usual parameters: Pulse under 60 or greater than 120 - hold dose & notify physician.
- Monitor patient's potassium levels as hypokalemia may potentiate the risk of digoxin toxicity
- The antidote for digoxin toxicity is Digibind
- Elderly patients are at greater risk for developing digoxin toxicity

4. Patient Education:

- Take as directed - do not discontinue without consulting physician
- Maintain adequate dietary intake of potassium to reduce toxicity
- Take pulse at the same time each day and follow physician's orders of when to call
- Notify physician if there is a loss of appetite, nausea and vomiting, persistent diarrhea, swelling of extremities, palpitation, yellowing or blurred vision, mental confusion, depression, or fatigue

D. Coronary Vasodilators (Antianginal agents)

Nitrites, Nitrates: Nitroglycerin [NTG] (Nitrobid, Nitrostat, Nitro-Dur)

Isosorbide dinitrate (Isordil), Isosorbide Mononitrate (Imdur)

1. Indications:

Treatment of angina pectoris, CHF, pulmonary hypertension, hypertensive emergencies

2. Serious Adverse Reactions:

- Thrombocytopenia
- Orthostatic hypotension

3. Common Reactions

- Hypotension
- Migraine headache

4. Nursing Indications:

- IV must be prepared in glass bottles and use special sets intended for NTG
- Transdermal patch labeled as mg/ hour
- Transdermal patches may be ordered to be removed at night to allow for a nitrate free period
- Do not crush sublingual drug product
- NTG infusion should be administered only via pump
- Isorbide mononitrate is a sustained released nitrate
- Viagra potentiates the hypotensive effects of nitrates; concurrent use is contraindicated
- Beta and calcium channel blockers, antihypertensives, and antidepressants may enhance hypotensive effects

5. Patient Education:

- Patient teaching related to NTG sublingual:
 - Tell patient to always carry bottle with them. Keep them in original dark glass bottle and replace 6 months after opening
 - Tell patient to put 1 tablet under tongue at first sign of anginal attack
 - Advise patient to sit or lie down for 10-15 minutes after taking drug to decrease side effects
 - Instruct patient to take additional SL tablets (up to 3) at 5-minute intervals if pain is not relieved. If pain is still present after 15 minutes, call 911.
- Use caution with elderly patients - risk of hypotension
- Do not chew or swallow sublingual tablets
- Do not chew extended release capsules
- NTG spray is sprayed directly on mucous membranes - do not inhale
- Transdermal patches are placed on hair-free area of skin; rotate sites
- May cause dizziness; use caution when changing position

E. Calcium channel blockers: Nifedipine (Procardia), Verapamil (Calan, Calan SR, Isoptin)

1. Indications: Used in the treatment of angina, hypertension, and pulmonary hypertension

2. Serious Adverse Reactions:

- Bradycardia/AV Block
- Arrhythmias
- Hypotension; Severe/Syncope
- CHF

3. Nursing Considerations:

- Monitor heart rate, blood pressure, signs and symptoms of CHF, peripheral edema
- Increased therapeutic and vasodilator side effects, including severe hypotension and myocardial ischemia, may occur if taken with grapefruit juice
- Serum levels may be decreased if taken with food
- Elderly may experience greater hypotensive response; constipation may be more of a problem in elderly as well
- Grapefruit juice increases bioavailability - monitor for altered effects

4. Patient Education:

- Take as directed and do not alter dosage regimen or stop without consulting provider
- Do not crush or chew tablets/capsules
- Change position slowly to prevent orthostatic events
- Maintain good oral care and inspect gums for swelling or redness
- May cause frequent urination at night
- Report irregular heartbeat, swelling, difficulty breathing, or new cough

F. Other Antihypertensive Drugs

Beta-Adrenergic Blocking Agents: Atenolol, Metoprolol tartate (Lopressor)

Carvedilol (Coreg), Nadolol (Corgard), Propranolol hydrochloride (Inderal), Sotalol (Betapace) Labetolol, Esmolol (Brevibloc)

Alpha 1 Adrenergic Agents: Doxazosin mesylate (Cardura), Prazosin hydrochloride (Minipress)

Alpha 2 Adrenergic Agents: Clonidine hydrochloride (Catapres)

