



NZVA
New Zealand Veterinary Association

Guidelines for the clinical use of antimicrobial agents in the treatment of **dogs and cats**





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Introduction

These guidelines are based on:

1. Guidelines for antimicrobial use in the treatment of dogs and cats compiled on commission from the Board of the Swedish Veterinary Society. The General Assembly of the Swedish Veterinary Association adopted these as their policy in October 2002.
2. The FECAVA (Federation of European Companion Animal Veterinary Associations) guidelines, October 2014.
3. Consultation with New Zealand veterinary specialists to combine the data from the above documents and adapt them for New Zealand conditions and diseases.

The intention is that this policy should be used as a general guide when choosing treatment for dogs and cats. This can sometimes mean either to refrain from treatment altogether or alternatively to choose a treatment that does not include antibiotics. The main aim is that the chosen treatments are as effective as possible and that any undesirable side effects are kept to a minimum.

The policy can be used both for clinical practice, as well as for educational purposes.

The document is divided into four main parts:

1. Antimicrobial policy.
2. The perioperative use of antibiotics.
3. Guidelines for treatment based on disease-oriented treatment.
4. General information concerning antimicrobial alternatives.

The main document is designed as a reference document with a summary in wall chart form to be utilised in consultation rooms and surgeries.

Note: The tables shown provide examples and should not be considered to be comprehensive. Regional data on resistance have to be taken into consideration. Use an antibiotic with known bioavailability at target site, and use as narrow spectrum a drug as possible.

Definitions

Antibiotic – a medicine that kills bacteria or inhibits their growth in the body. It includes natural substances (e.g. penicillin), semisynthetic substances (e.g. ampicillin) and totally synthetic substances (e.g. enrofloxacin).

Antiseptic – a chemical that has a non-selective effect on microbes and is safe enough to apply topically to animals.

Antimicrobial – a drug, chemical, or other substance that either kills or slows the growth of microbes. Substances that are considered antimicrobials include surface disinfectants, antibiotics, parasiticides, anti-fungal and anti-viral agents (MPI definition).

Acknowledgments

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1. Antimicrobial policy

One of the largest threats to public and animal health is the increase in antibiotic resistance. Bacterial resistance genes can be transferred between animals and humans and thus, the benefits of their use in animals must be weighed against the risk to public health.

Resistance development can be reduced by the responsible use of antimicrobials, good hygiene, and active infection control. Active advice to animal owners on, for example, hygiene and vaccination also plays an important part.

The objective of this document has been to produce a guide that can be used when deciding upon a course of treatment and it is written for current New Zealand conditions and practices. Sometimes the right choice can be to refrain from antimicrobial therapy altogether and instead to simply wait and see, or alternatively choose another treatment.

Antibiotic treatment is normally only indicated if:

- there is bacterial infection

OR

- there is sufficient reason to suspect that a bacterial infection is present

and

- the infection is not likely to resolve without antibiotic therapy.

Measures to prevent infection should be used where possible and if there is a non-antibiotic treatment which is likely to be effective, this should be used in preference to antibiotics.

Antibiotics prescribed “just in case” there is a bacterial infection is never acceptable. Prophylactic antibiotic treatment can be justified in a few specific surgical procedures, where the risk for bacterial infection is high or where an infection can drastically worsen the prognosis. Prophylactic use of antibiotics should never be used to cover for poor hygiene.

Lifelong antibiotic treatment of chronic or continually recurring conditions is not compatible with good veterinary practice. This also applies to prolonged treatments with a low dose (less than the therapeutic dose) or so-called pulse dosing.

When possible, the infectious agent should be cultured and identified. This is especially important in cases of therapeutic failure, relapse, and when antimicrobial resistance is suspected. Samples should always be taken from postoperative infections.

The risk of antibiotic resistance should always be considered when choosing an antibiotic. This means that the drug and the route of administration should be chosen so that the animal's normal flora is affected as little as possible (narrow-spectrum

antibiotics). Local treatment should be used where possible. Any effect on the normal flora can also be minimised if the course of treatment is kept as short as possible.

Drugs of last resort for serious infections in people should not be used in animals. Third or fourth generation cephalosporins should only be used in situations where their use is considered of the utmost importance to the animal's welfare, and where there is a sound basis to suspect that other treatments will not work.

Core principles

1. Consider the impact of antibiotic use on the animal, its owner and other people, and the environment.
2. Animals should receive antibiotics only when there is a susceptible bacterial infection, antibiotics are required to maintain their health and welfare, and when no other treatment will work.
3. When antibiotics are used, dose rates and regimes should be designed for maximal efficacy and to limit re-treatment.
4. There are antibiotics considered so important in human medicine that they should not be used as first line treatment, and only used where no other treatment will work.
5. There will be a reduction in selection pressure for antimicrobial resistance if a smaller total amount of antibiotics are used in veterinary and human medicine.

