Surgical Correction of a Closed Complete Oblique Midshaft Tibial Fracture in a Cat Using Intramedullary Pinning: A Case Report

Submitted By:
Uzzal Hossen
Roll No: 19/76; Reg No: 03286
Intern ID: 59
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Faculty of Veterinary Medicine
Chattogram Veterinary and Animal Sciences University, Khulshi,
Chattogram-4225, Bangladesh

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Surgical Correction of a Closed Complete Oblique Midshaft Tibial Fracture in a Cat Using Intramedullary Pinning: A Case Report

Approved By:

Dr. Bibek Chandra Sutradhar
Professor
Department of Medicine and Surgery
Faculty of Veterinary Medicine

Faculty of Veterinary Medicine
Chattogram Veterinary and Animal Sciences University, Khulshi, Chattogram-4225, Bangladesh

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Tables of contents

List of Figures

Abstract

This clinical report presents the case of a 12-month-old Indigenous male cat, weighing 4.5 kg, that sustained a femur fracture after falling from a fifth-floor building admitted to Purbachal Teaching and Training Pet Hospital. Upon examination, the cat was found to be lame and unable to bear weight on its right hind limb. Radiographic imaging revealed a complete transverse fracture in the midshaft of the right tibia. The fracture was treated using intramedullary pinning with a 2.5mm Steinmann pin under general anesthesia, guided by a C-arm X-ray. The cat was administered antibiotics (Cefixime 5–10 mg/kg) and anti-inflammatory medication(ketoprofen) postoperatively. Follow-up radiographs confirmed proper alignment and stabilization of the fracture. By day 18, the cat could partially bear weight on the injured limb, and by day 30, it was able to fully support its weight. This case highlights the effectiveness of intramedullary pinning in treating feline femur fractures, with favorable clinical and radiological outcomes when combined with appropriate surgical techniques and aftercare.

Chapter 1: Introduction

Cats have long been beloved members of households worldwide. As pets, they have evolved from being merely functional companions to becoming integral members of the family. With this elevated status, veterinarians bear a significant responsibility to ensure our feline friends remain healthy and happy. Among the most common and challenging medical issues in veterinary medicine are orthopedic injuries, particularly fractures (Aithal et al., 1999; Scott, 2005).

A fracture is essentially a break in the continuity and integrity of bone tissue, often caused by stress. Long bone fractures are especially prevalent in both cats and dogs, with the femur—the longest and strongest bone in a cat's skeleton—being particularly vulnerable. Femur fractures are one of the most frequently broken bones in both species, comprising approximately 50% of all feline fractures (Scott, 2005; Johnson et al., 1989). Harasen (2003) reported that 28% of femoral fractures occur in the femoral diaphysis, representing 45% of all long bone fractures. In a similar study, Das et al. (2010) found that femoral fractures accounted for 42.86% of cases, followed by humeral fractures at 25.40%, fractures of the radius and ulna at 20.63%, and tibial and fibular fractures at 11.11%.

According to Cullinane et al. (2001), the type of fracture a cat experiences is often influenced by the forces applied to the bone, such as compression, bending, tension, or twisting. The extent of the fracture and associated soft tissue damage may also depend on how quickly these stresses are applied (Johnson, 2002). Femoral fractures in cats can occur in various regions, including the diaphysis, trochanteric area, femoral neck, and distal sites such as the physeal plates or condyles. Tercanlioglu and Sarierler (2009) note that long bone fractures can involve the metaphysis, diaphysis, or epiphysis, though fractures in young cats are more commonly seen at the growth plates (proximal or distal physeal).

Proper assessment of a femoral fracture in a cat is essential for determining the most effective treatment. Due to their small size and natural inclination to roam, often into hazardous areas like roads, cats are highly susceptible to complex fractures. Palpation and radiographic imaging are crucial diagnostic tools, helping to evaluate the fracture's location, type (open or closed), joint involvement, and the displacement of bone fragments. Treatment options for femoral fractures typically include biological osteosynthesis or anatomic reduction with stabilization. Surgical intervention may be necessary in severe cases, while less severe fractures can often be treated with minimally invasive methods, allowing for recovery without the need for extensive surgery. The primary goal in treatment is to realign the fractured bone fragments, either through closed or open fixation techniques.

