

Chapter 1: Introduction

A common accidental occurrence in small animals is long bone fracture which usually takes place in the hind limbs and femur. Femoral and humeral fractures are among the most common orthopedic conditions in cats. (Voss.,2009).Motor vehicle injuries, falls from heights, biting and catching the animal by the limb are common causes of fractures in animals (O'Conner, 2005; Harvey et al., 1991; Denny, 1993, Hosgood and Hoskins,1998). As long as the extra loading forces on the bone are accepted, such as compression, flexion, tension, unique fracture patterns will occur (Johnson.,2007). The femur is the foremost influenced bone(50.84%) in cat. (Cardoso.,2016).Clinical symptoms associated with fractures are lameness, pain, local swelling, abnormal posture, crackling when palpating, abnormal mobility of the affected bone and neurological deficits. Tentative analysis may be made primarily based totally on clinical symptoms. However dependable diagnostic strategies ought to be implemented to make the better analysis which encompass orthopedic test, neurologic test, radiography and computed tomography.(Denny, 1993, Fossum et al., 2007).

External coaptation, cerclage wire, Intramedullary pinning (IMP) (single pin, stacked pins), external skeletal fixation with IMP, leg screw, bone plates, plate rod and interlocking nails (Scott, 2005; Scott and Mclaughlin 2007;) are the known techniques to treat fractures. Among them, IMP is popular for long bone fracture repair in cats, especially for humerus, femur and tibia. (Simon., 2016), that acts primarily as an internal splint of the medullary canal of the long bone which shares the load with the bones and maintains the axial alignment of the fracture and resists bending forces in all directions applied to the bone (Beale, 2004).

The purpose of this case report is to describe clinical and radiographic examination of femoral fracture in a cat and a successful fixation of the fracture by C-arm radiography guided intramedullary pinning.

Chapter 2: Materials and methods

Case Presentation

A mix bred cat of one year of age and weighting 2.6 kg was presented to the Teaching and Training Pet Hospital and Research Center (TTPHRC), CVASU with the complain of lameness, limping in hind limbs and the history of fall down from a height. A clinical examination revealed that, the cat was unable to carry weight on its hind limbs. Femoral fracture was suspected by clinical examination and recommended for radiographic examination for final confirmation.

2.1 Restraining and Anesthesia

Both physical and chemical restraining was done. For sedating the cat, Xylaxine was administered through intramuscular route at the dose 1 mg/Kg. For General Anesthesia (GA), a mixture of Diazepum-Ketamine was administered through the intravenous route at the dose of 0.3 mg/Kg and 5.5mg/Kg, for Diazepum and Ketamine respectively .

2.2 Radiographic examination

Prior to General Anesthesia (GA), digital palpation was performed over the suspected area. Pain response was observed while palpating the area. Lameness was observed during movement of the patient.

After, General Anesthesia (GA), the cat was placed on an x-ray table in the radiography room. The cat was set on lateral position. The suspected area (left hind limb) was individually placed on the x-ray table in lateral position to get good exposure. The selection of kvp(kilo-voltage peak) was 55 kvp and mAs (milliampere) was 2 mAs, to take radiographic images.

Several images were taken from this lateral position to have a good image. After evaluating the images taken, diaphyseal femoral (left) fracture was confirmed and recommended for surgical correction.

2.3 Surgical technique

The surgical site of the animal was prepared aseptically by clipping, shaving, applying povidone iodine and finally washing with 70% alcohol. The area of the site of surgery was covered by a draper. Along the skin of the affected area, an incision was made and skin was separated from subcutaneous layer. An incision was then made in the muscle carefully by avoiding and taking care of larger blood vessels. After separation of the muscles by blunt dissection, the muscle layer was incised and then a cut was guided by a finger, placed under the bone fracture. Then the partial of the broken bone was spotted and lifted with a bone curette and bone cutting forceps. By the help of Hohman retractor, the bone was brought back to its normal position. Then drilling was done through the injured bone with a bone drilling machine and fixation splint was attached. Then simple continuous suture by catgut (no. 1) was applied in muscle. Subcutaneous tissue apposition was done by using catgut (no. 1) in a simple continuous pattern. The skin apposition was done by using silk by cross mattress suture. The suture line was mopped by povidone iodine. The sequential steps performed to correct the fracture are shown in different panels of Figure 1. During the surgery, 5% dextrose in normal saline (200 ml) was administered intravenously. Then immobilization was done by applying a bandage in the affected leg.

