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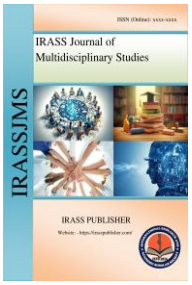

Radiographic Evaluation of Short Oblique Fracture of the Distal 1/3rd of the Humerus in a 2-Month-Oldtomcat (Case Report)

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Abstract: Several surgical procedures can be better planned with the use of diagnostic imaging modalities. Radiography is an imaging modality that uses X-rays, or similar ionizing radiation to view the internal structures of the body. Determination of the best management option to be used for treatment of a fracture can be established through radiography. A case of humeral fracture was presented at the Small Animal Unit of Usmanu Danfodiyo University Sokoto with a chief complaint of limping on the right forelimb and reduced feed intake. It was sent to the Radiology Unit for radiograph after which it was managed using open reduction and internal fixation using improvised screw driver as intramedullary (IM) pin. Radiographic monitoring of the healing progress was done at 2 weeks interval. Healing was achieved at 6 week and the intramedullary pin was removed. The fracture healed successfully without complications.

Keywords: cat, fracture, oblique, radiography, intramedullary pin.

Introduction

Achieving the right intramedullary length and diameter is crucial for fracture fixation, patient recovery, and overall result. A pin with the wrong diameter or length may interfere with the normal reduction process, leading to a fracture line becoming malrotated or distracted (Keltz et al., 2019), this can be avoided with proper preoperative radiograph to determine the size of the intramedullary pin to be used for surgical management (Roberts and Meeson, 2022). Approximately 70% of the medullary cavity should be filled by the IM pin: Measure the canal's size on radiographs and choose a pin that covers 70% of the cavity (Johnson et al., 2012). Determination of the best management option can also be established through radiography (Walsh et al., 2013). When making clinical decisions, the cost-effectiveness of diagnostic imaging for traumatic bone fractures is becoming more and more crucial (Mushlin, 1999). The utility of radiography in the diagnosis, and follow-up of bone defects of the limbs is reliable and cost efficient (Oviawe et al., 2023). Between 4.4% and 9.5% of feline fractures are humeral fractures, which are rather rare in veterinary practice (Cardoso et al., 2016). Of these, 75% to 87% are diaphyseal fractures (Matthiesen, 1992). Dogs, on the other hand, have a greater percentage of humeral condylar fractures. The humeral shaft's comparatively straight profile, the humeral condyles' wider and straighter shape, and the cat's absence of a supratrochlear foramen account for this discrepancy (Gall et al., 2022). Humeral and femoral fractures can be classified in the following three regional categories, with diaphyseal and distal being the most common fracture locations. Cats usually sustain a long bone fracture as a result of being stepped on, having something fall on them and falling from a height (Brinker et al., 2019). Significant impairments, functional limits, and disability are commonly the outcome of fractures. The arrangement of the skeletal tissue is disrupted and mechanical integrity is lost when fractures happen. Radiographically, radiolucent fracture lines are seen in cases where there is separation of fracture ends, where there is an overriding fracture, arrears of increased opacity is observed (Oviawe et al., 2017). Generally, fractures are immobilized by external or internal fixation. Among the external fixations Plaster of Paris (POP) is commonly employed for fractures below the knee and hock (O' Connor 2005). The internal fixation is a strategy for fracture repair that involves accessing the fracture site to realign the bone segments (called "open reduction") and stabilizing them with implants to enable bone healing to occur (Erwin et al., 2018). Intramedullary fully-threaded pins are manufactured from an alloy of titanium, aluminium and vanadium in a fully-threaded style. The diameters of the pins produces ranges from 4 mm to 11 mm. The pins ranges in length from 5 to 22 cm. The pins' distal end is usually slightly tapered to make it easier to insert them into cancellous bone, while their proximal end is usually made to fit into a hexagon-shaped screwdriver (Altunatmaz et al., 2012). Intramedullary pins can effectively be sterilized using steam sterilization before use in surgical procedures the same way suture materials are sterilized (Oviawe et al., 2015).

Case Details

A 2-Month-old Feline (Local Tom Cat) was presented at the Small Animal Unit of Usmanu Danfodiyo, Sokoto with a chief complaint of limping on the right forelimb. The client also complained of

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reduced feed intake which was noticed shortly after limping was observed (figure 1). The cat was fed on milk, cooked fish and meat. There was no history of medication nor vaccination.

Physical Examination and Clinical findings

Reluctant to move, swelling and upon palpation there was crepitation and withdrawal reflex in response to pain. Non weight bearing lameness on the right forelimb. Rectal temperature, pulse and respiratory rates were 38.7oC, 118 beats/min and 28 cycles/min respectively. Crepitation around the distal 1/3 of the humerus was observed on palpation.

Figure 1: showing the cat on the day of presentation not able to bear weight on the affected limb (blue arrow).

Case Management Plan

The cat was taken to the x-ray room for radiograph of the right forelimb in order to properly access the fractured bones, decide on the best management option and select an appropriate sized screw driver (improvised intramenullary pin) that can be used to manage the fracture depending on the size of the medullary cavity measured on the radiograph. Surgical intervention using open reduction and internal fixation using an improvised screw driver as intramedullary pin was decided on to be sterilized using steam sterilization method (figure 2 A).

Radiographic Presentation

The radiograph taken on the day of presentation was with the cat placed on right lateral recumbency on the x-ray table. An exposure setting of 10 mA and 50 kVs was used to make the exposure and a medio-lateral view of the humeral bone was taken which revealed an oblique fracture of the distal 1/3 of the humerus, soft tissue swelling was also observed around the fractured bones (figure 2 B).

