Veterinary Antibiotics

I. PENICILLINS—β-lactam, bacteriocidal

MOA – inhibit mucopeptide synthesis in the cell wall resulting in a defective barrier and an osmotically unstable cell wall

Adverse effects: Hypersensitivity, GI

Contraindications: Hypersensitivity: Maculopapular rash, urticaria, angioedema

Interactions: Synergism with aminoglycosides, cephalosporins

A. Natural Penicillins – narrow spectrum, penicillinase sensitive

Activity: Most spirochetes, G+ and G- aerobic cocci, aerobic and anaerobic G+ bacilli (Bacillus anthracis, Clostridium sp., Fusobacterium, and Actinomyces

1. Penicillin G Potassium (Pfizerpen®)
   - available IM/IV 20 million units/100 ml vial

2. Penicillin V Potassium
   - available orally (give on empty stomach)
     250 mg (400,000 units), 500 mg (800,000 units) tablets
     125 mg/ml, 250 mg/ml oral suspension

3. Penicillin G Procaine
   - 300,000 units/ml IM (250 ml vial)
   - mastitis syringes 100,000 units/ml in 10 ml syringes

4. Penicillin G Benzathine
   - 600,000 units/dose in 1 ml Tubex - IM

5. Penicillin G Benzathine + Penicillin G Procaine
   - 150,000 units/ml (each) IM (250 ml vial)
B. Amino Penicillins

Activity: G- aerobes not covered by the natural penicillins (E. coli, Klebsiella, and Haemophilus)

1. Ampicillin - fair oral bioavailability – food ↓ rate and amount absorbed
   - 250 mg, 500 mg capsules
   - 125 mg/5 ml, 250 mg/5 ml oral suspension
   - 125 mg/ml, 250 mg/ml IV

2. Amoxicillin
   - excellent oral bioavailability - food ↓ rate (↓ peak serum levels) but not amount absorbed

Available dosage forms:

- Amoxi-Tabs® - 50 mg, 100 mg, 150 mg, 200 mg, 400 mg tablets (dogs & cats)
- Amoxi-Drops® - 50 mg/ml oral suspension
- Amoxi-Bol® - 400 mg bolus for use in non-ruminating calves, including veal calves; slaughter withdrawal = 20 days
- Amoxi-Mast® – intramammary infusion 62.5 mg/10 ml syringe; slaughter withdrawal = 12 days milk withdrawal = 60 hours
   - 500 mg, 875 mg tablets
   - 250 mg, 500 mg capsules
   - 125 mg/5 ml, 250 mg/5 ml oral suspension

C. Anti-pseudomonal Penicillins (extended spectrum)

Activity: Similar spectrum to amino-penicillins with additional activity against G- organisms including Pseudomonas aeruginosa
1. Ticarcillin (Ticar®)

Available dosage forms: IM, IV (preferred)
- 3 g/vial (5.2 mEq sodium/g) for injection

D. Potentiated penicillins (β-lactamase inhibitor combos)

1. Amoxicillin-Clavulanate

Activity: β-lactamase producing strains (E. coli, Pasturella sp, Staphylococcus sp, Klebsiella, and Proteus) Clavulanic acid is a competitive suicide inhibitor of most β-lactamases

Indications: for use in dogs and cats for the treatment of urinary tract, skin, and soft tissue infections caused by susceptible organisms. Also indicated for canine periodontal disease due to susceptible strains.