Classification of Blood Pressure based on the JNC7 report

Category	SPB MM Hg		DPB MM Hg
Normal	Less than 120	And	Less than 80
Prehypertension	120-139	Or	80-89
Hypertension, Stage 1	140-159	Or	90-99
Hypertension, Stage 2	Greater than 160	Or	Greater than 100

Principles of Hypertension Treatment

Treat to BP less than 140/90 or BP less than 130/80 in patients with diabetes or chronic kidney disease

Majority of patients will require two medications to reach goal

Compelling Indications for Individual Drug Classes

Compelling Indication	Initial Therapy Options
Heart failure	Thiazide diuretic, Beta blocker, ACE Inhibitor, Angiotensin Receptor Blocker, Aldosterone antagonist
Post Myocardial Infarction	Beta blocker, ACE Inhibitor, Aldosterone antagonist
High CVD risk	Thiazide diuretic, Beta blocker, ACE Inhibitor, Calcium Channel Blocker
Diabetes	Thiazide diuretic, Beta blocker, ACE Inhibitor, Angiotensin Receptor Blocker, Calcium Channel Blocker
Chronic kidney disease	ACE Inhibitor, Angiotensin Receptor Blocker
Recurrent stroke prevention	Thiazide diuretic, ACE Inhibitor

1. Indications:

- Beta-blockers are indicated for treatment of hypertension, post myocardial infarction, improving cardiovascular outcomes with patient who have underlying cardiovascular disease and are undergoing noncardiac surgery, treatment of atrial fibrillation, unstable angina, and heart failure (cardiac selective)
- Alpha-blockers are indicated for treatment of hypertension

2. Adverse Reactions:**Beta Blockers:****Serious Reactions**

- Bronchospasm
- Hypotension, Severe
- Cardiac failure

Common Reactions

- Hypotension
- Dizziness
- Nausea
- Somnolence
- Confusion

Alpha Blockers:**Serious Reactions**

Arrhythmias

Common Reactions

- Dizziness
- Headache
- Orthostatic hypotension
- Fatigue

3. Nursing Indications:

- Minimize risk of bradycardia with initiation of treatment with a low dose and slow upward titration
- Administer medication with food
- Monitor blood pressure and heart rate
- Does not work well in elderly patients. Response rates only 20% to 50%
- Beta-blockers may mask symptoms of hypoglycemia

4. Patient Education:

- Instruct patient to report lightheadedness/dizziness associated with therapy
- Inform patients not to **abruptly stop** taking antihypertensive medications
- Encourage increased fluid intake. Increase dietary bulk for patients as constipation is common.
- Do not take with antacids and avoid alcohol or over-the-counter medications before consulting physician
- If diabetic, monitor serum glucose closely
- May cause fatigue, dizziness or postural hypotension; use caution when changing position from lying or sitting to standing
- May cause alteration in sexual performance
- Report unresolved swelling of extremities, difficulty breathing, or new cough

G. Antiarrhythmics

Amiodarone, Procainamide (Pronestyl)

Lidocaine hydrochloride (Xylocaine) – IV only

1. Indications:

- Lidocaine IV is used for acute treatment of ventricular arrhythmias due to myocardial infarction, cardiac manipulation, and digitalis intoxication
- Amiodarone and Procainamide are used for the treatment of both atrial and ventricular arrhythmias

2. Adverse Reactions:**a. Amiodarone:****Serious Reactions**

- Ventricular arrhythmia
- Prolonged QT
- Bradycardia, Severe
- Hypotension, Severe

- CHF
 - Cardiogenic Shock (IV)
 - Elevated liver function tests
- Hypothyroidism
- Pulmonary fibrosis

Common Reactions

- Photosensitivity; may result in a bluish coloring of the skin
- Fatigue

b. Procainamide

Serious Reactions

- Ventricular Fibrillation
- Asystole
- Seizures
- Thrombocytopenia

Common Reactions

- Hypotension
- Bradycardia

c. Lidocaine

Serious Reactions

- Seizures
- Respiratory arrest
- Worsened arrhythmia
- Status asthmaticus
- Heart block
- Bradycardia
- Coma