Figures

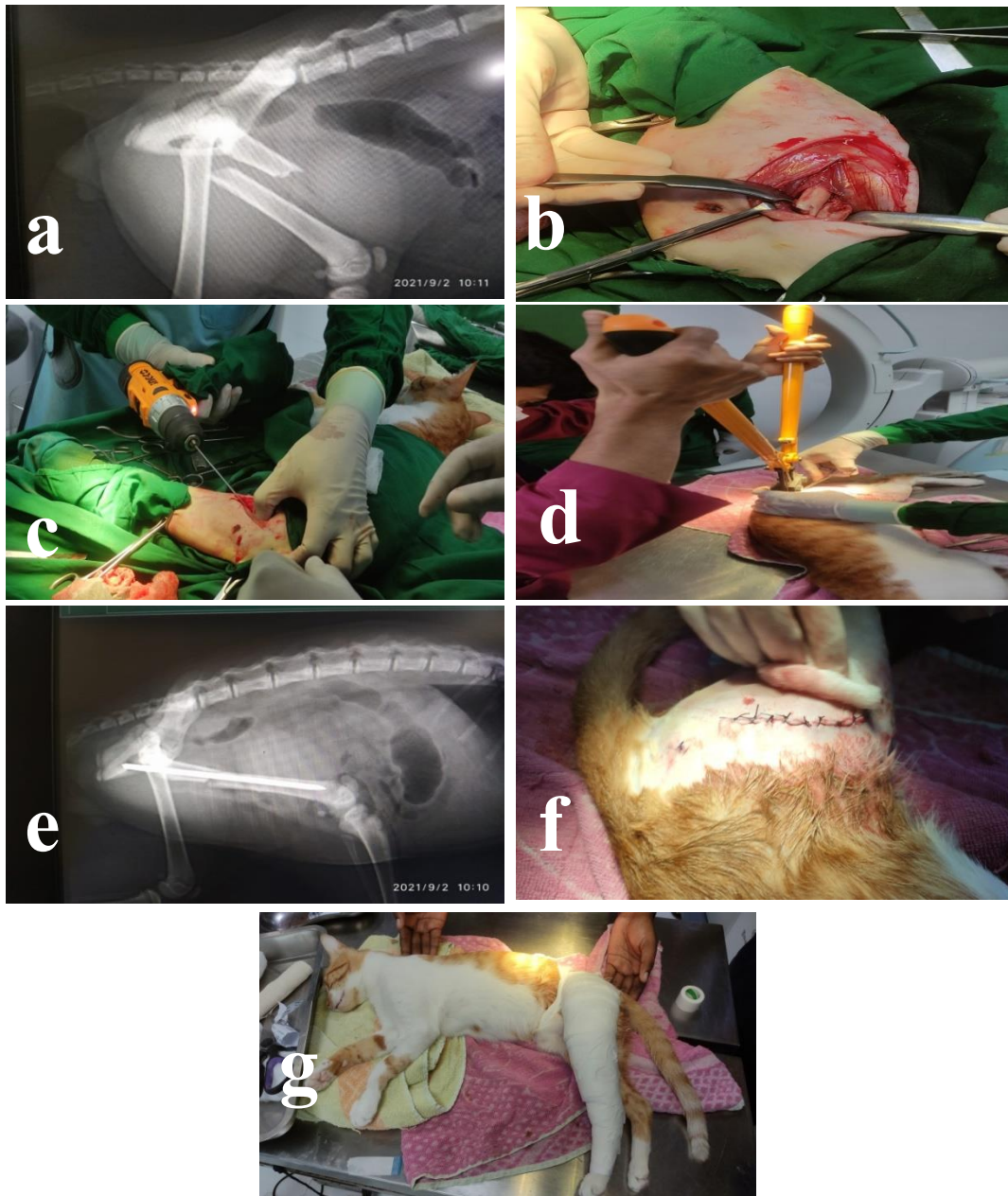


Figure 1: Sequential steps followed to correct diaphyseal femoral (left) fracture in a cat: a) Confirmation of the diagnosis by digital radiography; b) Getting through the fracture site by excising and separating the soft tissues; c) Placing the medullary pin for the bone and drilling to keep it placed by splint outside; d) Cutting the pin exposed to the surface; e) Retaking radiograph to verify bone correction-apposition after placing the medullary pin; f) Suturing of the soft tissues and skin cut during the surgery; and g) the cat lying at lateral recumbency after the surgery