Antibiotic classification

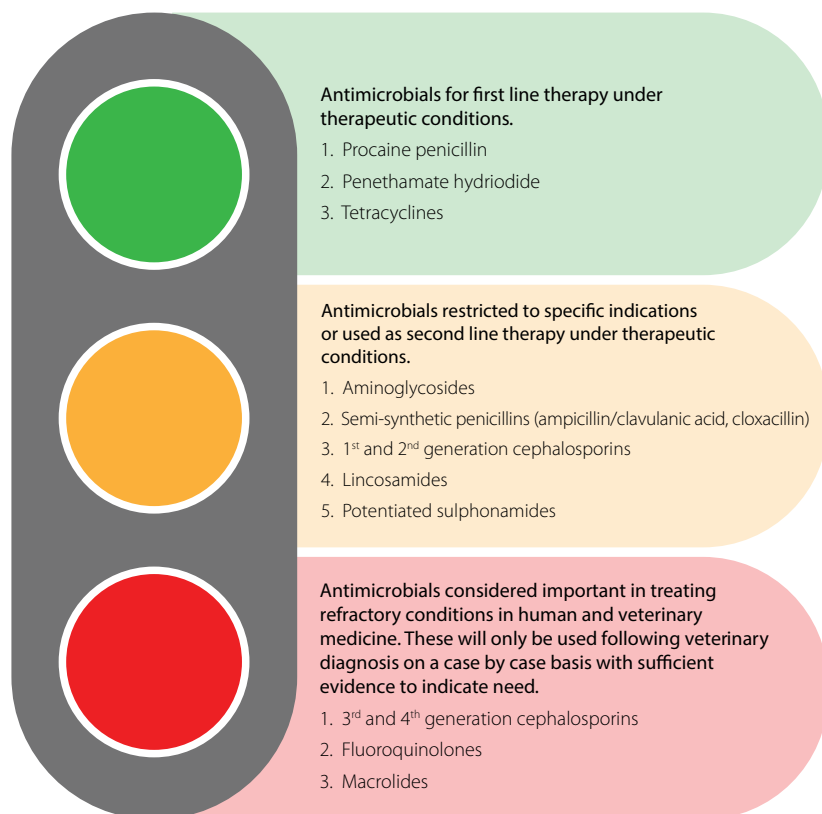
General guidelines classifying antimicrobials according to a three tier (traffic light) system is an example of a type of system that might be employed.

Culture and sensitivity testing should be used to guide the choice of drugs whenever possible.

Note: First line therapy represents the first choice for empirical therapy.

Narrow-spectrum antibiotics should be used in preference to broad-spectrum drugs when possible.

Topical therapy should be used in preference to systemic therapy whenever appropriate.



The 5 R's

Veterinary practices should have an antibiotic stewardship plan that covers:

Reduction

Reduction in antibiotic use is achieved by:

1. Preventative measures such as vaccination.
2. Avoiding use where there is no bacterial infection, for example, in uncomplicated viral infection.
3. Use of topical/local antimicrobials in preference to systemic delivery.
4. Avoidance of prophylactic antibiotic usage unless justified (see below).

Refinement

Continuously evaluate prescribing practices and therapeutic plans, based on:

1. Response to treatment
2. Previous similar cases
3. Published clinical studies
4. Local and published resistance data

Replacement

Selection pressure can be reduced by using non-antimicrobial alternatives where there is evidence of efficacy.

Responsibility

The success of a stewardship plan requires engagement, understanding, and personal responsibility of people at all levels involved in the prescription, treatment, and management of animals.

Engagement will be achieved through:

1. Positioning of the program and a clear description of the justification to all involved.
2. Ensuring understanding of the core principles not just the operational procedures.
3. Encouragement of 'upward leadership' – empowerment of team members to contribute to success of the plan, to bring new ideas and innovation, and to refine the processes.

Review

A stewardship plan is a 'living document' and will be subject to periodic (at least annual) review to ensure objectives are met.

1. Animal health and welfare outcomes remain top priority and monitored to ensure they are achieved.
2. Audit of compliance should be undertaken internally and by independent bodies.
3. Reduction and replacement strategies should be monitored through measurement of animal daily doses (ADD) used.
4. Susceptibility surveillance should be undertaken as appropriate to ensure appropriate selection of antimicrobials, maximise efficacy and monitor resistance in target pathogens.
5. Investigation of strategies that can be employed to improve stewardship of antimicrobials within the practice should occur on an on-going basis.

2. The perioperative use of antibiotics

Antibiotics should never be used as a substitute for asepsis. A whole series of measures to maintain sterility must be taken pre-, intra- and postoperatively with regards to the handling of the patient, hygiene routines for both the premises and equipment, as well as surgical asepsis and technique in order to reduce the risk of postoperative wound infections.

- Prophylactic antibiotics are not indicated for clean wounds.
- In clean-contaminated wounds, the use of prophylactic antibiotics can be justified if the operation is estimated to last more than two hours.
- Contaminated wounds should be flushed with sterile saline: this may be all that is required to prevent infection in fresh wounds. In older wounds, antibiotics may be justified.
- Dirty wounds presuppose that the surgical area is already infected at the time of operation and antibiotics should be given.

Indications for antimicrobial prophylaxis

The indications for antimicrobial prophylaxis in small animal surgery are few. Antibiotics should only be prescribed where there is a high risk of surgical complications or where the consequences of an infection are likely to be catastrophic, such as in the case of hip joint prosthetic surgery. Operations that are expected to be lengthy or surgical procedures performed on high-risk patients are also situations where antibiotics can be justified.

