

Bilateral calcaneal epiphysiolysis in a dog

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Keywords

Epiphysiolysis, calcaneal, tension band, dog

Summary

A case of bilateral calcaneal epiphysiolysis in a six-month-old female Dobermann Pinscher is described in this report. The absence of a traumatic event and the clinical, radiographic

and histopathological abnormalities led us to the diagnosis of simultaneous bilateral epiphysiolysis of the calcaneus. A tension band and a type II transarticular external fixator were placed. The clinical signs were resolved only temporarily because of the gravity of the bone changes.

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Introduction

Partial or complete separation of an epiphysis from the diaphysis of a bone is known as epiphysiolysis (1). In skeletally immature dogs, it is a common consequence of trauma resulting in Salter-Harris type I fractures (2). Separation and lysis of the femoral capital epiphysis without any history of trauma has been well described although few cases have been reported to affect the calcaneal epiphysis (2-5). The aim of this report is to present a case of non-traumatic bilateral calcaneal epiphysiolysis, describing the clinical, radiographic and pathological findings and the failure of the fixation method used.

Case report

A six-month-old, female Dobermann Pinscher dog weighing 27 kg, was presented to our hospital with a four-week history of progressive lameness involving both pelvic limbs. There was not any previous history of trauma or other medical problems. Prior

to presentation, the dog had been treated with firocoxib^a (5 mg/kg PO SID) for two weeks without any improvement. Physical examination revealed a weight bearing lameness affecting both pelvic limbs (grade 3 out of 5) (5). The gait was similar to a canine Wobbler syndrome affected dog because the dog was only supporting itself on the tiptoes. Both tarsal joints were swollen and the dog showed signs of pain on palpation. The tibiotarsal and interphalangeal joints were hyperflexed at rest (►Figure 1; tarsal angle of 120°; 135-140° is normal) (6). The animal also had difficulty rising from a resting position.

Radiographic examination of both hindlimbs revealed a severe irregularity and formation of new reactive bone, with avulsion of the apophysis of the calcaneal tuber from the proximal metaphysis of the calcaneus, and with severe swelling of the surrounding soft tissues. The caudal aspect of the proximal two-thirds of the calcaneus showed significant cortical irregularities. In

addition, the caudal aspect of both distal tibial physes showed small amounts of new, reactive bone formation (►Figure 2). No other radiographic signs of abnormalities in the pelvic limbs were observed.

An ultrasound examination of the Achilles tendon showed signs of moderate to severe tenosynovitis without rupture of its insertion (►Figure 3).

The results of the haematology, biochemistry and bleeding time analyses were normal. Serological ELISA tests^b and a proteinogram for Leishmaniosis and Ehrlichiosis were negative.

Considering that the closure time of the calcaneal physis normally occurs within seven weeks to eight months of age, a presumptive diagnosis of bilateral calcaneal epiphysiolysis was made based on the clinical and radiological findings and the lack of a history of trauma (7).

The owner was informed that the condition, if not treated surgically, may progress to bilateral rupture of the Achilles tendon and luxation of the superficial digital flexor tendon, and that the lysis and remodelling of the epiphyseal bone could worsen the prognosis. Consequently, the owner consented to the surgery.

The dog was premedicated with diazepam^c (0.1 mg/kg) and methadone^d (0.3 mg/kg), and anaesthesia was induced with thiopental^e and maintained with a gaseous mixture of isoflurane^f and oxygen. Postoperative analgesia consisted of the administration of buprenorphine^g (0.01 mg/kg

^b Igezim leishmania/ehrlichia: Ingenasa, inmunología y genética aplicada SA., Madrid, Spain

^c Valium[®]: Roche Farma, Madrid, Spain

^d Metasedin[®]: Laboratorios Dr. Esteve SA, Barcelona, Spain

^e Tiobarbital[®]: B. Braun Medical S.A., Melsungen, Germany

^f Isovet[®]: B. Braun Medical S.A., Melsungen, Germany

^g Buprex[®]: R.B Pharmaceuticals Limited, Berkshire, UK

^a Previcox[®]: Merial Limited, Duluth, GA, USA



Figure 1 At rest, hyperflexion and swelling of the tibiotarsal and interphalangeal joints.



Figure 2 Lateral radiographic images of the A) left and B) right hindlimbs. Nonunion between the calcaneal tuber with the body of the calcaneus. Evidence of bone remodelling.

