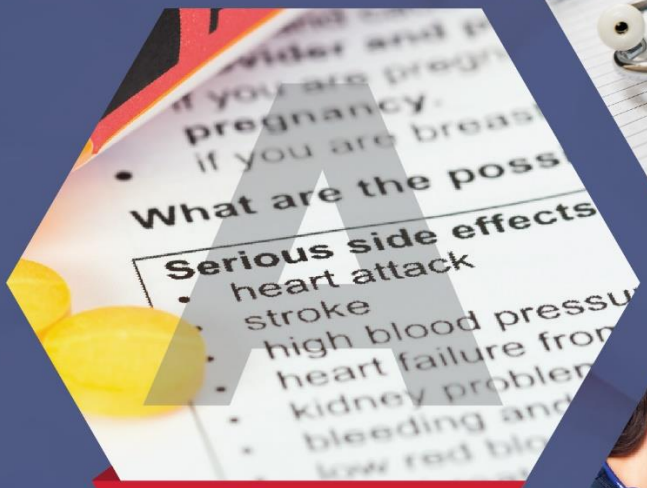
PHARMACOLOGY NOTES

NURSING IMPLICATIONS FOR CLINICAL PRACTICE

Administration

Therapeutic Effects



Adverse Effects

Teaching

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PHARMACOLOGY NOTES

NURSING IMPLICATIONS FOR CLINICAL PRACTICE

Overview

There are currently nine (9) units comprising this *Pharmacology Notes* resource. Units are broken down by body system and published individually for ease of retrieval:

Unit A: Autonomic Nervous System (ANS) Pharmacology

Unit B: Cardiovascular (CV) System Pharmacology

Unit C: Hematological System Pharmacology

Unit D: Central Nervous System (CNS) Pharmacology

Unit E: Skeletal System: Bone and Joint Pharmacology

Unit F: Immune System Pharmacology

Unit G: Digestive System Pharmacology

Unit H: Endocrine System Pharmacology

Unit I: Respiratory System Pharmacology

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UNIT F

IMMUNE SYSTEM PHARMACOLOGY

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- (SC) Cephalosporins
- (SC) Tetracyclines
- (SC) Macrolides
- (SC) Aminoglycosides
- (SC) Fluoroquinolones
- (SC) Sulfonamides
- (SC) Carbapenems
- (SC) Miscellaneous Antibacterials:
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  - (SSC) Monobactams
  - (SSC) Urinary Antiseptics

(MC) Antitubercular/Antimycobacterials

(MC) Antifungals

(MC) Antiparasitics
- (SC) Antiprotozoan

(MC) Antivirals
- (SC) Antiherpesvirals
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Drugs to Treat Cancer

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- (SC) Antitumor Antibiotics
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(MC) Antineoplastics: Non-Cytotoxics
- (SC) Hormones
- (SC) Anti-hormones
- (SC) Biologic Response Modifiers (BRMs)

Immune System Pharmacology

I. ANATOMY AND PHYSIOLOGY/PATHOPHYSIOLOGY REVIEW

A. Immune System Responses

1. Primary – First Line of Defense: innate (nonspecific) body defenses (ex.):
   a. Physical barriers (skin, respiratory, GI mucous membranes)
   b. Phagocytes
   c Natural killer (NK) cells
   d. Inflammatory response
2. Secondary – Adaptive (specific) Body Defenses: lymphocytes interact with antigens:
   a. Humoral (antibody-mediated) immunity – steps in process:
      1) initiated when antigen encounters B-lymphocyte cell
      2) activated B-cell divides and becomes plasma cells ⇒ secrete antibodies
      3) peak production occurs in ~10 days with initial exposure
      4) memory cells can speed up a future defense with re-exposure
      5) antibodies neutralize or destroy antigens:
         a) active immunity:
            (1) takes weeks or months to develop
            (2) long-lasting protection
         b) passive immunity:
            (1) pre-formed antibodies (immune sera) transferred from one person to another
            (2) short-term protection
   b. Cell-mediated immunity – activates T-lymphocytes (T-cells):
      1) helper T-cells (CD4 receptor) activates other immune cells, including B-cells
      2) cytotoxic T-cells (CD8 receptor) travels through body killing bacteria, parasites, viruses, cancer cells
      3) T-cells produce cytokines – hormone-like proteins; regulate intensity and duration of immune response
      4) classes of cytokines: interferons and interleukins