The use of surgical implants, such as plates, screws or pins in the case of fractures, corrective surgery, TPLO or TTA, are not in themselves indications for prophylactic antibiotics. Antibiotics should also not be prescribed in connection with arthroscopy, laparoscopy or thoracoscopy. Dental treatments, such as tartar removal, oral sanitation or tooth resection, should not be performed at the same time as other surgical procedures due to the risk of haematogenous dissemination of bacteria from the mouth to the surgical area.

Some examples of operations and/or conditions where antibiotic prophylaxis can be justified:

- Extensive operations in the gastrointestinal tract such as resections.
- Bile duct surgery with a pre-existing infection in the biliary tracts.
- Extirpation of a lung lobe with a pre-existing infection in the airways.
- Cemented hip joint and other joint replacements.
- A complicated fracture operation with extensive soft tissue trauma.
- An operation on a high-risk and immunocompromised patient or on a patient with a generalised skin infection.

Antibiotics should be administered at least 30 but not more than 60 minutes prior to incision, i.e. with the induction of anaesthesia. Intravenous administration is the preferred route as intramuscular or subcutaneous administration results in more uncertain serum concentrations, and they should not be given by mouth. Numerous human studies have shown that the risk of infection is not reduced if antibiotic prophylaxis is started after the operation has been completed. Human studies also show that there is no further prophylactic effect if treatment is continued following the operation's conclusion, but that extended treatment increases the risk of side effects and the development of bacterial resistance.

Recommended drugs: benzylpenicillin sodium 10mg/kg iv every one to two hours throughout the operation or cephazolin 20mg/kg iv every one to two hours throughout the operation.

If a post-operative infection occurs, it must be sampled for culture and sensitivity testing and treated accordingly.

3. Guidelines for treatment

Skin

Skin is always colonised by bacteria, but infection is usually an indication of underlying disease. Successful treatment of skin infections usually requires ancillary treatment for the underlying disease, e.g. ectoparasites or hypersensitivity. Many, if not most, cases of skin infection in dogs and cats are the result of hypersensitivity (e.g. atopic dermatitis) and antimicrobial drugs alone rarely work, particularly in the long term. This is especially true for suppurative otitis externa caused by bacteria such as *Pseudomonas* spp, which rapidly develop resistance over the course of treatment. As the condition is likely to recur, this makes subsequent treatment difficult. The hypersensitivity should be appropriately managed.

The most common skin pathogen in dogs is *Staphylococcus pseudintermedius*, usually coagulase positive, and frequently penicillinase producing. Narrow spectrum drugs are best. Superficial infections are better treated with antiseptic washes (chlorhexidine or povidone iodine).

Culture samples with the determination of bacterial resistance should be taken from:

1. Pyodermas that do not respond to treatment (when there is a poor response to antibiotic therapy at the 10–14 day follow-up examination).
2. Recurring pyodermas.
3. Deep pyodermas.

Clipping in pyoderma

Clipping is trauma and exacerbates the cellulitis associated with deep pyoderma. Clipping is best performed after one week of antibiotic therapy because it is less traumatic and can often be achieved with scissors rather than clippers and without general anaesthesia.

Pulse antibiotics in idiopathic recurrent pyoderma.

Pulse therapy is indicated when all of the following criteria are met:






















1. Where no underlying disease can be found and addressed (with repeat investigations at least annually).
2. Where topical biocides are ineffective in terms of prevention.
3. Where the use of antibiotics in this manner is effective i.e. no clinical signs arise during such treatment.
4. Where pulse antibiotic therapy results in fewer antibiotic treatment days in a year than would be otherwise be required – treating new episodes of pyoderma as clinical signs arose.

However this technique is better suited to referral centres and should not be used in primary practice.

Cat bite abscesses require drainage, copious irrigation, and debridement of necrotic tissue. If the cat has been recently bitten but an abscess has not yet formed, a single injection of procaine penicillin is likely to be sufficient. Culture and sensitivity is recommended for non-resolving cases. Third generation cephalosporins e.g. cefovecin, should NOT be used for cat bite abscesses.

In uncomplicated otitis externa, topical treatment should be based on a cytological evaluation of the discharge. The ear should be cleaned and dried, and possibly acidified (with a proprietary acidic cleaning solution or dilute vinegar) to discourage *Pseudomonas*. Broad spectrum (including antifungal and antiparasitic) ear drops can be used: Many drugs are potentially toxic in the middle ear and in a significant number of cases the tympanic membrane cannot be visualised so care needs to be taken if rupture of the tympanic membrane is suspected. Recurring otitis must be properly investigated.

