ADVANCES IN AMPHIBIAN CLINICAL THERAPEUTICS

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Abstract

This review covers recent developments in the field of amphibian therapeutics without repeating previous extensive clinical reviews, formularies, and compendia. The information provided in this article would aid the veterinary practitioner treating amphibian species through the use of updated clinical therapeutic techniques and dosages. Copyright 2014 Elsevier Inc. All rights reserved.

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Amphibians have a long history of veterinary care in captivity, primarily as research animals and more recently as pet species. As amphibians become more popular as companion animals, the level of veterinary care provided to these species continues to develop. Even with the advancement of amphibian veterinary medical knowledge, most amphibian therapeutic information still relies on anecdotal drug dosing recommendations and extrapolation from taxonomically distant taxa (e.g., reptiles and mammals). Thorough pharmacotherapeutic reviews have been previously published on amphibians. This article focuses on new pharmacotherapeutic scientific literature that has been published in the last 10 years.[1-6] The reader would be wise to consult the referenced textbooks and formularies for amphibian drug dosages and treatment regimens to augment the information contained within this article (Table 1).

THE IMPORTANCE OF HUSBANDRY IN AMPHIBIAN THERAPEUTICS

When formulating a therapeutic plan, it is essential to account for the environment in which the amphibian patient lives. Close interaction of the animal and the aquatic environment means that poor water quality, contaminated substrate, and/or inappropriate temperature can lead to disease development.[7] Changes in pH, oxygen content, ammonia, bacterial load, and temperature can disrupt an animal's homeostatic mechanisms, resulting in secondary infections.

Viral, bacterial, and parasitic diseases in amphibians are infrequently caused by a single virulent pathogen, but often are the result of the patient's immunosuppressed status. Treating bacterial and fungal diseases usually requires addressing the predisposing husbandry deficiency. Primary infection with a virus that causes the patient to become immunosuppressed may result in clinical signs of a secondary bacterial septicemia (e.g., cutaneous erythema, edema, and ascites). Similarly, general debilitation from a cutaneous fungal infection could decrease an animal's ability to seek out prey items, leading to emaciation and death.

A number of nonpathogenic bacterial and fungal organisms can be cultured from captive amphibians and their enclosures. Although treatment plans are usually based on microbiological culture and antimicrobial sensitivity, there is the potential for isolating nonpathogenic and commensal microorganisms from the animal or its environment. Most amphibians utilize their skin and cutaneous secretions as a critical mechanism in the innate

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TABLE 1. Selected amphibian drug formulary. Reported dosages of drugs in amphibians based on prospective studies: 2000 to 2013. This is not a comprehensive formulary. Readers should consult references 1-6 for extensive drug dosing recommendations

Drug	Amphibian Species	Dose	Side Effects	References
Antiparasitic medication				
Ivermectin	*Engystomops pustulosus*	0.2-2 mg/kg topically	None reported	3,9
Selamectin	*Rana catesbeiana*	6 mg/kg topically	None reported	11
Antifungal medication				
Terbinafine	Multiple species	0.01% (dilution of over-the-counter 1% spray)	None reported	17
Chloramphenicol	*Litoria caerulea*	20 ppm for 14-28 days	None reported	13
Analgesic medication				
Dexmedetomidine	*Rana pipiens*	120 mg/kg SC	None reported	20
Morphine	*Rana pipiens*	30-100 mg/kg	None reported	19
Fentanyl	*Rana pipiens*	1.0 mg/kg SC	None reported	19
Meloxicam	*Rana catesbeiana*	0.1 mg/kg IM	None reported	21
Anesthetic medication				
MS222	*Xenopus laevis*	1-2-g/L bath for 20 minutes	None reported	24
Clove oil	*Ambystoma tigrinum*	450-ppm bath	Mortality and gastric irritation reported in other species	25-27
Propofol	*Ambystoma tigrinum*	25-35 mg/kg intracoelomically	Delayed induction and respiratory depression	27
Sevoflurane	*Bufo marinus*	3.5:3:1.5 sevoflurane: lubricant jelly: distilled water 37.5 µL of mixture per gram BW topically	None reported	29
Ketamine/diazepam	*Rhinella marina*	K: 200 mg/kg D: 0.2 mg/kg IM	Prolonged recovery	26

BW, body weight; SC, subcutaneously; IM, intramuscularly.

immune response. Antimicrobial peptides in the skin of frogs and salamanders can protect the body from colonization by pathogenic bacteria and fungi.[8] A disturbance in these skin peptides from environmental temperature or pH can leave the animal susceptible to bacterial or fungal colonization.

A variety of nonpathogenic protozoa and nematodes reside in the gastrointestinal tract of healthy amphibians. The density of previously innocuous organisms may increase in debilitated animals contributing to systemic disease. The myriad of commonly occurring, nonpathogenic organisms and environmental contaminants can cloud the interpretation of culture results, thereby increasing the usefulness of cytodiagnostics. Cytology of cutaneous lesions can quickly provide critical information while being provided at a low cost to the client. Gram-stained impression smears can guide treatment recommendations while bacteria/fungal culture samples are being processed at the diagnostic laboratory. Molecular diagnostic testing (e.g., polymerase-chain reaction techniques) is rapid and useful and commonly available to pet exotic animal practitioners.

When treating a clinical problem in an individual or group of amphibians, serious consideration should be paid to "treating" the environment as well. As an example, in a study comparing topical ivermectin treatment to daily changing of substrate as a means to treat gastrointestinal nematodiasis in frogs, both ivermectin administration and husbandry modification were equally successful at controlling