



## **The World Small Animal Veterinary Association (WSAVA) List of Essential Medicines for Cats and Dogs**

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### **Members of the WSAVA Therapeutic Guidelines Group (TGG)**

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## Background

This list of essential medicines is presented by members of the WSAVA Therapeutic Guidelines Group (TGG) following extensive internal and external peer-review. Internal peer-review was provided by TGG members and its subcommittees, whereas external peer-review was performed by board-certified individuals and other WSAVA working/guideline groups. The first draft of this document was presented at the WSAVA annual meeting in Toronto (2019) followed by a three-month audit during which WSAVA member affiliates were asked to provide comments, suggestions and overall feedback. These were then carefully considered by the TGG. The final list is a product of several rounds of revision and based on expert consensus.

This list of essential medicines should allow veterinarians to provide proper preventive care and treatment of the most frequent and important diseases in dogs and cats while maintaining appropriate animal welfare standards. The purpose of the list is to improve and facilitate regulatory oversight for ensuring appropriate medicines availability, drug quality, use and pharmacovigilance, while mitigating the growing black/counterfeit market of pharmaceutical products. The list of essential medicines is not intended to define what medicines should be always available within the clinic/hospital; rather that veterinarians should have ready access to these (medicines) if required for the prevention and treatment of specific diseases and conditions. Additionally, the committee understands that there is no “one-size fits all” and that there may be specific medicines used for endemic/epidemic diseases in some countries that the list does not cover. For example, the essential antimicrobials were defined as those medicines that are recommended as first line agents for treatment of at least one common disease condition.

## Definition

Essential medicines are those that satisfy the primary health care and welfare needs of cats and dogs.

## Using the List of Essential Medicines

The definitions of essential medicines were based on a similar list of essential medicines in human medicine by the World Health Organization.<sup>1</sup> From a regulatory standpoint, it should be adapted in accordance with specific regional or national needs and conditions. The presence of a medicine in the essential medicines list carries no assurance as to the pharmaceutical quality of products containing that medicine. It is the responsibility of the relevant national or regional drug regulatory authority to ensure that each product is of appropriate pharmaceutical quality (including stability) and that, when relevant, bioequivalent products can be interchangeable.

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<sup>1</sup> <https://www.who.int/medicines/publications/essentialmedicines/en/>

Individuals should be also aware of potential different concentrations and formulations of each compound/medicine, and possible drug combinations present in a commercial product. Additionally, this list is not meant to be used as a reference for dosage regimens, drug interactions, indications or contra-indications, adverse effects or description of pharmacologic effects. It does not describe what medicines require monitoring, specific means of disposal/elimination/record keeping or follow-up consultations as the list should not be used as guidance for therapy.

Essential medicines are presented in alphabetical order and divided by either drug category (anaesthetic, analgesics, immunomodulators, oncology drugs, sedatives, vaccines, antiparasitics and antimicrobials, including antibacterial, antifungal, antiprotozoal and antiviral drugs) or organ system/specialty (cardiorespiratory and renal, endocrinology, gastrointestinal, neurology, ophthalmology or reproduction). The essential list of medicines for dermatology is presented in other sections of the document (e.g. immunomodulators, antimicrobials, antiparasitics, etc.). Cross-reference between a drug category and an organ system is acknowledged where appropriate. Some veterinary specialties may not be listed as their lists of essential medicines have been merged into another drug category or organ system.

## Criteria for selection of essential medicines

Essential medicines are selected with due regard to disease prevalence and public/animal health relevance, evidence of clinical efficacy and safety, and comparative costs and cost-effectiveness. These medicines can be rarely replaced by other medicines and their absence could compromise public/animal health and welfare.

The **core list** presents a list of minimum medicine needs for a basic healthcare system, listing the most efficacious, safe and cost-effective medicines for priority conditions. Priority conditions are selected based on current and estimated future public/animal health relevance, and potential for safe and cost-effective treatment.

The **complementary list** presents essential medicines for priority diseases, for which specialized diagnostic or monitoring facilities, and/or specialist medical care, and/or specialist training are needed. In case of doubt, medicines may also be listed as complementary based on consistently higher cost or less attractive cost-effectiveness in a variety of settings and wide availability in the profession.

## Anaesthetic, analgesic, sedative and emergency drugs <sup>2,3</sup>

### Core list

#### 1) Oxygen

This is used for supplemental oxygenation to prevent or treat hypoxemia and patients with respiratory distress. It is also used as a carrier gas in volatile anaesthesia. Oxygen can be administered via 'flow-by', facemask, oxygen hoods or cages, nasal canula or endotracheal intubation.

#### 2) An agonist of alpha-2 adrenergic receptors (xylazine, medetomidine or dexmedetomidine)

Sedatives, muscle relaxants and analgesics that are used for premedication and chemical restraint with the benefit of reversibility (if an antagonist such as yohimbine, tolazoline or atipamezole is available). They are used as part of injectable protocols for spay-neuter programs and may counteract the muscle rigidity produced by ketamine.

**3) An antagonist of alpha-2 adrenergic receptors (yohimbine, tolazoline or atipamezole)**  
Reversal of the effects produced by alpha-2 adrenergic agonists. Reversal is often required to quicken anaesthetic recovery and manage adverse effects.

#### 4) Anticholinergic (atropine or glycopyrrolate)

Anticholinergic drug used for the prevention or treatment of bradycardia in the perioperative period and in the emergency setting during cardiac resuscitation. Topical atropine is used in the treatment of uveitis (see ophthalmology).

#### 5) Lidocaine (lignocaine)

Local anaesthetic drug with antiarrhythmic (i.e. treatment of ventricular arrhythmias), prokinetic and analgesic properties. Widely used in several local-regional anaesthetic techniques as the first line of analgesia in acute pain management including dentistry. Other local anaesthetic may be used topically (see ophthalmology).

