

Clinical evaluation and therapeutic management of traumatic injuries and complications in the white-eared opossums (*Didelphis albiventris*) – case report

[Avaliação clínica e terapêutica de lesões traumáticas e complicações em saruê-de-orelha-branca (*Didelphis albiventris*) – relato de caso]

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ABSTRACT

The increasing interaction between wildlife and urban environments poses significant challenges to wild animal health and welfare. In this context, the white-eared opossum (*Didelphis albiventris*) emerges as a relevant specimen, facing adverse impacts resulting from traumatic injuries, often stemming from territorial conflicts and human interactions. This case report aims to discuss the clinical assessment and exploration of therapeutic strategies applied to a rescued white-eared opossum in a debilitated state, with a particular emphasis on its exposure to lead pellet projectiles. The detailed analysis of traumatic injuries, surgical interventions, and associated complications seeks not only to contribute to understanding the clinical response of these marsupials to adverse events but also to provide insights for improving rehabilitation practices and management in similar situations.

Keywords: ballistics, neotropical marsupial, synanthropy, veterinary radiography, wild animal

RESUMO

A crescente interação entre a fauna silvestre e os ambientes urbanos impõe desafios significativos à saúde e ao bem-estar dos animais selvagens. Nesse contexto, o saruê-de-orelha-branca (*Didelphis albiventris*) emerge como um exemplar relevante, enfrentando impactos adversos decorrentes de lesões traumáticas, por vezes resultantes de conflitos territoriais e interações humanas. Este relato de caso se propõe a comentar a avaliação clínica e a exploração das estratégias terapêuticas aplicadas em um saruê-de-orelha-branca resgatado em situação de debilidade, enfatizando-se no relato a sua exposição aos projéteis à base de chumbinho. A análise detalhada das lesões traumáticas, das intervenções cirúrgicas e das complicações associadas visa não apenas contribuir para o entendimento da resposta clínica desses marsupiais a eventos adversos, mas também fornecer subsídios para aprimorar práticas de reabilitação e manejo em situações similares.

Palavras-chave: balística, marsupial neotropical, sinantropia, radiografia veterinária, animal silvestre

INTRODUCTION

The species *Didelphis albiventris*, known as the white-eared opossum, stands out as a neotropical marsupial belonging to the family Didelphidae, widely distributed in the regions of South America (Cáceres and Monteiro-Filho, 2001). The species is recognized for its adaptability to

various environments, ranging from tropical forests to urban areas, despite its resilience, they often face challenges such as territorial confrontations and interactions with humans, which can even result in the deaths of these animals (Almeida *et al.*, 2008).

It is noted that the synanthropy of this animal represents significant phenomena at the interface

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between wildlife and urban environments. This marsupial has been adapting to human presence, being observed in urban, peri-urban, and even rural areas close to population centers (Almeida *et al.*, 2008). Synurbanization refers to the ability of these animals to colonize and thrive in urban environments, adapting to changes brought about by urbanization; the ability to adapt, known as synanthropy, is highlighted by their capacity to exploit primarily available food resources in urban areas, such as garbage and household waste; so consequently interactions of the opossum with anthropized environments, often considered problems by the human population, raise relevant questions about the coexistence between wildlife and urban environments, as well as the impacts of these interactions on the health and behavior of these marsupials (Biolchi *et al.*, 2021; Lignon *et al.*, 2023).

The vulnerability of white-eared opossums to risks associated with urban violence, including exposure to gunshots, has become an increasing threat to this species (Gumier-Costa and Sperber, 2009). The use of projectiles, such as pellets, poses a significant danger to the physical integrity of these animals and carries broader environmental and public health consequences (Trinogga *et al.*, 2013; Felsmann *et al.*, 2014). The discovery of encapsulated projectiles in their bodies highlights the severity of these impacts and emphasizes the urgent need for awareness and education to promote harmonious coexistence between wildlife and urban communities; therefore, conservation strategies and regulatory measures are imperative to protect not only the integrity of opossums, also the diversity and balance of the ecosystems in which they play a crucial role.

The aim of this article was to investigate and document the clinical and therapeutic interventions adopted in the treatment of a white-eared opossum suffering from traumatic injuries, with an emphasis on the complications faced throughout the recovery process.

CASUISTRY

A white-eared opossum (*Didelphis albiventris*) rescued in August 2023 by a local resident was found in a debilitated state on a public road in the city of Araras, in the interior of São Paulo, Brazil. The animal was promptly taken to the CRAS (*Centro de Reabilitação de Animais*

Silvestres) Pró-Arara. Displaying a docile behavior, the opossum had perforations in the nasal cavity and head, indicative of confrontation and attack by other animals. Its initial weight was 950g. To proceed with the cleaning and suturing of the wounds, sedation was administered with 0.2mL of Zoletil® and subsequently a topical antibiotic based on rifamycin and Vetaglós®, a healing ointment containing antibiotics and anti-inflammatories, was applied to all lesions and additionally 50mL of Ringer's Lactate solution (RL) was administered subcutaneously.

