Chapter-I: Introduction

Long bone fracture is one of the most common orthopedic complications in small pets especially in cats (Parker and Bloomberg, 1984). Automobile injury, falling from height, bite and capturing the animal by limb are common sources of fractures in animals (O'Conner, 2005; Harvey *et al*., 1991; Denny, 1993, Hosgood and Hoskins, 1998). Among the long bones, femur is appeared to be the most frequently affected bone in fracture (Kushwaha *et al.*, 2011) in both dogs and cats (Maala and Celo, 1975; Johnson, 1994, Aithal, 1999). The clinical indications interconnected with fractures incorporate lameness, pain, local swelling, abnormal posture, crepitating sound on palpation, abnormal activity of intricate bone and neurological insufficiency along with the additional signs which are related to fractures are also observed. Tentative diagnosis can be arrived based on clinical signs but reliable diagnostic techniques should be applied to make the confirm diagnosis (Denny, 1993), which include orthopedic test, neurologic test, radiography, and computed tomography (Fossum et al., 2007). The basic principles of fracture management are reduction, retention and immobilization. Primary objective of fracture management is to gain the fastest possible healing and the anatomical reconstruction of the structure to enable the patient functioning normally by permitting early walking (Aron, 1998; Shahar, 2000). Reduction of long bone fractures can be achieved by closed and open methods. Reduction by the open method is associated with supplementary soft tissue trauma, periosteal stripping, and occurrence of hematoma at the site of fracture (Johnston *et al*., 1999). Important factors considered in repairing of femur fractures include, appropriate surgical approach, preservation of regional soft tissues and their attachments to bone fragments. Many techniques have been used to repair fractures that involve devices like lag screw, intramedullary pin (IMP), bone plate and screw, interlocking and cross pin, dynamic compression plate and Cerclage wire (Perren, 2002; Horstman *et al*., 2004). Among them, intramedullary pinning is most frequently used technique for repairing of long bone fractures. It performs primarily as internal splint of medullary canal of long bone along with maintaining axial alignment of the fracture and resists bending forces in all directions applied to the bone (Beale, 2004). Fixation methods embrace external coaptation, Intramedullary pinning (single pin, stacked pins), Cerclage wire, external skeletal fixation with IMP, bone plates, lag screw, plate rod and interlocking nails (Scott, 2005; Scott and Mclaughlin, 2007). Intramedullary pinning is a popular method of long bone fracture repair in cats that often used to stabilize fracture of the humerus, femur and tibia. The motive of this case report is to chronicle the clinical and

radiographic examination of femoral fracture in a Persian cat and triumphant fixation of the fracture applying retrograde intramedullary pinning.

Chapter-II: Materials and Methods

Signalment and history of the case

A 1.8 years old Persian cat weighing 4.8 kg was presented to the Teaching and Training Pet Hospital and Research Centre, Purbachal, Dhaka with a history of injury in the left hind limb. The owner complained that the cat got injured due to fallen down from the fifth floor of the building. This patient was unable to bear its body weight and reluctant to move.

Clinical examination

To assess the severity and type of fracture physical examination followed by X-ray was performed. Palpation of femoral area, revealed terrible pain. Palpation of the femoral area disclosed rustling and bulging on the left hind limb. For routine haematological examination and serum biochemical analysis (magnesium, calcium and phosphorus), blood was collected from the affected cat. All the blood and serum variable analyzed were found within normal range except stunted neutrophils count (Table-1) and moderately low level of magnesium (Table-2). To determine the accurate fracture location, preoperative radiograph was taken. Complete oblique distal diaphyseal fracture of femur was remarked on the X-ray examination (Figure-1). According to radiographic examination by duty clinician; X-ray guided intramedullary pinning using simple Steinmann pinning was decided to be executed. Owners consent was taken before commencement of the surgery and general status of the patient was also performed.

Table 1: Routine examination of blood of the cat

Parameter	**Result**	**Normal range**
Haemoglobin	9	8-12 g/dl
ESR (Wintrobe tube method)	0	0 mm in 1st hour
Total count of RBC	7.6	8-18 million/cumm
Total count of WBC	9.4	4-13 thousand/cumm
PCV	26	22-38%
Differential count for WBC		
Lymphocytes	66	50-70%
Neutrophils	25	30-48%
Eosinophils	4.5	1-8%
Monocytes	3.7	0-4%

Table 2: Serum biochemical test of the patient

Parameter	**Result**	**Normal range**
Magnesium	1.7	1.8-2.3 mg/dl
Calcium	9.1	9.7-12.4 mg/dl
Phosphorous	4.5	4.2-9.1 mg/dl