#### 6) Adrenaline (epinephrine)

Inotrope and vasoactive drug used in the emergency setting during cardiac arrest and/or the management of severe systemic anaphylaxis.

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<sup>2</sup> The WSAVA Global Pain Council has published the guidelines for appropriate recognition, assessment and treatment of pain including protocols with different drug availability - <https://www.wsava.org/Guidelines/Global-Pain-Council-Guidelines>

<sup>3</sup> The WSAVA Global Pain Council has published information on the minimum analgesic availability <https://www.wsava.org/WSAVA/media/Documents/Committee%20Resources/WSAVA-GPC-Position-minimum-analgesic-availability.pdf>

**7) Dissociative anaesthetic (ketamine or tiletamine-zolazepam)**

Dissociative anaesthetic with anti-hyperalgesic (i.e. analgesic) properties administered for induction of anaesthesia, chemical restraint and often as part of injectable protocols for spay-neuter programs or disaster medicine. Ketamine must not be administered alone (see benzodiazepines below) because it causes hypertonia and cataleptic effects.<sup>4</sup>

**8) A benzodiazepine (midazolam or diazepam)**

Depressants of the central nervous system used for muscle relaxation and anti-seizure therapy. Often administered in combination with ketamine for anaesthetic induction. Midazolam can be administered also intramuscularly (IM) as part of spay-neuter anaesthetic protocols.

**9) A nonsteroidal anti-inflammatory drug (NSAID)**

These drugs produce anti-inflammatory, antipyretic and analgesic effects that can be administered for the treatment of fever, acute and chronic pain. If one drug is to be chosen, preference should be given to a NSAID with good safety profile that can be administered by enteral and parenteral routes of administration to both dogs and cats for short or long term. Topical NSAIDs can be used in specific conditions (see ophthalmology).

**10) Opioids**

First line of analgesics for the treatment of acute pain in the perioperative period. These drugs are required in cases of moderate to severe pain, especially if other analgesics are contraindicated. Otherwise, pain management is suboptimal. If one drug is to be chosen, preference should be given to opioids with good efficacy and safety profile that can be administered to both dogs and cats. Some of these drugs have regulatory approval in various national veterinary markets (e.g. methadone or buprenorphine).

**11) Crystalloid solutions**

These are a mixture of water and electrolytes and may be hypo-, iso- or hypertonic. Isotonic fluids are commonly used to replace metabolic, procedural and ongoing losses (i.e. prevention and treatment of dehydration and hypovolemia) and to provide maintenance fluid requirements and a source of electrolytes (e.g. dextrose 5%, sodium chloride 0.9%, balanced electrolyte solutions such as lactated Ringer's or Hartmann's solution). Hypertonic solutions (e.g. hypertonic saline 7.5%) can be used for the treatment of increased intracranial pressure and in cases of hypotension.

**12) Potassium chloride**

This is used to prevent or treat hypokalaemia. However, it is also used for humane euthanasia once the animal is under general anaesthesia.

**13) Calcium gluconate 10%**

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<sup>4</sup> The WSAVA Global Pain Council has published a ketamine campaign - <https://www.wsava.org/News-Press/News/WSAVA-Ketamine-Campaign-%E2%80%93-an-update!>

This is used for the intravenous (IV) treatment of hypocalcaemia in dogs and cats, including periparturient hypocalcaemia. Cardiovascular parameters should be monitored during administration to prevent toxicity. This formulation is preferred over calcium chloride to avoid irritation associated with perivascular administration.

**14) Osmotic diuretic (mannitol)**

Mannitol is indicated to reduce brain oedema and intracranial pressure. It is preferred to hypertonic saline because it does not require monitoring of electrolyte levels. It is also used in ophthalmology to decrease intraocular pressure during a glaucoma crisis.

**15) Dextrose**

For emergency treatment of hypoglycaemia and fluid supplementation in case of acid-base disturbance associated encephalopathy.

**16) Heparin**

This is used mostly for thromboembolic disease with excessive clotting or increased risk of clot formation, but more commonly for maintenance of IV catheters.

**17) Vitamin K1**

Oral (PO) formulations are used in the treatment of rodenticide (e.g. warfarin, pindone, bromadiolone, etc.) toxicosis.

**+ Complementary list**

**18) Inhalant anaesthetic (isoflurane, sevoflurane)**

Inhalant anaesthetics have favourable pharmacokinetic profiles in terms of drug metabolism and elimination and should be preferred for long-term procedures where drug accumulation with injectable anaesthetic can compromise safety and animal welfare, or injectable anaesthetic are not available.

**19) Non-dissociative anaesthetic agent (propofol or alfaxalone)**

General anaesthetic for IV administration. It can be used for procedural sedation, anaesthetic induction and maintenance, especially if ketamine is not available.

**20) Antihistamines (hydroxyzine, chlorphenamine or diphenhydramine)**

These are antagonists of histamine H1 receptors. They can be used in histamine-mediated allergic pruritus including urticaria, angioedema, and hypersensitivity reactions including systemic anaphylaxis. Different formulations are available depending on the antihistamine drug. For example, diphenhydramine can be administered orally and intravenously. The final consensus for this group of medicines is that there is minimal evidence for the use of antihistamines; however, they have been reported to be used in clinical practice with few adverse effects.

**21) Fresh blood**

Giving the complexities of component processing and storage of other blood products, veterinarians should be able to perform at least fresh whole blood transfusion for the treatment of severe anaemia and/or thrombocytopaenia and factor replacement in coagulopathies within 4 to 6 hours of blood collection in dogs and cats. In some countries, veterinary blood banks are available. Quality control and transfusion practices of fresh blood should be optimal.

