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Tibial Fracture Repair in a Black Gibbon *(Hylobates concolor)*

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Abstract : A 5-year-old intact male black gibbon (*Hylobates concolor*) was referred for evaluation of the right pelvic limb lameness following a fight against other black gibbons. Fractures of the right tibia and fibula were suspected on physical examination and palpation of the right pelvic limb, but no other injuries or abnormalities were detected. While the black gibbon was sedated, pelvic limb radiographs were taken, which revealed diaphyseal oblique fractures of the right tibia and fibula. Open reduction of the fractures was performed. The tibial fracture was repaired by use of an internal fixation technique that included a tubular dynamic compression plate and cortical screws secured along the craniomedial aspect of the tibia. There were no complications during the postoperative rehabilitation period. At 9 weeks, radiographs revealed that bridging callus was well formed over the cortices of the tibial and fibular fracture area. The cast was removed 9 weeks after surgery. The black gibbon exhibited no evidence of lameness and was released back into the group. Presently, there are no published reports of internal fracture fixation in a black gibbon where a tubular dynamic compression plate and cortical screws provided excellent stabilization of the tibia and complete fracture healing allowing normal ambulation.

Key words **:** black gibbon, fracture, internal fixation, *Hylobates concolor*, tibia.

Introduction

A black gibbon is considered in lesser ape and has long arms and no tail (4,6). Trauma is the most common cause of long bone fractures in these animals (1,7). To the authors' knowledge, this is the first report of successful surgical repair of a tibial fracture in a black gibbon (*Hylobates concolor*).

Case

A 5-year-old intact male black gibbon (*Hylobates concolor*) weighing 4.58 kg was referred to the University of Konkuk Veterinary Medicine Teaching Hospital from The Children's Grand Park for evaluation of right pelvic limb lameness. A zoo keeper reported that the lameness was noted following a fight with other black gibbons. On physical examination, a soft tissue swelling of the right distal tibial and fibular area was noted. Fractures of the right tibia and fibula were suspected during limb palpation. No other injuries or abnormalities were detected.

Surgery followed immediately by radiography. The black gibbon was premedicated for radiography and surgery with butorphanol (0.2 mg/kg, IM; Butophan®; Myungmoon Pharm Co Ltd, Korea) and atropine (0.02 mg/kg, IM; Atropine sulfate®; Jeil Pharmacentrical Co Ltd, Korea), followed by anesthetic induction with tiletamine combined with zolazepam (5 mg/kg, IV; Zoletil®; Virbac Lab, France). The black gibbon was intubated and anesthesia was maintained with isoflurane (Isoflurane®; Choongwae Co Ltd, Korea) and oxygen. Lactated Ringer's solution was administered at a rate of 5 mL/kg/h through a 22 gauge intravenous catheter placed in the cephalic vein until completion of the surgical procedure. The black gibbon received cephradine (30 mg/kg, IV; Safdine®; Daehan Newpharm Co Ltd, Korea) at the time of anesthetic induction. The radiography was performed revealing diaphyseal fractures of the right tibia and fibula (Fig 1A). The right pelvic limb was prepped and draped routinely. The black gibbon was positioned in dorsal recumbence. A skin incision was made over the craniomedial aspect of the tibia. Blunt dissection of fasciae was performed to approach the fracture site. The saphenous nerve and medial saphenous artery and vein were gently retracted. The fracture edges were exposed (Fig 2A) and debrided of fibrous tissue using dry gauze. Reduction of the tibial fracture was performed. Two self-retaining reduction forceps were used to slowly force distraction of the bone segments and then a pointed reduction forceps was placed at an angle to the fracture line. The pointed reduction forceps was secured perpendicular to the fracture line until reduction was achieved. The tibial fracture was repaired using an internal fixation technique that included a tubular dynamic compression plate (Plate®; Anypia, Korea; size: 5 holes; thickness: 1 mm; width: 7 mm; length: 50 mm) and 2.7 mm cortical screws (Screw®; Anypia, Korea) secured along the craniomedial aspect of the tibia (Fig 2B). The five thread holes were drilled through the near and far cortices: three holes were drilled