Common Reactions

- Tremor
- Confusion
- Hypotension
- Blurred Vision

3. Nursing Indications:

- These drugs have a narrow therapeutic index. Monitor apical rate and blood pressure for bradycardia and hypotension
- Half-life increased in elderly due to decreases in both renal & hepatic function with age
- Monitoring of thyroid function, chest x-ray for pulmonary fibrosis, and liver function tests is needed for patients on amiodarone
- Monitor QT interval when patient on amiodarone or procainamide
- Amiodarone may increase the INR when taken with warfarin

4. Patient Education:

- May be taken with food to reduce GI disturbance
- Regular blood work, ophthalmic exams and cardiac assessment will be necessary while taking amiodarone and procainamide on a long-term basis
- Wear sunscreen while taking the medication
- Use caution when changing positions such as rising to sitting or standing
- Report persistent dry cough or shortness of breath, chest pain, palpitations, irregular or slow heartbeat, unusual bruising or bleeding

H. Anticoagulant Drugs: Warfarin sodium (Coumadin), Heparin, Low Molecular Weight Heparin: Ardeparin (Nomiflo), Dalteparin (Fragmin), Enoxaparin (Lovenox)

1. Indications: Prophylaxis and treatment of thromboembolic disorders

2. Adverse Reactions: With anticoagulants, bleeding is the major adverse effect. Hemorrhage may occur at virtually any site. Risk is dependent on multiple variables, including the intensity of anticoagulation and patient susceptibility.

3. Nursing Indications:**a. Coumadin/warfarin sodium**

- Warfarin should not be given in close proximity to other drugs because absorption may be decreased
- Monitor PT and INR (International Normalized Ratio) for effect. Therapeutic level for PT is 1.5 to 2 times the control; a target INR range of 2.5 to 3.5 is recommended.
- Antagonist is phytonadione (Vitamin K)
- Instruct patients to avoid alcohol intake
- Instruct patient not to change dietary habits once stabilized on warfarin therapy; a balanced diet with a consistent intake of Vitamin K is essential
- Instruct patients to avoid *large* amounts of alfalfa, asparagus, broccoli, Brussel sprouts, cabbage, cauliflower, green teas, kale, lettuce, spinach, turnip greens, and watercress
- Drugs that affect platelet function such as aspirin and NSAIDS may potentiate the risk of hemorrhage
- Numerous drugs interact with warfarin. The effect may be a decreased anticoagulant effect and increased bleeding tendency, or an enhanced anticoagulant effect. Check with the pharmacist regarding the drug interactions.

Ensure patients have discharge follow-up by an Anticoagulation clinic when discharged home on Coumadin.

b. Heparin

- Antagonist is protamine sulfate. An overdose of heparin will be reported immediately upon discovery. Drug withdrawal may be sufficient to manage the overdose. **If not, the administration of protamine sulfate is done by the physician**
- Heparin is never administered IM due to pain, irritation, and hematoma formation
- Do not massage the site if given subcutaneous

c. Lovenox

- Administer by deep subcutaneous injection to the left or right anterolateral and left or right posterolateral abdominal wall
- Do not expel air bubble from the syringe prior to injection
- Do not rub injection site

4. Patient Education:

- Do not take any medication that your physician is not aware of and follow diet and activity as recommended by your physician
- You may have a tendency to bleed easily while taking this drug
- Brush teeth with soft brush, floss with waxed floss, use electric razor, and avoid scissors or sharp knives and potentially harmful activities
- Report chest pain, persistent constipation, unusual bleeding or bruising, pain in joints or back, or numbness/tingling/swelling/pain at injection site
- Increased risk of bleeding if combined with chamomile, garlic, ginger, ginkgo, or ginseng therapy

Central Nervous System

A. General Information

1. All patients need to be assessed for pain. Analgesics are most effective if administered before pain becomes severe. The nurse should focus on relief of pain **as perceived by the patient**.
2. Opioids are categorized according to potential for abuse. Schedule 1 drugs, (heroin, etc.) have high potential for abuse. Schedule 2-5 drugs are controlled by the Controlled Substance Act of 1970, which means every drug is accounted for by licensed personnel. Even if part of a dosage is used, the wastage has to be witnessed and co-signed by another licensed person.