**22) Colloid solutions (Albumin, dextran, gelatin and hydroxyethyl starch solutions)**

These solutions are used to increase oncotic pressure and expand circulating plasma volume in surgical and critically ill patients with systemic inflammatory response, sepsis, hypovolemia, hypoproteinaemia, etc. The type of colloid, volumes and speed of administration and risk of adverse effects vary among colloid solutions, and the efficacy and safety profiles should be considered before administration.

**23) Lipid emulsions**

These fat emulsion solutions are used as a source of calories and essential fatty acids in parenteral nutrition. However, they are also used for the treatment of different toxicoses including local anaesthetic and ivermectin overdose.

## Antimicrobial drugs

### Antibacterial and antiprotozoal drugs

#### *Systemic administration*

##### Core list

**1) Amoxicillin/clavulanic acid or a first-generation cephalosporin (cephalexin or cefadroxil)**

These  $\beta$ -lactams are widely used for management of superficial or deep pyoderma and other common skin and soft tissue infections associated with staphylococci and other Gram-positive bacteria.

**2) Clindamycin**

This lincosamide is recommended in some countries as the first choice for management of canine superficial or deep pyoderma and elsewhere is considered as an important alternative to amoxicillin/clavulanic acid and first generation cephalosporins for these indications. It is also recommended for treatment of infections involving anaerobic bacteria. Injectable preparations are important for combination therapy of life-threatening infections such as sepsis and acute pneumonia in association with a fluoroquinolones or other antimicrobial providing Gram-negative coverage. Clindamycin has been shown to reach therapeutic level in the central nervous system and it is also used for the treatment of infections with *Mycoplasma*, *Neospora* and *Toxoplasma*.

**3) Amoxicillin**

This aminopenicillin is recommended as the first choice for treatment of bacterial cystitis and a variety of infections, including those caused by anaerobic bacteria.

**4) Ampicillin or benzylpenicillin**

Injectable preparations of these penicillins are recommended as alternatives to clindamycin for treatment of life-threatening infections such as sepsis and acute pneumonia in combination with fluoroquinolones.

**5) Cefazolin**

This injectable first-generation cephalosporin is recommended as the first choice when surgical prophylaxis is indicated.

**6) A sulfonamide potentiated with a dihydrofolate reductase inhibitor (for example, sulfadiazine/trimethoprim)**

Potentiated sulfonamides are recommended as an alternative to amoxicillin for treatment of bacterial cystitis and are useful antimicrobials for treating skin and other infections, including central nervous system infections caused by susceptible bacteria and protozoa.

**7) Doxycycline**

This tetracycline is an essential antimicrobial for treatment of upper and lower respiratory infections, Lyme borreliosis and a variety of infections caused by obligate intracellular bacteria (*Ehrlichia canis*, *Mycoplasma* and *Anaplasma* spp.).

**8) Erythromycin or tylosin**

These macrolides are recommended for treatment of severe *Campylobacter* infections and chronic enteric infections responsive to antimicrobial therapy.

**9) Metronidazole**

This nitroimidazole is recommended for management of selected bacterial and protozoal enteric infections (e.g. *Giardia* and *Trichomonas*) and some cases of acute and chronic diarrhoea. It also used to manage hepatic encephalopathy for its positive effects on modulation of the colonic microbiota.

**10) Enrofloxacin, marbofloxacin, orbifloxacin or pradofloxacin<sup>5</sup>**

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<sup>5</sup> The “OIE List of Antimicrobial Agents of Veterinary Importance” state that Fluoroquinolones (together with 3rd and 4th generation cephalosporins and colistin) should: 1) not be used as preventive treatment; 2) not to be used as a first line treatment unless justified, when used as a second line treatment, it should ideally be based on the results of bacteriological tests; and 3) Extra-label/off label use should be limited and reserved for instances where no alternatives are available. Such use should be in agreement with the national legislation in force.

[https://www.oie.int/fileadmin/Home/eng/Our\\_scientific\\_expertise/docs/pdf/AMR/A\\_OIE\\_List\\_antimicrobials\\_July\\_2019.pdf](https://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/AMR/A_OIE_List_antimicrobials_July_2019.pdf)

These fluoroquinolones are the first choices for treatment of prostatitis and meningitis due to their ability to penetrate the blood/prostate and blood/brain barriers, respectively. Injectable preparations are needed for treatment of life-threatening infections such as pyelonephritis, or sepsis and acute pneumonia when used in combination with clindamycin or a penicillin. They are also useful for treatment of infections caused by bacteria that are resistant to first line agents.

### **Topical administration**

#### **Core list**

**1) Fusidic acid**

This fusidane is the first choice for management of otitis, eye and localized skin and wound infections associated with staphylococci.

**2) Florfenicol**

An increasingly used antibacterial agent for the management of staphylococcal otitis, usually as part of a combination product that includes antifungal and corticosteroid drugs.

**3) Gentamicin or neomycin**

These aminoglycosides are the first choices for management of otitis externa caused by *Pseudomonas aeruginosa* and other Gram-negative bacteria.

**4) Enrofloxacin or marbofloxacin**

These fluoroquinolones are the first choices for treatment of otitis media and a valid alternative to aminoglycosides for management of otitis externa caused by Gram-negative bacteria.

**5) Polymyxin B**

This polypeptide is a useful alternative to aminoglycosides and fluoroquinolones for management of otitis externa caused by Gram-negative bacteria. It is often used in combination with miconazole, an antifungal agent with antibacterial activity.

**6) Chlorhexidine gluconate**

This biguanide antiseptic is available in different forms (e.g. shampoos, sprays and ointments) for a variety of indications, including but not limited to otitis externa, gingivitis, periodontal disease, superficial skin infections, topical disinfection of wounds and perioperative skin antiseptics.