Premedication, anesthesia and surgical approach

Restraining of the cat was done by both physical & chemical restraining techniques sedation was done by using intramuscular xylazine (1.1 mg/kg body weight). Afterwards the pet was prepared for aseptic surgery by clipping, shaving and applying povidone iodine on the dermis of the affected area. Then the patient was placed on the table in Operation Theater. The cat was given premedication in the form of xylazine 2% (1mg/kg BW) IM for sedation and for general anesthesia ketamine 2% (10 mg/kg BW) was used IM while maintenance used by Diazepum (0.5mg/kg BW) intravenously along with normal saline. A draper was put over the area of the surgical site. Before incision, the incision line was mopped by using povidone iodine and the skin

incision was made over the cranio-lateral aspect of the stifle joint and separated from subcutaneous layer (Figure 2). Then the muscle was incised and taken care to prevent severe of any blood vessels. Muscle layer was incised and then guided a cut by a finger placing under the bone fracture by following the discretion of the muscle by blunt dissection. Then the broken bone was detached by bone curette and bone cutting forceps. The fractured bone was then put down in its normal position by Hohman retractor bone holding forceps (Figure 3). Following this the bone was drilled with bone drilling machine (Figure 4) and fixation splint was attached with bone and pinned the bone and tied with screw. Later simple continuous suture by catgut size no. 1-0 was given in muscle layer (Figure 5). The subcutaneous tissue was apposed using catgut size no. 2-0 with a simple continuous pattern and the skin was apposed using silk by cross mattress suture (Figure 6). The suture line was mopped by povidone iodine. During surgery, normal saline (200 ml) was administered intravenously. Then a bandage was applied on the leg to immobilize the affected area (Figure 8) and the X-ray view was taken for confirmation of the successful intramedullary pinning (Figure 9).