Ready reference table for skin antibiotic therapy

Body system	Skin					Ears
Common conditions	Surface pyoderma (microbial overgrowth, fold pyoderma, acute moist dermatitis)	Superficial pyoderma (bacterial folliculitis, impetigo)	Deep pyoderma (furunculosis, cellulitis)	Wound/soft tissue infection	Cat bite abscesses	Otitis externa
Cytology and culture	 from impression smears, tape strips	 +  from pustule (if possible)	 +  following biopsy or by aspiration (not from surface exudate)	 impression smears +  for surveillance of surgical site infections or if complications/suspicion of multi-resistant bacteria (e.g. MRSP, MRSA, ESBL)	 + 	 of ear swabs obtained after preliminary cleaning +  not relevant due to topical therapy
Likely pathogen	Staphylococcus pseudintermedius (Malassezia sometimes involved)	Staphylococcus pseudintermedius	Staphylococcus pseudintermedius	Variable	Variable	Cocci (mainly Staphylococcus pseudintermedius), rods (mainly Pseudomonas), and/or yeasts, (Malassezia)
Empirical anti-microbial choice		Clindamycin or Cephalexin or TMPS	Cephalexin while  Pending	Cleansing and debridement coupled with modern wound dressings are often sufficient Systemic therapy based on  may be indicated in severe tissue damage and/or fever	 Amoxicillin when indicated	Antiseptics often sufficient Topical treatment e.g. cocci use fusidic acid, rods use polymyxin B, yeasts use miconazole
Remarks on therapy	Topical therapy with antimicrobial shampoos, lotions, spray gels, creams etc	Therapy alone (e.g. chlorhexidine) if infection is mild. Treat for seven days beyond clinical resolution	Always combine with topical therapy (e.g. chlorhexidine shampoo). Treat for two weeks beyond clinical resolution R if persistent	Topical antimicrobials are usually not recommended with granulating wounds If as above always take sample after wound cleaning	 Drainage, copious irrigation, and debridement of necrotic tissue Third generation cephalosporins e.g. cefovecin, should NOT be used for cat bite abscesses	Prior cleansing is essential Use gluco-corticoid to reduce swelling and inflammation Underlying causes must be investigated and resolved Systemic therapy is not relevant
Reference key	 Cytology	 Culture and antimicrobial susceptibility test	 Hospitalisation recommended	 Antimicrobial therapy not indicated	 Surgery	R Consider referral to specialist

The urinary tract

Urinary tract infections are usually caused by coliforms, but G+ bacteria are also reasonably common. Uncomplicated cystitis in female dogs should probably be treated for seven days, although there should be improvement in hours and clinical resolution in three days. A single large dose of antibiotic may even be sufficient. If there is some predisposing factor for cystitis, all that long courses of antibiotics do is to ensure that resistant bacteria develop. If there is no improvement in three days, the animal should be reexamined and the diagnosis confirmed. A culture and sensitivity is strongly recommended. Cystitis in cats is very rarely caused by bacteria: antibiotics that should not be used without prior culture and sensitivity testing include third generation cephalosporins, fluoroquinolones and amoxicillin/clavulanic acid.











The concentration and activity of an antibiotic in urine varies according to the pH. Although urinary pH can be altered to suit the chosen antimicrobial drug, it is more sensible to consider the activity / pH spectrum of the drugs available, and to choose a drug which is active in the conditions to be found. Remember, though, that as an infection is controlled, the pH of the urine may alter. Drugs with optimum activity in acidic urine are themselves acids or neutral: penicillins, tetracyclines, nitrofurantoin, hexamine. Drugs active in alkaline urine are themselves bases or neutral: erythromycin, aminoglycosides. Drugs relatively unaffected by pH: cephalosporins, sulphonamides, chloramphenicol, fluoroquinolones.

Many antimicrobial drugs are concentrated in the urine, particularly β -lactams, so in vitro resistance does not necessarily indicate that the drug will not be effective in vivo. Ensure that sensitivity testing is carried out at concentrations of antimicrobial drugs relevant to urinary tract concentrations of drug in vivo.

In male dogs the prostate is usually involved and four to five weeks of treatment may be required. Penetration of the drug to the site of the infection is a major problem. Normal prostatic fluid has a pH of about 6.4, so weak bases penetrate best. This is important in chronic prostatitis – in acute cases the barrier is usually broken down by inflammation. Castration or an antiandrogen such as delmadinone are usual adjuncts to antibiotics for prostatitis.

Pyometra arises due to an interaction between the progesterone-affected endometrium and commensal flora. E.coli is the dominant bacterium in both dogs and cats. The treatment that gives the most reliable results is an ovariohysterectomy. Unless the animal is seriously systemically ill, antibiotics are not indicated. If medical treatment with aglepristone is used, antibiotics effective against G- bacteria should probably be included.

Ready reference table for urogenital antibiotic therapy

Body system	Urogenital		
Common conditions	Upper urinary tract infection (pyelo-nephritis)	Lower urinary tract infection	Pyometra
Cytology and culture	  + of urine (collected by cystocentesis)	  + if recurrent infection (urine collected cystocentesis)	Usually not indicated (unless rupture, see peritonitis)
Likely pathogen	Escherichia coli	Escherichia coli	Escherichia coli
Empirical anti-microbial choice	Amoxicillin-clav or fluoro-quinolones while  pending If signs of systemic infection see sepsis	Amoxicillin or TMPS while  pending	
Remarks on therapy	 amoxicillin-clav three times daily	Amoxicillin three times daily	  In severe* cases use fluoroquinolones Medical treatment (occasional, not recommender) four to five days fluoroquinolones (or TMPS) and e.g. alepristone

Reference key						R
	Cytology	Culture and antimicrobial susceptibility test	Hospitalisation recommended	Antimicrobial therapy not indicated	Surgery	Consider referral to specialist









The respiratory system

The upper respiratory tract is frequently infected with viral pathogens. Elimination of normal flora by antibiotics can make the disease better or worse. Therefore, although culture and isolation is complicated by an abundant commensal population, it is very important to make a diagnosis. Purulent discharge is not pathognomonic for bacterial infection. Antibiotics are probably not indicated in the majority of upper respiratory tract infections in any species. Chronic

rhinitis in dogs requires a thorough investigation and empirical antibiotic therapy has no place.