Available dosage forms:
- Clavamox® – 62.5 mg, 125 mg, 250 mg, 375 mg tablets
- 125mg/5 ml, 200mg/5 ml, 250 mg/5 ml, 400 mg/5 ml oral suspension

2. Ticarcillin/Clavulanate (Timentin®)

Available dosage forms: IM/IV
- 3 g/100 ml for injection

II. CEPHALOSPORINS—Bacteriocidal

MOA: Inhibit mucopeptide synthesis in bacterial cell walls

Indications: empiric therapy and treatment of susceptible bacterial infections including respiratory tract infections, otitis media, skin infections, bone infections, genitourinary tract infections, and acute prostatitis; prophylaxis for endocarditis

Side Effects: Rare—decreased appetite, vomiting, diarrhea

Dogs: drooling, increased respiration rate, rash, excitability

Cats: Vomiting, rash, fever (>103°F)

Contraindications: May be cross-reactive with penicillins, avoid if hypersensitive.
Other Info: Cephalosporins resist hydrolysis by penicillinase, may need to be dose adjusted in patients with renal failure

Drug Interactions: Probenicid which may block tubular secretion of cephalosporins and increase serum levels; Use caution when combining with nephrotoxic drugs like Amphotericin B and aminoglycosies (Maybe used in combo for synergy). Chloramphenical may be antagonistic to the activity of these antibiotics.

A. 1st Generation—Cover Gram + organisms (not MRSA or Enterococci), poor G- coverage

1. Cefazolin (Ancef®)—offlabel use in animals; IV, IM, SC
   -Ancef Injections: 500 mg, 1 g, 5 g, 10 g, 20 g vials *Do not mix in same syringe as aminoglycosides

2. Cephalexin—(Keflex®)—offlabel use in animals; PO
   -Keflex: 250 mg, 500 mg caps or tablets
   -Keflex Oral Suspension: 25mg/ml and 50 mg/ml (100 or 200 ml bottles)

3. Cefadroxil (Cefa-Tabs®, Cefa-Drops®, Duracef®) approved for dogs and cats; PO
   -Cefa-Drops: 50 mg/ml oral suspension in 15 or 50 ml dropper;
   -Duri-Cef Oral Suspension 25mg/ml 50mg/ml 100 mg/ml (50 and 100 ml bottles, 100 mg also available in 75 ml bottle)

4. Cephaparin (Cefa-Lak®--for lactating cows only for the treatment of bovine mastitis, Cefa-Dry® for dry cows) (cannot use milk taken from cow until 96 hrs after last dose, cannot slaughter until 4 days after last dose)
   -Cefa-Lak: 200 mg/10 ml syringe (wait 4 days to slaughter and 96 hour milk out) given intramammary
   -Cefa-Dry: 300 mg / 10 ml syringe (not to be used within 30 days of calving) intramammary
B. 2nd Generation – Cover Gram + organisms and expanded G-, may or may not cover anaerobes (bacteroides fragilis—gut bacteria)

1. Cefoxitine (Mefoxin®)—offlabel use in animals; **anaerobes**
   Use with caution with other nephrotoxic drugs, Available IV or IM
   
   -Mefoxin Injectable solution: 1 g/ 50 ml and 2 g/ 50 ml
   
   -Mefoxin Powder: 1, 2, and 10 g vials

C. 3rd Generation—Cover some Gram + organisms (not as well as 1st and 2nd Gen, poor anti-staphylococcal), most G-, may or may not cover pseudomonas; can penetrate the blood brain barrier

1. Ceftiofur (Spectramast LC®, Excede®, Excenel RTU®, Naxcel®) – no slaughter or milk withdrawal time with label use in cattle or sheep, 4 day withdrawal in pigs; SE: Granulocytopenia, thrombocytopenia, diarrhea; and: bovine, sheep, goat respiratory disease, foot rot in cattle, swine bacterial pneumonia, UTI in dogs, some other small animal infections; Not for human use

   -Naxcel: 50 mg/ml (1g and 4 g vials) IM in cattle, swine, sheep, goats, horses; SC in cattle, dogs, day old chicken, turkeys

   -Excede: 200 mg/ml SC middle third of posterior aspect of the ear of beef and non-lactating dairy cattle

   -Spectramast LC: 125 mg/10ml per disposable syringe given intramammary (72 hr milk out)

