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Hematogenous Osteomyelitis Following Open Fracture in a Cat

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Abstract : A 6-month-old, weighing 2.8 kg, female, domestic short-haired cat presented with open fracture at right distal radius about a month ago. Based on radiological findings, hyperplasia at the right radioulna and left humerus was found. Results of the cytological examination were inflammatory reaction and reactive osteoblast. Distal radial ostectomy proceeded with necrotic bone debridement. Three weeks after operation, the radial bone lysis was seen on radiograph but clinical condition improved. Hyperplasia at the right radioulna and left humerus was dissolved. Two months after operation, she can use her both forelimbs despite right elbow have been diagnosed as arthrosclerosis because of periosteal reaction. Six months after operation, clinical symptoms of limbs were not detected. In this case, open fracture was treated through delayed surgical debridement procedure, therefore hematogenous osteomyelitis occurs at another forelimb. The longer a wound remains open, the more likely it is that infection will develop. The infection can occur to fracture bone and seed from hematogenous spread to another normal bone. In conclusion, when open fracture occurs, early antibiotic treatment and urgent surgical intervention are recommended.

Key words **:** Hematogenous osteomyelitis, Open fracture, Arthrosclerosis, Periosteal reaction, cat.

Introduction

Bacterial infections cause osteomyelitis in clinical practice. In most cases, gram-positive organisms such as *Staphylococcus* accounted for 60%. Unrestricted infection in the metaphysis can spread to the epiphysis, periostea and soft tissues (6,8,13).

Inoculation of bacteria can occur from an exposure of the bone via an open fracture or a surgical intervention. Avascular and unstable bone fragments are an ideal ecologic niche for bacteria to proliferate. Disruption of the blood supply is caused by damage to proliferating capillaries, promoting tissue necrosis and bacterial growth. During the initial phases of healing, soft tissues provide blood supply first to the ischemic bone. Tissue and vascular trauma are important factors when discussing posttraumatic osteomyelitis (6,16).

Haematogenous osteomyelitis is a rare case in dogs and cats (7). Clinical signs included pyrexia, pain and lameness (5,9,14). In case of open fracture, surgical debridement must be performed within 6 hours of the time of injury. The longer a wound remains open, the more likely infection will develop (4,10). Infection rates in people are reported to range from 2~10% for type 2 fracture (11). Septicemia and death may result from infections that are not treated appropriately (3, 12). Anaerobically grown bacteria are supposed, if no organism is cultured from material in which cytologic findings indicate infection. Anaerobic infections should be suspected by a foul odor, sequestra (1).

The purpose of this study was to emphasize early open fracture treatments through antibiotic administration and skeletal stabilization assist patient in an early return to function and report hematogenous osteomyelitis following open fracture infection.

Case

A 6-month-old, weighing 2.8 kg, female, domestic short-haired cat with open fracture at right distal radius a month ago was presented to the veterinary medical center of Chungbuk National University. The patient had exposed right radius which has avascular bone fragment and fracture instability (Fig 1A). Primary surgical closure of wound was not appropriate, because excessive soft tissue defect and severe inflammation. Systemic antimicrobials and corticosteroids had been given for 3 weeks per oral and intravenous at local animal clinic. They administered cephalexin (20 mg/kg, PO, bid), cimetidine (5 mg/kg, PO, bid) and prednisolone (0.5 mg/kg, PO, bid). The wound was dressed and the leg was bandaged. Drainage at open fracture site with chlorhexidine was made.

Physical examination revealed decreased range of movement (ROM) of right elbow and pain with flexion. There were no heat, swelling, redness and exudates at right radioulna. Based on radiological findings, the patient had been suspected as having bone hyperplasia at right radioulna (Fig 2A) and left humerus (Fig 2C). The left humerus was enlarged with moderate new bone formation along the metaphysis and diaphysis. The periosteal reaction was not seen on initial radiograph. After 2 weeks, the periosteal reaction was apparent at right radioulna and left humerus.

The cytological results of fine needle aspiration were inflammatory reaction and reactive osteoblast. No bacteria

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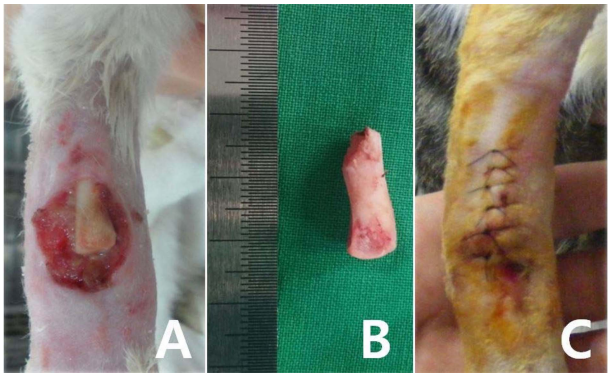

Fig 1. Surgical treatment of right radius with open fracture. Distal part of radius bone is exposed (A) and necrotic bone is removed by ostectomy (B). Wound is closed without complication after surgery (C).

