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Fore limb amputation following complicated fracture in a Striped hyena (*Hyaena hyaena*)

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Abstract
A female Striped hyena was presented with the history of compound radius ulna and metacarpal fracture of right fore limb due to infighting with other male Hyaena in same enclosure of Nandanvan Zoo, Raipur 03 days back. The extent of injury covered almost entire fore limb extending from proximal radius ulna till metacarpals. Initial conservative management of the injured animal using broad spectrum antibiotics and analgesics was already carried out by zoo Veterinarian for last 3 days followed by referral to Wildlife Health & Forensic Centre, Durg. The animal was anaesthetized using xylazine-ketamine combination and subjected to radiographic examination which confirmed compound fracture of right radius ulna at mid shaft region along with metacarpals. Hence, it was decided to perform fore limb amputation at the level of mid humerus to prevent chances of necrosis to spread to normal parts of the affected limb. The patient was prescribed for once daily administration of broad spectrum antibiotics ceftriaxone @ 20mg per kg body weight for 5 days along with analgesic meloxicam @ 0.5 mg per kg body for 3 days along with topical application of wound with 5% povidone iodine and fly repellant spray for 10 days. The skin sutures were removed after 2 weeks post-operatively and the patient made an uneventful recovery.

Keywords: hyaena, infighting, complicated fracture, fore limb amputation

Introduction
Musculoskeletal injuries in wild animals have been reported to make them vulnerable to predation or the animal may even succumb due to septicaemia. Limb amputation is salvage surgical procedure to remove a diseased or injured limb which is carried out only when there is irreparable injury to the limb and the chances of survival of patient with affected limb are very less due to chances of septicaemia or toxaemia. Limb amputation is generally indicated when the lower part of the affected limb undergoes conditions of necrosis, gangrene, extensive muscular/nerve/tendon or ligament injury, malignant tumours, frost bite etc. which generally would not respond to medicinal treatment [1]. However, with an amputated limb a wild animal can never be released back to free ranging wild conditions and it becomes mandatory to keep such animals in rescue centre or as an exhibit in captivity [2]. The present communication reports about a clinical case of complicated fracture in a female Hyaena which was surgically managed by fore limb amputation under general anaesthesia.

Materials and Methods
An eight years old female Striped hyena (*Hyaena hyaena*) weighing about 45 kg was presented with severe injury associated with compound radius ulna and metacarpal fracture along with massive tissue damage to right fore limb due to infighting with other inmate male Hyaena in same enclosure of Nandanvan Zoo, Raipur 03 days back. The injury was visible involving almost the entire right fore limb extending from proximal radius ulna till metacarpals. The animal was managed conservatively with broad spectrum antibiotics and analgesics at Nandanvan Zoo, Raipur for 3 days for initial stabilization of the patient followed by referral to Wildlife Health & Forensic Centre, Durg for expert opinion and treatment.
Clinical examination of the patient revealed acomplicated fracture of right radius ulna at mid shaft region along with exposed metacarpals. There was absence of skin and muscle covering over the fractured bones along with severe damage to tendons and ligaments.

Results and Discussion

The animal was anaesthetized with xylazine @ 1 mg/kg body wt. followed 10 minutes later on with ketamine @ 10 mg/kg body wt. administered via intramuscular route (Fig. 1) into thigh muscles [3]. The patient was blind folded and intravenous port was established for administration of fluid therapy and incremental dosage of anaesthetic drugs as and when needed during the surgical procedure. Continuous monitoring of heart rate and haemoglobin oxygen saturation (SpO_2) was performed using pulse oxymeter with its probe applied at the base of tongue throughout the procedure.

Lateral radiograph of affected limb revealed compound fracture of right radius ulna and metacarpals (Fig. 2). Keeping in view the chances of septicaemia to occur in this patient, it was planned to amputate the affected limbat the level of mid shaft of humerus to prevent further spread of infection and gangrenous damage to normal tissue of the affected limb.

The surgical site was prepared in routine manner by clipping of hair followed by scrubbing with antiseptic solution. A tourniquet made up of cotton gauze bandage was applied on the affected limb just above and below the proposed site of incision (Fig. 3) to reduce the chances of intraoperative haemorrhage.