The treatment of the wounds was maintained throughout the recovery period, with rehydration performed as needed. The animal was force-fed using mashed cat food sachets.

After a few days, the white-eared opossum exhibited new symptoms, including slight nasal bleeding and swelling in the thoracic and pelvic limbs. In response to these manifestations, a specific therapeutic intervention was initiated, following the recommendations by Nascimento and Horta (2014). To relieve inflammation and pain associated with these symptoms, 0.3mL of meloxicam was administered intramuscularly, which is double the normal dose. In addition, to support blood coagulation and overall health, 0.1mL of Vitamin K and 0.1mL of Vitamin B12 were administered. These were applied empirically following the dosage pattern used for cats, with a reduced dose of 0.1mL compared to the usual range of 0.5 to 10mL. To address possible nutritional deficiencies and strengthen the opossum's health, 0.1mL of iron was administered daily for 15 days and to manage the apparent swelling in the thoracic and pelvic limbs, 0.1mL of furosemide was administered intramuscularly over 7 days.

During this treatment period, a notable improvement in the animal's condition was observed, because it began to feed independently exhibiting normal drinking behavior, normophagia and normal urination and defecation behavior (Fig. 1). The diet included a continuous supply of cat food and water during the day, while at night, raw meat pieces, cat food sachets, boiled eggs and fruits were alternated, with fruits being offered only three days a week. This diversified dietary management aimed to ensure balanced and adequate nutrition for the opossum's continued recovery.

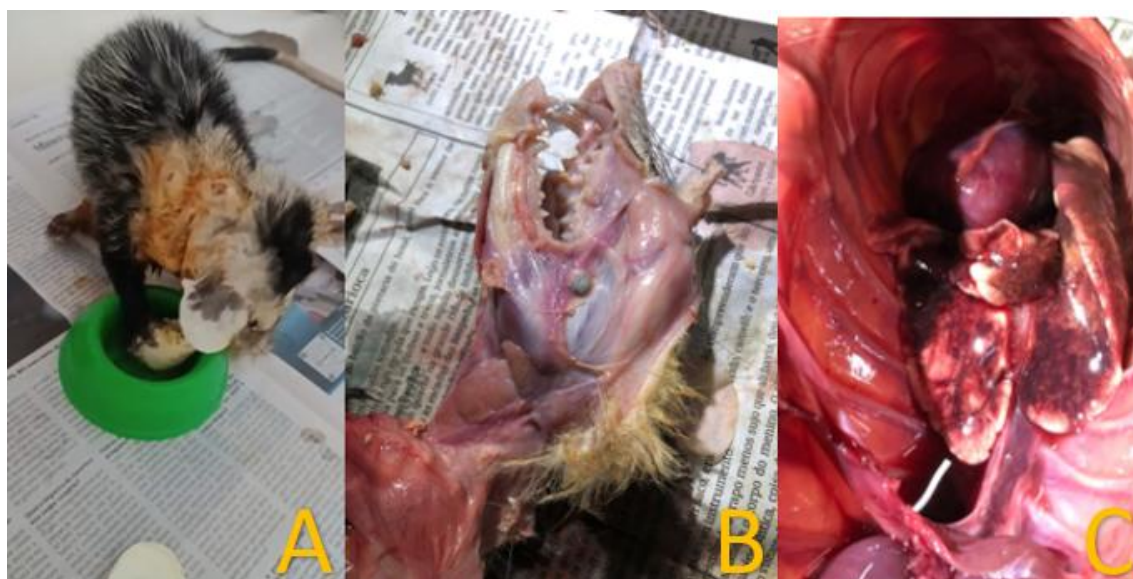


Figure 1. A - The feeding activity of the white-eared opossum (*Didelphis albiventris*) is evident, as it consumes banana and egg, seemingly displaying a normal appetite. However, the perforations caused by the pellets indicate an increase in volume in the region and the formation of exudates. B - After euthanasia and necropsy the dispersion of the lead pellet projectiles in sensitive and difficult-to-access areas can be observed. C - Necrotic points and an advanced degenerative stage in the lungs are observed, suggesting a possible therapeutic overload due to the rapid progression and compromise caused by lead pellet intoxication.

One week after the start of treatment, the animal underwent another sedation, this time using 0.15mL of Zoletil® intramuscularly, as the objective was to drain the limbs that had developed pus-filled abscesses. Concurrently, 0.1mL of the antibiotic Agemoxi CL, based on amoxicillin trihydrate and potassium clavulanate, was administered intramuscularly in two doses, with a one-day interval between them.

