# Conservative treatment of a femoral fracture in a young cat - a case report

*M. Katica*, M. Obhođaš, M. Shafie, Žana Stanić and M. Očuz*

## Introduction

Orthopaedic injuries in cats occur frequently and are amenable to a variety of surgical and non-surgical treatment options (Harari, 2002), all with the same goal: achieving the best bone union, and a functional result leading to early ambulation and optimal use of the affected extremity (Aron, 1998; Sharar, 2000). The indirect goal is to preserve the physiological axes passing through adjacent joints, therefore retaining the proper anatomic relations between the joints above and below the fracture site, and preserving complete extent of movement in the limb, with subsequent optimal extremity function (Piermatei and Flo, 2006; Milošević et al., 2008). The therapeutic options are numerous, from external to internal fixation, splints and casting, cage rest, to limb amputation. The appropriate treatment should be selected based on the nature of the lesion, available expertise and directives of the client (Harari, 2002). Conservative treatment with splinting is well known and well described, having numerous advantages. Emergency splintage is a form of first aid that is too often ignored in a busy though otherwise strong veterinary practice. This method is excellent in decreasing the likelihood of self-trauma of an injured animal in pain (Knecht, 1975). Definitive conservative treatment has its place when specific circumstances do not allow prompt surgical treatment of the fracture.

## Case History

A young, male domestic cat, 3.5 months of age, body mass about 1.5 kg, was brought into a private veterinary practice after a fall from a height of about 1 m that resulted in limping and pain in the right hind limb. Inspection revealed complete sparing of the right hind limb. There were no additional injuries. Palpation of the injured limb revealed crepitation of femoral bone structures, conjoined with massive oedema and pain in the femoral region. The cat was anxious, frightened, and in pain. Upon initial radiographic examination, a comminuted fracture of the middle shaft of the right femur was confirmed (Figure 1).

Muhamed KATICA*, DVM, PhD, Assistant Professor, (corresponding author, e-mail: muhamed.katica@vfs.unsa.ba), Muamer OBHOĐAŠ, DVM, Veterinary Faculty, University of Sarajevo, Bosnia and Herzegovina; Mehran SHAFIE, MD, Bone Surgery Clinic of Clinical University Centre Sarajevo, Bosnia and Herzegovina; Žana STANIĆ, MD, OB&GY specialist, Clinical Hospital Center Split, Split, Croatia; Muhamed OČUZ, DVM, Private Veterinary Medicine Practice „Uvorići d.o.o." Visoko, Bosnia and Herzegovina

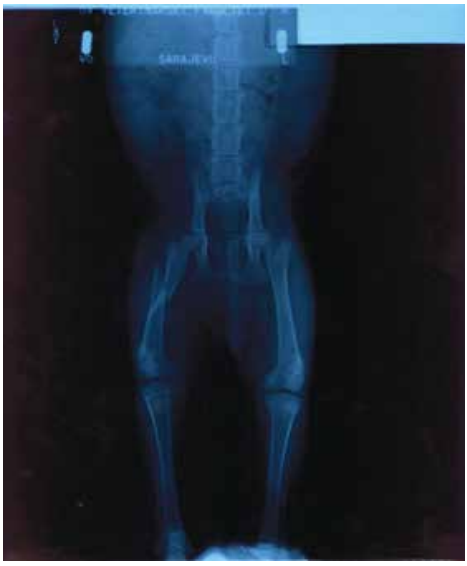

**Figure 1.** Comminuted spiral fracture of the middle shaft of the right femur as confirmed by emergency X-ray.

The bone fragments were mildly dislocated and comprised, with slight extremity shortening. Manual reposition using rotatory and extension forces was performed under general anaesthesia (Meloxicam 0.15 mg/kg, 30 min. before and Ketamine Hydrochloride 22 mg/kg body mass, i/m), and a variant of a lighter and softer bandage with plastic splint was applied to preserve bone fragment retention (Figure 2). The immobilizing plastic splint included a silk patch surface along the injured leg. The primary layer of bend was then placed. Thereafter came a secondary layer of cotton wool and plastic splints which were placed on the medial and lateral parts of the extremity. These plastic splints were fixed with adhesive tape. A tertiary layer of elastic self-taping bandage was then placed and attached to the adhesive tape, to ensure immobilisation (Figure 2).