B. Non-Opioid Analgesics; Antipyretics

Acetylsalicylic acid (Aspirin)

1. Has anti-inflammatory, anticoagulant, analgesic, & antipyretic actions; inhibits prostaglandin syntheses
2. Irritating to gastric mucosa. Instruct patient to take with milk or food.
Should be used with caution for patients with peptic ulcers. High risk for bleeding when given with anticoagulant therapy.
3. Toxicity is indicated by tinnitus (ringing in the ears)

Acetaminophen (Tylenol)

1. Non-irritating to gastric mucosa
2. Has analgesic and antipyretic actions
3. Toxic reaction includes liver damage
4. Do NOT exceed 4 Gm per day
5. Check OTC drugs patient may be taking for other sources of acetaminophen

C. Nonsteroidal Anti-inflammatory Drugs (NSAIDs): Ibuprofen (Motrin), Naproxen (Naprosyn), Indocin (Indomethacin), Ketorolac (Toradol)

1. Has anti-inflammatory, analgesic, antipyretic effects
2. Can be irritating to the gastric mucosa. Take with milk &/or food.
3. Use cautiously with patients with history of peptic ulcer
4. Affects coagulation (platelet aggregation)
5. Use cautiously with the elderly. As many as 60% can develop peptic ulceration and/or hemorrhage asymptotically. Use lowest possible dose for shortest period possible if necessary to use NSAIDs in elderly patients.
6. Avoid taking over-the-counter drugs while taking NSAIDs
7. Avoid taking NSAIDs with ACE Inhibitors

D. Opioid Analgesics Codeine, morphine, opium, and various opium derivatives

1. Use caution: Respiratory depression may occur in elderly
2. Codeine
 - a) Mild to moderate pain
 - b) Duration of action 4-6 hours
 - c) Very constipating - monitor bowel function
 - d) Common side effects: dizziness, sedation
3. Combination Dosage Forms
 - Tylenol #1 Acetaminophen 300 mg and Codeine phosphate 7.5 mg**
 - Tylenol #2 Acetaminophen 300 mg and Codeine phosphate 15 mg**
 - Tylenol #3 Acetaminophen 300 mg and Codeine phosphate 30 mg**
 - Tylenol #4 Acetaminophen 300 mg and Codeine phosphate 60 mg**
4. Morphine
 - a. For moderate to severe pain; acute and chronic pain
 - b. Common side effects: Nausea, vomiting, sedation, and dizziness; emptying of stomach is delayed, peristalsis decreased
 - c. Most versatile: Can be given SC, IM, rectal supp, PO, epidural, intrathecal, IV push
 - d. IV push slowly, 4-5 minutes for each 15 mg; dilute
 - e. Do not mix with any other drug solutions
 - f. May form a precipitate. Flush tubing thoroughly with 0.9% saline before and after IV administration. Do NOT use dextrose solutions. Use an in-line filter to collect in-line particulate matter

E. Antidepressants

Tricyclic: Amitriptyline (Elavil), Trazodone (Desyrel)

Serotonin Reuptake Inhibitor: Fluoxetine (Prozac), Sertraline Hydrochloride (Zoloft), Paroxetine (Paxil), Venlafaxine (Effexor), Citalopram (Celexa)

1. Takes 3-4 weeks to achieve a therapeutic effect
2. Overdose characterized by CNS signs such as confusion, agitation, autonomic effects (dilated pupils, flushing, hyperpyrexia) and cardiovascular signs such as tachycardia, arrhythmias, hypotension
3. Common side effects: sedation, atropine-like reactions (dryness of mouth, blurred vision, tachycardia, etc.), rash, urticaria, & constipation
4. Advise patient not to abruptly stop taking drug. Drug must be slowly weaned.
5. Tricyclics used with caution in elderly clients
6. Serotonin Reuptake Inhibitors tolerated better than tricyclics in elderly clients
7. Safety for use in children has not been established

Respiratory Tract Drugs

A. General Information: Side effects of respiratory drugs include:

- Cardiac: Tachycardia, arrhythmias, increased blood pressure, palpitations
- Nervous system: Increased anxiety, disorientation, restlessness, dizziness, headache
- GI: Nausea, vomiting

B. Sympathomimetic Bronchodilators: Albuterol (Proventil), metaproterenol sulfate (Alupent), Terbutaline (Brethine), Salmeterol (Serevent), Combivent (albuterol/Ipratropium)

1. Indications: These agents are used to relax the bronchial smooth muscle, thus reducing airway resistance and improving airflow. The noncatecholamine sympathomimetic agents as listed above are longer lasting and evoke less severe side effects.

