

Pantarsal Arthrodesis to Treat a Full-Thickness Lateral Trochlear Ridge Osteochondritis Dissecans in a Dog

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Abstract

Keywords

- osteochondritis dissecans
- hock
- arthrodesis
- locking plate

A 5-month-old female Golden Retriever dog presented with a 4-week history of right hindlimb lameness. A bone lesion on the proximal lateral trochlear ridge was detected at radiographic and ultrasound examinations. Osteochondritis dissecans (OCD) or an articular fracture was included in the differential diagnoses. Computed tomography revealed an OCD lesion. A pantarsal arthrodesis was performed using a pre-bent arthrodesis locking plate. Histological analysis revealed pathological features typical of OCD. Clinical and radiographical assessments were performed 7, 15, 62 days and 7, 12 months postoperatively. No signs of pain were elicited upon palpation. Mechanical lameness, secondary to tarsal joint immobilization, was detected.

Introduction

Osteochondritis is a growth disorder in which there is altered endochondral ossification which causes thickening and retention of a circumscribed area of cartilage.^{1,2} Osteochondritis evolves into osteochondritis dissecans (OCD) when the part of altered cartilage becomes detached from the subchondral bone, causing a joint flap.³ The hock is the third joint most frequently affected by OCD, after the shoulder and elbow² and is the site of 4 to 9% of all cases of OCD.⁴ Among dogs, it affects animals between 4 and 9 months of age,⁵ with a predilection for females and for the Rottweiler and Labrador Retriever breeds.^{6,7} In 79% of cases of OCD of the hock the medial border of the talar trochlea is affected,² while in the remaining 21% of the cases it is the lateral border which is affected (of which 70% of cases involve the dorsal part of the trochlear ridge).^{8,9} The surgical treatment consists of removing the fragment of detached cartilage via arthroscopy or arthrotomy.^{10,11} In 24% of the cases treated surgically, by removal of the joint flap, the clinical outcome is judged unsatisfactory, particularly when the flap is large, while in 42% of cases the patient has persistent, chronic lameness.^{6,12} The use of a synthetic osteochondral resurfacing implant for the treatment of OCD of the femoral condyle was reported as a successful and repeatable surgical procedure in selected patients.¹³ Fractures of the talar

trochlea are rare and poorly described in the literature.^{14–16} The recommended treatment for simple fractures of the lateral ridge of the talar trochlea is anatomical reduction in the joint fragment and fixation with screws or Kirschner wires^{15,16}; if the fracture cannot be reduced, arthrodesis is recommended.¹⁷ Pantarsal arthrodesis of the tarsus is considered in the literature as a limb-saving intervention in cases of chronic osteoarthritis, rupture of the plantar ligament, rupture of the calcaneal ligament, irreducible joint fractures, or traumatic tibiotarsal dislocation.^{17,18} A clinical case of full-thickness OCD of the lateral trochlear ridge of the talus managed with pantarsal arthrodesis is described.

Case Report

A 5-month-old, female Golden Retriever weighing 30 kg was brought for the clinical evaluation of right hindlimb lameness. The reported history was a sudden onset of limping and partial weight-bearing which developed secondary to a traumatic event (running in the park) and had become chronic (4 weeks). The orthopaedic evaluation revealed pain on deep palpation of the tibiotarsal region. The differential diagnoses included a fracture, a sprain or a hock OCD. The dog was given general anaesthesia to take X-rays of the

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Fig. 1 Preoperative X-rays. (A) Mediolateral and (B) anteroposterior views of the right, affected limb. (C) Mediolateral and (D) posteroanterior projections of the left, unaffected limb. Craniocaudal axial X-rays of the (E) right hindlimb and the (F) left hindlimb. The X-ray shows a lesion in the dorsolateral aspect of the lateral ridge of the talus (green arrow).

hindlimbs. The radiographic evaluation included mediolateral and dorsoplantar projections and a craniocaudal axial view of the talar trochlea with the tibiotalar joint flexed at 90° (**►Fig. 1**). The craniocaudal axial X-ray showed tibiotalar joint space narrowing, discontinuity of the subchondral bone of the lateral trochlear ridge of the talus and a fragment of fractured bone corresponding to the dorsal aspect of the lateral talar ridge (**►Fig. 1**). A subsequent ultrasound examination detected joint effusion and a fracture in the subchondral bone of the lateral ridge of the tarsal trochlea (**►Fig. 2**). A computed tomography (CT) study of both distal hindlimbs was performed to understand the lesion better and determine its extension. The CT images revealed an articular flap with the characteristic appearance of OCD (**►Fig. 3**). Ten days later, a pantarsal arthrodesis was performed (**►Fig. 4A**).

