Fish Surgery

Presurgical Preparation and Common Surgical Procedures

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KEYWORDS

• Fish • Teleost • Elasmobranch • Surgery • Surgical • Coelom • Bath anesthetic

KEY POINTS

- Fish are among the most diverse of all phyla, and a knowledge of anatomy, behavior, and natural history of the individual species greatly facilitates the ability to perform successful surgery.
- Basic surgical procedures used across fish species maintain surgical principles and instruments similar to those used in mammalian species, with some important adaptations.
- Fish surgery requires knowledge of bath and recirculating anesthetic applications and an understanding of basic analgesic principles. Fish must be kept moist during all surgical procedures.
- Common surgical procedures in fish include integumentary mass excision, intracoelomic mass removals, reproductive system procedures, gastrointestinal foreign body removal, ocular procedures, and radiotransmitter implantation.

INTRODUCTION

Many fish species are commonly maintained as pets, in zoos and aquaria, and in research facilities. With the burgeoning interest in fish medicine in recent years, the importance of developing, refining, and performing fish surgical procedures has increased dramatically. A considerable number of displayed fish species are valuable, from aesthetic, emotional, public interest, endangerment, and economic perspectives. Therefore, the application of surgical techniques to fish species has become critical to aquarium, zoo, wildlife, and exotic pet veterinarians.

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Surgical techniques performed on terrestrial animals can be similarly applied, and/or extrapolated, to fish across all sizes and species, from a 1-g zebrafish to a 500-kg tiger shark. If an elective surgical procedure is performed, the general guidelines of asepsis, hemostasis, good technique, and care, as with terrestrial animal surgery, should be followed. Of significance, is developing an understanding the natural history, behavior, and anatomy of the species considered for surgical procedures. During presurgical patient evaluation, if possible, the clinician should visually assess the animal in its home aquarium or primary enclosure to understand the individual or species behavior, movement, attitude, and general health condition. This assessment is vital to gauging a patient's postsurgical recovery and determining when it is safe for an animal to be placed back into its enclosure. Clinical observations of a healthy patient include normal species-specific swimming behavior patterns, strong rhythmic opercular movement suggesting adequate oxygenation, and no excessive mucus shedding or visible skin or ocular manifestations of disease. Presurgical health assessment should include a physical examination, bloodwork (complete blood cell count and serum biochemical profile), and imaging (eg, radiographs, CT scan, or ultrasound) as necessary. Presurgical and postsurgical supportive care should be considered in fish and may include fluid therapy and appropriate antimicrobial, analgesic, and anti-inflammatory medications. Perioperative antibiotics are commonly used in fish surgical procedures because of the general microbial contamination associated with the aquatic environment. The most common choices of antibiotics include oxytetracycline (10 mg/kg, intramuscularly [IM], every 24 hours); enrofloxacin (5–10 mg/kg, IM, every 24 hours); ceftazidime (30 mg/kg, IM, every 48–72 hours); and florfenicol (40 mg/kg, IM, every 24–48 hours). Antibiotics can be continued postoperatively if deemed necessary and may be administered parenterally, with immersive baths, or orally, in medicated feed or medicated gel food.[1,2] There are times when immediate surgical intervention is necessary regardless of a patient's health status. In these circumstances, it is important that the patient be given the best possible outcomes for survival, which include properly oxygenated water, excellent water-quality parameters that minimize or exclude infectious agents present within the system, and medically appropriate supportive care.

PRESURGICAL CONSIDERATIONS

Anesthesia and Analgesia

Regardless of species, a safe and effective anesthetic protocol is a key component of a successful surgical outcome. There is a vast difference between fish and terrestrial animal anesthesia, with most fish anesthetic procedures involving bath anesthetic drugs. Because a majority of fish surgeries occur out of the water, the animal must be placed on a recirculating water apparatus (commonly referred to as fish anesthetic delivery system [FADS]),[3] typically containing a bath anesthetic, such as tricaine methanesulfonate (MS-222) (**Fig. 1**). This apparatus allows simultaneous anesthesia in conjunction with the ability to keep the skin moist during prolonged procedures (**Fig. 2**). Select procedures can be performed, however, while the fish patient is partially submerged in water. Most of these partial submersion procedures are reserved for 1 of the following: (1) minimally invasive procedures, (2) large animals that make it logistically challenging for removal from the water column, and/or (3) inadequate space for out-of-water procedures. The primary disadvantages of partial submersion procedures are that there is increased chance of surgical site contamination and lack of adequate space for surgical equipment to be aseptically maintained.