A Successful surgical correction of closed complete oblique mid diaphyseal right femoral fracture of a cat using Intramedullary Pinning: A case report

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Abstract

All felines are sensitive to long bone fractures, and the femur is one of the most often broken bones in dogs and cats after serious trauma. The current case study details the treatment of a cat's femur fracture. A six-month-old female domestic shorthair cat that had been limping in its right hind limbs for ten days was brought to Teaching and Training Pet Hospital and Research Center (TTPHRC), Purbachal, Dhaka. The cat was hardly able to support its weight, according to a clinical assessment, and the damaged leg also showed signs of discomfort, limping, and crepitation. The right oblique distal diaphyseal femoral fracture was verified by radiography. Based on clinical and laboratory evaluation, it was decided to do retrograde intramedullary pinning in conjunction with a routine surgical procedure under xylazine and ketamine anesthesia. During surgery, it was discovered that the area around the shattered bone had extensive fibrosis. Following surgery, the cat was treated with NSAIDs, systemic antibiotics, and bandages for protection. In this instance, light weight-bearing was seen starting on the seventh postoperative (PO) day, and the sutures were safely removed after two weeks. Improved weight bearing was clinically seen a few days after the suture was cut, and radiographic analysis revealed subsequent bone repair. After two months and fifteen days of operation, it was discovered that the patient was leading a regular, pleasant life. The current case study demonstrates that internal femur fracture repair in cats may be accomplished simply, affordably, and effectively in the field by intramedullary pinning.

Keywords: Intramedullary pinning; Fracture management; Cat surgery; Femur fracture.

1. Introduction

The population of cats is increasing due to the improvement of people's livelihoods. Modern people like to rear cats as pets for companion or recreational purposes (Rahman, 2017; Turner, 1991). However, accidental injuries are increasing day by day due to frequent movement and mismanagement to them. Among them, fracture in particular long bones like hind limbs and femur is the most common surgical case frequently admitting to the hospital. (Langley-Hobbs, 2009). Animals often suffer fractures as a result of being run over by cars, falling from great heights, being bitten, or being restrained by their limbs (Denny & Butterworth, 2008; HASSAN, 2021). As long as the additional loading forces on the bone, such as compression, flexion, and tension, are allowed to be present, unique fracture patterns will continue to materialize (Hossain et al., n.d.; Paul, 2021).Lameness, pain, local swelling, abnormal posture, crepitating sound on palpation, abnormal activity of intricate bone, and neurological insufficiency are some of the clinical indications that are associated with fractures. Other additional signs that are associated with fractures can also be observed. Osteomyelitis, delayed union, nonunion, malunion, premature physeal closure, and fracture-related sarcoma are some of the major problems that might arise as a result of repairing a fracture. Both the presurgical examination of the patient and the postoperative care of the patient should take into account the potential for these problems(Jackson & Pacchiana, 2004). It is possible to arrive at a provisional diagnosis based on clinical indicators; nevertheless, reliable diagnostic procedures should be employed in order to make the definitive diagnosis. These diagnostic techniques include radiography, computed tomography, orthopedic and neurological tests, and so on(Denny & Butterworth, 2008; Fossum, 2007). Reduction, retention, and immobilization are the three pillars around which effective fracture care is built. The primary goal of fracture care is to achieve the quickest possible healing and the anatomical rebuilding of the structure to enable the patient to function normally by allowing early walking(Bada et al., 2017; Fathy et al., 2018; Talaat et al., 2022). This may be accomplished by minimizing pain and maximizing mobility. Both closed and open surgical procedures may be used in the treatment of long bone fractures. When a fracture is reduced using the open approach, further soft tissue damage, periosteal stripping, and the formation of a hematoma at the fracture site are all possible complications. When healing a femur fracture, it is essential to take into account a number of important criteria, including the most effective surgical technique, the preservation of regional soft tissues, and the attachments of those soft tissues to