The patient was placed in dorsal recumbency and a dorsal surgical access to the tibiotalar joint was performed. The osteochondral fragment was removed and sent to a veterinary laboratory for the histological examination (**►Fig. 5**). Cartilage and subchondral bone of the remaining part of the lateral tarsal ridge, on the tibial side, were removed by a high-speed bur (100,000 K) and an oscillating saw (Command 2 blade 5400–3–410; Stryker, Formello, RM, Italy). Subsequently, the

distal cartilage of the tarsus, calcaneus, proximal side of the central bone of the tarsus and the fourth tarsal bone down to the underlying subchondral bone were removed by a high-speed bur. The intratarsal and tarsometatarsal cartilage was removed by burring as well. The spaces created by the removal of the fragment, the cartilage and subchondral bone were filled with 2 mL of Fortigen P (Progenica Therapeutics; Kent, Washington, United States). For the purpose of stabilizing the joint, an angular, Fixin locking plate (Intrauma Ref. V3011, Rivoli, TO, Italy), pre-bent at 135° (120 mm long and 2.5 mm thick) was placed with eight screws: two 3.5-mm locking screws and one 3.5-mm compression screw in the distal tibia, two 3.0 mm locking screws into the talus and third tarsal bone, two 3.0-mm locking screws in the central and distal thirds of the third metatarsal bone and one 2.7-mm non-locking screw in the proximal third of the third metatarsal bone. Two X-rays were performed, one in a mediolateral projection and the other in a posteroanterior projection, to check the positions of the implants and the alignment of the limb (**►Fig. 4A**).

A light Robert Jones bandage was applied for 5 days, extending from the distal femur to include the phalanges. The dog was discharged with an antibiotic prescription (amoxicillin + clavulanic acid, 20 mg/kg twice daily [BID]) for 10 days, anti-inflammatory therapy (robenacoxib 1 mg/kg once daily) for 3 weeks and analgesia (tramadol 2 mg/kg BID) for 3 weeks. Cage confinement was suggested until radiographic confirmation of bone healing. Leash walking was limited to four times a day, for 10 minutes each. Clinical examinations were performed 7, 15 and 62 days after surgery. At day 7 and 15 evident lameness was detected. At 62 days the joint was stable and not painful on palpation, although walking was abnormal, with external rotation of the pes. At 62 days from surgery the radiographic follow-up revealed bone fusion (**►Fig. 4B**). Seven months after surgery, the patient was brought for a re-evaluation because of slight lameness. Moderate pain was elicited upon deep palpation of the distal tibia. A mediolateral X-ray was performed. Radiolucent areas were detected in the distal tibia and at the base of the metatarsal bones (**►Fig. 4C**). The implants were removed. The patient was referred for a clinical and radiographic control 1 year after surgery, at which time the joint was stable and not painful on palpation (**►Fig. 4D**). Walking and trotting were abnormal with external rotation of the pes.

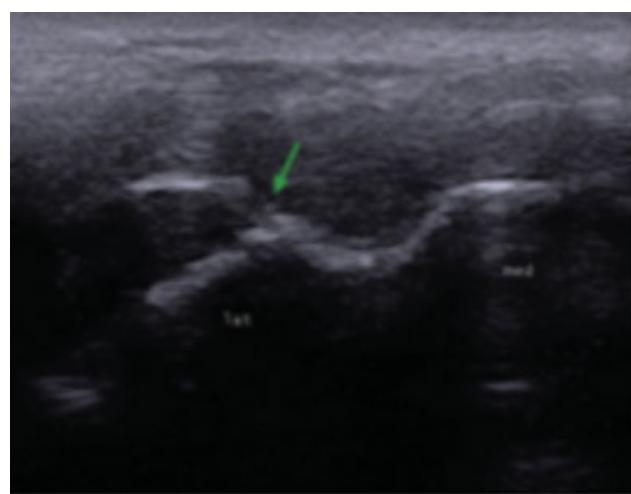


Fig. 2 Ultrasound image. Transverse section of the tarsus in extension at the level of the lateral and medial borders of the talar trochlea. Note the break in the lateral ridge of the talar trochlea (arrow).