I.M.) as required. Additionally the administration of carprofen^h (2.2 mg/kg SC BID) was continued for five days. Cephalotineⁱ (25 mg/kg IV) was administered at induction and then, after surgery, twice a day. Intra-operatively, the medial and lateral processes of the tuber calcanei on both sides were inspected and the bone appeared weak and fibrous in consistency. Tissue samples were collected from the separation between the epiphysis and metaphysis for histology. We decided to reduce and stabilize the epiphysis with bilateral pins and a tension band. When the tension band was placed, due to the weakness of the bone, the damaged epiphysis collapsed.

To counteract the traction forces exerted by the Achilles tendon, a type II transarticular bilateral external fixator was placed on both pelvic limbs. One 2 mm positive-profile threaded cortical pin was placed from the medial aspect of the tibial diaphysis, and two additional 2 mm positive-profile threaded cortical pins were placed through the metatarsal bones. The 4 mm connecting bars were linked with a frontal connecting bar to improve the stability of the fixation (► Figure 4).

Histologic examination of the surgically removed specimens showed areas with loss of the trabecular bone structure with formation of organized and disorganized osteoid tissue



Figure 3 Ultrasound image (Linear 10 MHz probe) of the Achilles tendon showed signs of moderate to severe tenosynovitis without rupture.

associated with a large amount of fibrocartilaginous proliferation (► Figure 5).

Post-surgically, the animal improved its standing position, and hyperflexion of the toes was not present. The lameness was reduced considerably. Unfortunately, the animal's condition worsened three weeks after the surgery; the animal showed digital hyperflexion and the radiographs revealed implant failure and collapse of the physis and progression of the osteolysis (► Figure 6). Revision surgery or tarsal arthrodesis were proposed but the owner refused these treatment options and the animal was euthanized.

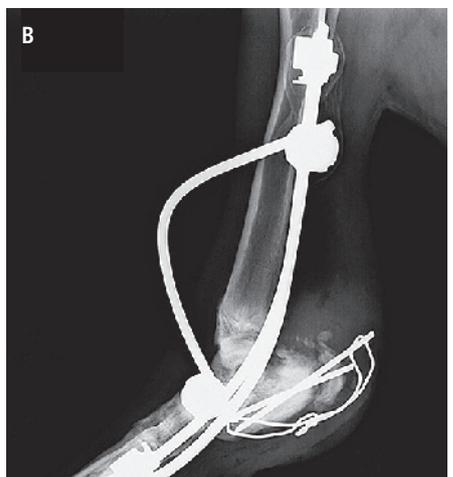


Figure 4 Postoperative lateral radiographic images of the A) left and B) right hindlimb. Stabilization achieved with pins, a tension band and a type II transarticular external fixator.

^h Rimadyl[®]: Pfizer, Sandwich, UK

ⁱ Cefalotina[®]: Laboratorios Normon, Madrid, Spain

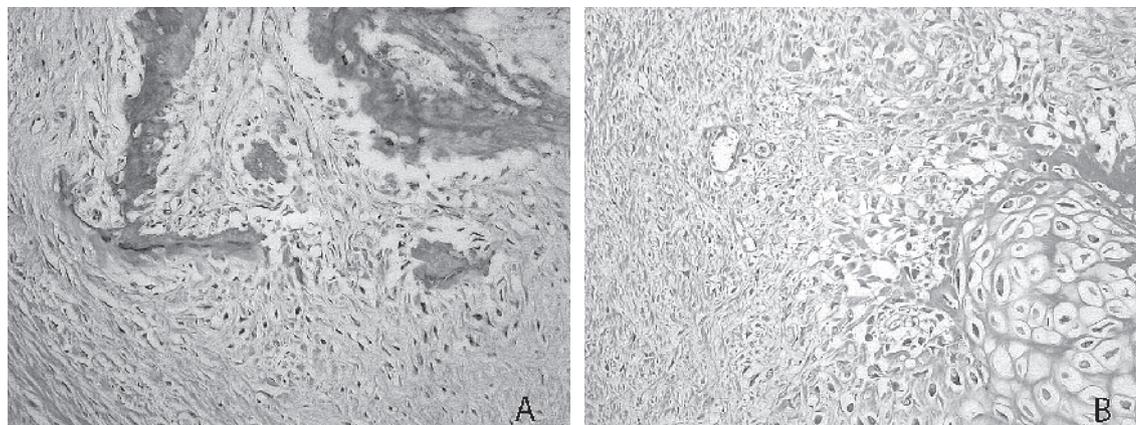


Figure 5
A) Irregular bone trabeculae and proliferating osteoblasts producing bone matrix. **B)** Irregularly arranged chondroid tissue in the periphery of bone growth. H/E. 200x. (Images courtesy of Histovet).

