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CLINICAL REPORT

Successful Management of Quadriceps Contracture in a Cat

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ABSTRACT

A six-month-old female domestic short hair cat was presented for bilateral hindlimb lameness. Radiographt revealed bilateral distal femoral physeal fractures and left sided acetabular fracture. Treatment performed by transfixation cross pinning for both limbs. The right hind limb was operated immediately, however, due to an open fracture on the left hind limb, the surgical intervention was postponed to prevent osteomyelitis. The delayed surgical intervention was associated with quadriceps contraction. Here, to treat the muscle contraction, muscle release operation followed by a 90 degree external coaptation was performed. After healing of the surgical wound, physiotherapy with neuromuscular electrical stimulation was performed for five sessions over three weeks and then the cat demonstrated significant improvement in the posture and gait. Quadriceps contraction often is observed as a complication during healing of femoral fracture after surgery. Physiotherapy may play important role in preventing postoperative pain and other complications.

Introduction

Quadriceps contracture occurs when fibrous adhesions form between the quadriceps muscles, particularly the vastus intermedius muscle, and the distal segment of the femur. It usually occurs due to callus formation.[1-3] It is often seen as a complication during healing of femoral fracture and may result from damage to nerves and vessels, osteomyelitis, poor stabilization of the femoral fracture, delayed ambulation after surgery, and prolonged stifle extension due to pain or external coaptation.[1,4,5] Other potential causes of quadriceps contraction includes infections such as toxoplasmosis, *Neospora* spp., or *Clostridium tetani.*[1,6]

Quadriceps contraction is frequently observed in young pet animals mostly 3-6months of age. The progression of the contraction is faster in younger animals thus surgical intervention should be performed as soon as possible.[7] The quadriceps contraction is more frequently reported in cats.[1,2,8,9] The condition is characterized by rigid stifle hyperextension, decreased range of motion, and quadriceps muscle atrophy.[2,5]

Case Description

A six-month-old female domestic short hair cat was presented to the Veterinary Teaching Hospital of Urmia University with a history of car accident and clinical presentations of non-weight bearing lameness on its both hind limbs. The patient's condition was stable and all vital signs including CRT, heart rate, respiratory rate, and body temperature were in normal range. The patient was reluctant to walk due to severe pain in both hindlimbs. The femoral fracture was noticed on orthopedic examination with crepitus sound in the

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distal femoral region in both limbs. There was a full-thickness open wound in the lateral aspect of the left femur and thus it was considered as an open fracture. Each affected limbs were evaluated by two orthogonal radiographic views under sedation. A physeal fracture of the distal femur (Salter-Harris type 1) was confirmed in both limbs. Furthermore, another fracture was also noticed in the left acetabulum of the pelvis (Figure 1).

Treatment and Outcome

Initially, the wound of the left hind limb was lavaged with 0.1% povidone-iodine diluted in isotonic saline and bandaged with sterile gauze and a topical antimicrobial mupirocin 2% (Emad Darman Pars, Kaveh, Iran). The bandage was changed at two-day intervals and the wound lavaged was repeated each time.

Following sedation using intramuscular injection of acepromazine (0.03 mg/kg, Alfasan, Woerden, The Netherlands) and ketamine (5 mg/kg, Bremer Pharma, Warburg, Germany), the patient was induced with the intravenous mixture of ketamine (5 mg/kg) and diazepam (0.2 mg/kg, Caspian Tamin, Rasht, Iran) and maintained on 1% Isoflurane (Piramal Critical Care, Bethlehem, USA) then the right hind limb was prepared for reduction and stabilization of the right femoral physeal fracture. The fracture was stabilized by open reduction and using of unilateral transfixation cross pin method via lateral approach through the distal femoral and stifle region. The pins were 2 mm in diameter. Radiography of the fractured site showed adequate alignment of the right femur. Exercise restriction was applied for one week until surgery on another limb was performed. After surgery, cefazolin (22 mg/kg, IV, q12h, Afa Chemie, Tehran, Iran) and clindamycin (33 mg/kg, IV, q24h, Zahravi, Tabriz, Iran) were prescribed to prevent surgical site infection and flunixin meglumine (5 mg/kg, IM, q24h, Rooyan Darou, Semnan, Iran) for analgesia. After one week the left limb was prepared aseptically for orthopedic reduction and stabilization of the fracture. The approach and method of stabilization were similar to the right leg. There was no need for treating the acetabular fracture because of fracture segments were not displaced and cage rest was recommended.

After the second surgery cage rest continued for 14 days post-operatively and antimicrobial treatment was prescribed as mentioned above.