After conservative treatment, the patient was kept in hospital in cage rest, with movement space reduced to 1 $m^3$. Sedative and analgesics were immediately included and the therapy lasted for three days (tramadol 2 mg/kg body mass s/c and meloxicam 0.15 mg/kg body mass, i/m). Dried food brickets and water were available ad libitum. The first day after treatment, the patient became restless and removed the splint. During the thee-week hospital recovery period, the patient removed the splint four times, especially once oedema and pain diminished, allowing activity of the young animal. Three weeks after reposition control, radiographs showed malunion of the bone fragments, with evident periosteal bone layers (Figure 3.).

Despite this finding, further therapy was discontinued at the owner's request. At the control examination three months later, the patient showed proper growth without limping. X-rays performed three years later revealed expected good spontaneous bone remodelling. Although spontaneous bone remodelling in an active young animal (Wolff's law) is well known, we suggest that the described method gives a patient better chance of avoiding development of permanent malunion, deformity or pseudoarthrosis, and therefore can be recommended to owners who cannot afford to treat their pets by surgical methods, as the golden standard and method of choice in the treatment of such femoral fractures.

As an adult, non-neutered cat, sustaining all forms of intensive physical activity, it shows no signs of the previous femoral fracture.

**Figure 2.** Immobilization splint

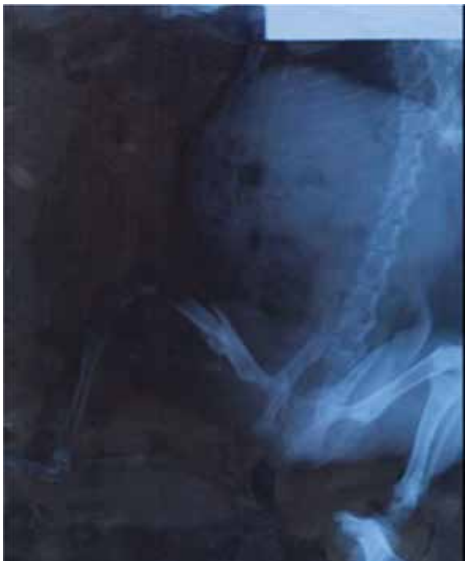

**Figure 3.** Three weeks after reposition - malunion of the bone fragments, periosteal bone layers.

## Discussion

Femoral fractures occur commonly in cats and dogs following substantial trauma by high energy forces. Compared to humans, animals more commonly fracture the major bones closest to the body, the femur and the humerus (Simpson and Lewis, 2003). Motor vehicle trauma is the most frequent cause of femoral fractures, and the victims tend to be young, non-neutered male cats who roam away from home and suffer in a collision. Cats of both sexes and of any age are susceptible to this type of trauma if not kept restrained (Chandler and Beale, 2002). Though cats are usually considered agile and graceful animals with great athletic abilities, including jumping, they occasionally experience fractures due to missed jumps. Fractures of the femur may be categorized as capital physeal, femoral neck, trochanteric, sub trochanteric, diaphyseal, supracondylar or condylar or distal physeal. Most femoral fractures are closed due to the heavy overlying muscle, unless from a penetrating injury such as a gunshot wound (Beale and Cole 2012). Cats can develop non-traumatic fractures (pathologic fractures) when suffering from malnourishment, systemic illness, kidney disease, or endocrine disorders such as hyperparathyroidism. Osteomyelitis or neoplastic illness can also lead to pathological fractures (McNichols et al., 2002; Harasen, 2004, Schwartz, 2013). Zones of accelerated growth in immature bones of young animals, growth plates (physes) that are still "open" and growing, are particularly susceptible to fracture complications, resulting in premature closure of the physes and later limb shortening. These regions of young bone are generally weaker than already formed bone. In young cats, femoral fractures are usually in the form of physeal fractures near the hip or knee joint. At this age, the femoral bone shows increased osteopoetic and osteogenetic potential with osteoblastic predominance that leads to fast healing of shaft fractures (Krasni and Hadžiahmetović, 2001). In adult feline patients, frequently encountered

