Radius and ulna locking plate osteosynthesis in giant anteater
(Myrmecophaga tridactyla)

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ABSTRACT

Osteosynthesis is a surgical technique performed in bone fractures for the reduction of bone fragments and their stabilization in a suitable position, allowing the patient to recover their motor activity. This report deals with the case of a giant anteater in the municipality of Yopal, Colombia, which was admitted to the veterinary service due to a thoracic limb injury caused by a car accident. The treatment performed was surgical, after a fracture of the radio-ulnar diaphysis was diagnosed. Resolution was carried out through osteosynthesis of both bone structures with a double locking titanium plate system under an anesthetic plan of 4 mg/Kg ketamine, 0.025 mg/kg dexmedetomidine and 0.1 mg/Kg midazolam. Maintenance was performed with isoflurane at a rate of 3% at the beginning of anesthesia and 1.5% as maintenance. The reduction of the fracture using the aforementioned technique resulted in its effective stabilization. The real and growing problem of bone fractures affects different wild fauna that move in search of food, water or shelter, directly threatening biodiversity.

Keywords: Orthopedics; wild life; trauma; surgery (Source: UNBIS Thesaurus).

RESUMEN

La osteosíntesis es la técnica quirúrgica que se realiza en las fracturas óseas para la reducción y estabilización de los fragmentos de hueso en una posición adecuada, permitiendo que el paciente recobre su actividad motora. El presente reporte trata el caso de un Oso hormiguero gigante en el municipio de Yopal, Colombia, el cual ingresa al servicio veterinario por lesión en miembro torácico causado por accidente automovilístico. El tratamiento instaurado fue quirúrgico tras diagnosticar fractura de la diáfisis radio-ulnar. La resolución se aborda mediante osteosíntesis de ambas estructuras óseas con un sistema de doble placa bloqueada de titanio bajo plan anestésico de ketamina 4mg/Kg, dexmedetomidina 0.025 mg/kg y midazolam 0.1 mg/Kg; el mantenimiento se realizó con isoflurano a razón de 3% como inicio de la anestesia y 1.5% de mantenimiento. La reducción de la fractura mediante la técnica mencionada mostró un resultado efectivo para la estabilización de esta. Esta problemática real y creciente afecta a diferentes animales de fauna silvestres que se movilizan en busca de alimento, agua o refugio, amenazando directamente a la biodiversidad.

Palabras clave: Ortopedia; fauna silvestre; trauma; cirugía (Fuente: Tesauro UNBIS).
INTRODUCTION

The giant anteater is known in Central and South America as one of the most representative animals of the region. This xenarthran has quite specific characteristics and is significantly threatened by various human activities that affect its habitats, for example road construction, which reduces its mobility (1,2). In Colombia, investigations into vehicular accidents have shown negative impacts, including isolation of populations, injuries and even the death of animals such as mammals, reptiles and birds (3,4).

The injuries that can be caused to wild animals in this way include bruises, dislocations and fractures. For fractures, resolution approaches in wild animals may be similar to those used for companion animals. Understanding bone biology and the principles of fracture management is essential in order to apply and adapt orthopedic surgery to these species (5,6).

As occurred in the case reported here, radioulnar fractures due to trauma that affect the diaphysis from the middle to the distal part can injure the soft tissue, due to its anatomical proximity. Moreover, they are associated with a high rate of complications associated with delayed unions or non-unions, the resolution of which requires specific techniques for their resolution (7).

The choice of osteosynthesis material and surgical planning, and thus the achievement of optimal consolidation and subsequent rehabilitation, largely depends on the appropriate classification of the type of fracture (8).

For this clinical case, osteosynthesis of the affected bone fragments was carried out, choosing a double locking plate of titanium material whose properties and design promote functional alignment, absolutely stability of the fracture and optimal cicatrization. (9)

This report deals with the case of an undomesticated male giant anteater (Myrmecophaga tridactyla), where surgical management was used to resolve a fracture of the radius and ulna caused by an presumed accident in a road in the municipality of Yopal, Casanare- Colombia. This is the first such case with this species in the department of Casanare.