2. Adverse Reactions:

- Tachycardia
- Insomnia
- Arrhythmias
- Palpitations
- Nausea
- Restlessness
- Anxiety

3. Patient Teaching:

- Instruct patient on how to use, care for, and maintain the inhaler (See HFH Administration of Medication by Metered Dose Inhaler (MDI) policy)
- Instruct patient to inhale drug slowly and hold in for as long as possible
- Emphasize the importance of cleaning the inhaler to avoid infection (mouthpiece and spacer must be rinsed after each use)

C. Parasympathetic Blockers: Ipratropine (Atrovent)

1. Indications: In some patients bronchospasm is caused less by adrenergic dysfunction than by excessive parasympathetic influence on the bronchioles. Inhaled anticholinergic drugs decrease activity of the parasympathetic nervous system on bronchial smooth muscle, resulting in bronchodilation.

2. Adverse Reactions:

- Dry mouth
- Nausea and GI upset
- Cough

3. Nursing Considerations:

- Use in caution with patients who have glaucoma or urinary retention
- Assess breath sounds for wheezing and aeration
- Check for hypersensitivity and overdose symptoms such as cough, headache, GI upset irritated throat, tachycardia or tremor

4. Patient Education:

- Instruct patient not to use this drug alone against acute bronchospasm but to administer with sympathomimetic bronchodilators
- Warn patient not to spray MDI into eyes
- Caution patient against mixing with Cromolyn to prevent precipitate

D. Phosphodiesterase Inhibitors (Methylxanthine Agents)

Theophylline derivatives (Slo-bid, Theo-Dur) Singulair

1. Indications: Used as a maintenance drug by asthmatics to control mild to moderate bronchospasm. It is also prescribed for patients with COPD and cystic fibrosis.

2. Adverse Reactions:

- Caffeine-like symptoms that may include: nervousness, insomnia, jitteriness, headache, frequent urination, and palpitations
- As serum levels increase, adverse effects become more severe such as nausea, vomiting, and tachycardia

3. Nursing Indications:

- Monitor heart rate and blood pressure
- Monitor for toxicity such as nausea, insomnia, seizures, and restlessness
- Assess breath sounds for decreased wheezing and improved aeration

4. Patient Education:

- Advise patient that if they smoke, the dosage will need to be adjusted
- Instruct patient not to crush SR tablets as this will release full dose immediately
- Instruct patient to take drug around the clock as ordered

E. Non-Steroidal Anti-inflammatory Respiratory Drugs: Cromolyn Sodium (Intal, Nasalcrom)

1. Indications: These agents prevent airway inflammation from occurring. They are particularly effective for the allergic asthmatic patients. These drugs reduce both the frequency and intensity of asthma attacks.

2. Adverse Reactions: Reactions are generally mild and rare, but may include irritated throat, dry mouth, cough, unpleasant taste, and headache

3. Nursing Indications:

- Record frequency and severity of asthma attacks
- Assess breath sounds and for reflex bronchospasm after treatment

4. Patient Education:

- Instruct patient not to swallow capsules
- Advise patient drug may take two to four weeks before producing results
- Tell patient to rinse mouth after administration of drug
- Advise patient to use bronchodilator prior to Cromolyn to maximize Cromolyn inhalation

F. Inhaled Steroids: Advair diskus, Pulmacort

1. Indications: Inhaled steroids are indicated for use by patients with asthma, chronic bronchitis, COPD, cystic fibrosis or lung disease characterized by chronic or acute inflammation. Inhaled steroids are not useful in acute exacerbations of asthma and may actually aggravate symptoms. These agents are not bronchodilators and are ineffective against acute bronchospasm. Severe exacerbations of either asthma or COPD may require additional dosing with systemically administered steroids.

