CASE REPORT

Pseudoacetabulum formation on the femur following untreated femoral neck fracture in a juvenile cat: Surgical management and outcome

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ABSTRACT

Femoral neck fractures are relatively common in cats and often occur after falls from significant heights. If not treated appropriately, these injuries may lead to long-term complications, such as pseudoarthrosis, joint instability, and impaired limb function. This report presents a rare case of pseudoacetabulum formation secondary to an untreated femoral neck fracture in a four-month-old kitten. Following a fall, conservative management was chosen over surgery. Over the next months, the cat developed progressive lameness and hip pain. At seven months, advanced imaging revealed separation of the femoral head from the acetabulum and the development of a pseudoarticulation between the femoral head and metaphysis, consistent with pseudoacetabulum. Surgical excision of the femoral head and neck led to satisfactory functional recovery. This case emphasizes the importance of timely surgical intervention in feline femoral neck fractures and documents pseudoacetabulum formation as a rare but clinically relevant complication of delayed or insufficient treatment.

Keywords: Animal, conservative treatment, extremities, lameness, pseudarthrosis

INTRODUCTION

Proximal femoral fractures can involve the femoral head, neck, greater trochanter, or subtrochanteric region in various forms. Although fractures occurring in this region are relatively rare, the literature contains limited information regarding their clinical outcomes (Roberts and Meeson, 2022). Management of proximal femoral fractures may involve either conservative methods or surgical intervention. The conservative treatment approach relies on the body's intrinsic biological mechanisms for fracture healing. This method may be considered a viable option, particularly in young cats with acute femoral neck fractures provided that bone resorption or the remodelling process has not yet commenced. However, if radiographic findings raise suspicion of metaphyseal osteopathy, clinical improvement is unlikely to be achieved through conservative management alone (Lafuente, 2011).

Pseudoacetabulum formation, a compensatory articulation typically described in human patients with chronic hip instability or post-arthroplasty, has not been well characterized in veterinary literature. Its development as a secondary complication of femoral neck fracture has not been previously documented in feline cases to the authors' best knowledge.

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The purpose of this case report is to describe the formation of both pseudoarthrosis and a pseudoacetabulum following non-surgical management of a femoral neck fracture in a juvenile cat. The case is presented with emphasis on clinical signs, diagnostic imaging, surgical approach, and functional recovery. This case emphasizes the potential for rare yet clinically significant complications resulting from delayed or suboptimal management of proximal femoral fractures in cats and highlights the critical importance of timely surgical intervention.

CASE DESCRIPTION

A four-month-old male domestic cat was presented to Ankara University, Faculty of Veterinary Medicine, Animal Hospital Surgery Clinic following a fall from height, exhibiting non-weight-bearing lameness of the right hindlimb. Orthopedic examination revealed a femoral neck fracture on the right side, and surgical repair was recommended. However, due to concerns regarding the risks associated with general anesthesia, the owner declined operative treatment. Consequently, conservative management consisting of cage rest and a seven-day course of non-steroidal anti-inflammatory drugs (meloxicam, 0.2 mg/kg SC as an initial (loading) dose on day 1, followed by 0.05 mg/kg SC, q24h) and analgesics (butorphanol, 0.4 mg/kg SC as an initial dose on day 1, followed by 0.2 mg/kg SC, q8h) was initiated without surgical intervention. The animal was not brought in for follow-up evaluation, as the owner perceived clinical improvement. However, seven months later, the cat was re-presented with progressive lameness, pain, and limited mobility in the affected limb. Anamnesis confirmed the absence of any treatment during the interim.

Initial clinical examination was performed in accordance with Barnhart's lameness scoring system (Table 1). The assessment revealed moderate lameness consistent with Grade 2 (intermittent non-weight bearing lameness), characterized by marked muscle atrophy of the right pelvic limb, restricted range of motion in the hip joint, pain elicited during passive flexion and extension, palpable crepitus, and mild subluxation. The cat exhibited minimal weight-bearing on the affected limb and frequently displayed unilateral limb-carrying behavior.

Table 1 Five-point lameness scoring system used for visual assessment before and following surgery (Barnhart, 2016)

None	No lameness observed	0
Mild	Weight-bearing lameness	1
Moderate	Weight-bearing lameness with intermittent non-weight bearing	2
Severe	Non-weight-bearing lameness with brief intermittent weight- bearing	3
Non-weight bearing	Lameness at all times	4

Computed tomography (CT) evaluation demonstrated malunion of the femoral neck fracture (Figure 1), with 180° rotational displacement of the femoral head, which had rearticulated ectopically (Figure 2). The femoral head was no longer positioned within the anatomical acetabulum and had developed an abnormal articulation with the proximal metaphysis of the femur. Based on these findings, a diagnosis of pseudarthrosis and pseudoacetabulum formation was established. Surgical intervention in the form of femoral head and neck excision arthroplasty was planned to restore function and alleviate pain.

