Use of Cross Pins and Temporal External Skeletal Fixator for Stabilization of a Tibial Physeal Fracture in a Korean Native Calf

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Abstract : A one-month-old, male Hanwoo calf was presented to Chonbuk Animal Medical Center with non-weight bearing lameness on its right hindlimb. The radiograph and CT scan showed a Salter-Harris III fracture at the distal tibia. Following open reduction, the fracture was stabilized by cross-pins. A temporal external skeletal fixator was used as an additional support for 5 weeks. 5 weeks after surgery, bone fracture had successfully healed with no complication. At 2 years after surgery, the calf could walk almost normally although intermittent weight-bearing lameness after active exercise. This is a rare case that the combined use of temporal external fixation and cross-pins fixation was sufficiently effective for treating a distal tibial physeal fracture in a calf.

Key words : Salter-Harris III fracture, tibia, temporal external skeletal fixator, calf.

Introduction

The diaphysis is the most frequent location for fractures to occur in cattle (8). Fractures of the tibia are common in the long bone and account for 12-40% of long bone fractures in calves (2,4,20). The physeal fractures in the long bone are second in frequency of occurrence (8). These most commonly occur in the distal metatarsus and metacarpus, distal femur and radius, or proximal tibia (14). However, a Salter-Harris III fracture of the distal tibia like in our case occurs very rarely in calves (8).

Treatments of physeal fractures in calves include plates, lag screw fixation, transverse pins, and cross pin fixation (14-16). Neonatal calves frequently have post-operative complications, such as migration of the pins and poor holding power of transcortical pins because of the low density and thin cortices of their bones (12,14). Transarticular fixation of external skeletal fixators has been used in small animals for arthrodesis of joints, temporary immobilisation of joints during the healing of soft tissue injuries, and for the treatment of fractures at the end of the long bones (7,13). This technique has also been recommended for the treatment of fractures near the joints in cattle.

In this case study, we report the successful use of a cross pin and temporal external skeletal fixator to repair a Salter-Harris III fracture of the distal tibia in a Korean native calf.

Case

A one-month-old, 28 kg male Hanwoo calf was presented to Chonbuk Animal Medical Center of Chonbuk National University with non-weight bearing lameness on its right hindlimb after trauma that was caused by the calf being caught in the cattle shed door. The right hindlimb was cast to the tibia by a local veterinarian. Upon admittance, physical and orthopedic examination was performed. The vital signs were within a normal range. After cast removal, a radiograph and computed tomography (CT) scanning of the affected limb revealed a Salter-Harris III fracture at the distal epiphysis of the tibia with caudal displacement of bone fragments (Fig 1).

The calf was premedicated with 0.1 mg/kg xylazine hydrochloride (Rumpun® 2% injection, Bayer, Korea) administered intravenously and general anesthesia was maintained with isoflurane in oxygen.

The calf was positioned in lateral recumbency and the affected limb was extended. The limb was clipped and aseptically prepared for surgery. The lateral aspect of the limb was incised from the lateral aspect of the tibia to the lateral malleolus of the distal tibia. A plane of dissection was created by displacing the long digital extensor muscle cranially and the bularis longus and lateral digital extensor muscles caudally. The fracture hematoma was removed and fragments were reduced by using a positive mid threaded pin of inserted tarsal bone and kern bone holding forceps. Three small Steinmann pins were placed diagonal, in normograde fashion through the lateral and medial malleolus. The skin incisions were closed. The fracture site was protected with a bandage and cast. Next, temporal external skeletal fixation was used to provide additional stability to the fracture. One positive mid threaded pin was inserted into the distal tibia. Two pins were connected by use of two connecting bars and acrylic pin external fixator alignment frame clamps.
Repair of a Salter-Harris III fracture of distal tibia

Radiograph and CT scanning was done immediately after the operation and adequate fracture reduction and alignment of bone fragments was observed (Fig 2). Postoperatively, 20 mg/kg cefazoline sodium (Cefazilin® Inj, Chong Kun Dang Pharm, Korea) was administered subcutaneously for 3 days. At follow-up examination 5 weeks after surgery, there was mild right hindlimb lameness with no external skeletal fixator related complication and there was progress in fracture healing in terms of periosteal callus and narrowing of the fracture line (Fig 3). At that time, temporal external skeletal fixator and cast was removed from the calf. The radiograph showed well maintained fragments and bone healing of the fracture site. At 2 years after surgery, although intermittent weight-bearing lameness was observed after active exercise, the calf weighed 450 kg, walked well and did not have any surgery-related complications.