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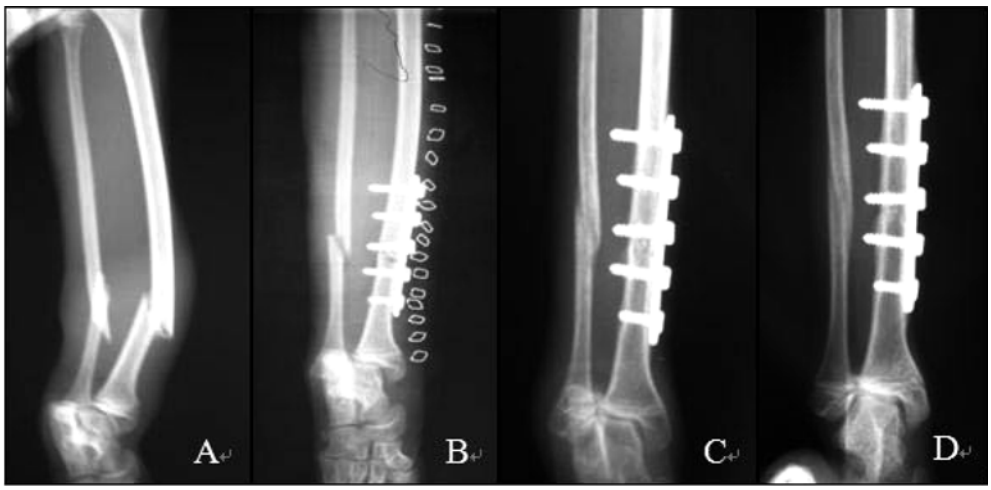

Fig 1. Radiographs prior to surgery (A), after surgery (B), 6 weeks after surgery (C), and 9 weeks after surgery (D). A. Short oblique fractures of the right tibia and fibula. B. Good apposition and alignment of the fractures right after surgery. C. Smooth callus formation visualized on ends of the fracture lines and along the lateral tibia and fibula. D. Bridging callus well formed over cortices of fracture areas.

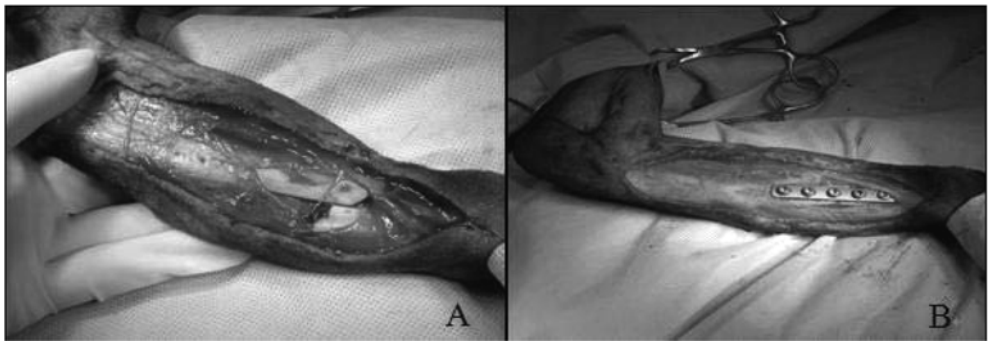

Fig 2. Intraoperative photographs of tibia. A. Before reduction of the fracture performed to the right tibia and fibula. B. Tubular dynamic compression plate (size: 5 holes; thickness: 1 mm; width: 7 mm; length: 50 mm) and 2.7 mm cortical screws were used for tibial fracture repair.

proximally and two holes were drilled distally. When drilling five thread holes, an eccentric drill guide was used. Two screws nearest the fracture line were inserted first. Both screws were placed in a loaded position and tightened to achieve compression of the fracture line. Subsequent screws were inserted in holes in an alternating fashion on either side of the fracture, working toward the plate ends. The fascia was closed using 3-0 polyglycolic acid (Safil®; B/Braun, Spain) in a simple continuous pattern. The skin was closed using skin staples. A cast (Robo™ cast; S & F Inc, Korea) was applied to stabilize tibial and fibular fractures and not immobilizing the tarsus and stifle joint.