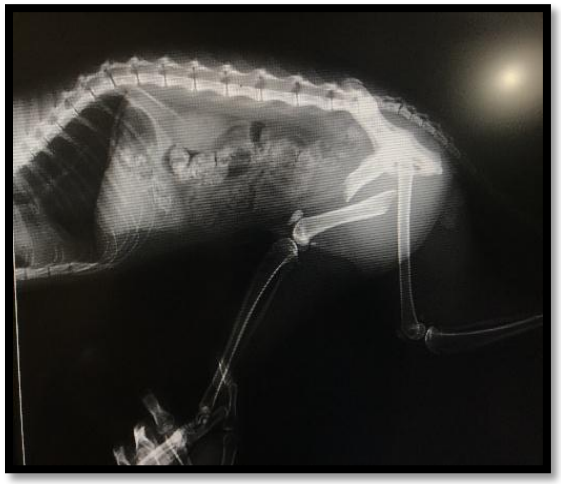

Figure 1. Complete oblique distal Diaphyseal Femur fracture

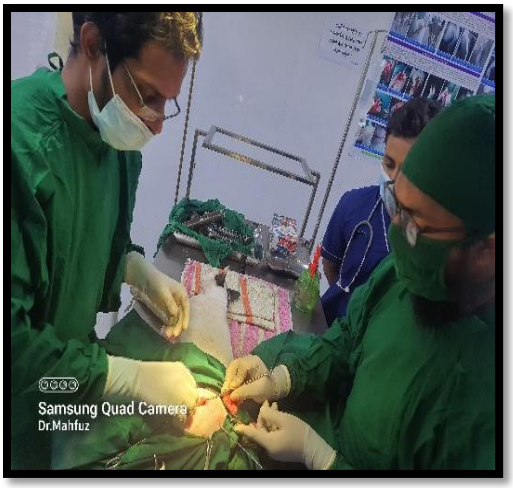

Figure 2: Incision of skin and muscle

Figure 3: Exposing the bone

Figure 4: Intramedullary pinning

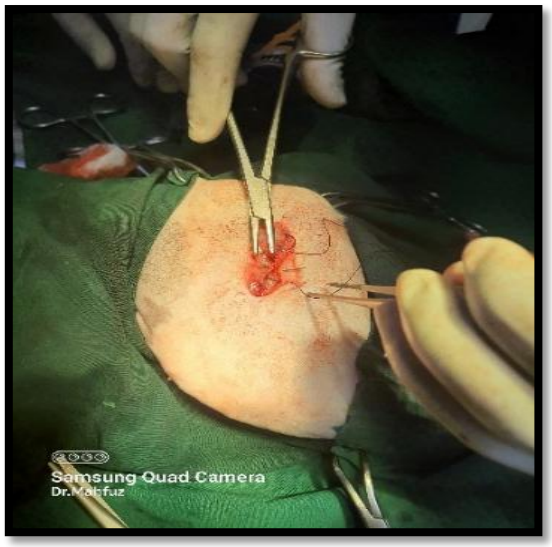

Figure 5: Suturing the muscle

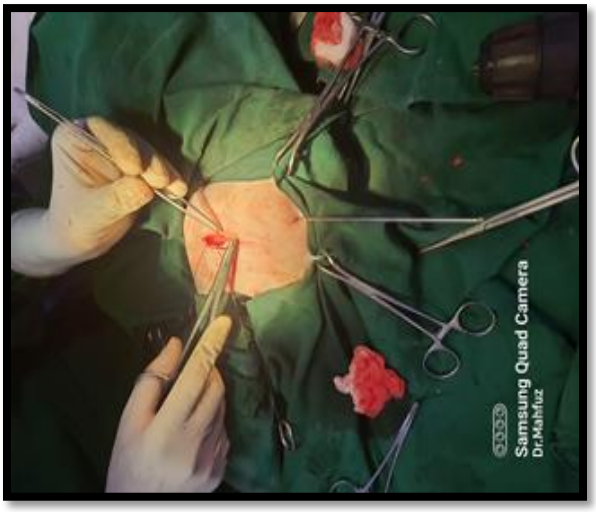

Figure 6: Suturing the skin

Figure 7: Intramedullary pinning

Figure 8: Bandage on the suturing line

Figure 9: X-ray view after operation

Post-operative Care

The cat was looked after for 5 days post operation to monitor any complication until complete healing. Following surgery, the pet was provided fluid substitutions, antibiotic (ceftriaxone) and anti-inflammatory drugs (Meloxicam) for 5 days. Calcium supplement (Calbo-D) and Vitamin B1 (Neuro-B) were given for 15 days. Normal saline (100ml) was given daily (5 days) through intravenous route for maintaining fluid level. Gesture and robust activity were prohibited. The sutures were removed after 2 weeks. Radiographic evaluation was continued until thorough healing of the fracture.

Chapter-III: Results & discussions

The present study depicted that the cat gained partial weight bearing ability from 4-7 days of post operation. Bone and shaft of the femur is the most common site of the femur fracture in cat. From the history it was revealed that falling from the height along with traumatic injury was the main causes of fracture (Mafi *et al.,* 2014). Classically, the process of internal fracture fixation intricate the use of pins, wires, screws, and plates to stabilize fractures rigidly that have been anatomically reduced (Sultana, 2019). Techniques that involves intramedullary pins have been devised for use of the femur. Among the few well established techniques for repairing distal femoral fractures, some methods have inherent drawbacks such as, improper reduction or pin placement, muscle tie-down, soft tissues irritation and joint pain or arthritis due to injuries by cut ends of pins and pin migration. Moreover, some techniques need secondary surgical intervention for removing the implants. Finally, some complications ended with loss of function and motion of stifle joint (Dehghani *et al.,* 2013). However, in order to overcome these challenges, arrow pin along with external fixation (Robert Jones Bandage) was found to be helpful in distal end femoral fracture. Generally an intramedullary pin should occupy 70-80% of the diameter of the medullary cavity. Intramedullary pin application is faster and more easily applicable, removal of the osteosynthesis material subsequent healing is easy. It is a more cost-effective technique and the treatment of supracondylar and diaphyseal femoral fractures in cat using intramedullary two-way stacked Kirschner wire application (Altunatmaz *et al.,* 2017). Appropriate pin selection is very important due to pin loosening and pin migration. Selection of appropriate pin depends on the size of the IMP cavity of the bone to be repaired, the fracture configuration and application of ancillary methods of fixation. Pin diameters of 1.6 mm to 4.8mm are preferable to use in most cats (Sultana, 2019). Few factors were considered in this study for the subjective assessment of mobility during the postoperative period. However, there is a potential to claim that the arrow pin technique is a better method for fixation of femoral fractures in cat, provided that proper scaled-based assessment for mobility and pain is used in extended study for fundamental results we obtained (Rathnadiwakara *et al.,* 2020). The patient was treated with post-operative antibiotic therapy so that it could exert effective control of secondary bacterial infections. Absence of post-operative swelling or discharges in the surgical site indicated that post-operative care was effective (Erwin *et al.,* 2018). Post-operative management is very important to escape complications. Pin detaching

and pin migrations are very common complications in intramedullary pinning technique. However, infections may also be common in open fracture.

Chapter-IV: Conclusions

The present case study suggests the intramedullary pinning was found to be an easy and effective method for the management of long bone fracture in animal. Postoperative success depends on the appropriate pin selection and postoperative care with antibiotics, immobilation and rest. In our study the result confirmed that the single arrow pin technique provided proper stability and acceptable resistance to rotational and axial forces in distal femoral fractures and confirmed that it would provide a significant fracture reduction in oblique distal femoral fractures in cat.

Limitations

- The intramedullary pin as the foreign body material delay healing
- Insertion of pin induce much pain and another surgery is required during removal of pin
- Lead to bone marrow destruction along with the inner blood circulation.
- May lead to infection due to entrance of microorganism.
- May lead to osteomylitis and lead to loss in the pins, less stable fixation,
- Slower return to function and secondary bone union

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Biography

I, Foysal Ahmmed, son of Md. Nurul Haque and Anowara begum was born in Shibpur Upazilla at Narsingdi, Bangladesh. . I completed S.S.C in 2013 with GPA-5.00 from Harishangan High School, Narsingdi and H.S.C in 2015 with GPA-5.00 from Trust College, Dhaka. I got admitted in Chattogram Veterinary and Animal Sciences University for the degree of Doctor of Veterinary Medicine course in 2015- 2016 session. I am currently an intern student under the Faculty of Veterinary Medicine. In future, my immense of interest toward the higher studies bas well as research in the field of companion animal medicine.