B. Infection

1. Terminology Related to Disease-Causing Microbes (Pathogens):
   a. Pathogenicity: ability of organism to infection
   b. Virulence: measure of disease-producing potential
   c. Invasiveness: ability of organism to grow rapidly and "invade" (cause direct damage to surrounding tissue); related to microbial numbers and production of toxins

2. Risk Factors of Infection:
    a. Immunocompromised/inadequate immune system
    b. Age extremes
    c. Malnutrition
    d. Impaired circulation/blood flow
    e. Disruption of natural barrier
    f. Other chronic illnesses
3. Diagnostic Tests for Infections:
    a. CBC: WBC and differential
    b. Microbiology: culture – identifies invading organism:
        1) obtain specimen from suspected site of infection (e.g. drainage or discharge from wound; sputum from respiratory tract; urine from urinary tract)
    c. Microbiology: sensitivity (often done with culture):
        1) identifies drugs that organism is sensitive to (will respond therapeutically) and those it is resistant to (will not be effective)

C. Cancer

1. Key Characteristics of Cancer Cells:
    a. Abnormal uncontrolled rapid cell division = high growth fraction
    b. Invade surrounding cells and travel to distant sites (metastasis)
    c. Rapid cell division requires much energy (nutrients), thus depriving normal cells of necessary nutrients for growth
2. Cancer Causation (Carcinogens):
    a. Chemical (e.g. tobacco, alcohol)
    b. Biological viruses (e.g. immunosuppression)
    c. Genetics
    d. Environmental (e.g. diet, sun exposure)

II. PHARMACOLOGY

A. Pharmacologic Connections for:

1. Immune System Modulators – drugs that "modify" or "adjust" the body's immune system:
    a. Immunizations promote humoral (**antibody-mediated**) immunity:
        1) vaccines produce <u>active</u> immunity
        2) immunoglobulins produce <u>passive</u> immunity
    b. Immunostimulants, also known as biologic response modifiers (interferons and interleukins) promote **cell-mediated** immunity
    c Immunosuppressants – inhibit immune system by suppressing some aspect of T- or B-cell function

2. Antiinfective Drugs – depend on pathogen and its drug sensitivity or resistance:
    a. Other factors determining choice of antiinfective agent:
        1) location
        2) organ function
        3) age
        4) pregnancy or lactation (i.e. teratogenicity)
        5) previous use/experience
        6) risk vs. benefit ratio
        7) cost
    b. Characteristics of antiinfective actions:
        1) –cidal = kills
        2) –static = prevents further growth
        3) some antiinfectives are both –cidal and –static
        4) action influenced by:
            a) timing of administration
            b) length of therapy
            c) drug dose/concentration
        5) spectrum:
            a) broad – effective against several groups of organisms; greater effect on normal host flora
            b) narrow – effective against specific organisms; increased risk of toxicity
        6) combination therapy:
            a) more than one anti-infective is used
            b) common with resistant organisms
            c) dosages may need to be adjusted/lowered
            d) can cause drug antagonism
        7) MOA: How does –cidal or –static effects occur?
            a) inhibit cell wall synthesis
            b) inhibit protein synthesis (necessary for cell walls and other structures)
            c) inhibit reproduction (inhibit RNA or DNA synthesis)
            d) inhibit cell metabolism and growth (antimetabolites)

3. Antineoplastic Agents (Chemotherapy):
    a. Goals of therapy: cure, control, and palliation
    b. Used alone or in combination with other tx: surgery, radiation therapy
    c. Chemotherapy is most successful against rapidly dividing cells or those with a *high* growth fraction; several cancer cells have *high* growth fraction
    d. Since there are *normal* cells with a *high* growth fraction (i.e. hair follicles, bone marrow, GI tissue/mucous membranes), this accounts for *many* adverse effects

e. Chemotherapy protocols often use combination therapy (multiple drugs from different subclasses):
    1) affects different stages in cancer cell cycle
    2) increases cytotoxic affects = ↑ cell kill
    3) reduces toxicity of one drug
    4) reduces development of resistance
f. Principles of administration:
    1) dosing schedules depend on type of tumor, stage of disease, and overall health status
    2) given as single dose or several doses
    3) may be given within days or several weeks
    4) sometimes optimum dose must be delayed due to severity of adverse effects

