

Fever - classes of medication

Acetaminophen	Mechanism of action: acts at hypothalamus to cause peripheral vasodilation, which enables sweating and allows body to rid excess heat No anti-inflammatory action Primary use: fever, mild to moderate pain, osteoarthritis
NSAID's	Same mechanism of action as acetaminophen (for fever) Because of acetaminophen's safety record (few drug interactions and side effects), it is first-line for fever NSAID could be more appropriate if inflammation is also present (ibuprofen > ASA) ASA is contraindicated in children ☑ Reye's Syndrome (ASA + virus + fever in child)

Adverse effects

NSAID	nausea, dyspepsia, ulcer with long-term use, potential anti-platelet action, hypertension, increased risk of cardiac event with long-term use Take with food Caution in kidney disease, cardiovascular disease, GI conditions
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Corticosteroids

Adverse effects (cont)

Acetaminophen	very rare liver toxicity (max dose of 4g/24h-ours), avoid alcohol, interacts with warfarin (but doesn't ↑ bleeding on its own)
1st-Generation Antihistamines	Significant sedation
2nd-Generation Antihistamines	
Intranasal Corticosteroids	nasal irritation, dryness and bleeding (epistaxis), bad taste, loss of smell
Decongestants <i>Phenylephrine, pseudoephedrine</i>	oral – hypertension, anxiety, insomnia; intranasal – nasal irritation, rebound congestion, rarely systemic effects
Penicillin	anaphylaxis, diarrhea, nausea, vomiting, pain at injection site, superinfections, some (minor) drug interactions
Cephalosporins <i>Cefotaxime</i> (3rd Gen.)	hypersensitivity, rash, itching, anaphylaxis, diarrhea, vomiting, nausea, pain at injection site, some (minor) drug interactions Must be given IV or IM (not orally)

Adverse effects (cont)

Tetracyclines	diarrhea, yeast infections, nausea, vomiting, epi-gastric burning, yellow-brown teeth discolouration in young children (we don't prescribe for kids), photosensitivity Can potentially interfere with oral contraceptives (recommend backup method) Higher chance of superinfections because it is broad-spectrum
Macrolides <i>Erythromycin</i>	: significant nausea, vomiting, diarrhea (take with food), some important drug interactions Warfarin, cyclosporine, anticonvulsants (all via CYP450 inhibition/induction) Fidaxomicin – new; for treatment of <i>C. difficile</i> ; not absorbed, stays in GI tract nausea, constipation, vomiting
Aminoglycosides <i>Gentamicin</i>	ototoxicity, nephrotoxicity



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Adverse effects (cont)

Fluoroquinolones <i>Ciprofloxacin</i>	nausea, diarrhea (can take with food), photosensitivity Separate from minerals like calcium, iron, magnesium, aluminum (including supplements and antacids) by 2h Serious adverse effects associated with fluoroquinolones: Tendinitis or tendon rupture (1.3-5.6 in 10,000) Cardiac arrhythmias (15-57 in 100,000) CNS effects ☑ seizures, tremors, altered mental state Peripheral neuropathy
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Sulfonamides <i>Sulfamethoxazole-Trimethoprim (SMZ-TMP, Septra®, Bactrim®, -DS)</i>	nausea, vomiting, skin rashes, photosensitivity, anemia, crystalluria Drink lots of water to prevent crystalluria Monitor for: painful urination, abdominal pain, blood in urine, fever
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Carbapenems <i>ertapenem, imipenem, meropenem</i>	skin reactions, inflammation at injection site, diarrhea, nausea, vomiting
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Clindamycin	High risk of superinfection (GI)
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Adverse effects (cont)

Nitrofurantoin	Changes urine to orange colour Must take with food
Metronidazole	Disulfiram reaction – flushing, tachycardia, shortness of breath, severe nausea & vomiting, throbbing headache, visual disturbance, confusion, dizziness Occurs ~ 5-10 minutes after intake, lasts 30 mins ☑ several hours

Vancomycin	Ototoxicity and nephrotoxicity
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Linezolid	lactic acidosis, myelosuppression (↓ WBC and platelets), peripheral and optic neuropathy, serotonin syndrome, diarrhea, Major drug interaction with any serotonergic drug, may need to discontinue until course of treatment finished, also inhibits MAO
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Rifampin (RMP)	Rashes, blood dyscrasias, GI disturbances, liver damage, nephrotoxicity Secretions coloured a reddish-orange (sweat, urine, sputum, tears)
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Adverse effects (cont)

Amphotericin B	fever & chills during infusion, vomiting, headache, phlebitis, nephrotoxicity, hypokalemia, ototoxicity
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Azole Antifungals <i>fluconazole, itraconazole, ketoconazole, miconazole, voriconazole</i>	Rare hepatotoxicity – avoid alcohol, watch for jaundice, monitor liver enzymes
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Nystatin	Oral thrush – swish and swallow oral suspension four times daily (works topically) (needs Rx)
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Adverse effects (cont)