**7) Povidone-iodine**

This iodophor antiseptic is widely used as an alternative of chlorhexidine gluconate for perioperative skin antiseptics, post-operative application to surgical incisions, and emergency antiseptics in patients with minor lacerations, abrasions and burns.

## Antifungal drugs

### Core List

Topical agents for the treatment of superficial yeast, principally *Malassezia*, and dermatophyte infections.

- 1) Azole antifungal drugs lead to depletion of lanosterol, the primary sterol of the fungal cell wall, by inhibiting cytochrome P450-dependent lanosterol C14-demethylase. Topical azoles include miconazole, econazole, clotrimazole and enilconazole.
- 2) Terbinafine is an allylamine fungicidal agent that inhibits fungal squalene epoxidase to interrupt synthesis of ergosterol.

### Complementary List

A number of antifungal agents can be administered to provide systemic activity against superficial and deep fungal infections.

#### 3) Azole antifungal drugs

These are available as PO preparations including itraconazole and fluconazole.

#### 4) Terbinafine

This is available as an oral preparation.

#### 5) Amphotericin B

This drug binds to fungal cell membrane ergosterol leading to increased permeability and intracellular cation loss. Amphotericin B has poor oral availability and is administered intravenously. Antifungal activity is highly dependent on the formulation administered.

## Antiviral drugs

### Core List

#### 1) Pyrimidine nucleosides

They are incorporated into DNA as a thymidine analogue and used to treat viral infections affecting the ocular surface and include idoxuridine and trifluridine.

## + Complementary List

### 2) Famciclovir

This can be used systemically for treatment of acute ocular disease caused by feline herpesvirus type 1.

### 3) Zidovudine (azidothymidine; AZT; 3'-azido-2',3'-dideoxythymidine)

This blocks the reverse transcriptase of retroviruses. It has been shown to inhibit FIV (feline immunodeficiency virus) replication in vitro and in vivo and can reduce plasma virus load, improve immunological and clinical status of FIV-infected cats, and increase quality of life.

## Antiparasitic drugs

### Core list

#### 1) Isoxazolines (alfoxolaner, fluralaner, lotilaner, sarolaner)

These drugs inhibit GABA (gamma-aminobutyric acid)-gated and glutamate-gated chloride channels. Depending on the formulation, they are effective against fleas, ticks, and mites. Monthly and long-term treatment formulations are available.

#### 2) Neonicotinoids (imidacloprid, nitenpyram, dinotefuran)

These drugs inhibit insect post-synaptic nicotinic acetylcholine receptors, thus having selective activity against ectoparasites.

#### 3) Phenylpyrazole (fipronil)

Fipronil is the only member of the class approved for use in small companion animals. It inhibits arthropod GABA-gated and glutamate-gated chloride channels and is active against fleas and ticks.

#### 4) Pyrethins and synthetic pyrethroids (pyrethrins, permethrin, deltamethrin, flumethrin)

These drugs disrupt sodium channels affecting cell polarization. They are effective against fleas and ticks depending on the drug and formulation. They may also have insect repellent properties and in some cases prevent the transmission of vector-borne pathogens.

#### 5) Macrocyclic lactones (avermectins: ivermectin, selamectin; milbemycins: milbemycin oxime, moxidectin)

These drugs interact with and activate invertebrate glutamate-gated chloride channels conveying antinematodal activity and, for some agents, ectoparasite control with activity against fleas, mites and ticks (e.g. selamectin).

Note: Ivermectin is only licensed for the prevention of heartworm while selamectin and the milbemycins have a broader spectrum of indications.

**6) Isoquinoline (Praziquantel, epsiprantel)**

This class of drug causes severe contraction/muscle spasm and paralysis of sensitive parasites, resulting in paralysis and death. These drugs are effective against cestodes (tapeworms) and many trematode species.

**7) Tetrahydropyrimidines (oxantel, pyrantel)**

These drugs are agonists of nematode acetylcholine nicotinic receptors with drug specific spectrum of activity against gastrointestinal nematodes.

**+ Complementary list**

**8) Spinosyns (spinosad)**

These drugs bind to nicotinic acetylcholine receptors in the insect's nervous system leading to disruption of acetylcholine transmission. They are effective against fleas.

**9) Amitraz**

Amitraz belongs to the formamidine class and acts as a monoamine oxidase inhibitor and octopamine agonist. It has activity as an acaricide and insect repellent, with major use in the treatment of demodicosis and myiases.

**10) Insect development inhibitors or Insect growth regulators (S-methoprene, pyriproxyfen)**

These drugs interfere with normal moulting and the development of arthropods.

**11) Oxadiazine (indoxacarb)**

This class of drugs is bioactivated by insect esterases and amidases and acts by blocking sodium channel receptors. It is effective against fleas.

**12) Benzimidazoles and probenzimidazoles (febantel, fenbendazole, flubendazole, mebendazole, oxbendazole)**

These drugs bind to beta-tubulin and prevent the formation of microtubules. They are particularly effective against nematodes, but selected agents can be used to treat other helminth and protozoal diseases).

**13) Emodepside**

A cyclo-octadepsipeptide acting as an agonist of latrophilin receptors providing a novel mechanism of nematocidal activity.

**14) Arsenicals (melarsomine)**

The trivalent arsenical melarsomine is a *Dirofilaria immitis* adulticide.

## Cardiorespiratory and renal systems

### Core list

#### 1) Loop diuretics (furosemide or torsemide)

These agents block the reabsorption of sodium (and water) in the ascending loop of Henle. They are available for IV or oral administration and are indicated for the management of acute pulmonary oedema and heart failure. They may induce electrolyte imbalances and their effect is limited by the activation of the renin-angiotensin system.