Bacterial infections of the lower respiratory tract are relatively rare. Usually the bacteria concerned are aerobes and approximately two thirds are G-. Except in the case of aspiration pneumonia, pure infections are common. Therefore, culture and sensitivity testing is usually required.

Ready reference table for respiratory antimicrobial therapy

Body system	Respiratory			
	Upper		Lower	
Common conditions	Rhinitis	Acute bronchitis (e.g. kennel cough)	Pneumonia	Pyothorax
Cytology and culture	Usually not indicated, limited clinical significance due to presence of commensal flora Samples collected by biopsy may be considered in chronic cases	Usually not indicated, limited clinical significance due to presence of commensal flora	Usually not indicated, since broncho-alveolar lavage is difficult to perform effectively	 +  on aspirate by thoraco-centesis (both aerobic and anaerobic incubation)
Likely pathogen	Variable	Viral	Variable	Variable (including anaerobes)
Empirical anti-microbial choice	 With secondary chronic purulent rhinitis consider doxycycline		Doxycycline or cephalexin or amoxicillin or amoxicillin-clav	If cocci use amoxicillin-clav, if rods use fluoro-quinolones while  pending
Remarks on therapy	Always address primary cause in chronic purulent rhinitis	In secondary pneumonia suspect Bordetella bronchiseptica and treat with doxycycline of TMPs or amoxicillin-clav Amoxicillin-clav three times daily 	 In severe* cases use a fluoroquinolone and penicillin G or amoxicillin or ampicillin IV Amoxicillin or ampicillin preferably as a CRI (constant rate infusion) or three times daily Amoxicillin-clav three times daily	 Drainage and lavage are essential for clinical resolution Amoxicillin-clav three times daily

Reference key						R
	Cytology	Culture and antimicrobial susceptibility test	Hospitalisation recommended	Antimicrobial therapy not indicated	Surgery	Consider referral to specialist

Mouth



The oral cavity is normally a very bacteria-rich environment and the majority of bacteria have not yet been identified. Cleaning and surgery is often sufficient for infections or inflammation in the oral cavity to be self-limiting. Antibiotic therapy is not justified either before or after routine dental prophylaxis.

Chlorhexidine is a well-tested antiseptic in the oral cavity and can be used in conjunction with surgical procedures as well as for follow-up care.

Examples where prophylactic antibiotics can be justified

- Immunodeficiency disease or immunosuppressive therapy.
- Simultaneous aseptic operation (e.g. when the patient is elderly or has an existing condition that means that repetitive anaesthetic treatment is not recommended).
- Pulp amputation (when the objective is a decontamination of the operational area).
- Heart murmurs are NOT an indication for antimicrobial treatment. Only cases of endocarditis, which is an extremely unusual diagnosis in dogs, can be justifiably treated with prophylaxis.

Ready reference table for oral cavity antibiotic therapy

Body system	
Common conditions	Oral infection (e.g. gingivitis, stomatitis, periodontitis)
Cytology and culture	Not indicated, limited clinical significance due to presence of commensal flora
Likely pathogen	Variable (including anaerobes)
Empirical anti-microbial choice	
Remarks on therapy	 And/or dental treatment If signs of systemic infection (fever, lymph-adenopathy) use clindamycin R

Gastrointestinal tract

Antimicrobial therapy is NOT indicated for routine treatment of undiagnosed or non-specific acute or chronic gastrointestinal disease. The only specific indication for antimicrobial therapy is invasive bacterial infection, secondary to severe mucosal damage. This applies also to diseases such as salmonellosis, or when systemic sepsis can occur secondary to viral infection e.g. canine parvoviral enteritis. In those cases, intravenous systemic therapy is indicated, but oral therapy is not.






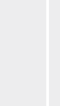










Vomiting and diarrhoea are an animal's primary defence mechanisms for removing pathogenic organisms acutely. Supportive therapy are all that is usually necessary in the first 24 hours.


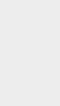
Normal flora are affected by most antimicrobial drugs. Anaerobes predominate distal to the ileum, but are difficult to culture. Broad spectrum antibiotics play particular havoc with the gut microbial population, often referred to as 'antibiotic responsible diarrhoea' in dogs. There is little consensus on the issue with some authors suggesting oral antibiotics be trialed for weeks prior to biopsy but others believing long term antibiotic therapy should only be considered after dietary therapy, and a full work up (including biopsy where indicated) with appropriate therapy (e.g. immunosuppressive therapy when indicated) has failed.

Peritonitis occurs after perforation of the bowel. The primary problem must be sorted out which usually means surgery. Flushing the peritoneal cavity is essential. Vigorous antimicrobial therapy is required using a broad spectrum combination including anaerobic cover.