the bone pieces. There are a variety of methods that may be utilized to heal fractures. Some of these methods include the use of devices such as lag screws, intramedullary pins (IMP), bone plates and screws, interlocking and cross pins, dynamic compression plates, and Cerclage wires(Perren, 2002; Stephan, 2002).Intramedullary pinning is the method that is used for the treatment of long bone fractures more commonly than any of the others. Its primary function is that of an internal splint for the medullary canal of the long bone, in addition to preserving the axial alignment of the fracture and preventing bending forces from acting in any of the possible orientations on the bone(Beale, 2004). Fixation techniques include external coaptation, intramedullary pinning (single pin, stacked pins), cerclage wire, external skeletal fixation with IMP, bone plates, lag screw, plate rod, and interlocking nails. Other methods include external skeletal fixation with IMP, bone plates, and interlocking nails(Franzen-Klein & Redig, 2022; Hart et al., 1985; Sharma et al., 2021). Intramedullary pinning is a common technique for the healing of long bone fractures in cats. This technique is most often used to fix fractures of the humerus, femur, and tibia(Franzen-Klein & Redig, 2022; Kurtz & Rozbruch, 2017; Menéndez Garmendia et al., 2014). The purpose of this case report is to provide a detailed account of the clinical and radiographic examination of a femoral fracture in a domestic shorthair cat as well as the successful fixation of the fracture through the use of retrograde intramedullary pinning.

2. Case Presentation

A complaint of lameness, limping in the hind limbs, and a history of falling down from a height was brought to the Teaching and Training Pet Hospital and Research Center (TTPHRC) at CVASU by the owner of a domestic shorthair cat that was 6 months old and weighed 2.4 kilograms. After undergoing a clinical evaluation, it was discovered that the cat was unable to support its body weight with its hind limbs. The radiographic examination revealed that the patient had a diaphyseal fracture of the right femur.

2.1. Restraining and Anesthesia:

There was restraint applied chemically as well as physically. The intramuscular method of administration of xylazine at a dosage rate of 2 mg/Kg was used in order to produce a sedated state in the cat. A combination of diazepam and ketamine was administered intravenously for general anesthesia (GA), with the doses of diazepam and ketamine being 0.5 mg/Kg and 10mg/Kg, respectively.

2.2. Clinical Examination:

A physical examination and then an X-ray were conducted so that the severity of the fracture and the kind of fracture could be determined. When the pain was palpated in the femoral region, it was excruciating. The femoral region was palpated, and it was found to have a rustling and bulging sensation on the right hind leg. Blood was drawn from the cat that was diagnosed with the condition so that a standard hematological examination and serum biochemical analysis (of magnesium, calcium, and phosphorus) could be performed. All of the blood and serum variables that were examined were determined to be within normal range, with the exception of a reduced neutrophils count and levels of magnesium that were somewhat low. A preoperative radiograph was obtained in order to have a better idea of where the fracture was exactly. The X-ray examination revealed that the patient had suffered a complete oblique distal diaphyseal fracture of the femur. Based on the findings of the radiographic examination performed by the duty physician, it was agreed that an X-ray guided intramedullary pinning procedure employing basic

Figure 2: Complete oblique fracture of femur

Steinmann pinning would be performed. At the beginning of the procedure, the owner's permission was requested, and a comprehensive examination of the patient was carried out as well.

Table 1: Routine examination of blood of the cat

Parameter	**Result**	**Normal range**
Hemoglobin	8.3	8-12 g/dl
ESR (Wintrobe tube method)	0	0 mm in 1st hour
Total count of RBC	6.9	8-18 million/cumm
Total count of WBC	9.9	4-13 thousand/cumm
PCV	27	22-38%
Differential count for WBC		
Lymphocytes	59	50-70%
Neutrophils	31	30-48%
Eosinophils	5.1	1-8%
Monocytes	3.7	0-4%