2. Adverse Reactions:

- Oropharyngeal irritation
- Sore throat
- Sinusitis
- Oral fungal infections

3. Nursing Indications:

- Assess for bronchospasm and do not administer. Notify physician.
- Check for sore throat and signs of oral candidiasis
- Monitor sputum color and viscosity
- Watch for new signs of systemic absorption in long-term user

4. Patient Education:

- Instruct patient to rinse mouth thoroughly to avoid Candida overgrowth
- Take medication regularly as ordered; not on PRN basis
- Clean inhaler daily
- Do not use during acute wheezing

Gastrointestinal Drugs

A. Antacids

Aluminum hydroxide (Amphojel), Sodium bicarbonate, Calcium carbonate, Aluminum carbonate, Aluminum hydro

General Information:

- Concurrent administration of antacids with medications (i.e. tetracyclines, oral contraceptives) decrease absorption of these medications from GI tract
- Systemic alkalosis / rebound hyperacidity with prolonged sodium bicarbonate use
- Advertised as a good source of calcium - actually, not a safe source of calcium
- Antacids react with many other drugs. They are also very high in sodium, aluminum, magnesium, and calcium

B. Gastric Pump Inhibitor: Omeprazole (Losec, Prilosec, Pepcid)

General Information:

- Commonly used for treatment of GERD, duodenal ulcers, and benign gastric ulcers
- Teach patient to take medication before meals (ac)
- Caution patient not to open, chew, or crush capsules
- Drug interactions:
 - Decreases absorption of diazepam (Valium), warfarin (Coumadin), and phenytoin (Dilantin)
 - Increases serum levels and potential increase in toxicity of benzodiazepines
- Common side effects: headache, dizziness, diarrhea, abdominal pain, nausea, vomiting, and upper respiratory infection symptoms
- S/S of overdose: Hypothermia, sedation, convulsions, decreased respirations

B. Histamine Antagonists: Ranitidine (Zantac)

General Information:

- Inhibits gastric acid secretion by blocking histamine effect on H2 receptors
- Used in short-term treatment of gastric / duodenal ulcers
- Give IV over 30 minutes to avoid bradycardia

Hormonal Agents

A. Insulin Products Used at HFHS

Rapid acting (will be discussed with the glycemic protocol)

- Insulin aspart (Novolog®)
- Give when the food tray arrives and not before

Short acting

- Human regular insulin (Novolin R®)
- ONLY insulin that can be given IV
- Hypoglycemia likely prior to lunch
- May be mixed with NPH or Lente – draw regular insulin (clear) up first

Intermediate

- NPH (Novolin N®)
- Hypoglycemia most likely to occur between 3pm and dinner

Long acting

- Insulin glargine (Lantus®)
- Glargine (Lantus) is a long-acting insulin with NO peak. It is clear and CANNOT be mixed with any other insulin
- Ultralente (Humulin U®)

Combination

- NPH 70%/Human regular 30% mixture (Novolin 70/30®)
- Usually given 15-30 minutes before breakfast and supper
- Ultralente (Humulin U)

Insulin Pharmacodynamics

Insulin	Onset (hr)	Peak (hr)	Duration (hr)	Appearance	Route of Admin.
Insulin aspart (Novolog)	5 – 10 Minutes	1 – 3	3 – 5	Clear	SQ
Human Regular	½ - 1	2 – 4	5 – 7	Clear	IV or SQ
NPH	1 – 2	6 – 14	24+	Cloudy	SQ
Ultralente	6	18 – 24	36+	Cloudy	SQ
Insulin glargine (Lantus)	1	None	24	Clear	SQ

B. Oral Hypoglycemic Agents

Chlorpropamide (Diabinese) **, Glipizide (Glucotrol)*, Glyburide (DiaBeta®, Glynase™, PresTab™, Micronase®), Tolbutamide (Orinase), Metformin (Glucophage), Tolazamide (Tolinase)

General Information:

- Stimulates insulin release from pancreatic beta cells and reduces glucose output by the liver
- Onset 1 hour, peak 3-4 hours, duration 60 hours
- Common side effects: anorexia, nausea, vomiting, epigastric discomfort, heartburn, hypoglycemia
- Give drug before breakfast. If severe GI upset, divide dose - one before breakfast and one before evening meal
- IV glucose for severe hypoglycemia
- Not to be used for type I diabetes, in pregnancy, or lactation.
- Avoid alcohol and take at the same time each day
- *Glipizide (Glucotrol) has very few drug to drug interactions and IS recommended for the elderly
- **Diabinese NOT recommended for the elderly
- Increased risk of hypoglycemia if taken with juniper berries, ginseng, garlic, fenugreek, coriander, dandelion root, or celery

C. Corticosteroids: Prednisone, prednisolone, hydrocortisone (Cortisol)

1. **Indications:** Treatment of a variety of diseases including adrenocortical insufficiency, hypercalcemia, rheumatic and collagen disorders; dermatologic, respiratory, gastrointestinal and neoplastic disease; organ transplantation; and a variety of diseases including those of hematologic, allergic, inflammatory, and autoimmune in origin.