Classic	Increased risk of infections,
Immuno	Increased risk of cancers such
-suppr-	as lymphomas, cysts, and polyps
essant	Frequency increases with
	intensity and duration of
	treatment, Kidney impairment,
	hepatic impairment, Hypert-
	ension, hyperlipidemia,
	CNS: tremor, headache, skin
	prickling sensation,
	GI: nausea, vomiting, abdominal
	pain, diarrhea, gingival
	hyperplasia,
	MSK: Muscle cramps, myalgia
	Endocrine: Menstrual distur-
	bances, gynecomastia, Hypert-
	richosis (abnormal amount of
	hair growth over body), Fatigue

Adverse effects (cont)

Chemot	short term
herapy	Nausea/vomiting, Diarrhea or
	constipation, Mucositis/stoma-
	titis, Myelosuppression, Hair
	growth alterations, Weight gain /
	weight loss, Taste alterations,
	Fatigue, Hepatic and renal
	changes, Cardiac function
	changes, Rash / skin changes /
	nail changes, High blood
	pressure
	Long term
	Infertility, Secondary malign-
	ancies, Heart failure, Osteop-
	orosis, Pulmonary fibrosis,
	Cataracts, Peripheral neurop-
	athy, Hearing loss, Fatigue,
	Endocrine abnormalities

Inflammation mediators

Histamines
Bradykinin
Leukotrienes
Cytokines
Interleukins
Prostaglandin

Inflammation classes of medication

Non-st-	Inhibit cyclo-oxygenase (COX),
eroidal	which reduces prostaglandin
anti-infl-	synthesis therefore inhibiting
amm-	inflammation
atories	Also have analgesic and antipy-
NSAID	retic properties
	For mild to moderate inflam-
	mation

Inflammation classes of medication (cont)

COX-1	– In all tissues, stomach
	lining (mucosa), involved
	in platelet aggregation
COX-2	more specific for inflam-
	mation
<i>Ibuprofen</i>	mild to moderate inflam-
	mation, fever, mild to
	moderate pain, dysmen-
	orrhea, musculoskeletal
	pain, arthritis
Corticosteroids	Mimic endogenous
	cortisol, attempting to
	bring body back to
	homeostasis after a fight--
	or-flight response
	Anti-inflammatory and
	immuno-suppressive
	For severe inflammation
	Serious systemic adverse
	effects limit use to
	emergencies and severe
	inflammation (multiple
	sclerosis, rheumatoid
	arthritis, auto-immune
	diseases)
	Local administration,
	short-term use preferred
	whenever possible



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Antibiotics - Classes of medication

Penicillins <i>-cillin</i>	Disrupt bacterial cell walls, Bactericidal Penicillin-binding protein: a protein only in bacterial cell walls that penicillin binds to which weakens the cell wall, allows fluid to enter and destroys the cell Penicillins contain a beta-lactam ring in its structure necessary for activity Many bacteria produce beta-lactamase (penicillinase) that is a natural defense to penicillin – it breaks the beta-lactam ring, leaving it ineffective therefore penicillin resistance
<i>Amoxicillin + Clavulanic Acid</i> (<i>Amoxiclav</i>)	Clavulanic acid inhibits β -lactamases (penicillinases) of some microorganisms to allow amoxicillin to be active against it Synergistic relationship

Antibiotics - Classes of medication (cont)

<i>Penicillin G Potassium</i> (<i>Pen G</i>)	Drug of choice against streptococci, pneumococci, staphylococci, gonorrhea and syphilis (given IV or IM)
Cephalosporins <i>-ce(f)ph</i>	Related to penicillins (1st gen. also have beta-lactam ring) Also inhibit cell wall synthesis, Bactericidal Classified according to "generation" (1 - 4) General Rules 1st generation not effective against bacteria producing beta-lactamase More potent as go up in generation Fewer similarities with penicillins as go up in generation Higher generations reserved for known resistant infections
<i>Cefotaxime</i> (<i>3rd Gen.</i>)	Has broad-spectrum activity against gram-negative organisms; for serious infections of lower respiratory tract, CNS, genitourinary system, bones, blood, and joints

Antibiotics - Classes of medication (cont)