A variety of devices are used to repair long bone fractures, each with its own advantages and limitations. These include lag screws, intramedullary pins, bone plates and screws, interlocking and cross pins, dynamic compression plates, and cerclage wires (Perren, 2002; Horstman et al., 2004). Among these options, intramedullary pinning has proven to be particularly effective for stabilizing femoral fractures in cats (Scott, 2005). This technique involves inserting a metal pin into the medullary cavity of the femur to stabilize the fracture and promote healing (Stigen, 1999; Scott, 2005). Intramedullary pinning is technically straightforward, cost-effective, and utilizes readily available tools and implants. The straight, tubular structure of the feline tibia with its large medullary canal makes it an ideal candidate for this method. The pin should ideally occupy about 70% of the canal's diameter, leveraging the bone's abundant external

blood supply to enhance healing. Most tibial fractures occur in the diaphysis or distal shaft, regions where intramedullary pinning is particularly effective. This technique is favored for its ability to minimize complications and facilitate postoperative recovery.

This case report provides a detailed clinical and radiological evaluation of a tibial fracture in a cat and demonstrates the successful stabilization of the injury using intramedullary pinning, guided by C-arm X-ray.

Chapter 2: Methods & Materials

2.1 Case history:

Indigenous male cat aged 12 months weighing 4.5 kg was admitted to Purbachal,Teaching and Training Pet Hospital and Research Center in Dhaka with a history of long bone injury. The cat's owner claimed that cat was hurt when it fell from the fifth floors of the building. Upon clinical evaluation, the cat was found to be unable to bear its own weight and displayed reluctance to walk.

2.2 Restraining and anesthesia:

The patient was restrained both physically and chemically. A sedative effect was achieved by administering xylazine intramuscularly at a dose of 2 mg/kg.. For general anaesthesia (GA), a combination of ketamine and diazepam was injected intravenously, with dosages of 10 mg/kg for ketamine and 0.5 mg/kg for diazepam.

2.3 Clinical Examination:

A. Physical examination

Close inspection:

The presenting signs were first carefully observed and noted during a close inspection. The patients were alert and active and also displayed lameness.

Direct palpation:

The damaged area was palpable with the tips of the fingers, and tibial bone felt broken in their original positions. The damaged area was intensely painful when palpated.

B. Imaging technique:

Radiography(X-Ray):

An X-ray was taken to determine the type and degree of the fracture. The X-ray revealed a complete transverse fracture of the tibia in the midshaft region. Based on this radiographic evaluation, the decision was made to proceed with X-ray-guided intramedullary pinning using a simple Steinmann pin. Prior to the surgery, the owner's consent was obtained, and a general examination of the patient was conducted.

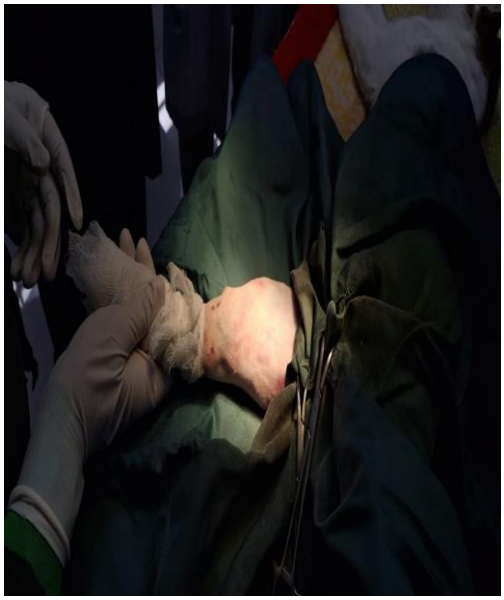

Figure 1: An X-ray revealed a complete fracture in the midshaft region of the tibia in the cat.