In people, antibiotic treatment has been shown to prolong shedding of Salmonella. Salmonella infections in other species should not be treated with antibiotics unless a bacteraemia develops. Remember that Salmonella infections are zoonotic and potentially lethal in children and old people.

Ready reference table for gut antibiotic therapy

Body system	Gastro-enteric		Abdominal cavity	
Common conditions	Gastroenteritis	Anal gland abscessation	Hepatic disease (cholecystitis, cholangitis, cholangio-hepatitis)	Peritonitis
Cytology and culture	Usually not indicated On specific suspicion submit  For Salmonella, Campylobacter and toxigenic clostridia	 +  of wound cavity if severe tissue damage and/or fever (after wounds cleaning)	 +  of aspirate or biopsy	 +  of aspirate obtained by abdomino-centesis (both aerobic and anaerobic incubation)
Likely pathogen	Mainly viruses (or parasites in young animals faecal sample for parasitology on suspicion)	Variable	Unknown or variable	Variable
Empirical anti-microbial choice	Self-limiting,  If signs of systemic infection see sepsis	 +  In severe tissue damage and/or fever use TMPS while pending	Doxycycline or cephalixin	Fluoro-quinolones and penicillin G or amoxicillin or ampicillin IV while  pending
Remarks on therapy		 Drainage  Removal recurrence		  Correction of primary cause (if possible), copious lavage essential Amoxicillin or ampicillin preferably as a CRI (constant rate infusion) or three times daily

Reference key						R
	Cytology	Culture and antimicrobial susceptibility test	Hospitalisation recommended	Antimicrobial therapy not indicated	Surgery	Consider referral to specialist

Eyes





Bacteria are rarely the primary cause of conjunctivitis in dogs. Primary bacterial conjunctivitis infections in cats are mainly caused by *Chlamydophila felis* and *Mycoplasma*. Herpesvirus can also cause conjunctivitis in cats.

Most infections are superficial and most drugs will easily get to where the bacteria are. Chloramphenicol was widely used because it has excellent ability to penetrate both chambers of the globe. However, infections of the deeper structures may require systemic antibiotics. Systemic tetracyclines are usually used in cats. Acyclovir drops are used for herpes virus infection.

Most antibiotics are applied as drops (or ointments). Subconjunctival injections can be made to prolong a drug's action. These routes can lead to significant systemic absorption. Powders should never be applied to the eye.

Beware – sulphonamides which can cause keratoconjunctivitis sicca in some breeds.

Ready reference table for eye antibiotic therapy

Body system	Eyes			
Common conditions	Conjunctivitis	Corneal ulcers	Keratitis	Blepharitis
Cytology and culture			 +	 +
Likely pathogen	Rarely bacterial in dogs, <i>Chlamydophila felis</i> and <i>Mycoplasma</i> in cats.	Primary ulcers rarely bacterial.	Rarely bacterial	Staphylococci, Streptococci
Empirical anti-microbial choice	Fusidic acid topically in dogs, tetracyclines in cats	Primary: fusidic acid Deep stromal: tetracyclines Melting: fluoroquinolones		Fusidic acid
Remarks on therapy	Systemic therapy rarely indicated		Consider cyclosporine	





Reference key						
	Cytology	Culture and antimicrobial susceptibility test	Hospitalisation recommended	Antimicrobial therapy not indicated	Surgery	Consider referral to specialist

Blood

A complete work up is necessary to try to find the original focus of infection, e.g. vegetative endocarditis (rare), unless it is obvious, e.g. umbilical infection in a neonate. This is necessary to make sure that the chosen drug gets to the site of the infection. Blood cultures are often negative as bacteraemia tends to be episodic. Multiple cultures may be necessary. Bacteraemia is thought to precede fever spikes.

Treatment must begin before bacterial isolation and identification, especially as it is often difficult to isolate the causative organism. Early, aggressive, broad spectrum anaerobic and aerobic treatment at high dose rates is recommended.

Ready reference table for blood antibiotic therapy






Body system	Blood
Common conditions	Sepsis
Cytology and culture	 +  of multiple blood samples taken over a 23-hour period (both aerobic and anaerobic incubation)
Likely pathogen	Variable (including anaerobes)
Empirical anti-microbial choice	Fluoro-quinolone and penicillin G or amoxicillin or ampicillin IV while  pending
Remarks on therapy	 Amoxicillin or ampicillin preferably as a CRI (constant rate infusion) or three times daily

Bones and joints

Osteomyelitis requires treatment with antibiotics. Although most antibiotics should reach adequate concentrations in bone when dosed appropriately, adequate blood supply to the site is also necessary. Areas of necrotic bone or sequestra will not heal without surgery. Parenteral antibiotics are indicated if a bacteraemia or septicaemia are present, otherwise oral antibiotics for four to six weeks should be used. Cephalosporins or amoxicillin/clavulanate are usually used. Tetracyclines should not be used as they bind to calcium in the bone and their activity is reduced.

Discospondylitis usually responds readily to antibiotics. If good improvement is not seen after five days, the animal should be re-evaluated.