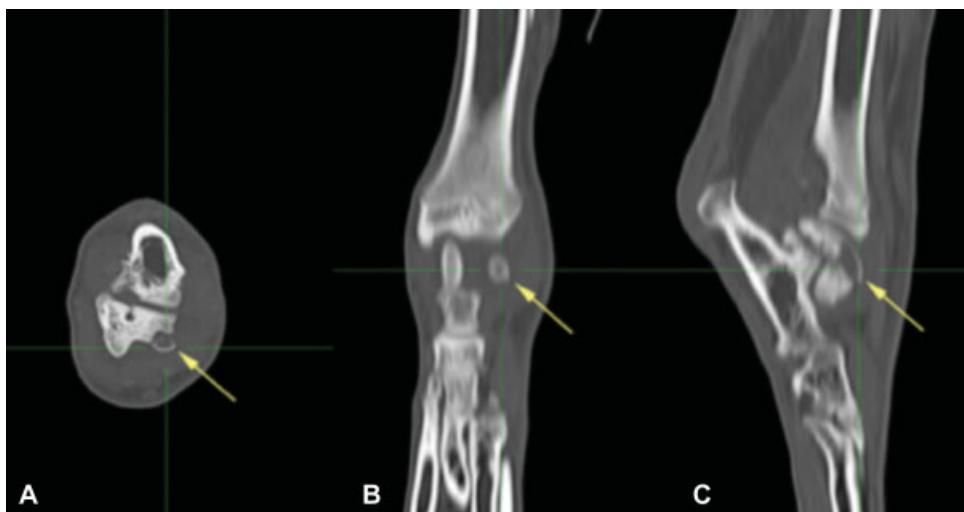


Fig. 3 Computed tomography multiplanar reconstruction images of the right limb. The arrows point to the osteochondritis dissecans lesions of the right talus on the transverse (A), frontal (B) and sagittal (C) planes. Periarticular moderate soft tissue swelling can be detected.



Fig. 4 (A) Postoperative, (B) 62 days, (C) 7 months and (D) 1 year X-rays in mediolateral view. X-ray control 62 days after surgery, showing radiographic healing: note the exuberant callous in the tibial portion of the plate. At 7 months after surgery: the red arrows highlight areas of radiolucency that could indicate a stress protection phenomenon.

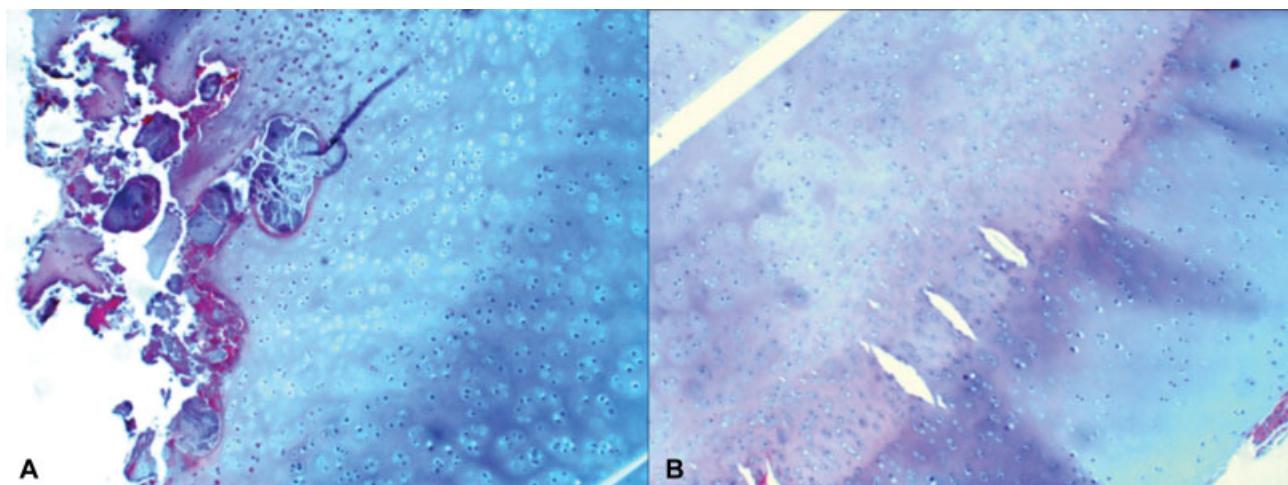


Fig. 5 Histological images of the osteocartilage joint fragment: a large area of vascular necrosis surrounded by immature, hypertrophic chondrocytes, often binucleated and arranged in small, irregular aggregates embedded in scarce deposits of amorphous chondroid matrix is observed. The alterations to the cartilage are compatible with osteochondritis dissecans. Staining technique Alcian blue periodic acid Schiff magnification 10X (A). Staining technique Alcian blue periodic acid Schiff magnification 40X (B).

