



Management Femoral Fracture in Cats using Intramedullary Pin and Wires Fixation

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Abstract

On April 2016, Veterinary Teaching Hospital, Faculty of Veterinary Medicine, Bogor Agricultural University (VTH FKH IPB) received 4 cases of femoral fractures in cats caused by trauma. Two cats suffered oblique diaphysis fracture femoral, one cat suffered comminuted diaphysis fracture femoral, and one cat suffered epiphyseal fracture femoral (column femoral and trochanter major). All cats were treated by open surgery using intramedullary pins (Steinmann) and cerclage wires (Kirschner). Fracture recovery went without complication and all cats were able to move their feet one week after surgery.

Background

Fracture is injury to bone tissue which caused bones to lose continuity and balance. Fracture may be caused by outside trauma, in which it would be called trauma fracture, or by some sort of disease, called pathological fracture. Femur fracture in cats usually caused by various kinds of trauma. It could happen to metaphyseal, diaphyseal, and or epiphyseal part of long bones (Tercanlioglu and Sarierler, 2009; Shiju *et al.*, 2010).

Basic principle of fracture treatment is to return the anatomical position of two fracture fragments either by using closed fixation or open fixation via surgery. Internal fixation device commonly used in fracture treatment are intramedullary pin, plate, screw, and wire (Mafi *et al.*, 2014; Mwangi and Mande, 2012). The majority of femoral fracture happens as closed fracture because of the thickness of the surrounding muscle (Beal, 2004). Several factors to consider in fracture treatment, are 1) blood supply to bones and bone fragment must always be protected from surgery trauma, 2) accurate restoration of the shape of the bones, especially around joints, 3)

mechanical reposition and fixation tools must be stable, 4) trauma caused by techniques used must be as minimum as possible, and 5) good rehabilitation begins as soon as definitive therapy is given (Stiffler, 2004; Tercanlioglu and Sarierler, 2009). Mwangi and Mande. (2012) stated that what must be paid in mind during fracture treatment are correct surgical approach, minimizing tissue damage, adequate stabilization, determining implant material and its implementation (fixation), and post-surgery care. In Indonesia, it is really difficult to obtain veterinary implant material to be used as fixation implant on animal fracture treatment. We tried to use intramedullary pin and wire to treat femoral fracture on 4 cats.

Clinical signs

On April 2016, VTH FKH IPB received 4 cats with reports of lameness after being ran over by vehicles. They are two domestic cats weighing 1.8kg and 2.1 kg, a Persian cat weighing 2.5 kg, and a Himalayan cat weighing 2.8 kg. Cat clinical examination resulted in normal temperature and mucosal membrane, lameness, and pain

upon femoral palpation coupled by crepitation sound. The cats were given Diazepam (Valisanbe[®], Sanbe Farma, Indonesia) 2 mg PO as sedative for X-ray shots in lateral and dorsal-ventral position. X-ray result showed oblique diaphysis fracture femoral in local cat (Figure 1a), epiphyseal fracture femoral in domestic cat (Figure 1b), comminuted diaphysis fracture femoral in Persian cat (Figure 1c), and oblique diaphysis fracture femoral in Himalayan cat (Figure 1d).

Surgery procedure

Pre-surgery clinical examination showed that all cats were in stable condition. Physiological parameter (temperature, heart rate, respiratory rate, and mucosal membrane) and blood profile (erythrocyte, leucocyte total, differential leucocyte, hemoglobin, hematocrit, and thrombocyte) were within normal value. Cats were given premedication in the form of atropine sulfate (Atropine[®], Ethica, Indonesia) 0.25 mg/kg BW SC, sedation by xylazine 2% (Xyla[®], Interchemie, Holand) 1mg/kg BW IM. General anesthesia used was ketamine 2% (Ketamil[®], Troy Laboratories PTY Limited, Australia) 10 mg/kg BW IM while maintenance used was by inhalation anesthetic (Isoflurane). Cats were covered by surgical drape, followed by incision on femoral area. The two fracture fragment were fixed then the skin was sutured just as shown on Figure 2. Two fragment of domestic cat's oblique diaphysis femoral fracture were fixed by using 2.5 mm intramedullary pin (Steinmann) and cerclage wires (Kirschner) (Figure 3a); fragments of epiphyseal fracture femoral (Column femoral) of domestic cat were fixed by using 1.0 mm intramedullary pin (Steinmann) (Figure 3b) after caput femoral was connected with corpus femoral which then followed by fixation of trochanter major to corpus femoral by using cerclage wires (Kirschner); fragments of comminuted diaphysis fracture femoral of Persian cats were fixed by 3.0 m intramedullary pin (Steinmann) while cerclage wires (Kirschner) were used to fixed the broken fragments (Figure 3c); and fragments of