2.4 Post-Operative Care

Antibiotic and anti-inflammatory drug were administered therapy along with calcium supplement and nerve tonic to prevent the bacterial infection and to help the healing process. i) Injection Ceftron® 250mg (Ceftriaxone at the dose rate of 50mg/Kg body weight) – was administered intramuscularly for 7 days to prevent infection and 0.2 ml ii) Injection Mel Vet ® (Meloxicam at the dose rate 0.04mg/Kg body weight) administered subcutaneously for 3 days along with iii) Calcium supplement (Calbo-D, at the dose of 50mg/kg body weight) and iv) Nerve tonic (Neuro-B, at the dose of 1ml/10kg body weight) was applied for assist healing. The owner was advised to restrict the movement of the cat until complete healing.

Chapter 3: Results

The intervention was successful. No clinical complication was reported during the post-operative phase of 7 days.

The owner of the cat was advised to restrict the movement of the animal until complete healing and to pay a visit to the hospital after one month for regular health check-up of the cat and to take radiographic image of the bone. The expected pin removal time was two months post-surgery conditional upon complete healing of the wound.

Chapter 4: Discussion

This case report describes the management of diaphyseal femur (left) fracture by intramedullary pinning in a mix breed cat using general anesthesia where Xylaxine was used for sedation and Diazepam-Ketamine mixture was used for anesthesia. The most commonly fractured bone in cats is femur and the most common site of the femur fracture is shaft of the femur.

External coaptation, cerclage wire, IMP (single pin, stacked pins), external skeletal fixation with IMP, leg screw, bone plates, plate rod and interlocking nails (**Scott, 2005; Scott and Mclaughlin 2007;**) are used for fracture management. Techniques that involve intramedullary pins have been devised for the use of femur bone (**Harasen.,2002**). Generally 70-80 percent of the diameter of the medullary cavity should be occupied by an intramedullary pin (**Peirone.,2002**). Faster and more easily applicable method is intramedullary pin application and subsequent healing is easier after removal of the osteosynthesis material as well as it is a more cost-effective technique (**Altunatmaz.,2017**) Pin diameters of 1.6 mm to 4.8mm are suitable for use in cats. (**Simon.,2016**) . In this case, the diameter of the pin used was 1.8mm which support the above statement.

To prevent post-operative complications, post-operative management is very important. Very common complications in this IMP technique are pin loosening, pin migration and seroma formation. (**Denny and Butterworth, 2007; Reems et al.2003.,Arun et al., 2011.,**). However, infection may also be common in open fracture. In the present case, no such occurrence was found .

Bone healing is usually seen in 6-12 weeks. (**Johnson and Dunning, 2005; Slatter, 1993**). A report of fracture healing within 20 days also reported (**Marshall et al. 2010**). As this case was observed up to 7 days post-operation, it could not be known when the complete healing occurred.

The number of pet owners is increasing day by day in Bangladesh. So, the cases of fracture are also increasing. Among all other methods of managing bone fracture, intramedullary pinning seems to be promising. It is a reliable method that can help healing faster. Vet graduates should be trained on it hands-on to be skilled to make this method available across the country for the wellbeing of the pet population.

Chapter 5: Limitations

Several laboratory tests, including biochemical and hematological tests, should have been performed before the surgery to check if the cat was fit for the surgery; but no laboratory tests were performed during or before this surgery due to lack of opportunity to do such testing.

Conclusions

Intramedullary pinning by using K wire should be a preferable approach for diaphyseal femur fracture correction in pet cats, because K wire gives more strength than stainless steel wiring or tape muzzle, facilitating rapid healing compared with other techniques.