An Informed Consent Form was obtained from the animal's owner prior to the examination and surgical procedure. All procedures in this case report were conducted in accordance with national animal welfare regulations and no additional experimental interventions were performed.

A multimodal anesthesia protocol was used. Premedication included medetomidine (10–20 µg/kg, IM, Pfizer, Finland) and butorphanol (0.3 mg/kg, SC, Richter Pharma, Austria). Anesthesia was induced with ketamine (5 mg/kg, IM, Richter Pharma, Austria) after initiating prophylactic cefazolin (25 mg/kg, IV, Tümekip Med, Türkiye). Maintenance was achieved with isoflurane (1.5–2.5%, Piramal Critical Care, USA). Intraoperative monitoring, lactated Ringer's infusion (Koçak Farma, Türkiye), and thermal support were provided.

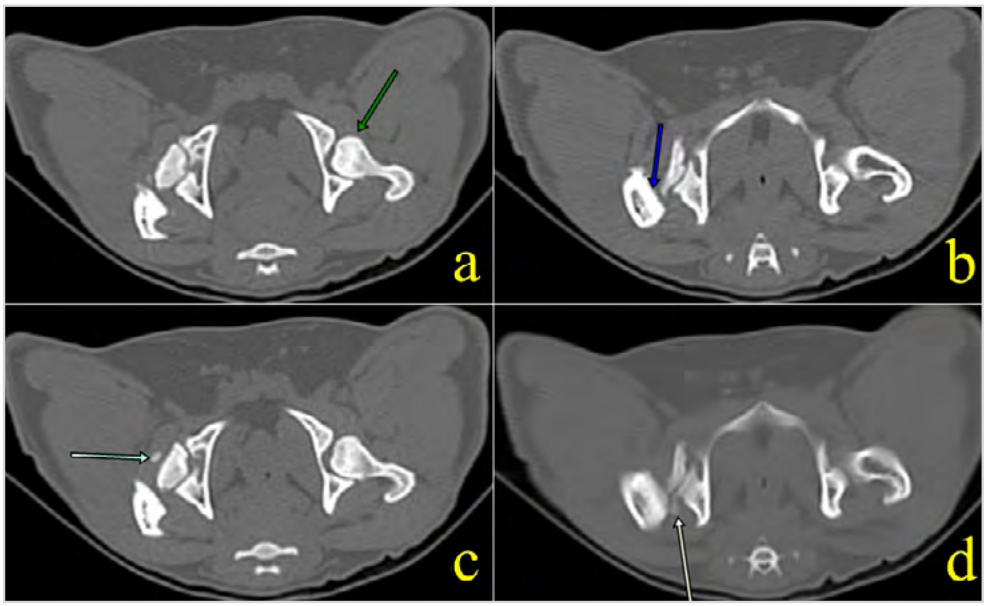

Figure 1 Transverse plane CT images of the coxofemoral joints a) Normal anatomical configuration of the left coxofemoral joint (green arrow). b) Pseudoacetabular cavity formation in the proximal region of the right femur secondary to displacement of the fractured femoral neck together with the intact femoral head (blue arrow) c) Residual bone fragment within the right coxofemoral joint, associated with fractures of the femoral neck and head (light blue arrow) d) Pseudoarthrosis formation between the right acetabular cavity and the femur, resulting from residual fragments of the femoral head (white arrow)

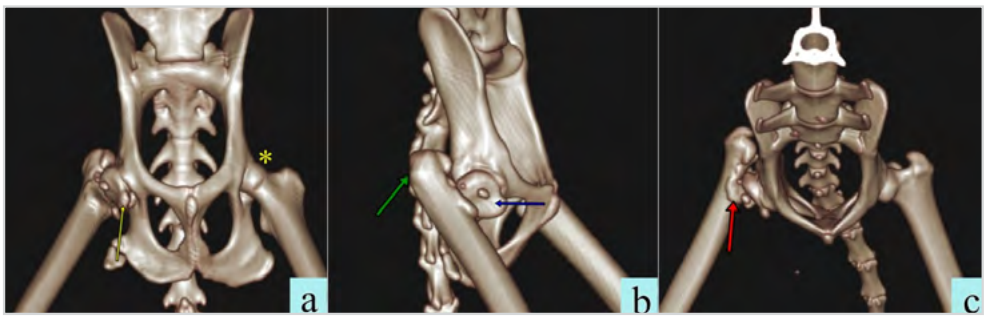

Figure 2 Three-dimensional reconstruction of pelvic CT images a) Coronal CT view showing the pseudoacetabulum observed in the right coxofemoral joint (yellow arrow) and the contralateral normal coxofemoral joint (asterisk) b) Sagittal CT view of the right coxofemoral joint demonstrating the femoral head within the acetabular cavity (blue arrow) and rest of the femur is displaced cranioposteriorly (green arrow) c) Coronal CT view demonstrating the pseudoacetabulum together with the remaining femoral head, while the rest of the femur is displaced cranioposteriorly (red arrow)