#### 2) Inodilator (pimobendan)

It combines the effect of a vasodilator and an inotrope in dogs with heart failure. It improves long term outcome in preclinical stages of dilated cardiomyopathy and mitral valve disease (heart enlargement) as well as during cardiac failure. Pimobendan can be administered IV or orally.

#### 3) Vessel selective calcium channel blocker (amlodipine)

Amlodipine is the first-choice drug for feline hypertension and is titrated orally to effect. It is used in cats with chronic renal disease. Chronic use of amlodipine has uncommonly been associated with reversible gingival hyperplasia.

#### 4) Angiotensin Converting Enzyme (ACE) inhibitors (enalapril, benazepril, captopril, lisinopril, ramipril)

ACE inhibitors are mild vasodilators and reduce systemic vascular resistance, hypertrophy and aldosterone release, especially in the treatment of dogs with dilated cardiomyopathy or myxomatous mitral valve degeneration (i.e. cardiac failure), and as second line for the management of systemic hypertension in association with other drugs.

#### 5) Aldosterone antagonist (spironolactone)

Spironolactone reverses cardiac remodelling in chronic cardiac disease and can be combined with other antihypertensive drugs for refractory systemic hypertension. It can be used judiciously alongside loop diuretics for its anti-aldosterone effect and potassium-sparing activity.

### Complementary list

#### 6) Antagonists of $\beta$ -adrenergic receptors or $\beta$ -blockers (propranolol, atenolol or esmolol) AND

#### 7) Cardiac-selective calcium channel blockers (verapamil or diltiazem)

These are used in the management of supraventricular arrhythmias and feline hypertrophic cardiomyopathy. Esmolol and diltiazem are administered intravenously. They are negative inotropes and chronotropic drugs that can cause hypotension and reduce cardiac output. Propranolol and atenolol are oral  $\beta$ -blockers, whereas esmolol is an IV  $\beta$ -blocker.

**8) Cardiac glycosides (digoxin)**

This drug inhibits the sodium-potassium pump and facilitates increased concentrations of calcium influx. It produces weak positive inotropism while reducing sympathetic input and improving renal blood flow. Digoxin blocks the atrioventricular node and can be used in the treatment of atrial fibrillation. The drug is used in combination with other therapies in the treatment of heart failure in some specific cases. The drug can be administered orally or intravenously.

**9) Sodium Channel Blockers (lidocaine/lignocaine or procainamide)**

They are indicated for the management of significant ventricular arrhythmias that are associated with important haemodynamic changes. Lidocaine can be toxic when recommended dosage regimens are not followed.

**10) Salbutamol**

This is a selective agonist of  $\beta_2$ - receptors that may produce bronchodilation after aerosol or oral administration with the assumption that bronchoconstriction exists, particularly in cats.

**11) Fluticasone**

This is an inhaled synthetic corticosteroid with profound anti-inflammatory effects that is used in several upper respiratory tract and pulmonary disorders in dogs and cats including rhinitis, bronchitis, asthma and eosinophilic pneumonia. Metered dose inhalers combined with a spacer and appropriate mask should be used for administration.

## Endocrinology

 **Core list**

**1) Insulin (short, intermediate and long acting)**

Insulin is required for emergency treatment of diabetic ketoacidosis (short acting insulin), resulting from unregulated or undiagnosed diabetes mellitus. Porcine zinc insulins or human recombinant insulins (intermediate acting) are required for the long-term stabilization and control of diabetes mellitus. Long acting insulin might be required when intermediate formulations fail to regulate. All currently available forms of insulin are injectable only.

**2) Steroid hormone synthesis inhibitor**

These medications inhibit the production of pregnenolone from cholesterol and prevent the synthesis of steroid hormones. These medications should be used in the treatment of hyperadrenocorticism and include trilostane and mitotane. These medications are for oral administration.

### **3) Glucocorticoids**

A class of corticosteroids that bind to the glucocorticoid receptor. Necessary for the diagnosis of hyperadrenocorticism, including the differentiation of pituitary and adrenal dependent hyperadrenocorticism. Necessary for the acute treatment of undiagnosed hypoadrenocorticism or emergency treatment of hypoadrenocorticism, in addition to immune-mediated disease. Prednisolone is also beneficial in the treatment of insulinoma. See gastrointestinal drugs and neurology for cross-reference.

### **4) Mineralocorticoid/Corticosteroid with mineralocorticoid effect**

Mineralocorticoids or corticosteroids that act as mineralocorticoids that influence salt and water balance are needed in the maintenance of hypoadrenocorticism. These include deoxycorticosterone pivalate (injectable) or fludrocortisone (oral).

### **5) Antithyroid agent**

Thyroid hormone synthesis inhibitors act by interfering with the incorporation of iodine into the tyrosyl moiety of thyroglobulin. These agents are important in the treatment of feline hyperthyroidism and include methimazole (thiamazole). These medications are for oral administration but can be compounded as transdermal preparations.

### **6) Synthetic thyroxine**

Synthetic thyroxine is used to treat thyroid hormone deficiency in canine hypothyroidism. Levothyroxine is the most common form of this medication.

## **+ Complementary list**

### **7) Vasopressin analogue**

Desmopressin acetate is used in the treatment of central diabetes insipidus in dogs and cats. It functions as an antidiuretic. This is also administered intravenously or subcutaneously to dogs with Von Willebrand's disease since it increases the availability of specific coagulation factors.

### **8) Sympathomimetic Agent**

Functions as an agonist of alpha- and beta-adrenergic receptors and stimulates the release of noradrenaline (norepinephrine). Phenylpropanolamine is used in cases of urinary incontinence.

### **9) Hydroxylated metabolite of oestradiol, oestrone or similar class**

Functions as an agonist of oestrogen receptors to increase urethral sphincter tone. Oestriol is used in cases of urinary incontinence.