CASE REPORT

Anamnesis. This case relates to of an adult male anteater (M. tridactyla) found on a road in the municipality of Yopal, Casanare, by personnel from the autonomous corporation of the region. The animal was brought to the Unitropic university veterinary clinic several days after the accident. The anamnestic data reported were: poor resistance to handling, inflammation and pain, reluctance to support the left thoracic limb, weakness and loss of appetite.

Clinical findings. The clinical assessment showed: weight: 30kg; temperature: 34.4ºC; heart rate (HR): 64 bpm; respiratory rate (RR): 15 brpm; lower body condition (10): ectoparasites, skin lacerations. Using semi-technical methods of the musculoskeletal system, large-scale inflammation and loss of continuity of the radius and ulna compatible with a forearm fracture were found in the left thoracic limb (LTL).

A complete blood count and blood chemistry analysis (alanine aminotransferase, aspartate amino transpeptidase, creatinine, alkaline phosphatase, gamma glutamyl transpeptidase, albumin and cholesterol) were carried out. Additionally, a radiographic study was performed with the lateral-lateral (LL) and cranial-caudal (CC) incidences of the LTL.

The clinical examination and paraclinical tests were performed with the patient under chemical restraint (Figure 1). This was achieved with the use of ketamine at 4 mg/kg, dexmedetomidine at 0.025 mg/kg and midazolam at 0.1 mg/kg administered intramuscularly (IM) (11).

Figure 1. Giant anteater under sedation.
Radiography. The radiographic study of the latero-lateral (LL) (Figure 2a) and cranio-caudal (CC) (Figure 2b) incidences revealed a simple transverse radius fracture in the middle third (22A3 AO classification) and an ulna fracture in the third medium multiple / wedge butterfly wing (22B2 classification AO) (8).

Blood count and blood biochemistry. A blood sample was taken from the caudal vein for hemogram and blood biochemistry (12). The results of this showed lymphocytosis with eosinophilia, presence of regenerative hypochromic anemia and moderate thrombocytopenia. Blood biochemistry showed results within the reference values, with mild hypoalbuminemia.

Description of surgical technique. Osteosynthesis was carried out with a locking titanium biplate with a locking cortical screw. This technique is a cranial-medial approach to the medial end of the radio-ulnar area.

For this osteosynthesis, relaxation and induction were achieved with ketamine at of 4 mg/Kg, together with dexmedetomidine at 0.025 mg/Kg and midazolam at 0.1 mg/Kg IM. Maintenance was performed with isoflurane at a rate of 3% to initiate anesthesia and 1.5% as maintenance. Once under sedation, the patient was connected to a multiparameter device where temperature, heart rate, and respiratory rate were monitored (Figure 3).

The physiological constants for the giant anteater are: RR 18-26 brpm, HR 60 bpm, temperature (T°) 32-34°C (1).

The first step in the surgical procedure was to make an incision in the skin on the medial aspect of the radius. When making the incision it was taken into account that the cephalic vein crossed the area distally. The incision was continued through the antebrachial fascia along the medial fascia of the abductor longus muscle and elevated for visualization of the radius (13). The surgical field was exposed with the use of Gelpi forceps (Figure 4) and reduced using bone distractors at the distal and proximal levels of the fracture. The ends of both sides of the radial shaft were aligned and the PRCL-L titanium locking plate (“Point-contact”, “Reconstruction”, “Compression” and “Locking” - Large size) was contoured using 6 holes, 3 superior (distal) and 3 anterior (proximal), in order to position it (Figure 5). A 2.5 mm guide was placed for a 2.5 mm drill bit, adapting it to the orthopedic drill. At the beginning of the drilling, there was notable resistance to the passage of the cortices. Two 3.5 mm x 26 mm screws were placed in the most distal part of the plate and 4 locked 3.5 mm x 2.4 mm screws were placed in the other holes. The stability of the fracture was evaluated and the anatomical planes were closed. Synthesis of muscles and fascia was done with 2/0 polyglycolic acid and of skin with 2/0 polypropylene (14).
Deep dissection was carried out in the range of the flexor carpi ulnaris, flexor digitalis profundus, and extensor carpi ulnaris (15), and the cranial branch of the ulnar nerve was isolated to avoid neurological damage (16). Muscle distraction was performed with Gelpi instruments, exposing the ulnar fracture focus.