Nursing Implications: Immune Pharmacology: Immune System Modulators

Major Class/ Subclass	MOA	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects	T – Teaching – General
Immunization agents	Promotes antibody – mediated (humoral) immunity ***active*** immunity → Long-term protection	Vaccines	See http://cdc.gov/vaccines/schedules/index.html for the latest recommended immunizations	Route: IM/SQ	• Prevention of infectious diseases • Prevention of complications associated w/ infectious diseases • + antibody • + titer	• Local: mild tenderness at injection site, local inflammatory reaction • Systemic: fever, fatigue, malaise, headache • Hypersensitivity/allergic responses • Rare: Guillain-Barre' (flu, HPV)	• Explain risks of contracting vaccine-preventable diseases • Explain current CDC recommendations for immunizations (adult & child) • Females of CB age must avoid pregnancy for a month after receiving vaccination • Provide patient w/ evidence of immunization • Provide date for next vaccination • Discuss common side effects • Discuss symptoms to immediately report to healthcare provider
	Promotes antibody – mediated (humoral) immunity ***passive*** immunity → Short-term protection	Immune globulins		Route: IM/IV Most effective if given as soon as possible after exposure but not more than 2 wks Give vaccines 14 days prior to or 3 mos after immunoglobulin	• Prevention of, or shortened & less severe reaction, to exposure to pathogen	• Most common: pain, tenderness local inflammatory reaction at injection site • More severe: urticaria, angioedema, arthralgia, hypersensitivity (fever, chills, anaphylaxis), infusion reaction (nausea, flushing, HA, wheezing, back pain, abd cramps, anaphylaxis)	• Discuss common adverse effects • Timing: when to get/avoid vaccines • Injection technique if self-administered

Major Class/ Subclass	MOA	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects	T – Teaching – General
Immunostim-ulants	Promote ***cell-mediated*** immunity – cytokines: • Interferon normally produced by lymphocytes & macrophages within 4-6 hrs after viral infection • Enhances immune system to remove antigens; inhibit virus replication (antiviral) • Suppresses cancer cell growth	interferons interleukins		Route: SQ/IM (SQ if ↑ bleeding risk) ✓ baseline vs, wgt, mental status Establish baseline CBC, platelet count, liver & renal function Pt should be well hydrated before use	• ↑ immune system response – ↓ viral infection • Labs: WBCs improved; others related to ↓ viral infection • Hepatitis – improved liver function tests	• Most common: flu-like sx (50%): fever, chills, fatigue, dizziness • GI: N/V/D/A • CV: hypotension, dysrhythmias • More severe: myelosuppression, hepatotoxicity, neurotoxicity; mental status △'s: depression, psychosis	• Take as directed – proper injections technique • Contraception • Avoid alcohol use • Report adverse effects immediately • Report s/sx infection, bleeding • Follow-up labs: CBC, liver & kidney function tests • Monitor wgt & report ↓ PO intake • May take other meds for treating minor adverse effects
Immunosup-pressants Subclass: T- & B-Cell suppressors – Calcineurin inhibitor	• *Binds* to calcineurin to disrupt T-cell function, specifically, helper T cells → ***suppresses production of interleukins, interferons, & other cytokines.***	cyclosporine	Neoral, Sandimmune, Gengraf	Route: PO/IV – slow IV for first 30 mins Baseline labs: CBC, kidney/liver fn. tests, electrolytes Route: PO – mix w/ diluent – NO grapefruit juice	• Ø s/sx of organ rejection – graft tenderness or fever • Depending on transplanted organ, other labs (e.g. kidney – BUN, Cr) or diagnostic tests (ultrasound, biopsy) • ✓serum level of cyclosporine	• **nephrotoxicity (75% of patients)** – dose-dependent → ↑ BUN, Cr • Infection (74%) – fever, sore throat • CV – HTN • Neurotoxicity – tremors, paresthesia, psychosis • Hirsutism • Lymphomas • Less common: hepatotoxicity	• Take as directed – same time qd • Take medication w/ meals to reduce GI irritation • Enhance palatability of oral solution by mixing w/ milk, choc milk or orange juice; use a glass versus plastic container; avoid grapefruit juice • Contraception • Following labs: CBC, BUN, Cr, EGFR, electrolytes, AST, ALT, drug levels • Report adverse effects immediately, esp. s/sx infection, △ urinary status • Infection & injury prevention