   -Excenel RTU: 50 mg/ml IM/SC in cattle; IM in swine

2. Ceftazidime (Fortaz®, Tazidime®, Tazicef®, Ceptaz®)—**antipseudomonal**
   Use with caution with other nephrotoxic drugs, Available IV or IM; Exceptionally long t1/2 in reptiles so DOC for G- in them

   -Tazicef: 1 G

3. Cefotaxime (Claforan®)—offlabel use in animals; Monitor for signs and symptoms of anaphylaxis during first dose (CBC + diff), rarely causes neutropenia. Use with caution with other nephrotoxic drugs; IV or IM

   -Claforan: 10 g 1 g/ 5 ml or 1 g/10 ml
4. Ceftriaxone (Rocephin®) Rarely causes neutropenia. Use with caution with other nephrotoxic drugs. Available IV or IM. SE: Granulocytopenia, thrombocytopenia, diarrhea, mild azotemia, biliary sludging. CI: icterus Indication: serious infections not susceptible to other antibiotics or when aminoglycosides are CI or for Borrelia burgdorferi (Lyme’s disease)

- Rocephin (sterile crystalline powder in glass vials and piggyback bottles): 250 mg, 500 mg, 1 g, 2 g vials in boxes of 1 and 10; bulk powder containing 10 g;

- Rocephin (sterile injection of frozen, iso osmotic norpyrogenic solution): 50 ml single dose

- Rocephin: 1 g equivalent with 1.9 g Dextrose hydrous, or 2 g equivalent with 1.2 g dextrose hydrous

5. Cefpodoxime (Simplicef®, Banan®, Biocef®, Vantin® etc) Rarely causes neutropenia. Use with caution with other nephrotoxic drugs. Released in 2005.

- Simplicef: 100 or 200 mg tablets

III. FLUOROQUINOLONES—bacteriocidal

MOA: interfere with bacterial DNA topo-isomerase II

Activity: G- bacilli and cocci (Pseudomonas aeruginosa, Klebsiella sp, E. coli, Enterobacter, Campylobacter, Shigella, Salmonella, Aeromonas, Haemophilus, Proteus, Yersinia, Serratia, Vibrio) other generally susceptible organisms: Chlamydia trachomatis, Staphylococci, Brucella sp, mycoplasma, and Mycobacterium sp.

Adverse effects: Hypersensitivity, GI, CNS stimulation, crystaluria

Contraindications: hypersensitivity, relative CI in young growing animals due to cartilage abnormalities

Caution: hepatic or renal insufficiency, dehydration

Administration: PO preferably on an empty stomach

Interactions: Antacids, sucralfate, and bismuth may inhibit absorption (separate doses by 2 hours); Nitrofurantoin antagonized antimicrobial activity of fluoroquinolones and
concomitant use is not recommended; Probenecid blocks tubular secretion and may increase blood levels and T ½

A. Ciprofloxacin – bioavailability poor in dogs (use enrofloxacin)

- ciprofloxacin could be used as an alternative to enrofloxacin when a larger oral dosage form or intravenous product is desired

- caution in seizure disorders

Available dosage forms:

- 100 mg, 250 mg, 500 mg, 750 mg tablets
- 250 mg/5 ml, 500 mg/5 ml oral suspension
- 10 mg/ml IV

B. Enrofloxacin (Baytril®)

Indications: approved for use in dogs and cats (oral only) for the management of susceptible bacteria. It is also approved for use in cattle (not dairy cattle or veal calves).