2.4 Surgical Technique:

After the patient was carefully restrained and positioned on the operating table, a thorough examination was conducted to ensure safety. The surgical site was prepared under strict aseptic conditions first by clipping and shaving the area, followed by cleaning with povidone iodine and a final wipe with 70% alcohol. A sterile drape was placed to isolate the area, ensuring it stayed clean throughout the procedure. The surgery commenced with an incision over the fracture site, followed by careful separation of the underlying tissues. The subcutaneous tissue was gently opened, and the muscles were meticulously parted to avoid damaging any nearby blood vessels. Using a finger for guidance, the surgeon meticulously exposed the fractured bone by bluntly dissecting through the muscle. Once the bone was fully exposed, the damaged fragments were removed using bone curettes and cutting forceps. A retractor and bone-holding forceps were then used to align the fractured pieces into their natural position. To stabilize the fracture, a bone drill was used to create holes at the appropriate site, and a 2.5 mm Steinmann pin was inserted to hold the fragments securely in place. After securing the fracture, the focus shifted to closing the surgical site. The muscle layer was sutured with simple continuous stitches using Vicryl (size 2-0). The same material was used to close the subcutaneous layer, also with a simple, continuous pattern. Finally, the skin was closed using silk sutures in a cross-mattress pattern for added strength. The area was thoroughly cleaned with povidone iodine, ensuring the wound was sterile. During the procedure, 200 ml of normal saline was administered intravenously to support recovery. The wound was then carefully bandaged to immobilize the area. A postoperative X-ray was performed to confirm the successful placement of the intramedullary pin, ensuring the bone was properly aligned and stabilized.

Figure 2: The pictures show the preoperative preparation of the patient and the preparation of the surgical site.

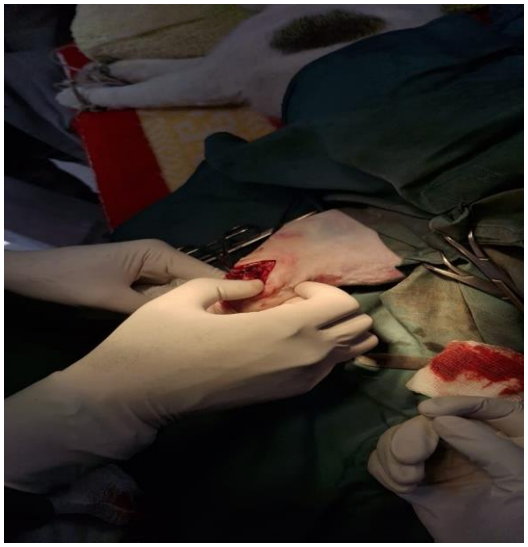

Figure 3 : An incision was made at the surgical site allowing exposure of the underlying tissues for pinning.

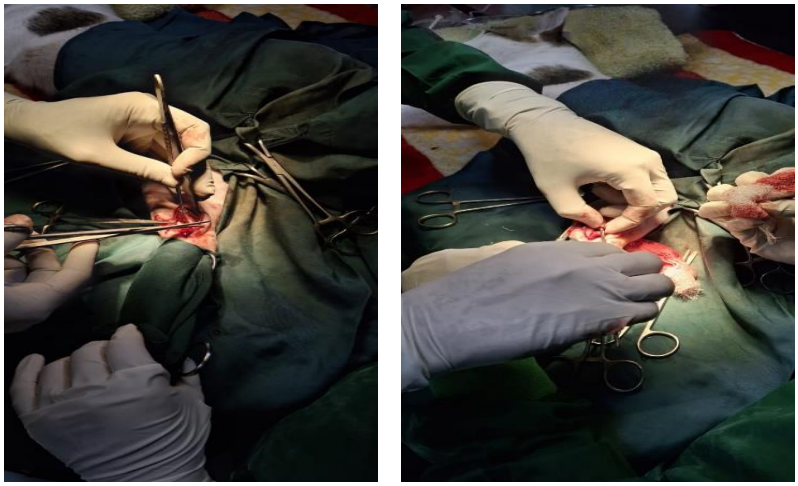

Figure 4 : The standard surgical technique was used to expose both the upper and lower fragments of the tibia before pinning.