Ready reference table for orthopaedic antibiotic therapy

Body system	Orthopedic	
Common conditions	Septic arthritis	Osteomyelitis
Cytology and culture	 +  of synovial aspirate or biopsy (synovial membrane) Before isolation and sensitivity testing incubate sample in blood culture medium for 24 hours at 37° C.	 Radiography and of bone biopsy
Likely pathogen	Variable	Variable
Empirical anti-microbial choice	Clindamycin or cephalexin or amoxicillin-clav	Clindamycin while  pending
Remarks on therapy	Copious lavage (aseptic) of joint space with saline or Ringer's lactate Amoxicillin-clav three times daily	Look for primary cause  Remove implants if possible R

4. General considerations regarding the choice of antimicrobial agents

Choice of antimicrobial

Consider

Does it kill the bacteria?

Does it get to where the bacteria are?

Is clinically significant resistance likely to develop?

- in the animal?
- in contacts?
- in the environment or people?

Then think about side effects, likelihood of owner compliance with administration instructions, cost, etc.

Prescribing should not be based on convenience, duration of action or route of administration.

Susceptibility

Higher concentrations than MIC are sometimes required to have an effect in vivo, as the drugs are bound in varying degrees to different tissue components, e.g. plasma proteins.

Antimicrobial susceptibility testing

When choosing an antibiotic, culture and sensitivity testing is increasingly important to support the decision. Results are usually reported as sensitive, intermediate or resistant. If a bacterium is classified as resistant, it generally means that treatment with any antimicrobial out of the same class of antimicrobial agents will not be successful. Very high concentrations at the site of infection can be achieved using local treatment; sometimes even bacteria that have been categorised as resistant can actually be sufficiently inhibited and a satisfactory therapeutic effect can be achieved. Sensitive bacteria should, in principle, be inhibited by treatment. The investigations are, of course, carried out in the laboratory using standardised conditions whereas the actual clinical outcome of a treatment can be affected by many other factors, e.g. at what point during the course of infection the treatment is started, the site of infection, the animal's own defences and so on. Bacteria that are classed as intermediary can be treatable if the infection is localised in an organ system where very high antimicrobial concentrations can be achieved. Such is the case, for example, with ampicillin and the urinary tract.

Pharmacokinetics and dynamics

Antibiotics must get to the site of infection in sufficient concentration in order to kill bacteria. In some cases, e.g. beta-lactams and macrolides, the time that the antimicrobial concentration at the site of infection is greater than MIC is the factor determining the treatment's effect (time-dependent antimicrobials). For other types of antimicrobial agents such as fluoroquinolones and aminoglycosides, the effect is dependent on the concentration of the antimicrobial substance: the higher the concentration the better the effect (concentration-dependent antimicrobials).

Combination therapy

Antibiotics with different mechanisms can, when given together, have an increased effect or a reduced effect. The interactions can be very complex and only well-tested combinations should be used.

