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PLATE OSTEOSYNTHESIS FOR THE TREATMENT OF A COMPLEX METACARPAL FRACTURE IN A SAND GAZELLE (*Gazella leptoceros*)

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Author AM designed the study, performed radiography, anesthesia management and designed the study. Authors MAB and AB performed the surgery. Author SB provides post-operative care. Author MCA managed the literature searches and wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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Case Report

ABSTRACT

A 5-month-old female gazelle (*Gazella leptoceros)* from Algeria was presented for consultation at the clinic, following a trauma that occurred when the gazelle was trapped in a wire mesh forelimb. The radiographic examination revealed a complex fracture displaced at the level of the left metacarpus, a surgical treatment by osteosynthesis was carried out, after approach and incision of the fracture site, a reduction and fixation of the bone was practiced using a screwed plate in steel and seven cortical bone screws, a suture by separate stitches was performed to close the skin, and a modified Robert Jones bondage was performed. X-rays performed 7, 15 and 21 days postoperative revealed very limited osteogenic activity and delayed healing despite bone alignment. This may be due to a defect in the periosteal vascularization linked to the direct surgical approach to the fracture.

Keywords: *Gazella leptoceros*; fracture; metacarpus; bone plate; bone callus.

ABBREVIATIONS

IUECN: The International Union for Conservation of Nature

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1. INTRODUCTION

The sand gazelle (*Gazella leptoceros*) belongs to the tribe *Antilopini*, subfamily *Antilopinae*, family *Bovidae*, genera *Gazella*, The species includes two subspecies, *Gazella leptoceros leptoceros* from the western desert of Egypt and Libya, and *Gazella leptoceros loderi*, from western and central Sahara [1,2], which is a rare species compared to other gazelle specie.

G. leptoceros is a medium-sized gazelle with a height of 65-72 cm at the withers and a weight that varies between 20-27 kg for male and 14-18 kg for female. The back is beige and yellowish separated from the white belly by a slightly darker band on the flanks. The face and neck are the same color as the back. The facial characters are not very marked. The ears are long and narrow. Horns are long, and straight, [2]. The external hooves are wider than the internal ones [3]. The widening of their surface makes walking on the sand easier [4]. The spot on the croup is white and slightly underlined. The tail is short, and ends with a black hairs tuft. The species is listed as "endangered" by the IUCN. About 5000 specimens remain.

2. CASE PRESENTATION

A 5-month-old female gazelle (Gazelle leptoceros) belonging to a private farm in Algeria was presented for consultation at the Eleos Vet hospital veterinary clinic located in Constantine, Algeria, following a trauma that occurred when the gazelle was trapped in a wire mesh.

Fig. 1. X-ray of the left forelimb showing a complex metacarpal fracture in a gazelle (*Gazella leptoceros*)

During the consultation the gazelle was conscious with increased heart rate and respiratory rate, and rectal temperature of 37.9°.
Examination of the left forelimb revealed a small hemorrhagic lesion in the metacarpal region with very marked deformity and severe pain on palpation.

X-rays ware performed in the clinic, the two Cranio-caudal and mediolateral views (Fig. 1) have shown the presence of a complex spiral diaphyseal metacarpal fracture, with a single bone fragment, and lateral proximal cranial displacement.

In this case external anatomical reduction of the fracture is not recommended, it may lead to delayed healing.

3. MATERIALS AND METHODS

The instruments used in this technic were the basic instruments of orthopaedic surgery (Fig. 2). The fastening material used consists of 10 cm long stainless steel plate with 08 holes for 2 mm screws. And seven 2mm non-locking cortical bone screws.

Fig. 2. Surgical preparation for screwed plate osteosynthesis

Surgery is performed under general anesthesia. After placement of the IV catheter, premedication was performed with 0.05 mg/kg 2% xylazine hydrochloride (Rompun), followed by induction with 5 mg/kg ketamine hydrochloride (IMALGEN 1000) [5] and maintained with intermittent intravenous boluses of 0.4 mg/kg ketamine.

The animal was placed in lateral recumbency on a surgical table. The operated limb was carefully prepared, shaved and coated with antiseptics (povidone iodine) in order to limit the risk of infection.

The metacarpus was approached in the dorsolateral side. A longitudinal skin incision (12 cm) long enough is made, and the subcutaneous tissue was carefully dissected to determinat the anastomoses of the palmar common digital artery and the lateral palmar nerve.

An extraperiosteal approach was performed. The clots from the fractured hematoma were pushed back to identify the bone ends, as well as the bone fragment. Anatomical reduction was performed using Farabeuf forceps. Bone perforation was performed on the lateral side of the metacarpal bone, 2 mm holes were made and the plate was positioned above the metacarpo-phalangeal joint and fixed to the bone with bone reduction forceps (Fig. 3).