## Euthanasia drugs

### Core list

#### 1) Barbiturates

Barbiturates (thiopental or pentobarbital) may not be essential as anaesthetic, but they are crucial euthanasia agents especially in the absence of other anaesthetic (ketamine, propofol, alfaxalone) to induce unconsciousness before humane euthanasia. These drugs are often combined with other medicines as part of euthanasia solutions.

#### 2) Potassium chloride

This is also used for humane euthanasia once the animal is under general anaesthesia. See also Anaesthetic, analgesic, sedative and emergency drugs.

## Gastrointestinal system

### Core list

#### 1) Antiulcer drugs: histamine-receptor antagonists (ranitidine or famotidine), sucralfate or proton pump inhibitors (omeprazole)

Histamine-receptor antagonists decrease proton secretion and decrease gastric acid secretion that is stimulated by histaminergic pathways. Sucralfate adheres to ulcerated tissues creating a physical barrier and protecting against hydrogen ions, pepsin and bile, promoting ulcer healing. Proton pump inhibitors bind and irreversibly block  $H^+/K^+$ -ATPase, blocking gastric secretion stimulated by all pathways. These agents are indicated for gastroduodenal ulceration, esophagitis and gastritis. It is common to combine one or more classes of antiulcer drugs.

#### 2) Emetic agent (apomorphine or xylazine)

Apomorphine stimulates dopamine receptors in the chemoreceptor trigger zone, inducing emesis after oral or parenteral administration. The drug is used in cases of inadvertent/accidental toxin/drug ingestion if given promptly. Xylazine is an agonist of  $\alpha_2$ -adrenergic receptors (see anaesthesia). It can be used in cats as an emetic agent; however, it may cause sedation.

#### 3) Antiemetic drugs: antagonists of D2-dopaminergic and 5-HT<sub>3</sub> serotonergic receptors (metoclopramide and ondansetron) or neurokinin-1 receptor antagonist (maropitant)

Indicated for the control of vomiting associated with drug administration or disease, and the prevention of motion sickness (i.e. maropitant only). These drugs are used for symptomatic therapy and do not treat the underlying disease. Metoclopramide lowers the risk of gastroesophageal reflux but does not prevent it.

**4) Immunomodulatory therapy with glucocorticoids (prednisolone)**

This is used as an immunosuppressant agent for the treatment of different immune-mediated diseases.

**5) Lactulose**

Lactulose acidifies the colonic contents. Ammonia ( $\text{NH}_3$ ) is then trapped as ammonium ( $\text{NH}_4$ ) and, in this form, the intestinal wall cannot absorb it. Lactulose is used to reduce ammonia concentrations in the treatment of hepatic encephalopathy, but also as an osmotic laxative in constipation. See neurology.

**6) Activated charcoal**

For the treatment of gastrointestinal toxicosis since this is not absorbed from the gastrointestinal tract. It adsorbs many, but not all, toxic substances.

## Immunomodulatory drugs

### Core list

**1) Immunosuppressive drugs (azathioprine, cyclosporine/cyclosporin)**

Immunosuppressive drugs can produce different levels of immune suppression or immune regulation to treat different immune-mediated disease or some inflammatory disorders (i.e. myasthenia gravis, immune-mediated haemolytic anaemia or thrombocytopaenia, skin diseases, inflammatory bowel disease, polyarthritis, systemic lupus erythematosus, etc.). They should not be used interchangeably. These therapies are generally used in combination with corticosteroids or used more in one species versus the other (i.e. azathioprine is only used in dogs and not recommended for cats, where chlorambucil is an alternative). Cyclosporine is licensed for the management of canine and feline atopic dermatitis, and for topical use in ophthalmology for the treatment of keratoconjunctivitis sicca (KCS) in dogs. Other than cyclosporin, these agents are not licensed veterinary medicines.

**2) Glucocorticoids (see endocrinology, neurology and gastrointestinal systems)**

The two recommended molecules for dogs and cats using the oral route of administration are prednisone and prednisolone. Dexamethasone can be used intravenously when the oral route is compromised.

### Complementary list

**3) Tacrolimus**

This drug is used in specific conditions for immunosuppression. In ophthalmology, the drug is used for keratoconjunctivitis sicca refractory to treatment with other immunosuppressants/immunomodulators.

## Neurology

### Core list

#### 1) Glucocorticoids (dexamethasone IV; prednisolone PO)

Glucocorticoids have anti-inflammatory and immunosuppressive properties depending on the dose. Injectable and oral formulations of dexamethasone are available; oral prednisolone is associated with lower prevalence of adverse effects in long-term therapy. Prednisolone is the preferred steroid in cats. See gastrointestinal, endocrinology and immunomodulatory therapy.

#### 2) Antiepileptic drugs (phenobarbital/phenobarbitone, IV, PO; pentobarbital IV; diazepam IV)

Phenobarbital and diazepam are recommended as first-line anti-seizure treatment in dogs and cats. Pentobarbital is a barbiturate that can be used as an antiepileptic, but also as an agent for euthanasia (see anaesthetic, analgesics, sedative and emergency drugs).

#### 3) Thiamine

Supplementation of thiamine or vitamin B1 is required in cases of deficiency in dogs and cats (in anorexic cats; inadequate diet; exposure to meat containing excessive sulphites).

#### 4) Osmotic diuretic (mannitol)

Mannitol is indicated to reduce brain oedema and intracranial pressure. It has an advantage over hypertonic saline because it does not require monitoring of electrolyte levels (see anaesthetic, analgesics, sedative and emergency drugs).

#### 5) Dextrose

For emergency treatment of hypoglycaemia and fluid supplementation in case of acid-base disturbance associated encephalopathy; see anaesthetic, analgesic, sedative and emergency drugs.