Discussion

Clinical manifestations of this dog were atypical. Lameness severity has been reported to be related to OCD fragment size

and to the severity of synovitis caused by joint instability.^{13,19} However, the patient described here had relatively modest lameness considering the notable size of the osteochondral fragment. The Golden Retriever is one of the breeds

most frequently affected by OCD of the lateral trochlear ridge.¹⁸ The patient was female, in accordance with the gender predisposition reported in the literature.⁶

Radiography is reported being the first diagnostic investigation to be performed in case of OCD suspicion in the dog.²⁰ Radiographic survey should include the following projections: mediolateral extended, mediolateral flexed, axial flexed craniocaudal, plantar-dorsal, plantar medial-dorsal-lateral and plantar lateral-dorsal-medial oblique.^{20,21} The dorsal-plantar projection provides the best diagnostic information for lesions of the dorsal aspect of the medial talar ridge, while the plantarolateral-dorsomedial 45° oblique projection provides the best diagnostic information of the lateral ridge.²⁰ The X-rays did not enable to diagnose OCD with certainty in the case here described, so CT was performed to better quantify the size and locate the fragment more accurately. Despite a detailed description of the canine tarsal radiographic anatomy,²² because of the superimposition tibia, fibula and calcaneus, radiographic images can be challenging to be interpreted. Computed tomography has been found to be superior to radiography for OCD diagnosis²¹. Computed tomography images showed an image suggestive of OCD on the lateroproximal aspect of the lateral ridge of the talar trochlea. The measured fragment was 10 × 6 × 5 mm. A slight joint space narrowing and a substantial decrease in bone density were observed (**►Fig. 3**). These findings are compatible with moderate osteopenia, likely secondary to disuse. Fragment borders were partially rounded, suggesting the chronic nature of the condition. In addition, moderate periarticular soft-tissue swelling and mild talar-calcaneal arthritis were detected probably because of the joint instability.

Ultrasonography was useful for detecting joint effusion and for showing the subchondral bone fracture on the lateral side of the talar trochlea. Ultrasonography has been found to be a valid diagnostic imaging technique for the evaluation of bone surfaces.²³ About 75% of the talar trochlear margin can be visualized by ultrasonography and the areas that can be seen are those most commonly affected by OCD.²³ Ultrasonography, in addition to radiographs and CT images, could increase the accuracy of tarsal OCD lesions evaluations.

According to canine tarsal OCD literature, important prognostic information are provided by the fragment size.²⁰ Removal of large osteochondral fragments usually results in severe incongruity, joint instability osteoarthritis and lameness.^{3,12} In this patient, given the size of the OCD fragment, fragment removal was not considered as an option. The pantarsal arthrodesis was then performed. The reported requisites for a successful tibiotarsal pan-arthrodesis include a rigid fixation system, as well as a complete approach to the joint surfaces and meticulous removal of the cartilage.¹⁸ Angular fixation systems provide greater and longer-lasting stability than conventional fixation systems.² This system was also chosen based on its feature of being already bent at an angle of 135°.²⁴ This shortened the surgery time.

Conventional screws were used to achieve compression between the surfaces of the plate and the bone, thereby reducing implant-bone offset and enabling better soft tissues

apposition. Bone healing was assessed on radiographic findings, which did not show any radiolucency of the juxtaposed bone surfaces and on the patient's clinical findings as no pain upon palpation. Implants were removed as at 7-month X-ray follow-up osteolysis around the screws and areas of bone radiolucency were detected. These findings were interpreted as stress-protection phenomena (**►Fig. 4**).²⁵ The dog had developed a florid, large bone callous at the tibial extremity of the plate, incorporating it and greatly increasing distal tibia thickness (**►Fig. 3**). This exuberant callous could have been the result of excessive flexibility of the plate, or a consequence of the age (young) of the dog or both.

The expected healing time for an arthrodesis of the tarsus is 2 to 3 months.²⁶ The rapid healing in the case reported here could have been facilitated by the patient's young age, the stability afforded by a locked system and/or the presence of abundant heterologous transplant material.²⁷ In humans, healing time can be shortened by using biomaterials in cases of trauma, tumours or corrective osteotomies.²⁷

Fragment histological examination determined that the joint fragment was a piece of cartilage with no signs of calcification or vascularization, leading to the histological diagnosis of hock OCD (**►Fig. 5**).

The tibiotarsal pan-arthrodesis clearly improved the patient's quality of life, despite the animal having a persistent lameness, which could be defined as a mechanical lameness with no pain, caused by joint immobility.

Numerous complications of tibiotarsal pan-arthrodesis have been reported in the literature, including calcaneal fractures, distal limb swelling, implant failure, infection, angular deformities, persistent lameness, wound dehiscence and plantar necrosis.¹⁸ No complications were noted in this case. On the basis of this experience and with all the caveats related to the evaluation of a single case, the authors consider that pan-arthrodesis is a surgical therapeutic possibility in cases of hock full-thickness OCD lesions which could cause severe joint instability and, osteoarthritis, thereby negatively affecting patient's long-term life quality.

Author Contribution

Petazzoni Massimo and Buiatti Michela contributed to study design, acquisition of data and data analysis and interpretation. Petazzoni Massimo also contributed to conception of study. Both authors drafted, revised and approved the submitted manuscript.

Conflict of Interest

None declared.

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