2.3. Surgical Technique:

After the animal was restrained and examined, the surgical site was prepped in a sterile manner by cutting, shaving, administering povidone iodine, and lastly cleaning with 70% alcohol. A drape was used to cover the region that would later be the location of operation. An incision was created all the way down the skin of the afflicted region, and then the skin was peeled away from the subcutaneous layer. After that, a meticulous incision was made in the muscle while paying attention to and avoiding the bigger blood arteries in the area. Following the dissection of the muscle using blunt forceps, an incision was made into the muscular layer, and then a cut was made while being guided by a finger that was put beneath the bone fracture. After that, a bone curette and bone cutting forceps were used to extract and elevate the portion of the shattered bone that had become detached. The bone was able to be returned to its natural place with the assistance of a Hohman retractor. After that, a bone drilling machine was used to drill through the damaged bone, and a fixation splint was applied to the drilling site. After that, a

straightforward continuous suture made of vicryl (no. 1) was placed in the muscle. The apposition of the subcutaneous tissue was accomplished using vicryl (no. 1) in a straightforward and continuous pattern. Silk was used for the cross-mattress suture, which was used to affix the skin layers together. Povidone iodine was used to clean the area around the suture line. During the operation, 250 milliliters of an intravenous solution consisting of 5% dextrose in normal saline was given to the patient. After that, immobilization was achieved by wrapping a bandage over the leg that was afflicted.

Figure 2: Incision in the Surgical area

Figure 3: Separating muscle fibrous tissue from bone

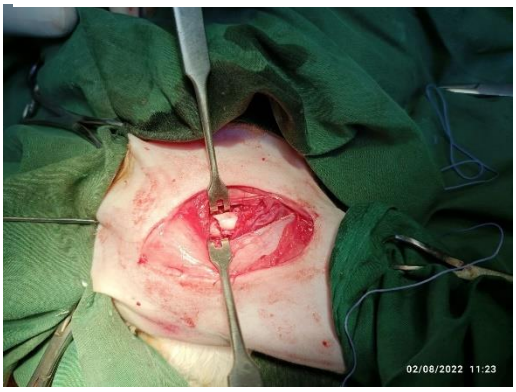

Figure 4: Apposition of two broken end of bone

Figure 5: Drilling Surgical Pin through bone

Figure 6: C-arm X-ray of Pin during surgery

Figure 7: After Pinning Successfully

Figure 8: Cutting Pin

Figure 9: Pressure bandage for external support

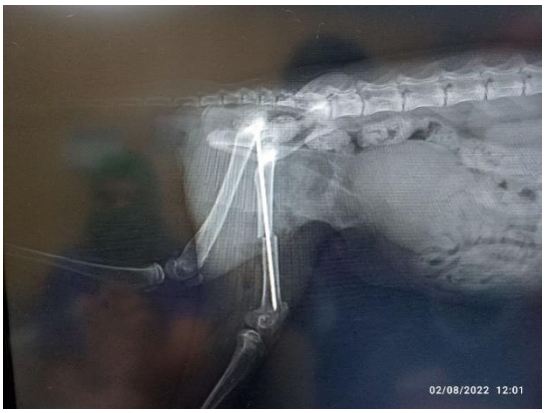

Figure 10: Confirmation X-ray after surgery

2.4. Post Operative Care:

The patient was treated with antibiotics and anti-inflammatory medication to expedite the healing process. 0.5 ml of Inj. Triject® 1gm (Ceftriaxone at the dose rate of 50mg/Kg body weight) was applied intramuscularly for seven days to prevent infection, and 0.2 ml Inj. Melvet ® (Meloxicam at the dose rate of 0.2mg/Kg body weight) was applied subcutaneously for three days to minimize inflammation and pain. Both treatments were administered for a total of fourteen days. Antihistaminic Inj. Phenadryl, which contains diphenhydramine hydrochloride at a dosage of 2 mg/kg of body weight, was injected intramuscularly as 0.2 ml over a period of seven days. It was recommended that the owner keep the cat away from water and limit the cat's activity until the animal had recovered completely.

