Fish Hematology and Associated Disorders

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KEYWORDS

• Fish • Teleost • Elasmobranch • Hematology • Erythrocytes • Leukocytes • Thrombocytes • Blood cells

KEY POINTS

- This article reviews blood-collecting techniques including restraint, venipuncture sites, and sample handing.
- The section on hematologic evaluation includes the steps necessary to perform manual counts for total red and white blood cells, and cell descriptions for identification.
- Tables are included summarizing the reported etiology of changes in cell counts, packed cell volume, and red blood cell indices.

INTRODUCTION

There are scientific descriptions of approximately 27,300 different species of fish, which exceeds that of all other vertebrates combined.[1,2] With this many different types of known fish, the intrigue of their diversity is understandable. Ownership of captive pet fish shows an upward trend with approximately 148 million fish, or more than 41% of owned pets in the United States, in more than 69 million households.[3] In addition to pet fish, captivity also encompasses those in public aquaria, other educational facilities, and aquaculture. With the growing number and value of freshwater and marine fishes in captivity, the demand for their medical care increases. Fish handling, diagnostics, medicine, and surgery are often more challenging than in terrestrial and arboreal animals simply because of their aquatic nature.

One diagnostic tool that may assist the veterinary staff with detecting disease or identifying change is hematologic evaluation. As with other animals, normal variation from intrinsic or extrinsic factors or diseases affecting blood cells and counts may be evaluated by clinical hematology. Obtaining even a small blood sample may reveal information helpful in guiding treatment options.

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The volume of information pertaining to reference intervals and interpretation of blood test results is relatively limited, which is expected given the number of different fish. Other challenges involved with hematologic evaluation in fish include the differences between publications regarding the nomenclature and function of blood cells. Research is ongoing, and the purpose of this article is to summarize the value, technique, and general interpretation of fish hematology.

BLOOD COLLECTION

Restraint Techniques

Blood collection from fish may be accomplished with either physical or chemical restraint. Physical restraint is the method used if the patient is cooperative or severely debilitated, and when the clinician is comfortable doing so without causing a great amount of stress to the animal. The integument of fish provides many functions, and should be approached and handled with caution for protection of the fish and the handler. Appropriate gloves should be worn to protect the handler from zoonotic disease and from physical and chemical defense mechanisms of the fish, and to protect the mucous layer of the fish.[4] Most small fish can be approached by using one hand to grasp near the base of the tail while supporting the body with the other hand.[5,6] The use of ancillary equipment, such as nets or stretchers, may be required depending on the size of the animal (**Fig. 1**). Some elasmobranchs may enter a hypnotic state referred to as tonic immobility when placed in dorsal recumbency (**Fig. 2**).[7–10] Tonic immobility has been noted in several species, and offers a short duration of decreased activity allowing for minor procedures such as physical or ultrasonographic examination, venipuncture, or administration of medications.

When physical restraint cannot be accomplished and the animal can withstand anesthesia, chemical assistance typically is used. There are many agents used for fish anesthesia but one of the most commonly used Food and Drug Administration–approved agents is tricaine methanesulfonate (Tricaine-S, previously Finquel). Tricaine methanesulfonate is also commonly referred to as tricaine, TMS, MS-222, or triple-2. Tricaine requires buffering with 2 parts sodium bicarbonate and is used to create induction and anesthetic baths. Many factors, such as physical characteristics of the fish, environmental conditions, and the procedure, will contribute to the optimum dose and therefore should be considered before use. Suggested initial doses

Fig. 1. Four aquarists restraining a sandbar shark (*Carcharhinus plumbeus*) in the red stretcher in preparation for examination.