During treatment, the appearance of pus-filled abscesses on the animal's neck was observed. To address this new complication, specific measures were adopted, including the cleaning and superficial drainage of these wounds on alternate days. Prior to these procedures, 0.1mL of morphine was administered intramuscularly for pain relief, maintaining this medication on the days when the procedures were not performed.

To ensure the patient's comfort during the deep drainage of all abscesses, the opossum was sedated using 0.1mL of Zoletil® combined with 0.05mL of diazepam, with an additional dose of 0.06mL of Zoletil®. Simultaneously, 0.05mL of enrofloxacin was administered intramuscularly,

following the recommendations by Nascimento and Horta (2014) and continued for 10 days.

Parallel to the infection treatment, the presence of helminths in the animal's feces was identified. Consequently, treatment with levamisole was initiated administering 0.03mL and repeating the dose after 20 days to combat the parasitic infestation. This comprehensive approach aimed to ensure the complete recovery of the opossum, addressing both bacterial infections and parasitic infestations.

Days after the previous interventions, the opossum experienced a sudden worsening, manifesting anorexia, apathy and discomfort. Faced with this condition, an analgesic approach was adopted, administering 0.1 ml of tramadol hydrochloride and 0.1mL of morphine sulfate for three days, with a gradual reduction of the dose each day. Simultaneously, the wounds were cleansed with hydrogen peroxide (H₂O₂) and treated with a topical antibiotic based on rifamycin, Vetaglós® and Terra-Cortril® spray (containing terramycin), with the limbs closed with a bandage. By the end of August, the

animal's weight reached 790g, initiating supplementation with the probiotic Organew®.

In early September, during the cleansing of the wounds on the neck, two encapsulated lead bullets were manually identified. Faced with this finding, the animal was immediately referred for emergency radiography, revealing a total of ten

bullets, seven in the head region and one in the foot (Fig. 2). The administration of 0.1mL of an antidote with hepatoprotective action, indicated for the treatment and prevention of intoxications, was initiated and maintained until all bullets were removed. The dressings were replaced, removing two more bullets from the neck.

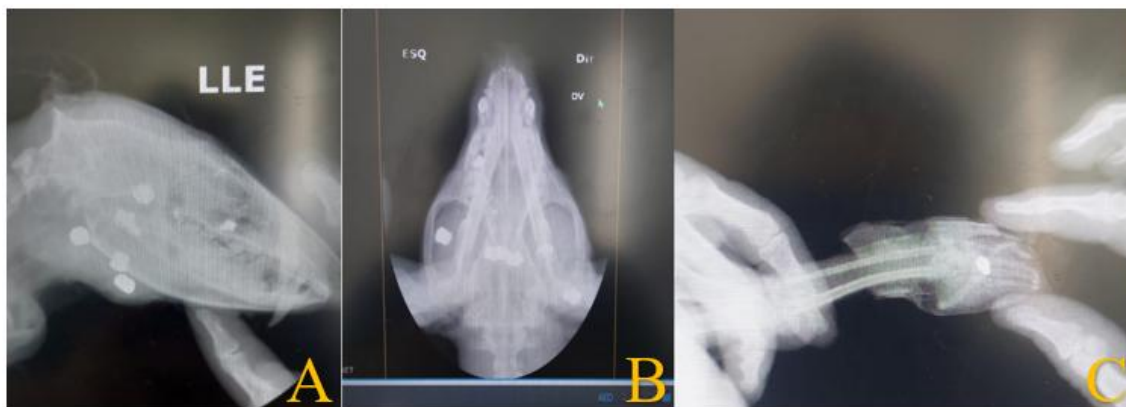


Figure 2. A – Lateral view of the patient's skull (white-eared opossums) showing lead pellet projectiles dispersed throughout, with emphasis on the mandible and nasal region. B - Ventral radiographic view of the patient's skull, highlighting the distribution of lead pellet projectiles in nasal cavities, condylar process, and zygomatic region. C - Shows a projectile identified in the animal's left pelvic limb, which resulted in compromised mobility and necessitated limb amputation.

In an attempt to preserve the animal's life, considering the abscess and the location of the bullet, the decision was made to amputate the left pelvic limb. The procedure was conducted under sedation using 0.1mL of ketamine, 0.05mL of diazepam and local lidocaine. After the surgery, treatment with enrofloxacin (0.05 ml), dexamethasone (0.1mL), meloxicam (0.1mL), Vitamin K (0.1mL), Vitamin B12 (0.1mL) and iron (0.1mL) was resumed maintaining these administrations until the completion of treatment. The approach aimed not only at the recovery of the white-eared opossum after amputation, but also at the management of complications caused by the gunshot bullets.

Despite the initially positive response to treatment, the persistence of complications led to the decision to also amputate the left thoracic limb, which no longer had any connection of joints and tendons, a consequence of the trauma caused by the entry and exit of one of the bullets. The procedure was conducted with the animal

sedated again, using 0.1 ml of ketamine, 0.05 ml of diazepam and local lidocaine.