References

1. Altunatmaz K, Karabağlı M, Gydin D, Güzel O, Yalin EE, Uğurlu U, Sadalak DJ, Ekici H. The treatment of supracondylar and diaphyseal femoral fractures in cats using intramedullary two-way stacked Kirschner wire application. *Turkish Journal of Veterinary and Animal Sciences*. 2017 Apr 19; 41(2): 282-7.
2. Arun Prasad A, Ayyappan, S., Das, BC, Md. Shafiuzama, Priya, S and Suresh Kumar, R. Surgical management of long bone fractures in cats: a review of 12 cases. *Indian Journal of Veterinary Surgery*, 2010., 31(1): 45-46
3. Beale B. Orthopedic clinical techniques femur fracture repair. *Clin Tech Small Animal Pract* 2004; 19: 134-150.
4. Cardoso CB, Rahal SC, Agostinho FS, Mamprim MJ, Santos RR, Mortari AC, Monteiro FO. Long Bone Fractures In Cats: A Retrospective Study. *Veterinária e Zootecnia*. 2016 Jan 9;23(3):504-9.
5. Denny, HR, Butterworth SJ, 2007. The femur. In : a guide to canine and feline orthopaedic surgery. 4th edition, Blackwell Science Ltd, London, pp: 495-510
6. Denny H.R, (1993); A guide to canine and feline orthopedic surgery. Blackwell scientific Publication, Oxford
7. Fossum TW, Cheryl SH, Johnson AL, Schulz KS, Seim HB III, Willard MD, Bahr A, Carroll GL (2007) *Small animal surgery*. 3rd ed. Mosby: Elsevier.
8. Harasen G. Fractures involving the distal extremity of the femur: Part 2—The mature patient. *The Canadian Veterinary Journal*. 2002 Feb;43(2):131.
9. Johnson A.L, 2007. Fundamentals of orthopedic surgery and fracture management, p.930- 1014. In: Fossum T.W. (Ed.), *Small animal surgery*. Mosby, St. Louis. 1632p.
10. Johnson, A. L. and Dunning, D. (2005). *Atlas of Orthopedic Surgical Procedures of the Dog and Cat*, 1st edition, pp: 138-139.

11. Marshall, W.G., Farrell, M., Chase, D. and Carmichael, S. (2010). Maxillomandibular circular external skeletal fixation for repair of bilateral fractures of the caudal aspect of the mandible in a dog, *Vet. Surg*, 39:765-70.
12. O'Conner J.J.D (Ed) (2005); *Dollars veterinary surgery. General, operative and regional*. Satish kumar jain, Dariya ganj. New Delhi, 110002 India; 813-818.
13. Peirone B, Camuzzini D, Filippi D, Valazza A. Femoral and humeral fracture treatment with an intramedullary pin/external fixator tie-in configuration in growing dogs and cats. *Veterinary and Comparative Orthopaedics and Traumatology Archive*. 2002;15(2):85-91.
14. Reems MR, Beale BS, Hulse DA. Use of a plate-rod construct and principles of biological osteosynthesis for repair of diaphyseal fractures in dogs and cats: 47 cases (1994–2001). *Journal of the American Veterinary Medical Association*. 2003 Aug 1;223(3):330-5.
15. Scott H.W. & McLaughlin R. 2007. Fracture classification, decision making, and bone healing, p.43-49. In: *Ibid. (Eds). Feline orthopedics*. Manson Publishing, London. 384p. Edinburgh. 582p.
16. Scott, HW and McLaughlin R, 2007. Fracture fixation methods: principles and technique. In *Feline Orthopaedic*. 1st edition. Manson Publishing Ltd. London, UK, pp:58-86.
17. Scott H. Repair of long bone fractures in cats. *In practice*. 2005 Sep 1;27(8):390-7.
18. Simon, M. Shiju, Gupta Chhavi, P. Sankar, R. Ramprabhu, and N. Pazhanivel. "Repair of Diaphyseal Femoral Fracture Using Intramedullary Pin and Cerclage Wire in a Cat.". *Indian Veterinary Journal*. 2016 February., 93 (02) : 67 – 68
19. Slatter, D. J (1993). *Textbook of Small Animal Surgery*, Ed. 2 , pp 1910-1921.
20. Voss K, Montavon P.M. 2009. Fractures, p.129-151. In: Montavon P.M., Voss K. & Langley-Hobbs S.J. (Ed.), *Feline orthopedic surgery and musculoskeletal disease*. Mosby Elsevier, Edinburgh. 582p.

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Biography

I am Piyal Paul, son of Palash Kanty Paul and Nibadita Paul. I passed my Secondary School Certificate (SSC) examination from Chittagong Government High School, Chittagong in 2012 and Higher Secondary Certificate (HSC) examination from Chittagong College, Chittagong in 2014. I enrolled for Doctor of Veterinary Medicine (DVM) degree in Chattogram Veterinary and Animal Sciences University (CVASU) Bangladesh. I have immense interest to work in the field Of Pet Animal Medicine.