oblique diaphysis fracture femoral of Himalayan cat was fixed by using 3.0 mm intramedullary pin (Steinmann) (Figure 3d). Surgery region was cleaned by sterile saline solution 0.9%. Suturing of muscular biceps femoral (simple interrupted pattern) and fascia lata (simple continuous pattern) was done by using polyglactin thread 910 3.0 USP (Vicryl[®], Ethicon Inc.). Subcutaneous tissue was sutured (simple continuous pattern) polyglactin thread 910 3.0 USP (Vicryl[®], Ethicon Inc). Suturing of skin (simple interrupted pattern) was using silk thread 3.0 USP (Silkam[®], BRAUN, Indonesia). Surgery region was wrapped by framycetin sulfate (Sofra-Tule[®], Pantheon UK Limited, Swidon, UK for Sanofi-Aventis, Thailand) and changed on day 3, 6, 9, and 12 post-surgery. For post-surgery care, amoxicillin and clavulanic acid 62.5 mg/cat (Claneksi[®], Sanbe Farma, Indonesia) and Caprofen (Rimadyl[®], Pfizer/Zoetis, USA) 2.2 mg/kg BW orally administered for 14 days 2 times a day.



Figure 1. Radiography image of femoral fracture before surgery; (a) Lateral view of oblique diaphysis fracture (domestic cat), (b) Ventral-dorsal view of epiphyseal femoral fracture (domestic cat), (c) Lateral view of comminuted diaphysis femoral fracture (Persian), (d) Lateral view of oblique diaphysis femoral fracture (Himalayan).

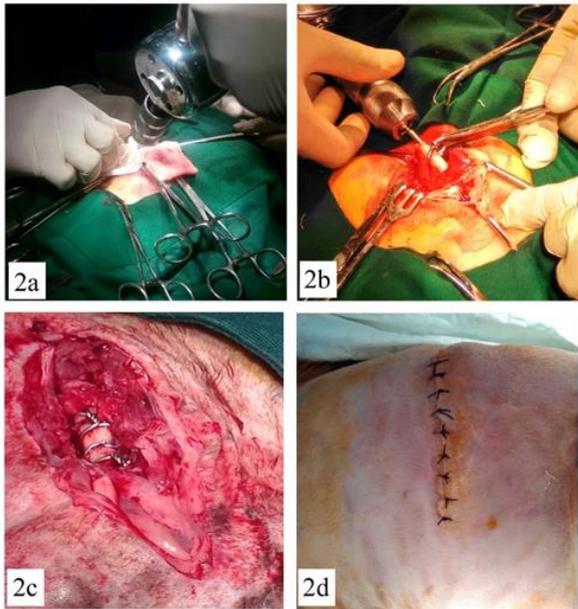


Figure 2. Surgery procedure. Intramedullary pin fixing (2a), Intramedullary pin is slid through in order to be inserted again into distal canalis medullaris of fracture fragment (2b) Installing bone cerclage wires (2c), skin suturing by simple interrupted suture (2d).