Major Class/ Subclass	MOA	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects	T – Teaching – General
Immunosup-pressants (cont.) Subclass: corticosteroid	Inhibits inflammation by suppressing lymphocyte proliferation	prednisone		**Refer to Endocrine Pharmacology**			
Subclass: anti-metabolites/ cytotoxic agents	Kills B&T lymphocytes undergoing proliferation	etanercept methotrexate cyclophos-phamide	Enbrel Rheumatrex Cytoxan	**Refer to Bone and Joint Pharmacology** **Refer to Drugs for treating Cancer**			
Subclass: monoclonal antibodies	Binds to T-lymphocytes (CD3) to block T-cell function	infliximab muromonab-CD3	Remicade Orthoclone OKT3	**Refer Bone and Joint Pharmacology**			
Other new Subclasses: • interleukin receptor antagonist	Blocks activity of interleukins that are released in inflammatory or immune responses	anakinra	Kineret				
Other new immune modulators	Blocks release of various cytokines & sequesters lymphocytes in lymph nodes →↓ autoimmune response	fingolimod	Gilenya				

Nursing Implications: Immune System Pharmacology: Antiinfectives

Major Class	Clinical Uses	MOA	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects (MC)	T – Teaching – General
General (for most antiinfectives)	Treat actual infection or prophylaxis	-cidal or -static	• Check MAR for identification of any drug allergies • Send specimen of probable infection source for C&S before starting therapy when possible • Administer on time & at appropriate intervals to provide consistent blood levels • If IM – give in deep muscles • If IV – ✓ for incompatibilities if giving > 1 drug • Oral agents – give on empty stomach • Contradictions: pregnancy	• Monitor for systemic s/sx of infection: ○ WBCs ○ ✓ temp • Monitor actual site of infection • Repeat C&S • Monitor peak & trough levels	<u>Non-toxic</u>: • GI upset: ✓I/O, GI upset • Superimposed infections: ○ ✓ 'new' signs of infection: ○ oral-thrush ○ skin ○ GI/GU ○ resp • ✓hypersensitivity: ○ rash ○ fever ○ anaphylaxis • ✓resistance – lack of response <u>Toxic</u>: • Nephrotoxicity: ○ ✓ BUN, Cr ○ I/O • Neurotoxicity: ○ ✓ hearing ○ ✓ LOC • Hepatotoxicity: ○ ✓ ALT, AST ○ Jaundice • Blood dyscrasias – BMD: ○ ✓ CBC ○ ↓ levels	• Take entire course of meds (don't share/ save) • Take at regular intervals • Report signs of hypersensitivity • Stress good nutrition & personal hygiene • Take probiotics or cultures daily products • Use contraception (alternative to BCPs)

Nursing Implications: Immune Pharmacology: Antiinfectives – Antibacterials

Subclass	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects – Specific (SC)	T – Teaching – Specific (SC)
Penicillin	penicillin G amoxicillin piperacillin/ tazobactam	Bicillin LA, Pfizerpen Amoxil, Trimox Zosyn	• ✓ allergies • Take w/ full glass of water; no acidic juice	**Refer to those for antiinfectives in general**	• Hypersensitivity • Resistance • GI upset • ✓ electrolytes PCN = PRURITIS	• F/U electrolytes • DDI: anticoagulant; BCPs, diuretics
Cephalosporins	cephalexin cefazolin cefaclor cefditoren	Keflex Kefzol Ceclor Spectracef	• ✓ allergies		• Hypersensitivity • GI: antibiotic – associated pseudomembranous colitis (AAPMC) • Nephrotoxicity if preexisting renal dz CEPHALO = COLITIS	• Report: diarrhea • F/U Labs: BUN, Cr • Avoid: alcohol • DDI: anticoagulants

Tetracyclines	tetracyclines	Sumycin	Route: PO/IM/topical
			Freq: 4x/day
			
			• Do not give w/:
			  ○ milk products
			  ○ iron
			  ○ Mg++ –antacids
			  ○ antilipidemics
			• Contraindications: pregnancy, children < 8 y.o.
					• Teeth discoloration if given to patients < 8 y.o.
					• GI: N/V/D
					• Photosensitivity
					• Pregnancy risk cat.=D
					• Resistance
					