- higher doses (>5mg/kg/day) not recommended in cats; may cause blindness

- CI in seizure disorders

Available dosage forms:

Baytril®

- 22.7 mg, 68 mg, 136 mg tablets
- 22.7 mg/ml IM
- 100 mg/ml SC cattle only

C. Marbofloxacin (Zeniquin®)

- CI in seizure disorders
Available dosage forms:

- Zeniquin® - 25 mg, 50 mg, 100 mg, 200 mg tablets

D. Orbifloxacin (Orbax®)

Indications: for use in dogs and cats; may also be of benefit in treating susceptible G- infections in horses

- caution in seizure disorders

Available dosage forms:

- Orbax® - 5.7 mg, 22.7 mg, 68 mg tablets

E. Difloxacin (Dicural®)

Indications: for use in dogs; may be a better choice over other quinolones for dogs with moderate to severe renal failure because it has more extensive hepatobiliary excretion and may be less likely to accumulate to toxic levels.

- labeled for once daily administration

- caution in seizure disorders

Available dosage forms:

- Dicural® - 11.4 mg, 45.5 mg, 136 mg tablets

F. Danofloxacin (A180®)

Indications: treatment of BRD (bovine respiratory disease) associated with Mannheimia (pasteurella) haemolytica and pasteurella multocida

- not intended for dairy cattle; do not use in calves to be processed for veal
- animals must not be slaughtered with in 4 days from last treatment (withdrawal time has not been established)

Available dosage forms:

- A180® - 180 mg/ml SC (max 15 ml per site)
IV. TETRACYCLINES—Broad-spectrum bacteriostatic, effective against rickettsia, spirochetes, mycoplasma, and Chlamydia

**MOA:** bind at the 30s ribosome interfering with the binding of tRNA

**Adverse effects:** GI distress, photosensitivity, staining of developing teeth and bones, superinfections

**CI:** Hypersensitivity, pregnancy

**Caution:** liver, renal insufficiency

**Administration:** empty stomach preferred, if stomach upset occurs small amount of food may help

**Interactions:** antacids and iron products ↓ absorption of TCNs; may interfere with cidal activity of penicillins, cephalosporins, and aminoglycosides (controversial); may depress plasma prothrombin activity

A. Doxycycline

   Indications: reasonable to use in small animals when tetracycline is indicated

   - may be used in renal insufficiency

   - do not dry pill cats with oral doxycycline: follow with at least 6 ml of water or use a compounded slurry

   Available dosage forms:

   - Doxirobe® - 8.5% gel for oral application for the prevention and treatment of periodontal disease in dogs

   - 50 mg, 100 mg capsules

   - 50 mg, 100 mg tablets

   - 5 mg/ml oral suspension

   - 10 mg/ml for injection (do not use in horses)

B. Tetracycline

   - cats do not tolerate well (anorexia), horses may break with severe diarrhea
Available dosage forms:

- **Panmycin Aquadrops®** - 100 mg/ml liquid

- 5-way Calf Scour Bolus® - 500 mg oral bolus; slaughter withdrawal = 14 days

- **Panmycin 500®** - 500 mg oral bolus; approved for use in calves; slaughter withdrawal = 12 days

- 100 mg, 250 mg, 500 mg capsules

- 25 mg/ml oral suspension

C. **Oxytetracycline**

Indications: for use calves, non-lactating dairy cattle, beef cattle, swine, fish, and poultry; can be used in dogs and cats but no known products are being marketed

- cats do not tolerate well, horses may break with severe diarrhea

Available dosage forms:

- Terramycin® - 102.4 g/packet for use in drinking water only

- **Terramycin® Scours Tablets** - 250 mg bolus for non-lactating dairy and beef cattle; slaughter withdrawal = 7 days

- **Terramycin® Ophthalmic Ointment**

- Tetradure® - 300 mg/ml; can use in pre-ruminating veal calves and swine; slaughter withdrawal = 28 days

- Agrimycin® - 100 mg/ml IV; slaughter withdrawal = 22 days

- Luquamycin LA-200® - 200 mg/ml; slaughter withdrawal = 28 days; milk withdrawal = 96 hours; SC cattle; IM swine; rapid IV admin can cause animal collapse, give over at least 5 minutes
V. MACROLIDES—bacteriostatic, derived from Streptomyces bacteria, macrocyclic lactone chemical structure; have shown effective against mycoplasma, mycobacteria, some rickettsia and chlamydia.