After 2 weeks the incisional wound was healed without any complications and the sign of bone healing was obvious on the radiographic examination. By 14 days after surgery, extension of the left hind limb affecting the stifle and tarsal joints as well as limb atrophy were noticed (Figure 2). Clinical signs included non-weight bearing lameness, carrying the affected limb in full extension and stiffness of stifle joint. For treatment of muscle contraction, surgical intervention was performed to release the quadriceps femoris muscle from the fibrous attachments and callus surrounding the fracture site. Under general anesthesia, the surgical site was re-opened. Furthermore, the cross pins were removed to relieve tension on the insertion of the quadriceps femoris muscle. Postoperatively the stifle joint was bandaged with a fiberglass cast in 90˚ flexion of both stifle and tarsal joints for one week. Cefazolin (20 mg/kg, Exir, Tehran, Iran), clindamycin (15 mg/kg, Soha, Tehran, Iran), and flunixin meglumine (1 mg/kg, Razak, Tehran, Iran) were prescribed post-operatively. After a week the fiberglass bandage was opened and physiotherapy exercises including passive range of motion and stretching exercises were performed every day. After the healing of the surgical wounds, neuromuscular electrical stimulation (NMES) was done to improve muscular

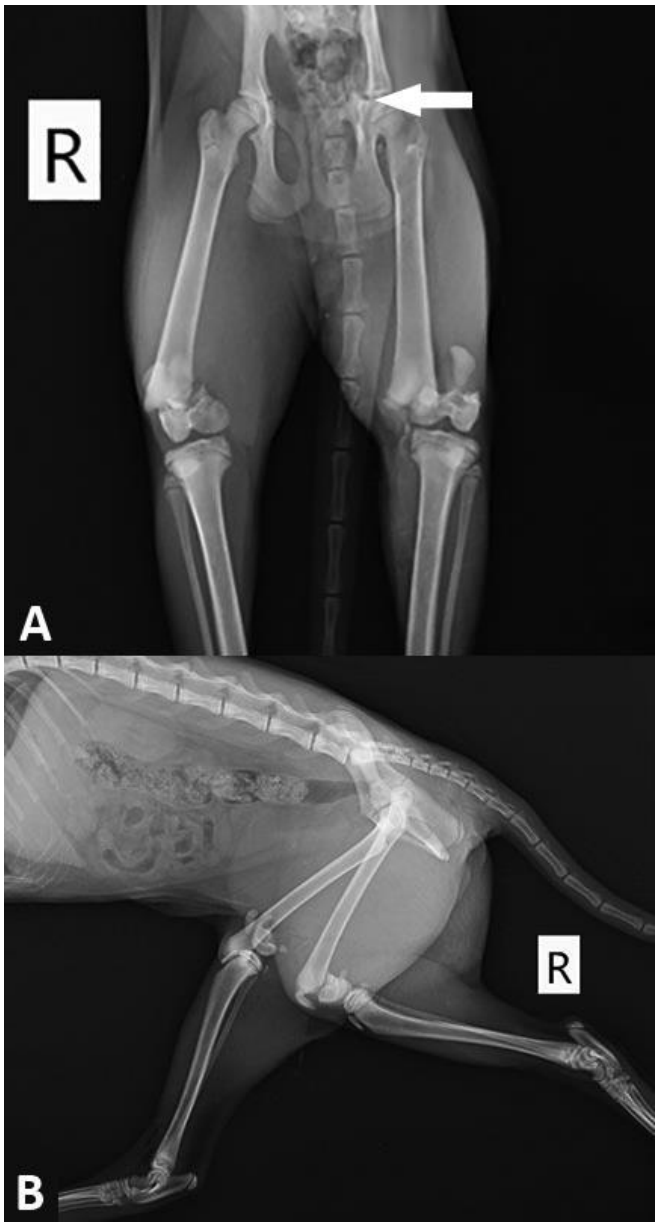

Figure 1. A) Ventrodorsal and B) Lateral radiographs of fractured limbs. A physeal fracture of the distal femur (Salter-Harris type 1) was confirmed in both limbs. White arrow indicates a left sided acetebaular fracture.

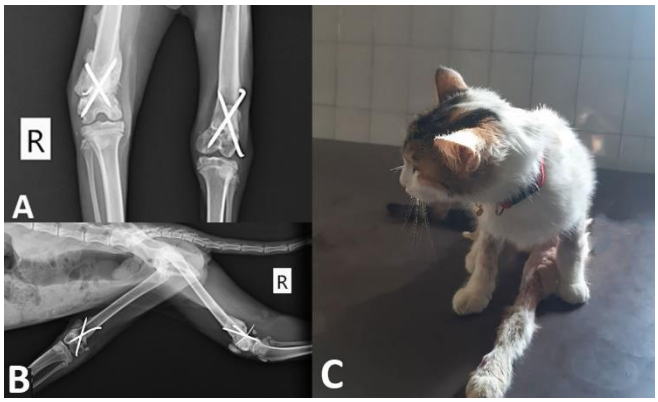

Figure 2. A) Radiograph after surgery shows transfixation cross pin method. B) In lateral view of radiographs, the extension of the left hind limb including the stifle and hook joint can be observed. C) Quadriceps contraction in left hindlimb after surgery.