After the successful recovery from the first amputation and the remarkable resilience of the animal, the stitches from the second procedure opened, resulting in the formation of abscesses on the remaining limbs. The delicacy of the procedure and the fragility of the opossum's state made it impossible to remove the remaining bullets lodged in the head. Therefore, given the complexity of the situation, the decision was made to euthanize the animal. Thus, at the end of September, the animal was sedated with 0.5 ml of ketamine and 1 ml of xylazine, followed by the administration of 0.3 ml of T-61® (containing mebezonium iodide, embutramide and tetracaine hydrochloride) intravenously. On the day of the procedure, the opossum weighed 800g. This outcome was a careful choice to ensure the well-being of the animal, considering the impossibility of effective treatment and the compromised quality of life due to irreversible complications.

DISCUSSION

The foray into cities represents a pronounced adaptive response, driven by increasing deforestation pressure, which forces white-eared opossums to seek refuge in different conditions. This transition also triggers significant challenges, including competition for food among the opossums themselves and territorial fights, intensifying the struggle for survival in this new context and increasing the risk of spreading sanitary diseases (Cáceres *et al.*, 2016; Silva *et al.*, 2017). Additionally, coexistence and competition with abandoned animals, including domestic cats, dogs and other feral species, pose significant risks because these interactions can lead to the exchange of diseases and predatory behaviors, particularly with larger animals such as stray dogs and feral cats (Cáceres *et al.*, 2016).

The survival of the white-eared opossum described in this case, subjected to 10 shot pellets, raises conjectures about its resilience and adaptive abilities. The ability to withstand multiple shot pellets may, in part, be attributed to the animal's sensory agility, allowing for rapid evasion in critical moments (Argot, 2002). Furthermore, the nocturnal nature of these marsupials may have contributed to avoiding threats, providing them with a strategic advantage during daytime activities (Noronha and Tokumaru, 2023).

The detection of lead pellets introduces a concerning dimension to the case, opening space for legal considerations and toxicological issues. Lead pellets, containing toxic substances such as the heavy metal lead, pose a significant risk to the animal's health and raise concerns about their origin and possession (Hutchinson *et al.*, 2023). In the Brazilian context, current legislation prohibits the manufacture, sale and possession of compressed air guns that fire lead pellets without proper legal authorization. Thus, the presence of these pellets in the opossum highlights a potential violation of these regulations, as well as exposing the animal to serious risks, considering the toxicity of lead and its potential ramifications on the health and well-being of the marsupial (Passos *et al.*, 2023). It is noteworthy that in the field of toxicology, the presence of this metal can cause damage to internal organs, leading to neurological, renal and hematological disorders; moreover, when the pellet hits the marsupial's

body, it causes traumatic injuries that can result in considerable internal damage (Navas-Suárez *et al.*, 2022). In the outlined scenario, the opossum, due to the presence of pellets in sensitive areas such as the paws and skull, suffered extensive injuries and even throughout the follow-up, the decision to amputate both left limbs became imperative, highlighting the seriousness of the incident's consequences.

Even after the intervention for the removal of the pellets and the application of supportive treatment, some bullets remained in the animal's skull due to the inherent surgical complexity and the potential risk of serious complications. These projectiles, located in critical areas such as the jaw (near the trachea and esophagus), nasal cavity, palate fissure and the region of the zygomatic arch near the left eye, presented considerable challenges for complete removal (Fig. 2). The delicate location of these projectiles implied a high risk of irreversible damage to vital structures, significantly increasing the danger of complications that could lead to the animal's death.

The potential toxicological effects were also discussed, including the observed lung compromise during necropsy (Fig. 1), and following the post-amputation recovery of the limbs, the discussion regarding the animal's quality of life emerged as a crucial point. Due to the limitations imposed by the delicate location of the projectiles an ethical and animal welfare-based approach was chosen. The deliberation involved the perspective that the necessary surgical procedure to completely remove the projectiles would entail additional stress, prolong the animal's suffering and, most importantly, pose a substantial risk of serious complications, compromising its quality of life (Duarte *et al.*, 2012). In this context, the decision to proceed with euthanasia was grounded in the principle of providing the opossum with a compassionate closure, avoiding potential adversities that could compromise its well-being.

CONCLUSION

The case of the white-eared opossum described illustrates the dynamics between wildlife and human interventions. The rescue of the animal in debilitated conditions and the clinical efforts to treat traumatic injuries illustrate the species'

resilience in face of environmental challenges. However, the presence of lead pellet projectiles in the opossum's skull presented surgical complications and health risks. Additionally, the amputation of the limbs would no longer allow it to live freely in the wild. These factors culminated in the ethical decision to euthanize the animal for its well-being.

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