**MOA:** inhibition of bacterial protein synthesis by binding reversibly to the subunit 50S of the bacterial ribosome, thereby inhibiting translocation of peptidyl-tRNA and bond formation

**Indications:** broad spectrum for wounds, abscesses and osteomyelitis caused by staphylococcus aureus in dogs and cats; maybe used in protozoal infection including toxoplasmosis; Erythromycin approved for dogs, cat, swine, sheep, and cattle.

**Side Effects:** Gastroenteritis (emesis, diarrhea +/- blood), pain at IM injection site

**Contraindications:** Hypersensitivity; Do not give with cisapride.

**Drug Interactions:** Use with caution with other neuromuscular blocking agents; Kaolin may decrease absorption of Lincomycin. May increase cyclosporine and digoxin levels.

**Other Info:** Use caution in liver or renal function, may need dose adjustment; May increase LFTs

A. Clindamycin (Antirobe®, Clinbiotic®, Clintabs®, Clinda-Guard®, Cleocin®)
   Do not use in Horses, Rodents, Ruminants, or Lagomorphs.
   - Anitrobe: 25 mg, 75 mg, 150 mg capsules
   - Antirobe-Aquadrops, Clindadrops: 25 mg/ml (20 ml bottle)
   - Cleocin (non-vet) PO: 75 mg, 150 mg, and 300 mg capsules
   - Cleocin (non vet) SC: 150 mg/ml (2, 4, and 6 ml vials)
   - Cleocin (non vet) SC: bulk powder in 60 ml vials

B. Erythromycin (Gallimycin®, Uddermate®, Ery-Tab®, E-Mycin®)
   Do not use in rabbits, gerbils, guinea pigs and hamster. Do not use orally in ruminants or adult horses due to severe diarrhea. SE: Thrombophlebitis, hyperthermia (foals)
   **DOC with rifampin for C (Rhodococcus) equi infections in foals; No vet approved products**
   - Ery-Tab (delayed release): 250 mg, 333 mg and 500 mg tablets
   - Ilosone Liquid Oral Suspension: 25 mg/ml and 50 mg/ml (100 ml and 480 ml bottles)
- Ilosone Pulvules or Tablets: 250 mg and 500 mg capsules or tablets
- EES: 200 (125 mg base) and 400 (250 mg base) mg tablets
- EES Liquid & Ery-Ped Drops & Pediazole Suspension: 80 mg/ml (50 mg base)
- Erythromycin stearate filmtabs: 250 and 500 mg tablets

C. Lincomycin (Lincocin®, Lincomix®)—SE: rapid IV administration can cause hypotension and cardiopulmonary arrest; Do not use in Horses, Rodents, Ruminants, or Lagomorphs.

- Lincocin: 100, 200 and 500 mg tablets
- Lincocin Aquadrops Liquid: 50 mg/ml (20 ml dropper)
- Lincocin Sterile Solution: 100 mg/ml (20 ml vial) sterile inj for SC, IM,

D. Azithromycin (Zithromax®)—less GI effects than other macrolides; CI: concurrent use with pimozide

E. Tylosin (Tylan®) not for human use; Avoid in horses. SE: edema of rectal mucosa and mild anal protrusion with pruritis, erythema, and diarrhea in swine;

F. Tulathromycin (Draxxin®) nor for human use; SQ for Cattle and IM for Swine;

VI. AMINOGLYCOSIDES—bacteriocidal, active against G- aerobic bacilli

MOA: ↓ translation of mRNA and stop protein synthesis

Adverse effects: nephrotoxicity, ototoxicity (use with caution in “working” dogs), neuromuscular blockade (cats may be more sensitive to toxic effects). Risk factors for toxicity include preexisting renal disease, age (neonatal and geriatric), fever, sepsis, and dehydration.