Fig 2. Pre and post-operative radiographs. The periosteal reaction is shown in right radioulna (A) and left humerus (C) before surgery. The bone lysis and arthrosclerosis are shown in right radius (B) and periosteal reaction decreased in left humerus (D) at 2 months after surgery.

were cultured from material in which cytological findings indicate infection. Blood chemistry and complete blood cell count were normal.

We administered cephalexin (30 mg/kg, PO, bid), famotidine (0.5 mg/kg, PO, bid), and tramadol (1.5 mg/kg, PO, bid) for 1 week as the initial treatment before surgery.

The patient was taken to the operating room for debridement of the fracture and skeletal stabilization. Surgical treatment was proceeded by right distal radial ostectomy and radioulnar fixation. The patient was put under general inhalation anesthesia (isoflurane). The operation site was shaved and disinfected. The inflamed skin and soft tissue were surgically resected. The patient's open fracture was irrigated with 0.9% sodium chloride solution. During right distal radial ostectomy, we used osteotome and rongeur to cut avascular bone fragment. After removal of avascular bone fragments (Fig 1B), proximal radial fragment was stabilized with ulna by 1.2 mm k-wire. The open fracture wound was closed with 3-0 Surgifit (AILEE Co., Korea) and 3-0 nylon (Fig 1C). The leg was bandaged with the Robert Jones bandage.

After surgery, the patient was medicated with cephalexin (30 mg/kg, PO, bid), famotidine (0.5 mg/kg, PO, bid), and tramadol (3 mg/kg, PO, bid) for 10 days.

The radioulnar fixator was removed at 3 weeks after operation. Full soft tissue coverage and healing of the wound were achieved.

Two months after operation, she could use her both forelimbs despite right elbow had been diagnosed as arthrosclerosis because of periosteal reaction. Craniocaudal and lateral radiographs revealed hyperplasia at the right radioulna (Fig 2B) and left humerus (Fig 2D) was dissolved and the radial bone lysis was seen on radiograph. The patient proceeded to return weight bearing and function well.

Pain and swelling of left and right forelimbs were not detected on 6 months after surgery, however range of motion of affected elbow joint was severely limited. The patient returned to satisfactory quality of life.

Discussion

This case was presented with avascular tissue and ischemic bone open fracture at right distal radius during a month. The patient was unsuccessfully treated with exposed and unstable fractured bone during 3 weeks. Fracture instability, avascular bone fragments and tissue necrosis may cause infection in the bone.

The cytological results were of inflammation. However no bacteria were cultured from material in which cytological findings indicate infection because of long-term antimicrobial treatment, anaerobic infection or immune dysregulation.

Six months after operation, clinical symptoms of left forelimb and right forelimb were not detected. Despite loss of ROM of right elbow and lysis of right radius, the patient can use her right forelimb and jump up. Feline ulna is more substantial than canine. In comparison with the dog, the distribution of load at a walk is different with the hind limbs of the cat sharing more of the loads.

Multifocal sterile pyogranulomatous osteomyelitis is caused by immune dysregulation rather than infection. Bacteria and fungi could not be cultured from bone samples (1). On the basis of the negative microbiological findings and the inflammatory bone changes, the dog treated with immunosuppressive doses of prednisolone improved problems such as fever and lameness resolved, appetite and condition. However, clinical signs recurred 4 weeks later despite continued glucocorticoid therapy (2). This report presents another manifestation of a histiocytic disorder of unknown etiology.

Successful treatment of open fracture includes excessive debridement and restoration of contaminated material, nonviable tissue and soft tissue coverage to healing bone. The osteomyelitis treatment should include debridement and administration of appropriate antimicrobial drugs. Surgical curettage and systemic antibiotics were successful in eliminating the infection in dogs and cats (12,15).

In conclusion, delayed closure of open fracture wounds can make osteomyelitis and also cause hematogenous osteomyelitis. If early closure of non-contaminated open fracture wounds can be made, early closure of open fracture wounds can decrease the rate of infection. When early antibiotic administration couples with early debridement and closure, the rates of infection can be dramatically decreased. Early skeletal stabilization is also necessary. Adhering to these principles can help surgeons provide optimal care to the patients and assist them in an early return to function. When open

fracture occurs, early antibiotic treatment and initial surgical interventions should be conducted as soon as possible.

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