Figure 3 Postoperative day 14 ventrodorsal pelvic radiograph demonstrating the separation between the proximal femur and the irregular acetabulum following excision arthroplasty (arrow)

A craniolateral surgical approach to the right hip was performed, with the animal positioned in left lateral recumbency. The *M. tensor fasciae latae* and *M. biceps femoris* were retracted, and the *M. gluteus medius* and *M. gluteus profundus* were displaced ventrally and dorsally, respectively. When the surgical site reached the fibrotic and irregular joint capsule, the femoral head fusion in an inverted position to the proximal metaphysis, without anatomical articulation with the acetabulum was observed. The abnormal bony structure was excised using a bone rongeur. The fractured part of collum femoris was removed using a sagittal saw and after that smoothed with bone rasp (Figure 3), and anatomical reconstruction of surrounding musculature was performed prior to routine closure of the surgical site. The total duration of the surgical procedure, measured from the initial skin incision to extubation was 55 minutes.

Postoperative analgesia was achieved using meloxicam (0.1 mg/kg, SC, q24h for 5 days, Bavet, Türkiye) and butorphanol (0.2 mg/kg, SC, q12h for 3 days). Prophylactic antibiotic therapy with cefazolin (25 mg/kg, IV, q12h, Tümekip Med, Türkiye) was initiated preoperatively and continued for 7 days. Postoperative pain was effectively managed, and the surgical site healed uneventfully, without any complications.

Passive range of motion exercises and controlled mobilization were initiated on the 10th postoperative day. Ambulation on irregular surfaces, with owner assistance, was incorporated to prevent muscle atrophy and to maintain joint flexibility. Throughout the recovery process, the cat's ambulation and comfort levels were monitored daily. Over the course of two months, the patient exhibited improved limb use and marked reduction in lameness. The lameness score decreased to grade 1 postoperatively and eventually approached grade 0.

DISCUSSION AND CONCLUSION

In feline orthopedic practice, fractures involving the proximal physis and femoral neck are relatively common, with traumatic femoral neck fractures being more frequently documented in the literature (DeCamp et al., 2016). While growth plate injuries are often considered the weakest anatomical points for fractures in juvenile animals, it has been reported that in kittens under six months of age, femoral neck fractures occur more frequently than physeal separations (Perez-Aparicio and Fjeld, 1993). The present case is noteworthy as it illustrates the consequences of non-operative management of a femoral neck fracture in a 4-month-old cat following a fall, which ultimately led to the rare formation of both pseudarthrosis and a pseudoacetabulum.

In young cats presenting with hindlimb lameness or weakness, femoral head and neck fractures should always be included in the differential diagnosis, regardless of trauma history. These injuries often result from high-energy trauma such as vehicular accidents or falls. Pain elicited during manipulation of the hip joint, including restricted motion, crepitus, or subluxation, may provide clues to the underlying pathology (Lafuente, 2011). In the present case, a definitive diagnosis of a femoral neck fracture was established through clinical and tomographic evaluation.

Pseudoacetabulum formation, characterized by abnormal articulation of the femoral head with the ilium in chronic hip dislocations, has been well-documented in human medical literature—an observation notably emphasized by Odak (2012) in his radiological evaluation. However, reports of pseudoacetabulum formation in

veterinary patients remain exceedingly rare. Jones et al. (2019) documented seven canine cases in which chronic hip dislocation resulted in pseudoacetabulum development near the true acetabulum. Witsberger et al. (2007) described pseudoarthrosis-like structures where the femoral head articulated with the iliac wing. To the authors' knowledge, the formation of a pseudoacetabulum directly on the femur has not been previously described in either dogs or cats. In this respect, the presented case is remarkable, as it represents an unprecedented clinical report in the veterinary literature of pseudoacetabulum formation originating from the femur. In light of this, it should also be noted that the main limitation of this report is its single-case nature, which restricts the generalizability of the findings; thus, the conclusions should be interpreted with caution and validated in future studies involving larger cohorts.