Two elliptical incisions were made through the skin 4-5 cm above the elbow joint on both medial and lateral aspects of the affected limb with surgical blade. Adequate care was taken to prevent the loss of normal skin to prevent shortening of skin flap for closure of stump after completion of the surgery. The skin flaps were reflected and ligation of the underlying blood vessels was carried out with catgut no. 1. The muscle bundles were bluntly separated away from the humerus bone up above the point where amputation was planned (Fig. 4) followed by amputation of the humerus at mid shaft region using a sterilized saw blade (Fig. 5).

The incised bone stump was copiously lavaged with sterile normal saline to flush out remnant debris followed by topical sprinkling of antibiotic powder to prevent chances of infection. The muscular stump was sutured in simple continuous pattern using chromic catgut no. 2 taking adequate care to obliterate the dead space between the muscle bundles to prevent formation of seroma during post-operative period [2]. The skin flaps were brought in apposition with horizontal mattress sutures using braided silk no. 1 followed by application of fly repellant ointment over the suture line (Fig. 6).

Post operatively, the animal was kept under antibiotic umbrella comprising of ceftriaxone @ 20 mg per kg body weight for 5 days and analgesic agent meloxicam @ 0.5 mg per kg body weight 3 days administered via IM route [4]. Dressing of wound with 5% povidone iodine solution along with fly repellant spray for 10 days was also carried out twice daily to prevent wound infection and maggot infestation. Skin sutures were removed on 14th day postoperative day and the animal made an uneventful recovery.

There are successful reports of fore limb amputation in various species of animals like dogs [5], horses [6], cattle [7] and cervids [2, 11]. However, amputation is considered to be last resort of treatment and should be considered as the only option when all other therapeutic measures fail to respond in the patient or when there are chances of contralateral limb getting affected due to excessive weight bearing [8].

A combination of xylazine and ketamine was used during the present clinical situation which has also been previously reported to be adequate for major surgical procedures like dental extraction in Striped hyena [4]. However, combination of xylazine along with Etorphine hydrochloride (M99) has also been found to be effective for the immobilization of wild free living Spotted hyaenas [9, 10].

In the present clinical situation, partial amputation of the right fore limb above the elbow joint and subsequently saving the particular animal was carried out successfully to save the life of animal. Severe injury to nerves, muscles and blood vessels around the fracture site leading to gangrenous changes in distal limb demanded amputation. Forelimb amputation in red deer [11] and sambar deer [2] have been previously reported in literature. However, this is first clinical report of fore limb amputation in Stripped hyaena.

Fig 1: Administration of anaesthetic drugs after restraint inside squeeze cage

Fig 2: Radiograph showing compound fracture of mid shaft of radius ulna and metacarpals (Right fore limb)

Fig 3: Surgical preparation of the affected limb

Fig 4: Separation of muscle bundles over humerus bone

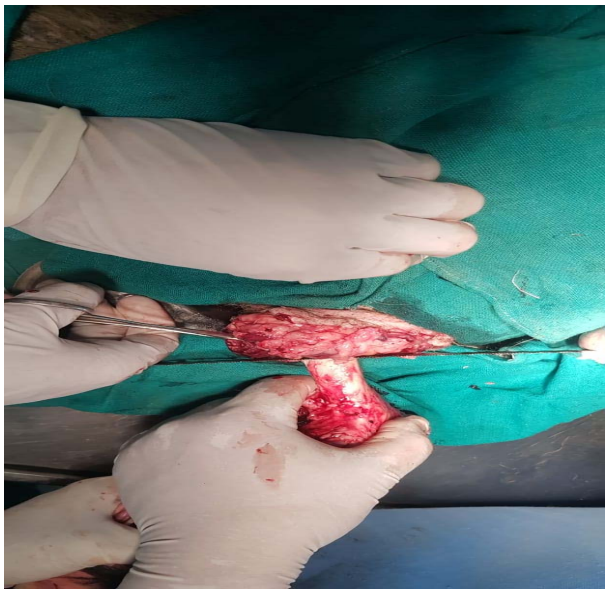

Fig 5: Amputation of humerus bone at mid shaft level using sterile saw blade

Fig 6: Completion of surgical procedure

Conclusion

A clinical case of complicated fracture of right radius ulna and metacarpals in a Spotted hyaena was managed successfully by fore limb amputation at mid humerus level under xylazine-ketamine anaesthesia. The main aim of the amputation in the present clinical situation was to save the life of the animal which was suffering from irreparable injury to the affected limb.

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