					TETRACYCLINE = TEETH
						• Take as directed
						• Ø children < 8 y.o.
						• Do not take w/ milk, iron, antacids, antilipidemic
						• Sunscreen
						• Contraception
						• DDI: BCP

Macrolides	erythromycin azithromycin	E-Mycin, Eryc, Erythrocin Zmax	• Take w/ full glass of water; Ø fruit juice • Shake/mix suspensions well • Contraindications: liver dz, cardiac dysrhythmias		• GI: N/V/D abd pain • Hypersensitivity MACROLIDES = MINOR, MANY	• DDI: anesthetics, AEDs, antidysrhythmics, anticoagulants

Subclass	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects – Specific (SC)	T – Teaching – Specific (SC)
Aminoglycosides	gentamicin neomycin	Garamycin (Neo-Fradin)	Route: IM/IV/PO • ✓ BUN, Cr ○ Contraindications: N-M disease, renal dz	**Refer to those for antiinfectives in general**	• Nephrotoxicity • Neurotoxicity: ototoxicity • N-M blockade "A ***MEANIE***" AMINOGLYCOSIDES	• Drink adequate fluids • ✓ hearing • ✓ BUN, Cr, peak & trough levels • DDI: anesthetics, AEDs, other drugs causing ototoxicity
Fluoroquinolones	ciprofloxacin	Cipro	Route: PO/IV • Do not take w/ antacid or iron • Contraindications: neuro conditions, alcoholism		• GI: N/V/D. hepatotoxicity • NS: dizziness, HA, sleep disturbances, peripheral neuropathy • photosensitivity • MS: tendonitis; tendon rupture • CV: dysrhythmias • Psych: △ in attention orientation, agitation, memory, delirium • F/E: hypoglycemia FLUORO = FLOW (URINE)	• Avoid taking w/ iron or antacids (take 4 hrs before) • ✓ ALT, AST • ✓ neuro checks • Sunscreen • ✓ muscle pain • ✓ HR & BP
Sulfonamides	trimethoprim – sulfamethoxazole, cotrimoxazole silver sulfadiazine	Bactrim, Septra, TMP-SMZ, Co-Trim Silvadene	Route: PO/topical • Give w/ full glass of water when given PO • ✓ allergies		• Hypersensitivity • Resistance • GI upset • Renal insufficiency • Heme: blood dyscrasias SULFA = SENSITIVITY	• Adequate fluids • Report: rash • ✓ BUN, Cr • Sunscreen • ✓ CBC
Carbapenems	imipenem ertapenem	Primaxin Invanz	Route: IV		Similar to PCN – only given IV	

Subclass	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects – Specific (SC)	T – Teaching – Specific (SC)
Miscellaneous Antibacterials: • Glycopeptides	vancomycin	Vancocin	Route: IV/PO	**Refer to those for antiinfectives in general**	• GI: N/V • Nephrotoxicity • Neurotoxicity: ototoxicity • "Red-man syndrome" ***VICIOUS*** VANCO	• Adequate fluids • ✓ BUN, Cr • ✓ hearing • ✓ coordination, sensation • ✓ peak & trough • ✓ skin • DDI: other ototoxic drugs
• Monobactams	aztreonam chloramphenicol clindamycin	Azactam Chloromycetin Cleocin	Route: IV/IM Route: PO Route: IV/PO		• GI: N/V/D • Skin: rash • Hypersensitivity • Rare: blood dyscrasias	• Adequate fluids • ✓ skin • ✓CBC
• Urinary Antiseptic	nitrofurantoin	Macrodantin, Macrobid, Furadantin	Route: PO		• GI: N/V/A, dark urine • Hypersensitivity • Rare: hepatic necrosis, interstitial pneumonitis	• Report: jaundice, breathing problems

Nursing Implications: Immune System Pharmacology: Antiinfectives – Antitubercular and Antifungals Agents