Interactions: use caution with other nephrotoxic, ototoxic, and neurotoxic drugs including: aminoglycosides, acyclovir, bacitracin (parenteral), cisplatin, methoxyflurane, polymyxin B, vancomycin; Concurrent use with loop (furosemide) or osmotic (mannitol) diuretics may increase nephrotoxic potential

Monitoring: Therapeutic drug monitoring is highly recommended when using this drug systemically. Attempt to draw samples at 1, 2, and 4 hours post does. Peak level should be at least 40 mcg/ml and the 4-hour sample less than 10mcg/ml. Pre-therapy renal function tests and urinalysis (repeated during therapy) are recommended.
A. Amikacin

Indications: Parenteral use is only approved in dogs; intrauterine infusion is approved in mares

Available dosage forms:
- 50 mg/ml, 250 mg/ml IM/SC
- 250 mg/ml intrauterine solution

B. Gentamicin

Indications: approved for use in dogs, cats, chickens, turkeys, and swine. Use in horses is only approved for intrauterine infusion

Available dosage forms:
- Garacin® Piglet Injection - 5 mg/ml approved for use in piglets up to 3 days of age; slaughter withdrawal = 40 days
- Garacin® Oral Solution - 5 mg/ml approved for use in swine; slaughter withdrawal = 3 days
- 50 mg/ml, 100 mg/ml (only for intrauterine use in horses); approved for use in dogs, cats, and horses not for food

C. Tobramycin

Indications: no approved veterinary tobramycin products in the US, may be useful clinically to treat serious G- infections in most species

Available dosage forms:
- 10 mg/ml, 40 mg/ml for injection
- ophthalmic solution

VII. POTENTIATED SULFAS

MOA: Sulfonamides compete with PABA for incorporation into dihydrofolate while trimethoprim/ormetoprim inhibit the enzyme responsible for converting DHF to tetrahydrofolic acid preventing the formation of folic acid.

Adverse effects: GI, hypersensitivity, hematologic effects, local injection site reaction, teratogenic (risk vs. benefit)
Dogs – keratoconjunctivitis sicca, hypersensitivity acute neutrophilic hepatitis with icterus, vomiting, anorexia, diarrhea, fever, hemolytic anemia, urticaria, polyarthritis, facial swelling, polydipsia, crystaluria, hematuria, polyuria, cholestasis, hypothyroidism, anemias, agranulocytosis, idiosyncratic hepatic necrosis

Cats – anorexia, crystaluria, hematuria, leukopenias, anemias

Horses – transient pruritic

**CI:** hypersensitivity to sulfas, thiazides, or sulfonylureas; severe renal or hepatic impairment

**Caution:** diminished renal or hepatic function, or urinary obstruction or urolithiasis

**Interactions:** may prolong clotting times; antacids ↓ bioavailability

**Monitoring:** thyroid function test should be considered (particularly in dogs) at baseline and ongoing if receiving long term treatment.

**Administration:** Animals must be allowed free access to water and must not become dehydrated during therapy.

A. Trimethoprim/sulfamethoxazole (human use product used by many veterinarians)

   Available dosage forms:
   - SMX 400 mg/TMP 80 mg, SMZ 800 mg/TMP 160 mg tablets
   - SMX 200 mg/ TMP 40 mg per 5 ml oral suspension
   - SMX 80 mg/TMP 16 mg per 5 ml for injection

B. Trimethoprim/sulfadiazine (veterinary product approved for use in dogs, cats, and horses)

   Available dosage forms:
   - Tribrissen® - TMP 5 mg/ SDZ 25 mg, 20/100, 80/400, 160/800 tablets; approved for use in dogs
   - Tribrissen® 400 Oral Paste – TMP 67 mg/ SDZ 333 mg; approved for use in horses not intended for food
- Tribrissen® 48% Injection - 48%/100 ml vials for injection – approved for use in horses not intended for food

C. Sulfamethazine

Available dosage forms:

- Calf Bolus® - 8.02 g/bolus
- Sulfam Max III – 32.1 g/bolus
- Sustain III – 32.1 g/bolus

D. Sulfadimethoxine (Albon®)

Indications:

Dogs and cats: for respiratory, genitourinary, enteric and soft tissue infections caused by susceptible organisms.