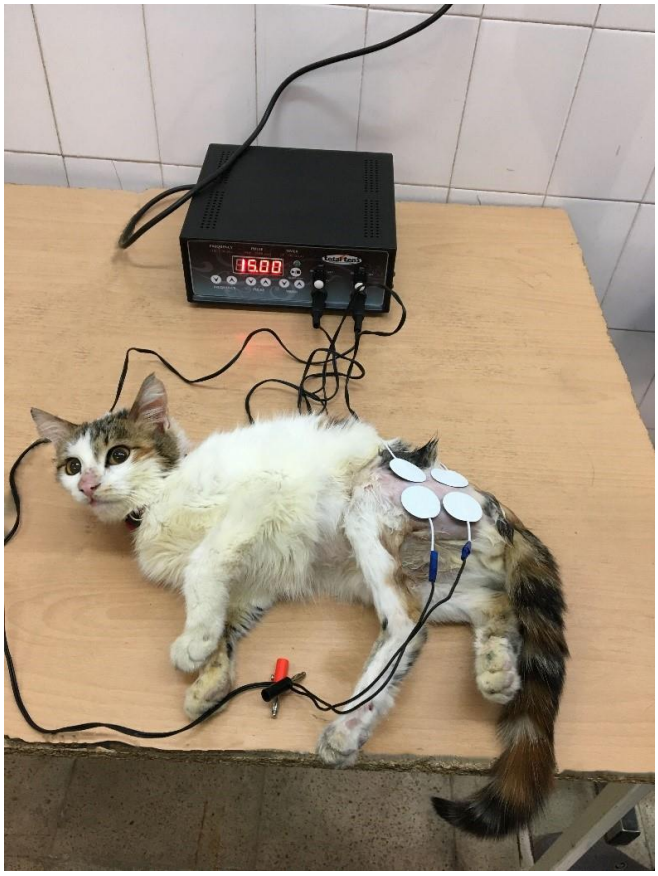

Figure 3. Performing of NMES on hamstring muscles. The cat was sedated and for better results skin was clipped.

Figure 4. Standing posture and weight bearing after treatment period.

function and prevent atrophy of the quadriceps femoris muscle (Figure 3).

The NMES was done for the hamstring muscles to strengthen and prevention of disuse contraction. To achieving better outcomes, the skin on the affected muscles was clipped and the cat was mildly sedated. The NMES was performed for 15-30 minutes, and the stimulation frequency was set to 30 Hz, and 15 contractions were delivered per session with a TOTAL TENS device (PM70 2-channel, Total Tens, Tehran, Iran). The voltage was adjusted 3 volts until the contraction was observed without any patient discomfort. After five sessions over three weeks, the cat demonstrated significant recovery and started weight bearing walk with minimal lameness (Figure 4).

Clinical Relevance

The prognosis for chronic quadriceps contraction is guarded to poor[1] and in such cases quadriceps muscles are atrophied, non-painful, and can be palpated as a thick cord.[1] However, treatment in the earliest stages will result in improved functional recovery of the limb.[8,9]

The treatment of quadriceps contraction depends on the time elapsed after trauma, the surgical procedure, and the severity of contraction. Surgical intervention has been recommended on adhesion detachment to increase the stifle range of motion.[7] Some of these surgical procedures include manual detachment of adhesions, application of dynamic stifle flexion apparatus, performing "Z" type myoplasty of the femoral quadriceps muscle, sliding myoplasty, release of rectus femoris, arthrotomy and stifle arthrodesis.[3,5,7,8,10]

Physiotherapy plays an important role in management of secondary joint disease after trauma or surgery.[11,12] Physiotherapy modalities such as passive range of motion and stretching exercises may reduce fibrous formation, edema, effusion, and result in improved joint movement.[3,7,12] Reportedly, physiotherapy should be started as soon as possible and performed three to four times daily.[8,13,14]

The NMES is a modality that sends electrical impulses to nerves which causes the muscles to contract mimicking the action potential coming from the central nervous system. It may be applied during functional movement or without functional movement. It can be considered as a non-invasive and safe alternative for muscle rehabilitation which is suitable for treating weak and atrophied muscles, neuromuscular disorders, reduced weight-bearing on the operated limb via stimulation of muscle activity. It also increases the joint range of motion and reduce the pain and edema. Neuromuscular electrical stimulation aims to produce muscle contraction through the peripheral nervous system to restore, maintain or improve the functional capacity of the muscles.[3,4,13-15]

In conclusion, the presented case highlights the importance of immediate diagnosis and management of quadriceps contraction after surgical stabilization in distal femur. Early recognition and appropriate intervention, along with a comprehensive treatment plan including surgery, physiotherapy, and NMES can lead to successful outcomes and improve functional recovery of the affected limb. It is crucial for veterinary professionals to remain vigilant for signs of muscle contracture after surgery and to take prompt action to prevent the development of chronic contracture.

Conflict of Interest

None to declare.

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