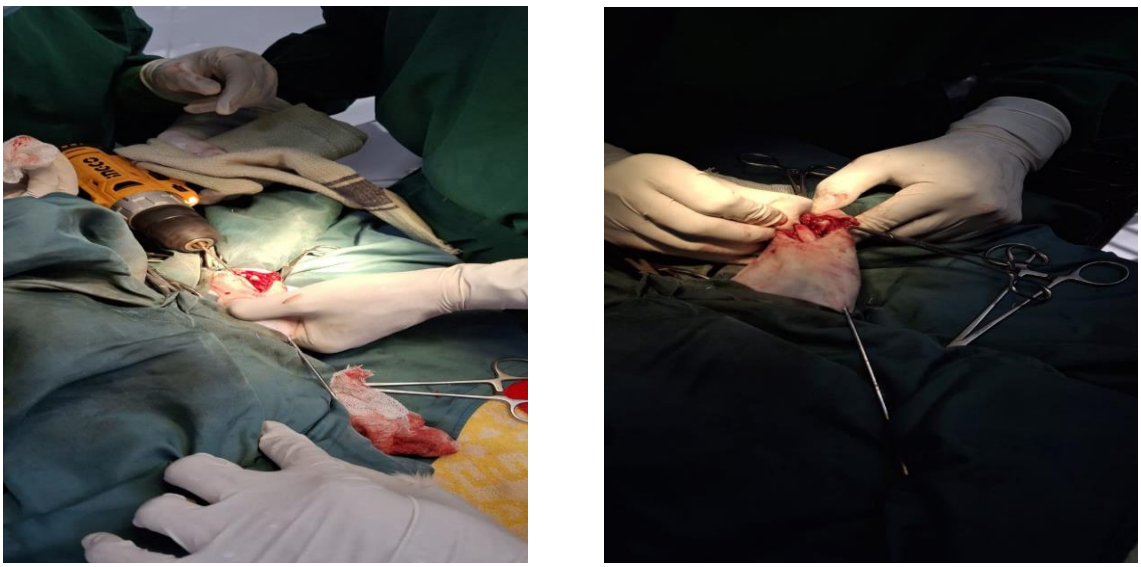

Figure 5 : The upper and lower portions of the tibia were drilled and a Steinmann pin was implanted to correct the fracture in this cat.

Figure 6 : C-arm X-ray was performed during the surgery followed by bandaging after the successful internal fixation with the Steinmann pin.

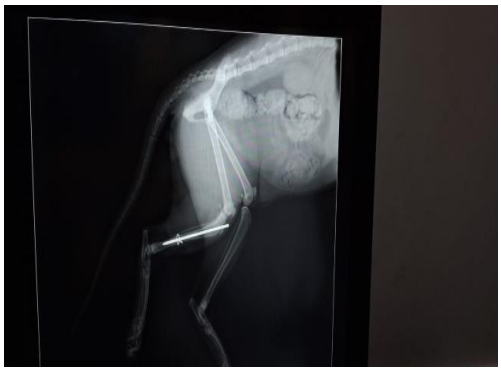

Figure 7: Three days after the surgery, the implant was correctly positioned showing on the X-ray.

2.5 post-operative care:

Antibiotics and anti-inflammatory drugs were given to the patient to hasten the healing process. Cefixime was administered orally for seven days at a dose rate of 5-10 mg per kilograms (Syp. Cef 3) to prevent secondary bacterial infection and ketoprofen was administered orally for three days to reduce swelling and pain. Both treatments were continued for a total of fourteen days. Additionally, diphenhydramine hydrochloride, an antihistamine, was given intramuscularly at a dose of 0.2 ml per day for seven days, at 2 mg/kg body weight. The cat was prescribed a calcium supplement (Tab. Calbo-D) for one month, with instructions to limit its activity and keep it away from water until it had fully healed. After two weeks, the sutures were removed. Radiographic assessment continued until the fracture had fully healed.

Chapter 3: Result and Discussion

Intramedullary pinning plays a crucial role in treating tibial fractures in cats by providing stability and support to the broken bone. This technique involves inserting a metal pin into the bone's hollow center to keep the fragments aligned, promoting proper healing. It's a relatively straightforward and cost-effective method that minimizes disruption to surrounding tissues, making it less invasive than some other options. Intramedullary pinning is often combined with other techniques, like wires or external fixators, for more complex fractures to ensure the bone stays in place during healing. With this approach, cats can regain mobility faster, helping them return to their playful selves sooner. There's a lot to explore beyond intramedullary pinning when it comes to treating tibial fractures in cats. For example, researchers could look into how external fixators or modern plating techniques compare in terms of stability and healing. Studies on bioabsorbable implants or bone grafts might reveal new ways to speed up recovery. Biological enhancers like stem cells or platelet-rich plasma could help improve bone regeneration, while rehabilitation therapies such as underwater treadmill exercises might boost mobility. Even advanced imaging techniques or 3D-printed implants could change how we monitor and treat these injuries, making recovery smoother and more effective for feline.