Postoperative radiographs showed good apposition and alignment of the fractures (Fig 1B). Additional radiographs were obtained at 6 and 9 weeks. At 6 weeks, smooth callus formation was visualized at the fracture sites and along the lateral aspect of the tibia and fibula (Fig 1C). At 9 weeks, a bridging callus was adequately formed over cortices of the fractured areas (Fig 1D). The cast was removed 9 weeks after surgery. There was no evidence of the right pelvic limb lameness. The black gibbon follow-up was completed by telephone 3 years after surgery. The zoo keeper was asked to describe the patient's gait. The zoo keeper reported that there was no evidence of lameness and surgical wound dehiscence.

Discussion

There are various causes of fractures in animals. Trauma is the most common cause of long bone fractures (1,7). Related to human activity, causes of fractures include shooting, trapping, wire fence, and automobile accidents (1). Automobile accidents are the most common cause of fractures in the dogs and wild animals (1,4). However, automobile accidents are a rare cause of fractures in zoo animals. Pathologic fractures in zoo animals secondary to tumor or inadequate nutrition are considered as common causes. Black gibbons live in a group in which there is a definite hierarchical arrangement, with one male and female being the dominant (1-3). This hierarchical arrangement might often result in fighting between males or females in the same group or between groups. In this study,

fighting among males was the cause of this fracture. Fractures resulting from fighting and pathologic fracture should be considered as the common cause.

Chemical restraint is advised for safe handling to perform physical examination. Inadvertent manual restraint is highly dangerous because primates have a high potential to be carriers of zoonotic diseases including hepatitis, tuberculosis, shigellosis, salmonellosis, and herpes B virus (7). When manual restraint is tried, it must be performed by at least two people wearing protective clothing and full-length leather gloves, and individuals who handle a black gibbon must be adequately trained.

In dogs and cats, fractures of the tibia and fibula are the most common site, accounting for 20% of all fractures (4). In birds, the radius and ulna are the commonest fractures encountered, occurring in approximately 46% of long bone fracture cases, followed by tibiotarsal fracture (25%) (3). In the case reported here, fracture site was the tibia and fibula. A study of large series is warranted to better determine the location of fractures in the black gibbon.

The craniomedial surface of the tibia is not covered by muscle and can be easily palpated to provide a landmark for the incision and placement of the plate and screws. However, the limited soft tissue covering often causes open fracture in tibial fracture. In addition, this lack of overlying soft tissue is the likely cause of the high rate of infection in tibial fracture (4). Therefore, prompt physical examination is required in cases where fighting or lameness is observed.

Stabilization of an oblique fracture requires rotational and bending support. This can be achieved with a bone plate, an IM pin with an external fixator, or an external fixator alone. In this case a bone plate, screws, and a cast were successfully used to prevent rotational and bending loads. In addition the cast lasted 9 weeks whereas a typical cast lasts 4-6 weeks. Because a black gibbon walks in the erect position, the pelvic limbs are the main weight bearing extremities.

During postoperative care, a black gibbon should not be placed in a cage with other cagemates until the cast material is removed because cagemates frequently groom and remove cast materials. Subcuticular suturing without skin suture is recommended when cast materials are not used. This technique can prevent the black gibbon from tampering with the wound and eliminate the need for suture removal. In this case report, the black gibbon was isolated from the group until the cast was removed.

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긴팔원숭이에서 발생한 경골 골절의 외과적 정복 1례

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요 약 : 5년령의 체중 4.58 kg 수컷 긴 팔 원숭이가 후지 파행 증상으로 건국대학교 동물 병원에 내원하였다. 신체 검사에서 우측 후지 경골 부위의 연부조직 손상을 보였으며 방사선 사진에서 우측 경골과 비골의 단순 골절이 관찰되었다. 개방형 정복을 실시한 후 tubular dynamic compression plate와 나사를 이용한 고정을 실시하였다. 수술 9주 후 방사선 사진 검사에서 잘 발달된 가골 형성이 골절 부위 피질에서 관찰되었다. 수술 3개월 후 후지 파행 증상을 보이지 않고 정상 보행이 가능하였다.

주요어 : 긴 팔 원숭이, 골절, 내고정, 경골.