2. Adverse Reactions:

- Chronic, long-term use may result in Cushingoid appearance, osteoporosis, muscle weakness, and suppression of the adrenal-hypothalamic-pituitary axis
- Insomnia
- Nervousness
- Increased appetite
- Indigestion
- Headache
- Diabetes mellitus
- Cataracts
- Glaucoma
- Hirsutism

3. Nursing Considerations:

- Monitor patient for weight gain and fluid retention
- Withdraw therapy with gradual tapering of dose
- Administer oral dose with food or after meals to reduce GI irritation
- Prednisone may decrease response and increase potential infections
- Prednisone may increase blood glucose levels

4. Patient Education:

- Take exactly as directed. Do not take more than prescribed.
- Do not discontinue abruptly
- Take with meals or after meals
- If diabetic, monitor serum glucose closely and notify physician of changes
- Notify physician if experiencing higher than normal levels of stress as medication may need to be adjusted
- Periodic ophthalmic examinations will be necessary with long-term use
- Monitor for signs and symptoms of infections and avoid crowds or infectious people with contagious diseases
- Report weakness, change in menstrual pattern, vision changes, signs of hyperglycemia, signs of infection or worsening of condition

Agents for Fluid and Electrolyte Balance

A. Diuretics

Thiazides: Hydrochlorothiazide (Hydrodiuril), Chlorthalidone (Hydrodiuril)

Loop diuretics: Furosemide (Lasix), Bumetanide (Bumex), Ethacrynic acid (Edecrin)

Potassium sparing diuretics: Spironolactone (Aldactone), Amiloride (Midador)

1. Indications: Used to treat edema in CHF; hepatic or renal disease; & hypertension by increasing water & sodium excretion

2. General Nursing Considerations:

- Monitor electrolytes
- May need to increase potassium intake with thiazides and loop diuretics. Encourage foods rich in potassium.
- Warn patient to contact their physician immediately for any of these side effects: irregular heartbeat, skin rashes, unusual bruising, ringing in the ears, irreversible hearing loss, or jaundice
- For patients taking potassium-sparing diuretics, you must monitor for hyperkalemia and instruct the patient to avoid foods and salt substitutes that are high in potassium

B. Electrolytes

1. General Information:

Concentrated IV electrolyte solutions are considered **High Alert Medications and will not be given by students**

2. Potassium Supplements: Potassium Chloride (KCL), Oral – K-Dur, Slow K (Extended release). Do not crush

a. Indications: To return and/or maintain the patient's potassium level within normal limits

b. Nursing Considerations:

- IV by infusion only, never IV push. Maximal infusion rate 20 mEq/hour. Can cause cardiac arrest if infused too fast.
- Monitor for signs of hyperkalemia: cardiac arrhythmia, heart block, ECG changes
- Monitor for signs of decreased kidney function, such as decreased urine output (since kidneys excrete potassium, this usually leads to an increased potassium level)

3. Magnesium Supplements: Magnesium gluconate, Magnesium sulfate

a. Indications: To return and/or maintain the patient's magnesium level within normal limits

b. Nursing Considerations:

- Use with caution in renal disease, especially when injected
- Excessive oral doses can cause diarrhea and GI irritation
- Geriatrics require reduced doses because of renal dysfunction
- Monitor serum magnesium levels and clinical status to avoid overdose
- Monitor IV sites for extravasation

Herbal Supplements/Alternative Therapy

Herbal supplements are more popular now than ever before. Approximately 25% of patients undergoing active medical treatment or monitoring take herbal supplements, but only 70% of these patients report this practice to their healthcare provider. All herbal supplements have the potential of causing adverse interactions with certain disease states and prescription medications. Therefore, it is important for patients to report every medicine, herbal, or nutritional supplement that they take to their provider