Tetracyclines <i>doxycycline, minocycline, tetracycline</i> <i>-cycline</i>	Inhibit bacterial protein synthesis, Bacteriostatic Broad-spectrum (both gram-positive and negative) Usually given orally (PO) Should not be given at the same time as iron, calcium, magnesium (ions bind to drug so it can't absorb) – separate by 2h
<i>Tetracycline</i>	Used for Rocky Mountain spotted fever, h.pylori infections, acne vulgaris, chlamydia
Macrolides <i>azithromycin, clarithromycin, erythromycin, fidaxomicin</i> <i>-thromycin</i>	Inhibit bacterial protein synthesis, Some are bactericidal, some bacteriostatic No structural similarities to penicillin – zero chance of cross-reactivity
<i>Erythromycin</i>	Used for upper and lower respiratory tract infections, whooping cough, diphtheria, or for other infections in patients who cannot take penicillins



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Antibiotics - Classes of medication (cont)

Aminoglycosides Inhibit bacterial protein synthesis and cause abnormal protein synthesis, *amikacin*, *gentamicin*, Dose-dependent bactericidal *streptomycin*, Very effective, usually reserved for serious infections (like tuberculosis) *tobramycin* or when other antibiotics have failed. Require therapeutic drug monitoring – levels must be in specific range to be effective, but not toxic. Injection or topical.

Gentamicin Used for serious (life-threatening) infections or when other antibiotics have failed (also topically as eye drops and creams/ointments – this would not require therapeutic drug monitoring)

Antibiotics - Classes of medication (cont)

Fluoroquinolones Affect bacterial DNA synthesis, Bactericidal. Most often used orally (also ear, eye). Absorption is affected by minerals (calcium, iron, magnesium) and need to be separated (~2h). Generally not used in children – affects cartilage development. *besifloxacin*, *ciprofloxacin*, *gatifloxacin*, *levofloxacin*, *moxifloxacin*, *norfloxacin*, *ofloxacin*, *-floxacin*

Ciprofloxacin Used commonly for respiratory, urinary, ophthalmic, gastrointestinal, and gynecological infections – high usage in community/out-patient

Sulfonamides Suppress bacterial growth by inhibiting essential folic acid needed within the cell, Bacteriostatic. Broad spectrum, older class ☑ more resistance seen. Orally and topically (acne). “Sulfa” is also a common “allergy”

Antibiotics - Classes of medication (cont)

Sulfamethoxazole-Trimethoprim Both drugs inhibit essential folic acid synthesis; work synergistically (a pharmacodynamic interaction). *Septa®*, *Bactrim®*, -*DS*) Used to treat urinary tract infections

Carbapenems Relatively new-ish. Contain beta-lactam ring and inhibit cell wall synthesis (like penicillins). The beta-lactam ring is very resistant to destruction by penicillinase. Broad spectrum – and very effective; as a newer class, they are being reserved for resistant infections (like MRSA, etc.)

Miscellaneous VIPs

Clindamycin protein synthesis inhibitor; bacteriostatic. Used topically (acne), oral or IV for serious systemic infections. High risk of superinfection (GI)



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Antibiotics - Classes of medication (cont)

Nitrofurantoin inhibits protein, RNA, DNA, and cell wall synthesis; bactericidal
Excreted unchanged through the kidney (no metabolism), therefore used only for urinary tract infections
Changes urine to orange colour
Must take with food

Metronidazole destroys bacterial DNA; bactericidal
For anaerobic bacteria
NO ALCOHOL USE (even small amounts present in cough syrup or mouthwash)

Antibiotics - Classes of medication (cont)

Vancomycin inhibits cell wall synthesis; bactericidal (through different mechanism than aminoglycosides)
Reserved for severe infections that are resistant to anything else ☑ usually only used in hospital (methicillin-resistant staph. aureus - MRSA)
Injection or oral
If IV given too quickly ☑ Red Man Syndrome (flushing, red face, hypotension) ☑
slow down infusion
Therapeutic drug monitoring required (like aminoglycosides)

Linezolid inhibits bacterial protein synthesis
Use to treat vancomycin-resistant enterococcus (VRE), pneumonia or skin infections caused by MRSA i.e. Severe infections resistant to other antibiotics

Allergies- Classes of Medication

Antihistamines

Allergies- Classes of Medication (cont)

1st-Generation Antihistamines Block H1 receptors
Shorter acting, cause more drowsiness, and work faster than 2nd Generation
Used mostly to treat allergic response
Diphenhydramine and *chlorpheniramine* most common
Have anticholinergic effects
Significant sedation – some use as a sleep aid

2nd-Generation Antihistamines
Cetirizine (Reactine®), *loratidine (Claritin®)*, *desloratidine (Aerius®)*, *fexofenadine (Allegra®)*

Intranasal Corticosteroids To reduce inflammation in nasal mucous membranes, and local immunosuppression
Used daily to prevent symptoms
Can take up to 2 weeks for full effect
Local administration prevents systemic side effects



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Allergies- Classes of Medication (cont)

Decongestants Sympathomimetics – stimulants – cause vasoconstriction and reduction of mucous production

Phenylephrine, pseudoephedrine For immediate relief of nasal congestion – oral or intranasal