Discussion

Few reports in the literature provided guidance about the proper treatment of this condition of calcaneal epiphysiolysis. We found two other reports of bilateral calcaneal epiphysiolysis in the dog (4, 5). These authors recommended either application of a cast and cage rest or surgical treatment (5). Considering the severity of the progression of the bone remodelling and lysis, we decided that surgery was the best approach.

The tension band technique is an accepted stabilization method for bone fragments under traction (6). This technique was used in the two cases described prior to ours, but both had problems with bone union.

Van Ee and colleagues reported the case of a 13-month-old Rottweiler treated with a tension band that had to undergo revision surgery 25 weeks after the initial surgical repair because of implant failure and the inefficacy of the conservative treatment. The radiographs showed a proximal epiphyseal separation of the tuber calcaneus. An epiphysiodesis of the right calcaneus was performed using a 4.5 mm cortical bone screw in lag fashion with a spiked washer and autogenous cancellous bone graft (4). We were not able to use this method because of the age of our patient and the weakness of the bone (4).

Elkins and colleagues reported the case of a six-month-old Doberman Pinscher treated with a bilateral tension band and stabilized with bilateral modified Robert Jones bandages supported with fibreglass.

One of the epiphyses was displaced dorsally because of the distraction produced by the calcaneal tendon mechanism. During the follow-up period the hock remained swollen with limited weight bearing on the limb. However, after jumping, a fracture through the distal hole of the tension band wire in the calcaneal body occurred (5).

Compared with these previously reported cases, the radiological signs of bone changes (bone lysis and remodelling) were much worse in our case. For this reason, we

decided to treat both extremities surgically by using a tension band. In order to maintain the standing angulation, a type II transarticular external fixator reinforced with a cranial interconnecting bar to provide a temporary joint immobilization was placed. Nevertheless we were aware that the immobilization of the tarsal joint did not completely eliminate calcaneal tendon traction during weight bearing (8).

There are many unproven theories explaining the aetiology of calcaneal epiphysiolysis (4- 6). The most accepted one is that this condition may be a form of osteochondrosis (4, 5). This is known as a generalized skeletal disturbance of endochondral ossification in which parts of the physis or the deeper layers of the articular surfaces fail to mature (6). Less accepted theories include an excess of mechanical traction on the epiphysis because of an increased tibiotarsal angle. This is more frequently seen in large dog breeds such as the Rottweiler (4).

The epiphysis of the calcaneus is a traction epiphysis and may represent a former sesamoid in the gastrocnemius tendon (4, 9). Physeal areas are considered to be a natural weak point during periods of rapid growth (3).

Sever's disease, and other similar conditions described in human medicine such as Osgood-Schlatter disease, little-leaguer's elbow, and iliac apophysitis are believed to be caused by decreased resistance to shear stress at the bone-growth plate interface (10). Studies have indicated that traction epiphyses have a higher composition of fibrocartilage than epiphyses subjected

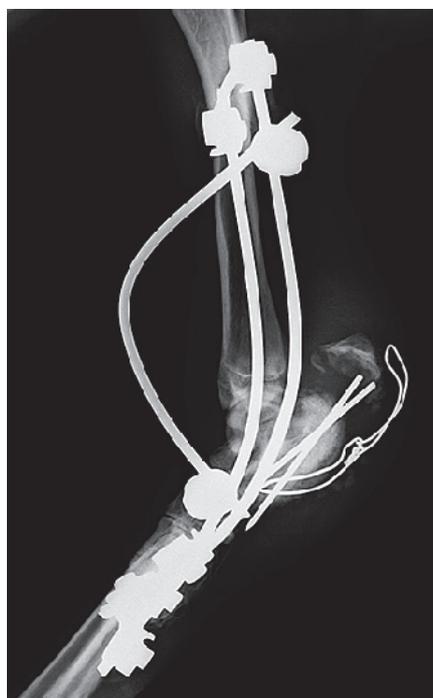


Figure 6 Lateral radiograph of the right hindlimb (3 weeks after surgery). Separation and collapse of the physis and progression of the osteolysis.

more to axial load, which are composed predominantly of hyaline cartilage (10). The calcaneal apophysis in humans is subjected to significant shear stress because of its vertical orientation and the direction of traction from the strong gastroc-soleus muscle group (10).

The third theory proposed involves micro-trauma resulting in fractures with disruption and avulsion of the epiphysis (10, 11, 12).

In conclusion, epiphysiolysis of unknown origin in growing dogs can affect different bones. Those that involve the calcaneus bilaterally are very rare, based on the few cases reported. Its functional prognosis is grave in view of the results obtained. More studies need to be done to provide information about the best approach for this condition.

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Conflict of interest

None declared.

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