

## CASE REPORT

### Birds

# Surgical stabilisation of a radio-ulno-carpometacarpal luxation in a common buzzard (*Buteo buteo*) with a distal radio-ulnar screw

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#### Abstract

A 4-year-old, captive, male common buzzard (*Buteo buteo*) was presented for sudden inability to fly. A radio-ulno-carpometacarpal luxation was diagnosed using radiography. A complete closed reduction of the luxation was unsuccessful. A novel technique of open reduction and stabilisation with a distal radio-ulnar screw proximal to the ulnar carpal bone was performed. The range of motion of the wing was normal in immediate postoperative because the ulnar carpal bone was not immobilised. Then, the wing was immobilised with a figure-of-eight bandage for 2 weeks and the bird had restricted exercise for 4 weeks postoperatively. Six months postoperatively, follow-up radiographs revealed that the implant location was unchanged with periarticular fibrosis. Discrete loss of extension of the wing was observed. The bird recovered the ability to fly and training resumed 9 months after the surgery. The novel surgical technique described in this case report represents a feasible and effective technique for the treatment of an avian radio-ulno-carpometacarpal joint luxation.

#### KEYWORDS

Anatomy, Biomechanics, Birds, Orthopaedics, Surgery

## BACKGROUND

Radio-ulno-carpometacarpal luxation is an uncommon traumatic injury.<sup>1</sup> Few case reports exist regarding ulno-carpal luxation in birds.<sup>1,2</sup> In general, pet and aviary birds are more susceptible to pelvic limb and spinal luxations, while wing luxations are more frequently observed in wild birds.<sup>1</sup>

A recent study demonstrated that the wing skeleton, including the four main wing bones (humerus, radius, ulna and carpometacarpus) and the two carpal bones (radial carpal bone and ulnar carpal bone), best represents the wing's biomechanics via a three-dimensional skeletal kinematics.<sup>3,4</sup> The radial accessory bone is also a carpal bone, but it does not contribute to the wing biomechanics.<sup>3,4</sup> The carpal joint consists of the radius and ulna, which connect via the radial and ulnar carpal bones to the carpometacarpus.<sup>3,4</sup> During flexion and extension of the wing, the ulnar carpal bone primarily slides along the ulna, while the radial carpal bone remains relatively stationary.<sup>3,4</sup> Both radial and ulnar carpal bones primarily rotate about the head of the carpometacarpus.<sup>4</sup> The pivotal role of the sliding ulnar carpal bone is the most critical for the articulation.<sup>4</sup> This reciprocal mechanism is dependent on the ligamentous attachments from the carpus to the radius and ulna.<sup>3</sup>

Several procedures have been described to repair joint luxations in birds. Closed reduction and bandaging with a figure-of-eight bandage has been described.<sup>5</sup> Surgical man-

agement has been recommended in large birds, in cases where there was significant laxity following reduction, or birds with chronic luxation.<sup>5</sup> Type 1 external skeletal fixation has been described for the repair of metacarpophalangeal and carpal luxation with good outcomes.<sup>5,6</sup> Few techniques have been described for internal fixation. A transarticular pin through the main body of the carpometacarpus and into the ulna has been described for treatment of carpal luxation, but long-term outcomes are rarely reported.<sup>5</sup> The aim of these techniques was to create a periarticular fibrosis to provide long-term stability to the joint, but the impact on wing movement after the surgery was not described even if the ability to fly remained adequate for the birds.

This report describes the management of a radio-ulno-carpometacarpal luxation with an internal fixation (positional screw) through the distal articulation of the radius and ulna with a minor impact on wing movement and a recovery of flight capacity 9 months after the surgery in a common buzzard (*Buteo buteo*).

## CASE PRESENTATION

A 4-year-old, 1.02 kg, male common buzzard (*B. buteo*) used in falconry for public show was presented for an acute inability to fly. The bird was found on the ground the day of the presentation, and no traumatic event was observed. A collision with the aviary's metallic mesh wall, or an injury inflicted by

one of the griffon vultures with which the buzzard coexisted is suspected. On physical examination, the body condition score was 3.5/5, and the bird had a slight unilateral wing droop without any other apparent sign. Clinical examination revealed pain at manipulation of the right wing associated with swelling and instability of the right carpus. Focal ecchymosis was observed without open wound or feather loss. The remainder of the examination was unremarkable. A right distal radius/ulna fracture or carpal luxation was suspected, so orthogonal radiographic of the region was proposed and accepted by the owner.