Horses: for the treatment of respiratory infections caused by Streptococcus equi.

Cattle: for shipping fever complex, calf diphtheria, bacterial pneumonia and foot rot caused by susceptible organisms.

Poultry: added to drinking water to treat coccidiosis, fowl cholera, and infectious coryza

Available dosage forms:

Albon®

- 400 mg/ml IV – slaughter withdrawal 5 days, milk withdrawal 60 hours
- 125 mg, 250 mg, 500 mg tablets; approved for use in dogs and cats
- 50 mg/ml oral suspension

- 5 g, 15g oral boluses; approved for use in cattle; slaughter withdrawal = 7 days, milk withdrawal = 60 hours; not to be used in calves to be processed for veal; no withdrawal time has been established for pre-ruminating calves

- 12.5g sustained release oral bolus; approved for use in non-lactating cattle; slaughter withdrawal = 21 days; not to be used in calves to be processed for veal; no withdrawal time has been established for pre-ruminating calves
- 94.6g/packet soluble powder for addition to drinking water; approved for use in dairy calves, dairy heifers, beef cattle, broiler and replacement chickens only, and meat-producing turkeys; slaughter withdrawal = 7 days (cattle); 5 days (poultry- do not use in chickens over 16 weeks old or in turkeys over 24 weeks old)

E. Sulfadimethoxine-ormetoprim(Primor®)

Indications: treatment of skin and soft tissue infections in dogs caused by susceptible strains of Staphylococcus aureus and E. coli.

Available dosage forms:

- Primor® - 100/20, 200/40, 500/100, 1000/200 tablets; approved for use in dogs

VIII. CARBAPENEMS—Bacterocidal, broad spectrum, reserved for more serious infections

MOA: Inhibition of cell wall synthesis by binding PCBs

Side Effects: GI effects, CNS toxicity pruritis thrombophlebitis, rarely transient increase in BUN and sCR, and LFTs, hypotension or tachycardia

Indications: small animals and equine for serious or resistant infections

Contraindications: Avoid in head trauma and patients with seizure and other CNS disorders

Drug Interactions: Synergy with aminoglycosides, antagonism with other beta lactam antibiotics; Synergy with Trim/Sulfa against Nocardia asteroids; antagonism with chloramphenicol

Other Info: Dose adjust in renal disease

A. Imipenem-Cilastatin (Imipem®, Primaxin®,)

-Primaxin (non-vet): 250 mg and 500 mg sterile vials for IV injection
IX. MISCELLANEOUS ANTIBIOTICS

A. Chloramphenicol (Amphicol®, Duricol®, Viceton®)—broad spectrum

-Chloramphenicol Sterile Solution for IV: 100 mg/ml (Freeze dried must reconstitute) Available in packs of 10 vials; Preservative Free.

-Chloramphenicol tablets: 250 mg, 500 mg, 1 g

MOA: binds at the 50s ribosomal subunit, preventing protein synthesis

Side Effects: GI, myelosuppression (chloramphenicol appears to have an affinity for mitochondrial ribosomes of rapidly proliferating cells thus bone marrow suppression)

Indications: small animals and horses for anaerobic bacteria, etc.

Contraindications: food animals; avoid in pregnancy, neonates, hepatic or renal failure (cats), preexisting hematologic disorders, IV use in cardiac patients

Drug Interactions: Inhibits metabolism of phenytoin, primidone, phenobarbital, pentobarbital, and cyclophosphamide. Use with caution with other myelosuppressive drugs. Chloramphenicol may antagonize the bacteriocidal activity of penicillins or aminoglycosides. Rifampin may decrease chloramphenicol levels. Macrolide antibiotics may antagonize the activity of chloramphenicol or vice versa.