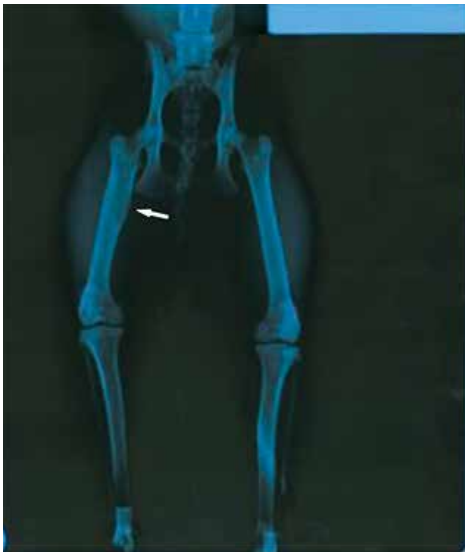

**Figure 4.** After three years- expected good spontaneous bone remodelling.

fractures are the fractures of the femoral neck, femoral shaft or the fractures of the adjacent joints (Chandler and Beale, 2002). In both groups, fractures can be open or closed, depending on whether the skin surface has been damaged during the injury, and can be classified as simple or comminuted, depending on the count of bone fragments (Piermatei and Flo, 2006). The shape of bone fragments, and the direction of fracture lines point to the mechanism of fracture onset (Šehić, 2000). Each case of femoral fracture must be thoroughly evaluated, containing all important variables to determine the most appropriate treatment: patient age, the type and severity of the fracture, the experience of the surgeon and financial concerns of the owner. The primary symptoms of the cat with femoral fracture originate from pain. An injured cat is eager to hide the pain, with unusual voicing and behaviour, avoiding movement, feeding or grooming. Meticulous inspection and palpation should be performed in search for signs of fracture: swelling may be hidden by large muscle mass, and bruising, limb shortening or crepitus may be hidden by a non-cooperative, frightened patient in pain. Injuries of adjacent and even distant organs should not be overlooked. Conservative treatments with splints or casting give a good functional result in juvenile patients, and even in adults, when there is no substantial bone fragment dislocation (Krasni and Hadžiahmetović, 2001). On the other hand, placing and maintaining casts or splints represents a major challenge in dogs and cats. Keeping casts clean and dry, and avoiding pressure sores under the bandage material, can be nearly impossible in active pets. In addition, in very small animals, the weight of a cast or splint may make it difficult to impossible for the animal to move around. Femoral fractures are generally not amenable to conservative repair, and some kind of internal fixation is generally required. Implant systems suitable for the repair of femoral fractures include bone plates, interlocking nails (Endo et al., 1998; Larin, 2001), plate-rod constructions, lag screws, pins and wires and external fixators (Worth, 2007). Fractures may be repaired using anatomic reduction and rigid fixation or using the principles of biologic osteosynthesis. The primary goal of fracture fixation surgeries is to restore broken bones to their original anatomic position and to rigidly fix them in place while healing occurs. In some cases, the fracture may be too severe to permit perfect anatomic restoration of all pieces, though typically, there will still be a way to provide stability to the fractured bone and to allow use of the limb during the healing period. Biological osteosynthesis is particularly effective for highly comminuted fractures, as vascular supply and soft tissue attachments to bone fragments are preserved, speeding the formation of bone callus that can be achieved with cortical and cancellous bone grafting techniques (Harasen, 1997). Articular fractures should be anatomically reduced and rigidly stabilized to reduce the chance of progressive osteoarthritis (Lafuente, 2011). Inappropriate case management, inadequate surgical stabilization, or poor aftercare can lead to complications such as non-unions, malunions, osteomyelitis, or a non-functional extremity. Malunion leads to affection and progressive damage of the adjacent knee and hip joints, with subsequent vertebral pain and dysfunction. In cases where surgical repair is delayed or when limb use is poor following surgery, quadricep contracture may develop, resulting in a poor outcome. Conservative treatment of feline femoral and humeral shaft fractures, in the absence of extensive dislocation of bone fragments, can be recommended. According to the experience from this case, the use of a standard splint did not