### Complementary list

#### 6) Antiepileptic drugs (imepitoin, potassium bromide, levetiracetam, gabapentin)

Multi-antiepileptic-drug-therapy is often required as refractory cases of epilepsy are not uncommon. Potassium bromide is inexpensive and can be used in dogs with hepatic dysfunction. Loading doses of potassium bromide are required to reach a steady state faster. Loading doses are associated with a higher prevalence of adverse effects. This drug should not be administered to cats. Imepitoin is approved in the veterinary market for use in dogs. Levetiracetam should be administered as an adjunct to other antiepileptic drugs. Gabapentin is also an anti-epileptic drug that can be used for the treatment of painful conditions including neuropathic pain.

## Oncology<sup>6</sup>

### Core list

#### 1) Alkylating agents (cyclophosphamide, chlorambucil, lomustine, melphalan)

Cyclophosphamide is available in oral and IV forms and it is used commonly to treat canine and feline lymphoma in conjunction with other medications as part of a multi-drug protocol. Chlorambucil is orally administered and it is used to treat chronic lymphocytic leukaemias, mast cell tumours and transitional cell carcinomas. Lomustine crosses the blood-brain barrier and it is widely used for tumours of the central nervous system. It is also essential to treat canine and feline lymphoma, histiocytic sarcoma and mast cell tumours. Melphalan is orally administered and used to treat multiple myeloma in dogs and cats.

#### 2) Anti-tumour antibiotics (doxorubicin)

A chemotherapeutic agent used alone or in combined protocols to treat lymphoma, hemangiosarcoma, osteosarcoma, mammary carcinomas, feline injection site sarcomas and most epithelial and mesenchymal tumours in dogs and cats.

#### 3) Vinca alkaloids (vincristine, vinblastine)

Vincristine is a first line chemotherapeutic agent used in many lymphoma and leukaemia protocols and for the treatment of transmissible venereal tumour (TVT). It is used in a multiagent protocol for treatment of hemangiosarcoma. Vinblastine is commonly used for the treatment of mast cell tumours and transitional cell carcinomas.

#### 4) Platinum agents (carboplatin)

Carboplatin is widely used to treat a variety of sarcomas and carcinomas, including osteosarcoma, transitional cell carcinomas, prostatic carcinomas, head and neck carcinomas, pulmonary carcinomas and others.

#### 5) Corticosteroids (prednisolone)

Prednisolone is the most routinely used corticosteroid for the treatment of almost all round cell tumours.

### Complementary list

#### 6) Tyrosine kinase inhibitor (toceranib, masitinib, imatinib)

These drugs are targeted therapies that can block specific receptors that are frequently aberrantly expressed in certain tumours. Initially developed for the treatment of mast cell tumours, their use has been expanded to treat apocrine gland adenocarcinomas of the anal sac,

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<sup>6</sup> The relapsed disease using rescue protocols or cases of toxicity with a specific drug cannot always be treated with this essential list of drugs

pulmonary neoplasia, oral squamous cell carcinomas and most endocrine neoplasia such as insulinomas, thyroid carcinomas, pancreatic and adrenal carcinomas (anecdotal evidence).

**7) Interferons (omega interferon)**

Interferon omega is an antiviral cytokine of feline sequence used in the treatment of feline leukaemia, viral disease, fibrosarcoma, papilloma in cats, and also for adjunct management of canine parvovirus infection

**8) Nitrosureas (lomustine)**

A drug for oral use in the treatment of canine cutaneous lymphoma, mastocytoma in cats, histiocytic sarcoma in cats or relapsing lymphomas.

**9) Other vinca alkaloids**

Vinorelbine is mostly used in the treatment of primary lung carcinomas.

**10) Hydroxyurea**

Mostly used to treat polycythaemia vera and can be considered for certain forms of leukaemia.

## Ophthalmology

### Core list

**1) Glucocorticoids**

Topical steroids that are potent (dexamethasone phosphate) and/or have good penetration through the cornea (prednisolone acetate) are often required to treat ocular surface disorders and intraocular disorders.

**2) Non-steroidal anti-inflammatories (NSAIDs)**

Topical NSAIDs (e.g. flurbiprofen, diclofenac, ketorolac) are routinely used to treat ocular surface or intraocular disorders. They can also be used to prevent intraocular inflammation when there is an increased risk for that to occur (e.g. lens-induced uveitis).

**3) Immunosuppressive/immunomodulatory drugs**

Cyclosporine and tacrolimus are immunosuppressive/immunomodulatory drugs that are routinely used in immune mediated disorders (e.g. keratoconjunctivitis sicca). These drugs are used topically (e.g. cyclosporine, tacrolimus) (see immunosuppressive drugs).

**4) Mydriatics and cycloplegics**

Topical administration of antagonists of cholinergic receptors (tropicamide and atropine) are commonly used to allow visualization of the lens, vitreous and retina and as an adjunctive treatment for uveitis. Mydriatics and cycloplegics can be used topically.

**5) Local anaesthetic**

Local anaesthesia can be administered topically (e.g. proparacaine, tetracaine) or during loco-regional anaesthesia (see anaesthetic).

**6) Prostaglandin analogues (latanoprost)**

This drug is used in some types of glaucoma (e.g. primary glaucoma) and contraindicated in other types of glaucoma (e.g. anterior lens luxation, uveitic glaucoma).

**7) Carbonic anhydrase inhibitors (dorzolamide)**

Topical carbonic anhydrase inhibitors should be considered to decrease intraocular pressure by decreasing aqueous humour production in cases of glaucoma.