3. Result and Discussion

According to the findings of this study, the cat was able to start bearing some weight 7 days after the operation, and it was able to bear all of its weight 2 months and 15 days after that. The most common place for a fracture to occur in a cat's femur is in the bone and shaft of the femur. It was discovered through research into the past that the two most common causes of fractures are a fall from a significant height and a traumatic injury(Denny & Butterworth, 2008).Traditional methods of internal fracture repair used the use of pins, wires, screws, and plates to firmly anchor fractures that had been anatomically reduced. This was done in order to limit the risk of further fractures(Sultana, 2019).For usage with the femur, procedures have been developed that require the insertion of pins into the intramedullary space. Some of the well-established methods for repairing distal femoral fractures have inherent flaws, such as improper reduction or pin placement, muscle tie-down, soft tissue irritation, and joint pain or arthritis as a result of injuries caused by cut ends of pins. However, these methods are among the few that are available. In addition, some methods need further surgical intervention in order to remove the implants once they have been inserted(Dehghani Nazhvani et al., 2013; S Dehghani & AR Raayat, 2013).However, it was discovered that using an arrow pin in conjunction with external fixation was helpful in treating distal end femoral fractures. This was done in order to circumvent the problems described above. In most cases, the diameter of the medullary cavity should be occupied by an intramedullary pin to the extent that it is between 70 and 80 percent. The placement of an intramedullary pin is quicker and more simply applied, and the following healing is straightforward when the osteosynthesis material has been removed. When it comes to the treatment of supracondylar and diaphyseal femoral fractures in cats, the intramedullary two-way stacked Kirschner wire application is a method that is both more effective and more cost-efficient(Altunatmaz et al., 2017).Because of the possibility of pin loosening and pin migration, selecting the appropriate pins is of the utmost importance. When choosing an adequate pin, consideration should be given to the size of the IMP cavity in the bone that has to be repaired, the geometry of the fracture, and the use of any supplementary means of fixing. For the majority of cats, it is best to use pins with diameters ranging from 1.6 mm to 4.8 mm(Sultana, 2019). But in our case, we used 2.5mm pin for better rigidity as the cat was too much active. In this particular research, just a few parameters were taken into consideration for the subjective evaluation of a patient's mobility throughout the postoperative period. However, there is a

possibility that it is possible to claim that the arrow pin technique is a superior method for the fixation of femoral fractures in cats, provided that an appropriate scaled-based assessment for mobility and pain is used in an extended study for the fundamental results that we obtained in the majority of cats. This would be the case only if the results obtained in most cats were studied for a longer period of time(Rathnadiwakara et al., 2020).Following surgery, the patient received post-operative antibiotic medication in the expectations that it would be able to effectively manage any secondary bacterial infections that may have developed. The lack of post-operative edema or discharges at the surgical site in cats was indicative of successful post-operative care being administered there(Erwin et al., 2018).In order to avoid complications, post-operative management is of the utmost importance. The intramedullary pinning technique is known to have a high risk of complications, the most common of which are pin detachment and migration. On the other hand, infections are another risk that comes with open fractures. In this study, the cats immunity also helped him for quick healing.

4. Conclusion

According to the results of the current case study, intramedullary pinning was discovered to be a procedure that is both simple and successful for the therapy of lengthy bone fractures in animals. The effectiveness of the postoperative treatment, which includes the administration of antibiotics, immobilization, and rest, is contingent on the correct pin being chosen. The findings of our research showed that the single arrow pin technique offered adequate stability as well as an acceptable resistance to rotational and axial powers in distal femoral fractures. Furthermore, our findings showed that this technique would offer a significant reduction in the number of fractures that occurred in oblique distal femoral fractures in cats.

Limitations

In order to determine whether or not the cat was healthy enough to undergo surgery, a number of laboratory tests, such as hematological and biochemical testing, had to be done beforehand. In spite of this, only hematological tests were carried out either during or before to this operation; this is a drawback of the research. The C-arm guided intramedullary pinning that was used in the treatment of the current instance was shown to be effective and offers stable fracture immobilization.

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Biography of Author

This is Eftakharul Islam Evan, the oldest child of Ziaul Haque and Latifa Easmin. He is now working for his Doctor of Veterinary Medicine (DVM) degree at Chattogram Veterinary and Animal Sciences University at the Faculty of Veterinary Medicine. He received a perfect score of 5.00 on both the Secondary School Certificate Examination (SSC) that he took in 2014 at Jangaldi High School, Sherpur Sadar, Sherpur and the Higher Secondary Certificate Examination (HSC) that he took in 2016 at Sherpur Govt. College, Sherpur Sadar, Sherpur. Both of these exams were passed with perfect scores of 5.00. He is in the end of his internship that will last for a whole year. He approaches his studies with a great deal of fervor, with the goals of improving his day one abilities and acquiring more practical information in order to better prepare himself for the present age of science.