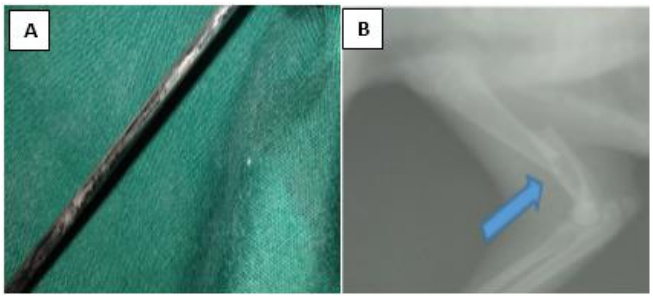

Figure 2: Showing the screw driver used as an intramedullary (IM) pin (A) and an overriding short oblique fracture of the distal 1/3 of the humerus (B).

Surgical Management

The surgical procedure was performed under sedation and general anaesthesia using a combination of 2% xylazine (0.2 mg/kg) and 1% (0.02 mg/kg) atropine administered intramuscularly for induction. Maintenance was achieved using 5% ketamine (10 mg/kg) and 2% xylazine (0.2 mg/kg) injection administered intramuscularly.

The surgical site was shaved and aseptically prepared using chlorhexidine. The area was draped and a surgical site incision of 7cm was made on the skin sub cute and muscles in order to access the fractured bone. The improvised IM pin (screw driver) was steam sterilized before used for the surgery. The pin was drilled in to the fractured bone in a retrograde position using a jackob's chuck to align the ends of the fractured bones (Figure 3). The excess pin was cut off using a bone cutter.

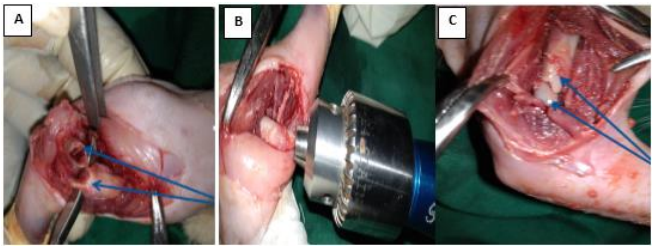

Figure 3: Showing the fractured bone (A), drilling of the IM pin into the bone (B) and complete alignment of the fractured ends after insertion of the pin (C).

Post-Operative management

The antibiotics administered was amoxicillin at 10mg/kg (IM) administered intramuscularly for five days, subcutaneous injection of diclophenac was used to control pain at 0.3mg/kg for 3 days. The regular daily dressing of the wound was done for 7 days. The cat was admitted for 2 week before discharging it to the owner. Post-operative radiograph (figure 4 A) was taken to ascertain proper insertion and alignment of the pin in the medullary cavity. Follow up radiograph at week 2 and 4 showed progress in the healing and at week 6, the animal was bearing full weight on the limb.

Result

In the second week, the cat with a fractured femur repaired by intramedullary pinning exhibited a progressive dense periosteal reaction at the fractured site indicating the start of periosteal callus bridging formation. In the fourth week, the cat's periosteal reactions were becoming denser and the full callus began to form at the 4th week.

Figure 4: Showing immediate post - operative radiograph (A), radiograph at 2 weeks (B), radiograph at 4 weeks (C).

Figure 5: Showing the cat walking at week 6 with a complete weight bearing on the limb.

Discussion

Humeral fracture obtained in this case, is not a common type of fracture encountered in cats but when it occurs, it usually affects the diaphysis the most as seen in this situation. A similar report was obtained by Gall *et al.* (2022) who analyzed feline humeral fracture morphology and reported that the diaphyseal humeral fractures accounted for 71% of all fractures in their cat population, making them the most common form of humeral fractures. The cause of this fracture was unknown although road traffic accident, falling from a height and being stepped on has been a major cause of humeral fractures in cats (Conroy *et al.*, 2019). Management of the humeral fractures using open reduction and internal fixation is a common and an effective treatment method. Similar statement was also reported by Zurita *et al.* (2022) who reported on management and treatment options. Radiographic was sufficient in confirmation of the fracture as a short oblique fracture. This report is similar to the work reported by Roberts and Meeson, (2022) who documented that majority of fractures and orthopaedic injuries are identified by radiography. Measurement of the medullary cavity using radiography in determining the size of intramedullary pin to be used was found to be of great help in the management process as it reduced the chances of intraoperative errors. These findings confirm the utility of preoperative medullary cavity measurements in predicting the feasibility of placing a specific size intramedullary implant as also reported by Walsh *et al.* (2013). The fracture in this case was managed using open reduction and internal fixation with an improvised sterilized screw driver pin used as an intramedullary pin which gave the bone a good stability (figure 4). This is in line with the work reported by Inas *et al.* (2012) who reported that intramedullary pinning offers high-quality balance for long bones. In this case, the cat was unable to support its weight on the fractured limb from weeks two through four. After that, non-weight bearing lameness was observed, and from week's five to six, full weight bearing was noticed (figure 5). This is in line with the work reported by Oryan *et al.* (2015), who report that the callus index is usually lower at week two, increase to a maximum level during weeks three and four, and then started to decline from week five to six. This suggests that a significant healing usually achieved from five to six weeks.

Conclusion

Pre-surgical planning using radiography as the imaging modality was successfully used in determining the size and length of the implant to be used based on the diameter of the medullary cavity of the humerus. Having an ideal measurement of the IM pin from the radiograph played an important role in the success of the surgery without complications. Screw driver was successfully used in place of an ideal IM pin to manage the fracture without any form of complication.

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