## INVESTIGATIONS

Analgesia was provided with meloxicam (1 mg/kg intramuscularly [IM]) (Metacam 5 mg/mL, Boehringer Ingelheim) and anaesthesia induced with isoflurane (Isoflurin, 1000 mg/g, Dechra) in oxygen (3% in 1.5 L/min) by face mask. Orthogonal radiographic projections of the right wing revealed a dorso-lateral radio-ulno-carpometacarpal luxation (Figure 1a–d). Closed reduction of the radio-ulno-carpometacarpal luxation was attempted by applying axial distraction and slight flexion to the dislocated joint. In this position, digital pressure was applied directly over the proximal segment of the displaced carpometacarpus from dorsal to palmar, while counter-support was applied to the distal segments of the radius and ulna. The carpus was then extended slightly. Reduction was only partial and not stable (Figure 2). Therefore, surgical stabilisation was planned. No other clinical pathology exams were performed due to financial constraint.

## TREATMENT

The surgery was performed 36 hours after the injury. The bird fasted for 24 hours before anaesthesia. Midazolam (0.4 mg/kg IM) (Midazolam 5 mg/mL, Hameln), butorphanol (1 mg/kg IM) (Butorgésic 10 mg/mL, Audevard) and meloxicam (1 mg/kg IM) (Metacam 5 mg/mL, Boehringer Ingelheim) were administered for premedication. Anaesthesia was induced with 3.5% isoflurane (Isoflurin, 1000 mg/g, Dechra) in 1.5 L/min oxygen using a face mask. The bird was intubated with an uncuffed tracheal tube (4 mm) and was maintained with 1%–3% isoflurane during the procedure. The catheter was placed in the left ulnar vein, using a 26G 0.6 × 19 mm (BD Neoflon Pro) catheter. The bird was monitored with capnography, oesophageal temperature and electrocardiography. Thermal support and crystalloid fluid therapy (10 mL/kg/h intravenously) (NaCl 0.9%, Aquapharm) were provided throughout anaesthesia. The depth of anaesthesia was evaluated by toe pinch and corneal reflexes. Intermittent positive pressure ventilation was provided to support respiration.

The common buzzard was positioned in sternal recumbency. The feathers were plucked on both the cranial/dorsal and caudal/palmar aspects of the wing, along the distal length of the radius and ulna, next to the carpal bones, and on the proximal part of the carpometacarpal bone. The pri-

## LEARNING POINTS/TAKE-HOME MESSAGES

- The carpal bones are an integral part of the biomechanics of the wing in a six-bar mechanism, which requires a full-fledged six-bar (humerus, radius, ulna, carpometacarpus, ulnar carpal bone and radial carpal bone) mechanism to model avian wing motion and anatomy in concert.
- The ulnar carpal bone has an essential pivotal role for the good flexion and extension of the wing and should not have to be immobilised during the surgery.
- Surgical stabilisation of a radio-ulno-carpometacarpal luxation with a distal radio-ulnar screw is a feasible and an effective technique with no post-surgical complication reported.
- Discrete loss of extension is noted but full fly capacity is reported at 9 months postoperatively.

mary remiges were left in place. For aseptic preparation, 4% chlorhexidine gluconate (Hibiscrub 40 mg/mL, Mölnlycke) and saline solution (NaCl 0.9%, Aquapharm) for rinse were used.

The luxated joint was approached using a dorsal approach to the carpal joint. A straight skin incision was made cranially on the distal part of the radius, 2 cm proximally to the carpus articulation, and extended distally on the dorsal surface of the joint next to the carpal bones with a 21 scalpel blade. The muscle and tendon of the extensor metacarpi radialis running along the cranial surface of the radius were retracted. The muscle and tendon of the extensor metacarpi ulnaris were found on the cranial surface of the ulna and were retracted. The tendon of the extensor digital common muscle was also retracted and the joint was visualised. The cranial and dorsal ligaments of the radio-radiocarpal joint were ruptured. The dorsal ligaments of the radio-carpometacarpal and ulno-carpometacarpal joints were intact. The luxation was reduced using Clamshell bone reduction forceps with speed lock with the wing in extension and internal rotation of the ulna. The wing was flexed and the ulnar carpal bone was confirmed to mechanically slide distally along the ulna. This provided more space to place the radio-ulnar screw proximal to the ulnar carpal bone without immobilising it, because the ulnar carpal bone was not visualised during the surgery.

A 2-mm hole with a mini drill bit (stainless steel, length 145 mm, diameter 2 mm, Kyon) was drilled in the radius and ulna 1 cm proximal to the carpal articulation cranio-caudally, perpendicular to the axis of the bones. A 2.7-mm cortical screw (self-tapping, Kyon) was inserted cranio-caudally in neutral position (Figure 3). Flexion and extension of the carpus were performed, and revealed adequate stability and normal range of motion of the joint. The skin was sutured in a simple interrupted pattern with absorbable suture (Monocryl 4/0, monofilament, conventional cutting needle, Ethicon). Postoperative radiographs revealed proper positioning of the implant (Figure 4a,b). The wing was folded and wrapped in a flexed position with a figure-of-eight bandage with a