After surgery, the cat recovered smoothly from both pre-operative anesthetic procedures. Standard methods for internal fixation of fractures involve using pins, wires, screws, and plates to stabilize fractures that are anatomically aligned. Intramedullary pinning is a commonly used technique for tibial fractures, where the pin typically occupies 60-70% of the medullary cavity's diameter. This method is favored for its simplicity, quick application, ease of removal after healing, and cost-effectiveness (Altunatmaz et al., 2017). Proper pin selection is crucial to prevent complications such as pin loosening and migration. The choice of pin depends on factors like the size of the medullary cavity, the bone being repaired, the fracture type, and whether additional fixation methods are used. Pin diameters ranging from 1.6 mm to 4.8 mm are generally suitable for most cats. Postoperative care plays a significant role in identifying and managing potential complications. Common issues associated with intramedullary pinning include pin loosening, migration, and seroma formation (Arun et al., 2011). In cases of open fractures, the risk of infection may also be highlighted. The surgeon follows proper surgical techniques (Arun et al., 2011). However, after the surgery, the patient was not brought back for follow-up, so further monitoring was not possible.

Chapter 4: Conclusion

The findings from this case study demonstrate that intramedullary pinning is an effective and straightforward method for treating long bone fractures in cats. The success of this treatment heavily depends on proper postoperative care, which includes the use of antibiotics, ensuring immobilization, and providing adequate rest, as well as selecting the correct pin for the procedure. Our observations revealed that the Steinmann pin technique offered excellent stability and effectively resisted both rotational and axial forces in repairing long bone fractures. Additionally, the results suggest that this method can significantly reduce the recurrence or complications associated with long bone fractures in cats.

Limitations:

Several laboratory tests, including hematological and biochemical examinations, were not conducted. The presence of the intramedullary pin, being a foreign body, can delay healing by disrupting blood circulation and damaging the bone marrow. This may lead to complications such as osteomyelitis and pin failure, which could compromise the stability of the fixation. As a result, secondary bone union may occur, and the process of regaining function may be slower.

References

Aithal, H. P., Yadav, S. C., & Rao, R. (1999). Orthopedic injuries in cats: A review of clinical and radiographic findings. *Journal of Small Animal Practice*, 40(9), 415-419.

Scott, H. W. (2005). Fractures in cats: Diagnosis and management. Veterinary Clinics of North America*: Small Animal Practice,* 35(2), 345-358.

Johnson, A. L., & Williams, D. A. (1989). Feline fractures and their management. *Journal of the American Veterinary Medical Association,* 194(8), 1153-1159.

Harasen, G. L. (2003). Femoral fractures in cats*: Diagnosis and surgical management*. *Veterinary Surgery,* 32(1), 1-12.

Das, A., Banerjee, A., & Gupta, R. (2010). Clinical study of femoral fractures in cats: Incidence and outcomes. *Indian Journal of Veterinary Surgery*, 31(2), 75-79.

Cullinane, D. M., McLean, A. N., & de Lange, A. (2001). Biomechanics of bone fractures in cats and dogs. *Journal of Veterinary Surgery*, 29(3), 157-162.

Johnson, K. A. (2002). Factors affecting fracture severity in cats and dogs. *Journal of Small Animal Surgery*, 43(5), 283-290.

Tercanlioglu, B., & Sarierler, M. (2009). Fractures in juvenile cats: Mechanisms and outcomes. *Veterinary Research Communications,* 33(3), 345-353.

Perren, S. M. (2002). The biology of fractures and the role of bone stabilization techniques. *Orthopedic Trauma*, 14(4), 365-377

Horstman, C. L., Wolf, D., & Musgrave, R. (2004). Surgical treatment of femoral fractures in cats: *A comparative study of techniques*. *Veterinary Surgery*, 33(6), 547-553.

Stigen, J. H. (1999). Intramedullary pinning: A reliable method for femoral fracture stabilization in cats. *Journal of Veterinary Orthopedics*, 22(4), 314-317.

Altunatmaz, K., Karabagli, M., Kaya, D.A. et al. (2017). 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, 41, 282-287.Arun, S., Kumar, S., Tiwari, S.K., & Manohar, S. (2011). Complications and management of internal fixation in femoral fractures of dogs and cats. *Indian Journal of Veterinary Surgery*, 32(2), 100-105.

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Biography

My name is Uzzal Hossen, and I'm currently an intern veterinarian at the Faculty of Veterinary Medicine at Chattogram Veterinary and Animal Sciences University, where I am part of the 24th batch. I completed my Secondary School Certificate (SSC) in 2016 and my Higher Secondary Certificate (HSC) in 2018. Originally, I am from Jagarman, Kalihati, Tangail. Looking ahead, I aspire to become a veterinary practitioner and focus on research related to clinical animal diseases in Bangladesh.