Other Info: Humans working with chloramphenicol should handle with care due to risk of fatal aplastic anemia. Do not inhale powder.

B. Rifampin (Rifadin®, Rimactane®)—bacteriocidal, anti-tuberculosis drug (covers rhodococcus, mycobacteria, and staphylococci) with activity against some fungi and viruses

-Rimactane: 150 and 300 mg capsules; 600 mg rifampin for IV injection in glass vials

-Rifadin: 150 and 300 mg capsules; 600 mg rifampin for IV injection in glass vials

MOA: inhibits DNA-dependent RNA polymerase thus suppressing the initiation of chain formation for RNA synthesis

Side Effects: Rash, GI distress, increased liver enzymes

Indications: treatment of Rhodococcus equi usually with erythromycin in young horses, proliferative enteropathy from Lawsonia intracellularisin foals, and in small animals may
be combined with antifungals to treat histoplasmosis or aspergillosis with CNS involvement

**Contraindications:** hypersensitivity; use caution in liver disease

**Drug Interactions:** hepatic enzyme inducer decreases propranolol, quinidine, dapsone, chloramphenicol, corticosteroids, warfarin, benzodiazepines, barbiturates, ketoconazole; Do not give with fluoroquinolones as antagonism has been reported.

**Other Info:** Do not use alone to prevent resistance. May cause red/orange urine, tears, and sweat.

C. *Nitrofurantoin (Macrodantin®, Macrobid®, Furadantin®)—bacteriostatic; activity against several G- and G+ including E. coli, Staph aureus and epidermidis, Enterobacter, Citrobacter, Salmonella, Shigella, and Corynebacterium.*

- Macrodantin: 25, 50, 100 mg capsules
- Macrobid: 100 mg capsule
- Furadantin: 50 and 100 mg tablets, 25 mg/ml suspension

**MOA:** inhibits various bacterial enzyme systems including acetyl coenzyme

**Side Effects:** GI disturbances, hepatopathy, infertility in males or peripheral neuropathy; potentially teratogenic, potentially toxic in neonates

**Indications:** UTIs primarily in small animals but occasionally in horses (not effective in treating renal cortical or perinephric abscesses or other systemic infections)

**Contraindications:** hypersensitivity, renal impairment

**Drug Interactions:** Sulfinpyrazone or probenecid may inhibit renal excretion of nitrofurantoin and increase risk for toxicity. Antacids may decrease absorption. Food and anticholinergic may increase absorption.

**Other Info:** Works best in acidic environments

D. *Aztreonam (Azactam)—Bacteriocidal, covers G-  
- Azactam (sterile injection): Single dose 15 ml vials: 500 mg/vial, 1 g/vial, 2 g/vial,
- Azactam Single dose 100 ml IV infusion bottle: 1 g/vial or 2 g/vial
- Azactam frozen 50 ml single dose IV infusion sol: 1 g/50 ml, 2 g/50 ml*
**MOA:** interacts with penicillin binding proteins and induces the formation of long filamentous bacteria

**Side Effects:** hematologic problems, GI upset (may include GI bleeding or pseudomembranous colitis), toxic epidermal necrolysis, rash, pruritis, hypotension, transient ECG changes (PVCs and ventricular bigeminy), wheezing, dyspnea, hepatitis, seizures, dizziness, insomnia, muscle aches, sneezing, mouth ulcers, etc.

**Indications:** GI infections including UTI, pyelonephritis, Respiratory tract infections including pneumonia and bronchitis, Septicemia, Skin infections, and Intraabdominal infections, Surgery and post-Surgery prophylaxis

**Contraindications:** hypersensitivity

**Other Info:** maybe cross-reactive with other β-lactam antibiotics, synergistic with aminoglycosides, test for susceptibility, β-lactamase resistant, monobactam