**8) Hyperosmotic agents (mannitol)**

Drugs that increase osmolality of the blood can be used intravenously to help decreasing intraocular pressure during glaucoma crisis (see anaesthetic, analgesics, sedative and emergency drugs).

**+ Complementary list**

**9) Agonist of cholinergic receptors/direct-acting parasympathomimetic (pilocarpine)**

This drug can be considered to treat neurogenic keratoconjunctivitis sicca by topical or oral administration.

**10) Proteinase inhibitors**

Proteinase inhibitors (EDTA, N-acetylcysteine and tetracycline antibiotics) are to be considered when the activity of matrix metalloproteinases is excessive, resulting in corneal melting, which can be common in geriatric dogs.

## Reproduction

**Core list**

**1) Gonadotropin-releasing hormone (GnRH) (Deslorelin)**

This is administered as subcutaneous implants. Deslorelin achieves reversible chemical sterilisation from 6 weeks post-implant and for periods of 6 months to one year in male dogs (4 years in ferrets) without significant adverse effects.

**2) Antiprogestogens (Aglepristone)**

These drugs are used for medical interruption of pregnancy (up to 45 days after mating), induction of parturition or medical management of pyometra.

**3) Dopamine agonists (Cabergoline)**

These are used for the cessation of lactation (pseudopregnancy or at weaning). They can cause vomiting and should not be used with dopamine antagonists.

**4) Oxytocin**

This drug is used for metritis or during problems associated with delivery in dogs and cats.

**5) Calcium gluconate**

This is used for the IV treatment of periparturient hypocalcaemia. (see anaesthetic, analgesics, sedative and emergency drugs).

**+ Complementary list**

**6) Antiandrogens (Osaterone acetate, Delmadinone acetate /Finasteride/ Flutamide)**

These drugs are predominantly used for the treatment of prostatic disease in dogs, including canine benign hyperplasia.

**7) Glucocorticoids (Dexamethasone)**

These induce abortion and enhance foetal maturation just before caesarean section.

## Vaccines

**🚩 Core list\***

All veterinary practices should be able to develop a core vaccine program for dogs and cats as recommended by the WSAVA Vaccination Guidelines Group or the other veterinary species or speciality organizations or academic institutions that have published science-based policies, guidelines, or principles. Recommended vaccination schedules for puppies and kittens, and adult dogs and cats, as well as animals in a shelter environment, may be found in the WSAVA Vaccination Guidelines.<sup>7</sup>

Core vaccines for the **dog**, as described in these guidelines, are those that protect against canine distemper virus (CDV), canine adenovirus (CAV) and canine parvovirus-2 (CPV). In any country in which canine rabies is an endemic disease, the vaccine for rabies is also considered core for the dog.

Likewise, core vaccines for the **cat** are those that protect against feline parvovirus (FPV), feline herpesvirus-1 (FHV) and feline calicivirus (FCV). In any country in which canine rabies is an endemic disease, the vaccine for rabies is also considered core for the cat.

<sup>7</sup> <https://www.wsava.org/guidelines/vaccination-guidelines>

These vaccines are ideally delivered as trivalent modified live virus combination products including CDV, CAV and CPV for the dog and FPV, FHV and FCV for the cat. In areas of high infectious disease prevalence, the availability of a bivalent product containing CDV and CPV antigens, designed for administration to puppies, allows earlier puppy core vaccination.

Rabies vaccine is ideally delivered as a separate vaccine component.

### **Complementary list\*\***

Non-core vaccines that might be administered to **dogs** in different areas of the world include:

- *Leptospira* vaccines (containing two, three or four antigens; composition depending on region)
- *Bordetella bronchiseptica* vaccines (for parenteral, intranasal or oral application; formulation availability differs between regions)
- Canine parainfluenza virus vaccines (for parenteral or intranasal application; sometimes in combination with *Bordetella bronchiseptica* vaccine; formulation availability differs between regions)
- *Borrelia* vaccines (mostly North America and Europe; varying formulations)
- *Leishmania* vaccines (Europe and Brazil; varying formulations)
- *Babesia* vaccine (Africa and Europe)
- Canine influenza virus vaccines (North America; different formulations)

The WSAVA Vaccination Guidelines Group does NOT recommend the use of non-core canine enteric coronavirus vaccine or *Giardia* vaccine.

Non-core vaccines that might be administered to **cats** in different areas of the world include:

- Feline leukaemia virus vaccines (different formulations available depending on region)
- Feline immunodeficiency virus vaccines (North America, Australia and New Zealand and some Asian countries)
- *Chlamydia felis* vaccines (parenteral)
- *Bordetella bronchiseptica* vaccines (intranasal)

The WSAVA Vaccination Guidelines Group does NOT recommend the use of non-core feline infectious peritonitis virus or vaccines against dermatophytes.

\*The WSAVA Vaccination Guidelines refer to the use of “international” companion animal vaccines of high quality that are produced by major global manufacturers. The Guidelines do not apply to nationally or regionally produced products of unknown quality. The issue facing veterinarians in many parts of the world (particularly in emerging economies) is that manufacturers and/or licensing authorities do not make available trivalent core vaccines that are easily accessed in the developed world. Practices in many countries sometimes only have access to multicomponent products including up to 10 different antigens (mixed core, non-core and not recommended), which makes it impossible to vaccinate according to WSAVA Vaccination global guidelines.

\*\*Veterinary practices would ideally offer clients a range of non-core vaccines that would be decided by knowledge of the regional prevalence of an infectious disease and by the lifestyle and exposure risk of that individual animal. Non-core vaccines would ideally be available as monovalent products or limited component products that could be selected for use in the individual animal. Availability and formulation of non-core vaccines will differ between regions and they could be as important as core vaccines depending on the prevalence of a specific disease in a region. WSAVA guidelines refer to such vaccines as supplied by major international manufacturers.

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