**Discussion**

A variety of physeal fractures of long bone in calves have been reported (1,6,14), because the physis structure of young animals is weaker than bone and the surrounding support structures (14). The most common fracture type to occur in young farm animals is the Salter-Harris type II fracture, where the epiphysis separates from the metaphysis through the physis with a small corner of the metaphysis fractured as well, followed by the Salter-Harris type I fracture, where the fracture only goes through the physeal cartilage. The prognosis for a straight, functional, pain-free limb is better with a lower Salter-Harris classification. Salter-Harris type I and II physeal fractures in farm animals generally have a favorable prognosis (11,14). Fractures of distal physis of the tibia are uncommon in calves (1,4). In this case, Salter-Harris type III fractures are very rare in calves because they involve a joint surface, and have a more guarded prognosis (11,14).

Three-dimensional CT scans are frequently used to assess fracture and deformity of bone in small animals (5,10,19,21), but they are used less frequently in large animals. The 3D CT scans are easier to interpret than two-dimensional CT scans and are helpful in the anticipation of important fracture characteristics and preoperative planning. However, the disadvantages of 3D imaging include increased time and effort, as well as increased cost to perform the reconstructions (17,18).

Physeal fractures of the tibia usually cause trauma of dystocia and handing (3,4,14). Several surgical techniques have been described for treatment of physeal tibia fractures in large animals, for example, the application of a plaster cast, a Thomas splint-cast, a bone plate, cross pin fixation, and a circular external fixator (4,9,14,15). The loosening of intramedullary pins and screws is commonly seen in neonatal calf bones because of a low bone density and thin bony cortices (12,14). Due to these reasons, it is necessary to provide an additional support for treatment of physeal tibia fractures. In a previous case, repair of a right in a foal with a hybrid external fixator was reported. This case showed that immediately after surgery, the foal had relatively good weight bearing. The proxi-
tibial Salter-Harris type II fracture was completely healed 1 year after surgery (9).

In our case, a one-month-old, male Hanwoo calf had a Salter-Harris III fracture of the distal tibia, which was repaired with cross pinning and transarticular fixation of the temporal external skeletal fixator. This case had a good outcome without any complications. Also, our method was found to be efficacious, inexpensive and easily applied in farm animals. This technique has been shown to be feasible in clinical practice. This is a rare case that the combined use of temporal external fixation and cross-pins fixation was sufficiently effective for treating distal tibial physeal fracture in the calf.

References


한우 송아지의 정강뼈 성장판 골절에서의 교차핀과 임시 외부 골격 고정장치의 이용

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요 약 : 한달 된 한우 수송아지가 오른쪽 뒷다리 체중부하를 못하는 문제를 가지고 전북동물의료센터에 내원하였다. 방사선검사와 CT 검사 상에서 Salter-Harris III형의 면쪽 정강뼈 성장판 골절로 진단하였다. 개방골절정복 후 교차핀을 이용하여 고정한 후 임시 외부 골격 고정장치를 이용하여 5주 동안 추가적인 지지를 실시하였다. 수술 5주 후 방사선검사에서 골절된 뼈의 유합이 관찰 되었다. 수술 2년 후 과도한 움직임 뒤에 미약한 체중부하 과병이 관찰 되었지만, 거의 정상 수준으로 보행이 가능하였다. 송아지에서 이와 같은 증례는 매우 드물고 교차핀과 추가적인 임시 외부 골격 고정장치를 이용한 골절 정복법은 면쪽 정강뼈 골절 치료에 유용하게 사용될 거라고 생각된다.

주요어 : Salter-Harris III 골절, 정강뼈, 임시 외부 골격 고정장치, 송아지