Short term-use only – rebound congestion if longer than 3-5 days (intranasal)

Drugs for Anaphylaxis

Epinephrine Stimulates both α and β adrenergic receptors

Via α -receptors: counters the high vascular permeability that occurs during anaphylaxis that leads to loss of intravascular fluid and hypotension

Via β -receptors: causes bronchial smooth muscle relaxation and relieves bronchospasm, dyspnea, and wheezing

Also alleviates pruritus, urticaria, and angioedema

Anti-fungals - Classes of medication

Amphotericin B Binds to fungal cell membranes, making them leaky, Given IV

Azole Antifungals Alter fungal cell membranes by depleting ergosterol

fluconazole, itraconazole, ketoconazole, miconazole, voriconazole Used orally, topically, injection; fluconazole available OTC

Safer than amphotericin B

Most often for vaginal candidiasis, athlete's foot, or thrush

metronidazole is NOT an azole antifungal

Miscellaneous

Ciclopirox topical med used for fungal nail or scalp infections (nail polish or shampoo)

Terbinafine oral med for fungal nail infections

Nystatin cream available without prescription for many topical fungal infections (ringworm, diaper rash)

Anti-Virals -Classes of medication

HIV Because of antiretroviral drugs, HIV patients are able to live symptom-free for much longer with very low counts of the retrovirus

Antiretroviral drugs block the HIV replication cycle

Anti-Virals -Classes of medication (cont)

HAART – Goal is to reduce plasma HIV to its lowest possible level - HIV still remains in the lymph nodes

highly active antiretroviral therapy Blood and lymph are separate rivers that cross occasionally

Use different classes of antiretrovirals at same time to reduce resistance

Each class 'attacks' different step of replication cycle

Herpes Infections

HSV1: oral cold sores

HSV2: genital ulcerations

Zoster: shingles (due to previous varicella-zoster infection)

Acyclovir, famciclovir, valacyclovir Mostly controlled by oral therapy of antivirals – taken at first sign of outbreak, continued for short term

These antivirals prevent viral DNA synthesis

Very well tolerated – take with food

Over the Counter medications for Herpes

Lipactin® - can reduce pain, may speed healing

heparin + zinc Mechanism does not match pathophysiology



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Anti-Virals -Classes of medication (cont)

Abreva® - prevents viral entry into cells, stops spread if caught early (can reduce duration of cold sore by ~1 day)

docosanol

Influenza BEST PROTECTION = VACCINATION

Amantadine, and neuraminidase inhibitors (oseltamivir and zanamivir) Antiviral drugs may decrease severity of symptoms of influenza and may shorten symptom time by a couple days IF taken within first 48 hours

Generally used only in patients at high risk of complications from influenza

Immunosuppression - Classes of Medication

Calcineurin Inhibitors "Classic" immuno-suppressants used for transplants (or topically for psoriasis)

Cyclosporine, tacrolimus, pimecrolimus (topical) Disrupt T-cell function by binding to calcineurin

They are not specific – suppress the ENTIRE immune system ☑ patient is very susceptible to any other infection

Extensive monitoring for detailed WBC counts and signs of infection (see slide on monitoring)

Immunosuppression - Classes of Medication (cont)

Corticosteroids Anti-inflammatory and immunosuppressant activity

Often used to control exacerbations of condition such as asthma, rheumatoid arthritis, MS, etc.

Pulse therapy (very high doses, gradual taper) to minimize side effects

Many, many side effects

Biologics medications produced using biological processes in living organisms such as yeast and bacteria

Have active pharmaceutical ingredients that cannot reasonably be synthesized by chemical means (too complicated)

Are complex, large molecules derived from living sources and produced through a number of intricate steps

Biologics can be immunosuppressant or immunostimulant (very specifically) or replace a substance that is missing (insulin)

Immunosuppression - Classes of Medication (cont)

Vaccines, Blood products, Hormones & growth factors, Enzymes Gene therapy, Cancer treatments

Chemotherapy

Cytotoxic drugs traditional; interfere with or damage DNA, causing apoptosis (programmed cell death)

Hormonal therapy not cytotoxic; effects mediated through hormonal receptors (deprivation) – for hormone-responsive cancer (breast, prostate, etc.)

Immuno-therapy monoclonal antibodies, vaccines; non-specifically boost immune system to help eradicate cancer (interferon alfa)

Targeted agents monoclonal antibodies, tyrosine-kinase inhibitors (TKIs); the future of treatment – to target cancer cells only

Tuberculosis medications

Rifampin (RMP) Most potent anti-TB drug available

Good bactericidal activity, prevents acquired drug resistance and is very important in preventing relapse

Current doses are based on studies performed in the 1960s, when the lowest effective dose was used because of the high cost of the drug; concerns now that dose is too low -> current trials -> dosing recommendations may change



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