Bacterial and Parasitic Diseases of Amphibians

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KEYWORDS

• Bacteria • Parasite • Amphibian • Frog • Salamander • Toad

Whether in private practice or in a zoologic setting, veterinarians of the exotic animal persuasion are asked to work on amphibians. As with most nondomestic species, many health issues in amphibians are traced back to problems with husbandry or nutrition. Because these areas are more adequately addressed in zoos, and even by hobbyists and pet stores, veterinarians are able to evaluate more thoroughly for true medical issues, with infectious diseases at the forefront. Until quite recently, many infectious diseases were unknown or even misdiagnosed as being caused by opportunistic secondary organisms. The challenge of convincing a client or even a curator to invest in diagnostic testing is often formidable. Likewise, amphibians can be a challenge to collect samples from in useful quantities for such testing. Amphibians have been proposed as environmental sentinels, but the dearth of research on infectious amphibian diseases is remarkable in opposing our support of that statement. Many times, the diagnosis comes from a necropsy, histopathologic examination, or various DNA polymerase chain reaction (PCR) test results that do not obviously help that individual animal but can be critical for managing and preventing the disease in the rest of the collection. One of the best current resources for amphibian diseases of all kinds and current updates is Rick Speare's (James Cook University, Townsville, Queensland, Australia).[1] This Web site served as a reference for many of the topics discussed in this article.

BRIEF MENTION OF RANAVIRUS AND *BATRACHOCHYTRIUM DENDROBATES*

Although this article is focused on bacteria and parasites, one must recognize that more and more research is coming to light indicating that underlying or concurrent viral and fungal infections play roles in bacterial and fungal infections.[2] A late 2008 review of journal articles in required reading for individuals studying to become a diplomate of the American College of Zoologic Medicine found that since 2004, 25% of all articles published on infectious diseases in amphibians were on viruses and 56% were

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on fungal diseases. A brief summary of the two most devastating viral and fungal diseases is included in this article.

Ranavirus is a genus of iridovirus. Iridoviruses are the new viruses on the block, although most of the "new" is actually in reference to their recognition in reptiles. Some have implicated amphibians as the reservoir of reptile infection. Previously, iridoviruses had been noted only in fish and amphibians, with lymphocystis in fish being the classic example. Ranaviruses have been implicated in frog and tiger salamander die-offs. Ranavirus type III is the cause of tadpole edema syndrome, because adults are subclinical carriers. As implied, the clinical signs in tadpoles are edema and subcutaneous hemorrhage. Iridoviruses are large double-stranded DNA viruses identified by an eosinophilic intranuclear inclusion in red blood cells or a basophilic intracytoplasmic inclusion in stomach gland cells.[1,3–6] DNA PCR testing is currently available for zoologic collections through the San Diego Zoo's Institute for Conservation Research. Frozen tissue (eg, liver, kidney, skin), buffy coat, pharyngeal or cloacal swab, and skin biopsy may be used (Allan Pessier, personal communication, 2009). For private practitioners, the author is currently unaware of antemortem testing options but recommends consulting with your exotic or zoologic pathologist for options. At this time, treatment tends to consist of supportive care, isolation, and culling. Although no antiviral agents have been tested against ranaviruses, the chances of obtaining cure of chronically affected or carrier amphibians is small. Glutaraldehyde, bleach, and artificially generated ultraviolet light are effective disinfectants.[1]

Most fungal infections are opportunistic as a result of suppressed immune systems from other infections or improper husbandry and diet. *Batrachochytrium dendrobates* (Bd) is the most important infectious disease of amphibians to understand as a clinician, however. Named after the first species it was identified in—the poison dart frog species (*Dendrobates azureus* and *D auratus*) and White's tree frog *(Litoria caerulea*), the species' affected range has expanded to almost every anuran, some urodelian, and even caecilian species.[7] Infections are so severe in the wild that many species have gone extinct as a result of exposure to Bd. Research suggests that *Xenopus laevis* use for detection of human pregnancy throughout the world in the middle of the twentieth century contributed to its worldwide spread. Other species, such as the marine toad (*Bufo marinus*) and American bullfrog (*Rana catesbeiana*), have been implicated as subclinical carriers and spreaders of Bd. Clinical signs include acute death, general malaise, skin shed, ventral edema or petechi, and toe-tip lesions in adults. Best samples to collect are toe tips or drink patch area. This disease generally does not seem to affect tadpoles clinically, although keratin beak deformities are noted.[1,6] At this time, PCR-based testing is the diagnostic method recommended because it has shown greater sensitivity than histopathologic examination or wet mount slides. DNA PCR testing is currently available for zoologic collections through the San Diego Zoo's Institute for Conservation Research using a skin swab (Allan Pessier, personal communication, 2009). The company Zoologix, Inc. (Chatsworth, California) offers testing for private practitioners (identified on the Web site as chytrid fungus[8];). Treatment generally consists of itraconazole or miconazole baths, isolation, and culling.[9] Raising environmental temperatures (not always the best thing to do for amphibians) seems to help the amphibians to avoid or resist Bd infections. Disposable gloves can act as a fomite; thus, new gloves or, less preferably, bare hands are recommended with each animal.[10] At this time, Bd is viewed as an amphibian-only disease. Typically, the organism functions poorly at temperatures approaching mammal body temperature; thus, zoonotic concerns are currently considered unwarranted.

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