Evidence-Based Advances in Aquatic Animal Medicine

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KEYWORDS

• Aquatic • Evidence-based medicine • Fish • Scientific evidence

KEY POINTS

- Evidence-based medicine is in its infancy in aquatic animal medicine regarding diagnostic techniques, especially because environmental parameters may be confounding factors influencing reference intervals in clinical pathology.
- Antiinfectious therapeutic agents have been studied extensively owing to commercial and ecological implications in aquaculture.
- Emerging diseases are commonly described in aquatic animal medicine; new diseases favored by environmental changes should be differentiated from newly discovered diseases.

INTRODUCTION

Piscine species are the most numerous and diverse group among vertebrates with more than 27,000 species.[1,2] Information derived from other vertebrates is usually not appropriate for the medical care of aquatic species. Although extrapolation may be possible among fish species, the reader should be aware that differences between 2 piscine species may be as great as between a cat and a rabbit. Hence, there is the need of species-specific evidence. Invertebrate aquatic species, included shrimps, snails, urchins, crabs, and corals, may be found in hobbyist aquaria and deserve the same level of medicine, whenever possible, as other animals.

Evidence-Based Advances in Diagnosis

Diagnostics tests available in aquatic animal medicine include blood tests, imaging, microbiology, and histopathology results. A recent article evaluated whether studies published between 2006 and 2012 about teleost diagnostic tests accuracy followed

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Standards for Reporting of Diagnostic Accuracy. Out of 66 peer-reviewed studies, only 11 complied with these guidelines, emphasizing the need for more rigorous validation of diagnostic tests in teleost fish.[3]

HEMATOLOGY AND THE INFLUENCE OF ENVIRONMENTAL PARAMETERS

Hematology reference intervals have been published for certain fish species.[4] However, environmental parameters and nutritional status have been shown to significantly affect these values, as exemplified in wild-caught and aquarium-housed lake sturgeon (*Acipenser fulvescens*), where specimens displayed different reference intervals in an observational study.[4] In contrast, parasitic infestation in wild-caught pike have been shown to influence hematology results only marginally, with a significant increase of mean corpuscular volume among all hematologic parameters investigated in a case-control study.[5] These findings highlight that blood tests may not be sensitive or specific in fish and should be further investigated to confirm their clinical relevance. Other conditions may cause more hematologic abnormalities, with significant hematologic changes associated with cyprinid herpesivrus 2 infection in 10 moribund Prussian carp (*Carassius gibelio*),[6] or with trematode experimental infection in Bluegill (*Lepomis macrochirus*).[7] Clinicians should be aware of the lack of evidence supporting direct extrapolation from domestic mammal clinical pathology results in fish.

MICROBIOLOGY

Microbiological tests, including bacterial and fungal cultures, are used extensively in aquatic animals. In invertebrates displaying an open vascular system in constant and direct contact with the environment, such as echinoderms, the interpretation of these tests is particularly challenging. Of note, some healthy fish normally display positive blood cultures.[8] The environmental conditions used for in vitro cultures are also critical to evaluate. The temperature of incubation should be close to the fish temperature to avoid in vitro selection of different germs. In addition, different incubation media may result in different results; for instance, marine agar, which contains salt and minerals close to marine water content, should be favored when dealing with samples collected from marine fish species. In addition, a precise identification of cultured colonies may be challenging and development of molecular diagnostic techniques, including matrix-assisted desorption ionization time-of-flight mass spectrometry is a recent advance in fish medicine.[9,10] This technology is based on ionization of biomolecules, identified by mass spectrometry:protein profile is then compared with a database created for the species of interest.[11] An increasing number of fish pathogens are being added to the available database for aquatic animal species.[12]

HISTOPATHOLOGY

Histopathology is a commonly used diagnostic test in fish. However, clinicians should be aware the limitations of immunohistochemistry using mammalian antibodies. The challenges of immunohistochemistry use in fish have been suggested in case reports[13–15] and experimental studies are needed to validate the use of immunohistochemistry in piscine species.

Evidence-Based Advances in Therapeutics

Pharmacokinetic and pharmacodynamic studies are available for certain fish species using various routes, including enteral, parenteral, and immersion treatments (**Tables 1** and **2**). The best route of parenteral administration is debated and likely depends on