prove valuable in retention of the bone fragments after anatomical reduction. To avoid complications with extremity bloodstream, which ultimately may result in ischemic necrosis of the extremities, we used a variant of a lighter and softer bandage. This type of splint was indicated as this was an acute injury accompanied by eyelid swelling (Matičić and Vnuk, 2010). The more valuable conservative treatment method is the use of the Thomas splint. The Schroeder-Thomas splint, recommended for immobilization of the distal femur and distal humerus, enables natural healing and keeping the bones in their proper position. Also, the Schroeder-Thomas splint may be useful in the rehabilitation of femoral fractures (Knecht and Charles, 1987).

## Conclusions

The use of an immobilization plastic splint in the conservative treatment of femoral fracture in cats is not the method of choice, especially if young restless cats are being treated. It can be assumed that in cases where the cat is calm and does not try to remove the splint, such as a well-laid Thomas splint, this could be feasible to repair the break.

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## Summary

Femoral fractures are one of the most frequent fractures in veterinary practice. The best results are achieved by surgical treatment - now considered the gold standard in treating these fractures. However, there is room for the use of conservative therapy in selected cases. We present a case of a young male cat with femoral fracture, which was treated exclusively by immobilization splint, at the request of the owner. Our goal was to bring the injured bone to axle alignment and to keep its length with this variant of conservative treatment. Despite poor splint tolerance and evident poor fusion of bone fragments on the X-ray, the expected complete establishment of extremity function was observed due to the good osteogenic potential of the young and active patient. Although this method cannot be recommended for the treatment of fractures of the thigh bone in this group of patients, it can still have its place in cats that tolerate the splint, in particular those with a well-laid Thomas splint, when complete repair of the fracture could be expected.

**Key words**: *immobilization splint, conservative treatment, femoral fractures, X-ray, young cat*

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## Konzervativno liječenje prijeloma bedrene kosti u mlade mačke – prikaz slučaja

Dr. sc. Muhamed KATICA, dr. med. vet., docent, Muamer OBHOĐAŠ, dr. med. vet., Veterinarski fakultet Univerziteta u Sarajevu, Bosna i Hercegovina; Mehran Shafie, dr. med., Bone Surgery Clinic of Clinicall University Centre Sarajevo, Bosna i Hercegovina; Žana STANIĆ, dr. med., OB&GY specijalistica, Klinički bolnički centar Split, Hrvatska; Muhamed OČUZ, dr. med. vet., privatna Veterinarska ambulanta „Uvorići d.o.o." Visoko, Bosna i Hercegovina

Prijelomi bedrene kosti spadaju među najučestalije lomove u veterinarskoj praksi. Najbolji rezultati postižu se kirurškim liječenjem koje se danas smatra zlatnim standardom u liječenju ovih prijeloma. Ipak, u izabranih slučajeva postoji prostor i za primjenu konzervativne terapije. Predstavljamo slučaj mladog mužjaka mačke s prijelomom bedrene kosti, koji je po zahtjevu vlasnika liječen isključivo imobilizacijskom udlagom. Cilj je bio ovom varijantom konzervativnog liječenja ozlijeđenoj kosti ponovno osigurati uspostavu pravilne osovine uz zadržavanje njezine duljine. Unatoč lošem podnošenju udlage te razvidnim pokazateljima lošeg spajanja ulomaka kosti na Rtg snimcima, zamijećena je očekivana kompletna uspostava funkcije okrajine zahvaljujući ponajprije dobrom osteogenom potencijalu mladog i aktivnog pacijenta. Iako se ova metoda ne preporuča za liječenje prijeloma bedrene kosti ovoj grupi pacijenata, ona ipak može imati svoje mjesto u mačaka koji toleriraju udlagu, kod osobito dobro postavljene Thomasove šine, kad se očekuje potpuna sanacija prijeloma.

**Ključne riječi**: *Imobilizacijska udlaga, konzervativno liječenje, prijelom bedrene kosti, X-zrake, mlada mačka*