The fragments were coapted directly to an anatomically aligned position for the installation of the PRCL-L titanium plate system, with dimensions of 3.5 mm and 8 holes. In this case, 2 distal and 2 proximal locked bicortical self-tapping titanium screws measuring 3.5 mm x 24 and 26 mm were used, for a total of 4 screws. For this purpose, a 2.7 mm drill bit and a 3.0 mm cannulated guide were used. The muscles and fascia were closed with 2/0 polyglycolic acid and the skin with 2/0 monofilament (17).

The post-surgical treatment of the patient was carried out with: tramadol at 2 mg/Kg, ketoprofen at 2 mg/Kg IM and enrofloxacin at 2.5 mg/Kg.

Comparative post-surgical radiographs were taken with medio-lateral and cranio-caudal incidences of the LTL (Figure 6) to verify the correct alignment of the bone structures.

Once the radius was aligned, a caudomedial approach was performed on the ulnar shaft. A dieresis was made on the skin on the medial edge, extending over the middle segment of the ulna. Dissection was continued through the fascia and caudomedial subcutaneous tissue.
DISCUSSION

Traffic accidents are among the challenges faced by wildlife, and can result in musculoskeletal injuries and death of these individuals (3). This situation has worsened over time (4).

The orthopedic approach chosen for the giant anteater in this clinical case was based on techniques applied in humans and canines, as these represent an effective alternative and lead to orthopedic success by restoring the bone structure to its natural anatomical form (17). Osteosynthesis of the radius and ulna with a locking plate in the giant anteater specimen presented promising results in terms of fracture resolution and bone consolidation, providing absolute stability for direct healing, which is consistent with what has been reported previously (15,18,19,20, 21,22).

In this case, the material chosen was titanium, since this has proven to be an excellent option due to its resistance, biocompatibility and low tendency to generate adverse reactions in changing tissue. Several previous studies support the efficacy of locking plates in the osteosynthesis of bone fractures in different species (23,24).

Satisfactory success rates in terms of recovery of bones and functionality have been reported in the application of locking plates in the fixation of fractures in felines and canines (25). Furthermore, the implementation of locking plates in the osteosynthesis of long bone fractures allows absolute stability as a means of direct coaptation (21). In the context of the giant anteater, the application of this surgical approach was favorable in terms of pain control, resolution and stabilization of the injury. This could represent an opportunity for the rehabilitation and reintroduction of individuals, having a positive impact on the conservation of this species (3).

The therapeutic plan was adapted according to the needs that arose during the surgical intervention due to the specific characteristics of the patient. Since the technical guidelines come mostly from experience with domestic canines, adjustments were necessary to ensure the effectiveness of the procedure. Several authors mention that the anatomical structure of the giant anteater is similar to that of canines, with slight conformation variations (7). These variations include the existence of a ridge, known as margo medialis or medial edge, in the dorsal part of the radius. This was clearly observed in this case, and prevented the stable placement of the plate in its usual position (15). Due to this characteristic, the position of the locking plate in the medial shaft of the radius was adjusted, achieving perfect stability in this space.

In conclusion, good presurgical planning enable the achievement of absolute stability in the fracture presented by the anteater. Osteosynthesis of the radius and ulna with locking titanium plates is an approach to fracture biomechanics in this species. This method, supported by research in other species, offers a promising strategy to address bone injuries in wild mammals, contributing to the rehabilitation and conservation of vulnerable species.

Conflict of interests

The authors declare no conflicts of interest.

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Author contribution

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