Major Class/ Subclass	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects – Specific (SC)	T – Teaching – Specific (SC)
Antitubercular (also known as antimycobacterials)	isoniazid	INH, Nydrazid	Route: PO – Long duration: 6 mos. to 2 yrs • Combination tx (2-4+) • Given prophylacti-cally for: ○ new (+) TB skin test results ○ immunocom-promised	• (-) CXR • (-) sputum smears • ↓ s/sx TB (productive cough, fever, night sweats)	• GI: N/V, hepatotoxicity • Neuro: peripheral neuropathy, optic neuritis • Resistance	• Nonpharmacological: diet, rest, sunshine • Give Vit B_6 (pyridoxine) prophylactically to ↓ risk of neurotoxicity • Isolation: airborne droplets • Complete full drug course-long duration • F/U tests: ✓ liver enzymes, CBC, CXR, sputum • F/U: vision tests • Teach re: red urine color (harmless) • Avoid: alcohol • DDI: phenytoin
	rifampin	Rifadin			• GI: N/V/D/A, epigastric pain, heartburn • Other: discoloration of body fluids – reddish-orange	
Antifungals	nystatin clotrimazole	Mycostatin, Nystop Lotrimin	Route: PO – 'swish-and-swallow' or 'swish-and-spit'; Ø eating or drinking 30 mins after	**Refer to those for antiinfectives in general**	• Topical-skin irritation, rash • Oral: N/V/D	• Use only as directed • Good oral/skin care • Avoid: tightfitting clothes
	ketoconazole fluconazole	Nizoral Diflucan	Route: PO/IV – Systemic		• GI: N/V/D, hepatotoxicity • Repro: menstrual abnormalities, gynecomastia, libido	• Avoid: alcohol • ✓ liver enzymes (AST, ALT) • ✓ sexual dysfunction • Good fluid intake
	amphotericin B	Fungizone, Abelcet	Route: IV – Systemic • ✓ BUN, Cr, AST, ALT, electrolytes • Give premeds • IV infusion – slow • ✓ VS		• Onset of tx: N/V, chills, fever, HA (subsides as tx continues) • Nephrotoxicity • Electrolyte imbalances • CV: cardiac arrest, hypotension, dysrhythmias • BMD: blood dyscrasias • Hepatotoxicity • Hypersensitivity AMPHO '***TERRIBLE***' TERICIN	• ✓ BUN, Cr • ✓ AST, ALT • ✓ electrolytes • ✓ CBC • Good fluid intake • Avoid: alcohol • ✓ IV site – report pain • DDI

Nursing Implications: Immune System Pharmacology: Antiinfectives – Antiparasitics and Antivirals

Major Class/ Subclass	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects – Specific (SC)	T – Teaching – Specific (SC)
Antiparasitic: Antiprotozoan	metronidazole	Flagyl	Route: PO/IV • Given 3x/day • Contraindications: pregnancy; hypersensitivity; blood dyscrasias, renal dz; alcoholism	**Refer to those for antiinfectives in general**	• GI: N/V/D/A • CNS toxicity: seizures, paresthesia, dizziness, HA • BMD • Darkening of urine • Unpleasant taste, dry mouth	• Take as directed • ✓ Labs: BUN, Cr, CBC • Avoid: alcohol (disulfiram reaction) • Report: neuro sx
Antivirals: Antiherpesviral	acyclovir ganciclovir	Zovirax Cytovene	Route: PO/IV Route: topical	• Improved lesions • Improved comfort • ↓ or Ø recurrences/ outbreaks	• GI: N/V/D • IV: nephrotoxicity w/ preexisting renal dx	• Timing: at onset of outbreak • Encourage fluid intake • ✓ Labs: CBC, BUN, Cr • Infection transmission
Antivirals: Anti-Influenza Agents	oseltamivir rimantadine	Tamiflu Flumadine	Route: PO	• Reduce duration of flu sx	• GI: N/V/D • Resp: bronchitis, bronchospasm • Skin: hypersensitivity • Psych: △ in behavior	• Maintain adequate hydration, rest
Antivirals: Antti-Hepatitis Agents (depends on hepatitis genotype)	adefovir	Hepsera	Route: PO • Length of tx: 12 wks or 24 wks • Often prescribed combination tx	• Negative Hep C (3 mos. after tx completion) • ↓ progression of inflammation & scarring of liver • ↓risk of developing cirrhosis & liver cancer	• Fatigue • Insomnia • GI: N/V/A/D • Resp: cough • Skin: rash	• Importance of adherence to tx • F/U appointments & lab tests • Rest, regular exercise, well-balance diet, regular sleep time • Small, frequent meals, Ø spicy, ↑ fluids, Ø alcohol • ✓ skin – moisturize daily • Use humidifier, cough drops • Preventing re-exposure – avoid blood-to-blood contact
Antivirals: Antiretrovirals	zidovudine nevirapine fosamprenavir enfuvirtide maraviroc raltegravir	AZT, Retrovir Viramune Lexiva Fuzeon Selzentry Isentress	HAART	• ↓ HIV RNA load • ↑ CD4 counts • Ø new infections	• GI: N/V/A/D, hepatotoxicity • BMD: anemia, thrombocytopenia • Generalized weakness, fatigue, myopathy, myositis • Neuro: peripheral neuritis • Endo: pancreatitis, lipodystrophy	• Take as directed • Nonpharmacologic measures to ↑ immune system • Labs: CBC • Infection prevention • Transmission prevention • Multiple DDIs