Both conservative and surgical options are available for managing proximal femoral fractures. Surgical treatment is typically favored to prevent complications such as nonunion and loss of function (Lafuente, 2011). In feline patients, femoral neck fractures are often managed surgically through Kirschner wire fixation or femoral head and neck excision (FHNE), particularly in cases of physeal fractures (Borak et al., 2017; McNicholas et al., 2002; Fischer et al., 2004). Overall, surgical management is generally preferred, as it offers better prospects for functional recovery and reduces the risk of complications (Fischer et al., 2004).

Femoral head and neck excision (FHNE) is considered a salvage procedure that can yield favorable functional outcomes in cats. This technique, along with total hip replacement (THR), may be indicated when primary surgical management of coxofemoral joint arthropathy is not feasible. Such situations may arise due to patient-related factors, such as inadequate bone stock for implant placement or client-related considerations, including financial limitations or difficulties in ensuring postoperative activity restriction (Yap et al., 2015).

In the present case, excision arthroplasty was selected due to the chronic nature of the fracture and the abnormal positioning of the femoral neck, which had fused to the acetabular region in an inverted orientation. Although advanced surgical interventions such as total hip replacement might have been considered, financial constraints led the owner to opt for femoral head and neck excision. The irregular and thinned morphology of the femoral neck also rendered anatomical repositioning unfeasible. Imaging studies, particularly CT, supported the decision for excision as the most appropriate treatment to relieve pain and restore mobility.

Intraoperatively, the femoral head and neck were confirmed to be malunited in an inverted position and were excised carefully. Closure of the surgical site preserved the anatomical integrity of surrounding tissues. Postoperatively, the patient exhibited progressive, pain-free mobility in the affected limb. At the 60-day follow-up, the cat demonstrated notable improvement in gait and absence of clinical signs of pain.

Femoral fractures in cats are typically not well suited to conservative management, and in most cases require some form of internal fixation to achieve successful healing (Beale, 2004), as delayed intervention or absence of treatment may result in fibrous nonunion and resorption of the femoral neck, ultimately leading to degenerative alterations within the joint (Aithal et al., 2023), as observed in this case.

In this case, conservative treatment was initially chosen due to concerns regarding the risks of general anesthesia. However, the formation of a pseudoacetabulum due to malunion underscored the limitations and potential severity of this approach. Surgical intervention ultimately became unavoidable due to the progression of clinical symptoms.

This report provides a detailed account of pseudoacetabulum formation originating from the proximal femur in a feline patient—a condition that, to the authors' knowledge, has been rarely documented in the veterinary literature. Following a comprehensive evaluation of treatment options and consideration of financial constraints, femoral head and neck excision was selected. Surgical removal of the abnormally fused femoral structures resulted in improved mobility and significant clinical recovery. This case highlights pseudoacetabulum formation as an uncommon but clinically relevant complication of untreated femoral neck fractures and contributes valuable insights to the field of veterinary orthopedic surgery.

CONFLICT OF INTEREST

The authors declared that there is no conflict of interest.

AUTHORS' CONTRIBUTIONS

Aİ.: Literature review, writing. REE: Conception, design, writing. ST.: Materials. IE.: Supervision, writing, critical review.

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Formiranje pseudoacetabuluma nakon neliječene frakture vrata femura kod mačeta: Operativni tretman i ishod

SAŽETAK

Kod mačaka su frakture vrata femura relativno česte, obično uzrokovane padom s velikih visina. Ako se adekvatno ne liječe, ovakve povrede mogu izazvati dugotrajne komplikacije kao što su pseudoartroza, nestabilnost zgloba i oštećenje funkcije ekstremiteta. Ovo je prikaz rijetkog slučaja formiranja pseudoacetabuluma uslijed neliječene frakture vrata femura kod četveromjesečnog mačeta. Mače je nakon pada liječeno konzervativno umjesto operativno, a u narednim mjesecima je došlo do razvoja progresivnog šepanja praćenog bolom u kuku. Za sedam mjeseci, napredno je snimanje pokazalo separaciju glave femura od acetabuluma i razvoj pseudoartroze između glave femura i metafize, što odgovara nastanku pseudoacetabuluma. Operativna ekscizija glave i vrata femura je dovela do zadovoljavajućeg funkcionalnog oporavka. Ovaj slučaj naglašava značaj pravovremene operativne intervencije kod fraktura vrata femura kod mačaka i dokazuje formiranje pseudoacetabuluma kao rijetke, ali klinički relevantne komplikacije odloženog ili nedovoljnog tretmana.

Kjjučne riječi: Ekstremiteti, konzervativna terapija, pseudoartroza životinja, šepanje