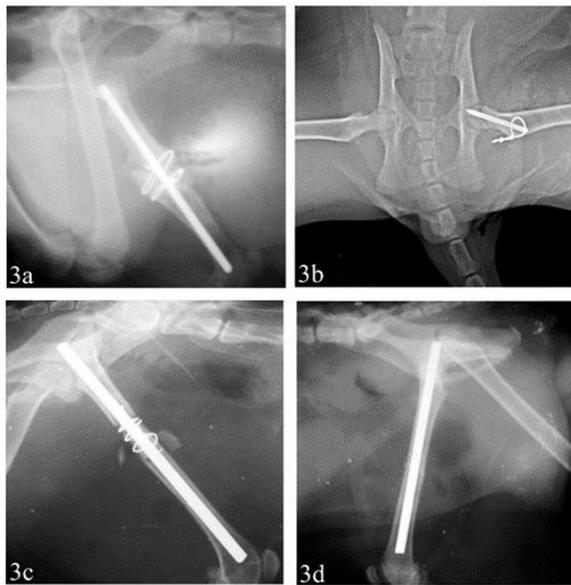


Figure 3. Radiography image of femoral fracture post-surgery (a) Lateral view of oblique diaphysis femoral fracture (domestic cat) fixed by 2.5 mm intramedullary pin (Steinmann) and cerclage wires (Kirschner), (b) Ventro-dorsal view of epiphyseal femoral fracture (domestic cat) fixed by 1.0 intramedullary pin and cerclage wires (Kirschner), (c) Lateral view of comminuted diaphysis femoral fracture (Persian) fixed by 3.0 mm intramedullary pin (Steinmann) and cerclage wires (Kirschner), (d) Lateral

view of oblique diaphysis femoral fracture (Himalayan) fixed by 3.0 mm intramedullary pin (Steinmann).

Discussion

Femoral fracture is the most frequent case found on cats (Beale, 2004) and commonly happens on left foot more than right one (Braden *et al.*, 1994). Bone recovery can happen faster if there is no gap between two broken fragments, and thus after recovery implant was not needed anymore. Implant material is hoped to be degraded by the body once the bone has recovered (NOAH, 2012; Ozkan *et al.*, 2015). Classic method of fracture treatment via internal fixation by using intramedullary pins, wires, screws, and plates, can stabilize two fracture fragments (Mafi *et al.*, 2014; Stiffler, 2004). Determination of internal fixation material is not only based on the shape of the fracture, but also by mechanical and biological factor, and the patient's own clinical parameter. In addition, determination of internal fracture fixation is also based on implant material availability. Intramedullary pin is an easily obtainable internal fixation material and often used in fracture treatment, but often combined with wire in its use (Saglam and Kaya, 2004; Tercanlioglu and Sarierler, 2009).

Intramedullary pin fixed within fractured femur creates good stability between two broken fragments. Intramedullary pin diameter must match animal body weight so that it can hold the weight of the animal itself. Use of intramedullary pin with large diameter may minimize complication, better, and experiences deflection or low bending possibility (McClure *et al.*, 1994; Saglam and Kaya, 2004). Intramedullary pin with 70-80% of femoral canalis medullaris diameter showed better recovery compared to intramedullary pin with 30-40% (Saglam and Kaya, 2004; Syafruffin *et al.*, 2004).

Patient able to walk by putting foot on the ground since day 3-5 post surgery, while on day 15-29 post surgery patient able to move most of its foot. This is an important progress since it is closely related to the possibility of complication and hind limb disorder. Femur fracture recovery is

preceded by fibroblast proliferation of periosteum and endosteum cell. Osteoblast cells produce intercellular matrix consist of collagen and polysaccharide that combined with calcium ion and created immature bones or young callus. Formed young callus undergoes further maturation cause by osteoblast activity and turned into mature bones as lamellas were formed. In this stadium actually recovery process has been completed. Forming of callus starts on days 20 post surgery. X-ray examination on day 40 post surgery showed excessive callus resorption and decrease of periosteal reaction in forming new bones. This phase occurred 4 weeks after fracture, however in young animal it may happen faster (Joshi *et al.*, 2010; Mwangi and Mande, 2012).

Recommendation

Intramedullary pin and combination of intramedullary pin and wire can be used as femoral fracture's internal fixation on cat by stabilizing the two fracture satisfactorily. Post-surgery care on cat consisted of broad spectrum antibiotic and non-steroid analgesic for 14 days.

Acknowledgement

A word of thanks is expressed to all doctor and animal care giver in Veterinary Teaching Hospital, Faculty of Veterinary Medicine, Bogor Agricultural University, Indonesia, who has helped on these fracture surgeries.

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