Fig. 3. Different stages of surgery; identification, reduction, plate fixation and skin suturing

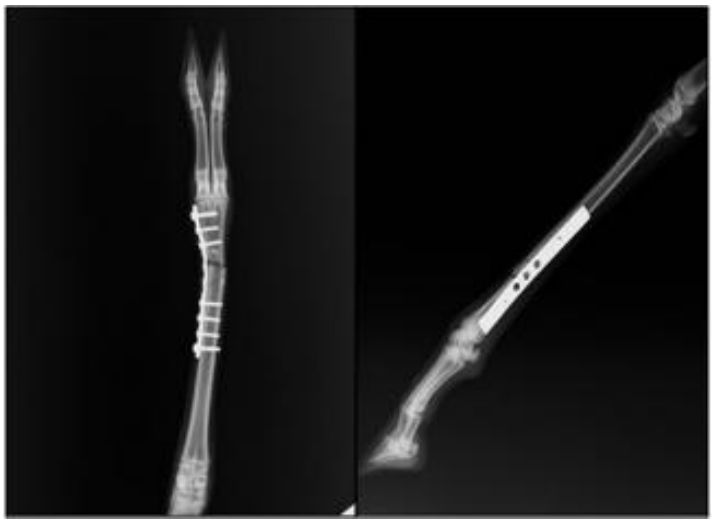

Fig. 4. Postoperative X-ray (Cranio-caudal and mediolateral views)

The plate was anatomically contoured, adapting to the convexity of the external face of the metacarpal bone. The plate was fixed, with seven cortical bone screws of appropriate length, 4 proximal and 3 distal.The correct position of the plate was confirmed (Fig. 4 by X rays (Fujifilm FDR smart 500mA, prima t2).

Before closing the outbreak, extensive washing with antiseptics was done, avoiding the removal of blood clots. The subcutaneous tissues were closed with Vicryl Ethicon USP 2-0, using a satin stitch overlock. The skin was sutured with separate stitches, and a modified Robert Jones bondage was applied to the limb (Fig. 5).

Fig. 5. Modified Robert Jones Bondage at Treated Limb

Postoperative pain management was provided by intravenous injections for 3 days of Meloxicam (metacam 20) 12 mg-kg, combined with etranitidine hydrochloride 2 mg-kg. Antibiotic therapy consisted of intramuscular administration of 2.2 mg-kg ceftiofur hydrochloride once daily for 7 days.

The hospitalization lasted 20 days. The animal was confined in a box, in order to limit movements and avoid constraints on the osteosynthesis material.

4. RESULTS AND DISCUSSION

The operative time was 90 minutes, there were no surgical incidents, the chosen anesthesia protocol proved effective, and the animal tolerated the modified Robert Jones dressing well and did not exhibit difficulty standing. The surgical wound healed without complications. An effective anesthetic protocol with stable physiological parameters in Thomson's gazelles (Eudorcas thomsonii) at doses of Medetomidine 40 mu g/kg, ketamine 5 mg/kg, and butorphanol 0.40 mg/kg was reported [6]. However, arterial hypertension was reported in sheeps given an intramuscular injection of 125 mg/kg medetomidine and 2.5 mg/kg ketamine [7].

X-rays performed 7 and 15 and 21 days postoperative showed very limited osteogenic activity in the periosteum and delayed callus bone formation at the fracture site, despite the good bone reduction. This may be due either to an infection or to a defect in the periosteal vascularization linked to the direct surgical approach to the fracture. According to a study, plate fixation has a negative impact on the periosteum [8], and the use of bone plates can further reduce the viability of the periosteum [9].

In another sudy reported, a perfect reduction from the 28th postoperative day of a metacarpal fracture in a goat treated with standard external skeletal fixators [10]. Other results revealed the recovery of an open diaphyseal fracture of the metacarpal treated by a splint in roe deer (*Capreolus capreolus*) after 3 weeks [11]. Another study showed a bone consolidation from 45 days after a metacarpal fracture in a Chinkara (*Gazella banettii*) [12].

A study conducted on a comminuted diaphyseal metacarpal fracture in Dama Gazelle (Nanger Dama) surgically treated with an external fixator revealed callus formation and bone consolidation were reported with significant periosteal proliferation around the site of fracture and fracture misalignment and moderate valgus deformity [13].

5. CONCLUSION

The surgical treatment by a screwed plate of the fracture of the metacarpus in the gazelle of the sands seems not very interesting, this is due to the delay of the bone consolidation of the fracture and the risk of having a complication in pseudarthrosis, this can be due to a major periosteal vascular circulation impairment, another technique such as external skeletal fixators is recommended for the treatment.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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