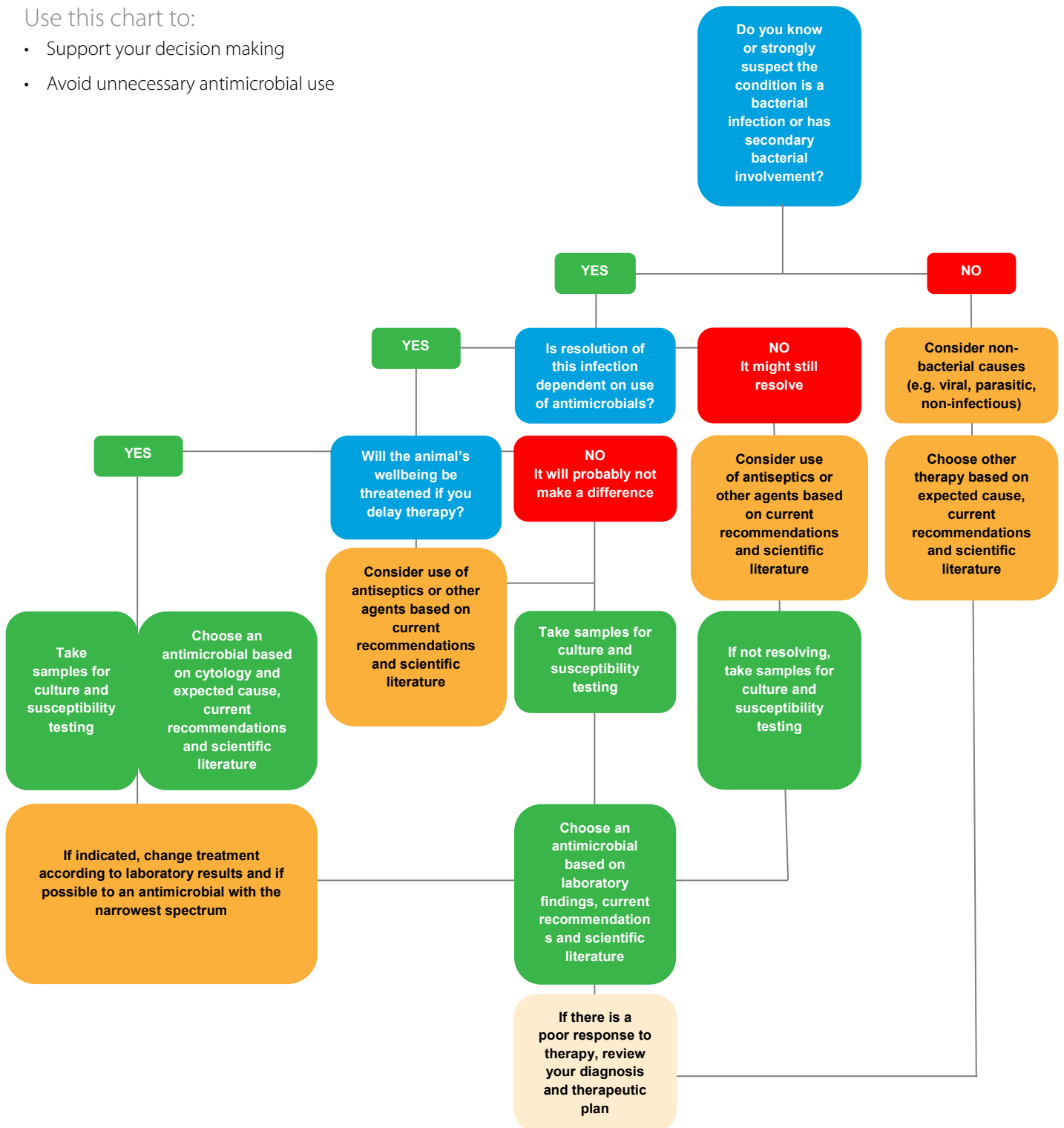
Duration of treatment

There is limited evidence to support any recommendations. Clinical experience of how different types of infections respond is usually used. Chronic infections, and especially intracellular infections, usually require a considerably longer course of treatment than acute infections. For acute infections, a high dose for a short period may be best to reduce resistance development.

Antimicrobial decision tree

Use this chart to:

- Support your decision making
- Avoid unnecessary antimicrobial use



Indications where systemic antimicrobial use is normally unnecessary:

- Routine dental descaling and polishing
- Treatment of in-contact but unaffected cohort animals
- Before mating/at weaning time

Surgery of uninfected/uncontaminated tissue

- Routine castrations and spays
- Routine laparotomy
- Caesarean section
- Removal of non-infected tumours
- Clean orthopaedic surgery of short duration (<1.5 hours)
- Neurosurgery
- Reconstructive surgery, otoplasty, skin flaps etc

Uncomplicated conditions of known or suspected viral aetiology

- Acute canine cough
- Acute gastrointestinal infection
- Feline upper respiratory viral infections
- Feline calicivirus infection
- Feline leukaemia virus (FeLV)/Feline immunodeficiency virus (FIV) infections
- Rhinitis

Other conditions without pathogenic bacterial involvement

- Feline lower urinary tract disease (FLUTD)
- Juvenile vaginitis
- Acute conjunctivitis
- Chronic bronchitis
- Inflammatory bowel disease (IBD)
- Prostatic hyperplasia or prostatic cysts
- Anal sac inflammation/engorgement without abscessation
- Wounds with well-established granulation tissue

Conditions likely to respond to antiseptics or other topical agents

- Uncomplicated skin lesions or mildly infected wounds and bites
- Surface and superficial pyoderma
- Seborrhoeic skin diseases
- Otitis externa
- Periodontal disease

Other uncomplicated conditions with bacterial aetiology

- Bite abscesses in cats
- Salmonella gastroenteritis
- Campylobacter spp gastroenteritis
- Clostridium difficile gastroenteritis

This table provides examples and should not be considered comprehensive.

Information to animal owners

Inappropriate use of antibiotics (antimicrobials) could harm your pet, you and your family and is a threat to global health. Everyone needs to act responsibly, including you as an animal owner.

Antibiotics are important

Many infections cannot be managed without antibiotic but resistance towards these is becoming an issue. Owners and veterinarians need to work together to solve this.

Are antibiotics really necessary?

- Not all infections are caused by bacteria, e.g. some are viral and do not respond to antibiotics. Also, not all bacterial infections require antibiotic therapy.
- Many wound and skin infections can be resolved by local wound care and antibacterial washes. Ask your veterinarian to show you how to do this.

Diagnostics are important

To investigate if a bacterial infection is the cause of your animal's illness; the veterinarian might need to collect samples to look for signs of infection or to identify the bacteria involved through bacterial culture. Supporting this will increase the chance of your animal's recovery without unnecessary risks (e.g. treatment failure).

Don't expect antibiotics

Do not demand antibiotics if your veterinarian does not prescribe them; in most cases it is not appropriate to use antibiotics in a precautionary manner.

Always follow your veterinarian's advice

- Give the antibiotics as instructed. Contact your veterinarian if the treatment is not effective within the recommended period.
- Do not change dosage or stop therapy in advance and keep your follow up appointments.
- Do not share antibiotics with other animals or animal owners.
- Never use leftover medicines.

Handle your animal in a clean way

Always use disposable gloves and wash your hands before and after attending to wounds or cleaning ears.

- No rings, wristwatches or jewellery should be worn.
- Hands should be washed before handling your animal.
- Disposable gloves should be worn when handling infected tissue or wounds.



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