Nursing Implications: Immune Pharmacology: Antineoplastic Agents – Cytotoxic

Subclass	MOA	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects – General (cytotoxic agents)	T – Teaching – General (MC)
Alkylating Agents	Alters DNA structure → prevents cell replication; alkylates DNA causing cross-links & strand breakage. • cell cycle phase nonspecific	cyclophos-phamide cisplatin busulfan chlorambucil	Cytoxan Platinol Myleran Leukeran	Route: various Pre-chemo ✓ labs: • CBC • BUN, Cr • electrolytes • uric acid	Reduction or remission: • depends on type of malignancy (grade, stage) • tests to evaluate size of tumor	• Blood: BMD/ pancytopenia: ○ anemia ○ thrombocytopenia ○ leukopenia • GI: N/V • Oral: ○ thrush ○ stomatitis • Integumentary – hair: alopecia • Renal – nephrotoxicity • Others: cardiotoxicity, pulmonary effects, neurotoxicity, hepatotoxicity • IV site extravasation (chemo-vesicant) • Psych: depression/ anxiety associated w/ chronic illness	• Receive blood products & other hematopoietic agents transfusion reactions: F/U labs – CBC: ○ safety – take rest periods ○ safety – bleeding precautions ○ infection prevention; protective isolation; s/sx infection – personal hygiene • Diet modification – ✓weight daily; take antiemetics, antiulcer agents; ✓electrolytes • Diet modifications: ○ antifungal ○ oral rinses/meds for pain (e.g. viscous lidocaine) ○ eat bland, soft, non-acid foods • Body image support – uses of scarves, hat, wigs • Hydration – strict I/O; diuretics; antigout agents; ✓BUN, Cr, EGFR • F/U labs as ordered: ECG, liver enzymes • Report pain or burning at site • Support groups
Antimetabolites	Interferes w/ nutrient or nucleic acid metabolism of rapidly-dividing cells → stops cell production needed for DNA/RNA synthesis: • S-phase specific	methotrexate cytarabine mercaptopurine	Rheumatrex, Trexall Cytosar Purinethol				

Subclass	MOA	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects – General (cytotoxic agents)	T – Teaching – General (MC)
Antitumor Antibiotics	Binds to DNA (intercalation), altering its structure → inhibits DNA/RNA synthesis • cell cycle phase nonspecific	doxorubicin bleomycin dantinomycin	Adriamycin Blenoxane Actinomycin-D	**(See previous page)**	**(See previous page)**	**(See previous page)**	**(See previous page)**
Antimiotics	Stops cell division (mitosis) → produces apoptosis • M-phase specific	vincristine	Oncovin				
Topoisomerase Inhibitors	Interrupts DNA synthesis • S-phase specific	topotecan etoposide	Hycamtin VePesid				
Cancer-cell – Specific Agents	Inhibits protein tyrosine kinase →↓ tumor cell growth & division	imatinib	Gleevec				

Nursing Implications: Immune Pharmacology: Antineoplastic Agents – Non-Cytotoxic

Subclass	MOA	Prototype – generic	Prototype – trade	A – Admin	T – √ Therapeutic Effects – General (MC)	A – √ Adverse Effects – General (cytotoxic agents)	T – Teaching – General (MC)
Non-Cytotoxics: • Hormones • Anti-hormones	• Enhances/increases or blocks certain hormones that support growth of various tumors	dexamethasone tamoxifen	Decadron	**Refer to Endocrine Pharmacology**			
Non-Cytotoxics Biologic Response Modifiers (BRMs)	• Increases immune system & decreases production of cancer cells by removing tumor cells	interferon alfa 2-B (cytokine)	Intron-A	**Refer to Immune System Pharmacology: Immunostimulants**			