

Pain management for eyelid surgery utilizing multimodal analgesia and peribulbar anesthesia in a square-lipped rhinoceros (*Ceratotherium simus*)

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Introduction Ophthalmic surgeries produce moderate to severe pain due to rich sensory innervation of the orbit and ocular structures. The treatment of perioperative ocular pain in wildlife species is further compounded by the fact that these animals avoid showing pain behavior. Thus, it is crucial to have an analgesic plan in advance of ophthalmic surgery in these species.

Synopsis A 24-year-old female square-lipped rhinoceros (*Ceratotherium simum*), with an estimated body weight of approximately 2,000 kg, developed chronic conjunctival allergy to habronema. Conjunctival proliferation rendered her right eye non-sighted, and surgical excision of the proliferative tissue to restore sight was scheduled. Immobilization was induced with a combination of detomidine-butorphanol-midazolam (30-30-15 mg, respectively) IM using a dart gun. Once intravenous access was obtained, 100 mg ketamine was administered IV to induce anesthesia, followed by an infusion of guaifenesin-ketamine (40 and 1 mg/ml, respectively) at 450 ml/hour. Following aseptic preparation, and before initiation of surgery, four peribulbar injections with lidocaine 2% (10 ml) and bupivacaine 0.5% (10 ml) were administered in each eyelid. No response to surgery occurred, although the rhinoceros was in a light anesthetic plane. For reversal, atipamezole (75 mg) was administered IM and naltrexone (100 mg) and flumazenil (1 mg) were administered IV. Phenylbutazone (8 g) was administered orally twice a day for 5 days postoperatively. Recovery from anesthesia was quick, smooth and uneventful. The rhinoceros started eating soon afterwards, and vision in her right eye improved.

Discussion Wildlife species possess the same physiologic pain pathways as other species, although, these species are more likely to mask their pain. Providing adequate pain relief in other species was shown to improve recovery and healing. Pain management utilizing multimodal analgesia is considered best practice in human and veterinary medicine, and refers to the combination of several analgesic agents with different mechanisms of action such as opioids, alpha-2-adrenergic agonist, nonsteroidal anti-inflammatory drugs [NSAIDs], *N*-methyl-D-aspartate [NMDA] receptor antagonists, and local anesthetics. Local anesthetics block nerve conduction and therefore provide excellent analgesia. Peribulbar anesthesia has not been previously described in rhinoceros or other wildlife species; however, it is widely used in humans and in companion animals to control pain during ophthalmic surgeries. In comparison to humans and companion animals, where 1-2 peribulbar injections suffice, the rhinoceros' thicker skin, larger eyes and tissue proliferation required 8 peribulbar injections in order to achieve adequate distribution of the local anesthetics.

Conclusion Veterinarians should strive to provide a multimodal analgesic plan when treating wildlife species in which pain is very difficult to assess. The plan should include opioids, NMDA-antagonists, NSAIDs, and whenever possible local or regional anesthesia should be incorporated.