Pantarsal Arthrodesis with a Customized Titanium Medial Plate in a Dog

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ABSTRACT

Background: Tibiotalar joint luxations are mostly traumatic and due to automobile accidents. The arthrodesis of this joint is considered the final solution for trauma with ligament lesions without repair, luxations without possibility of joint recovery and chronic joint diseases. The direction to which the joint is dislocated is associated with the forces of trauma, and bilateral ligament injuries are not uncommon. However, the medial ligaments are more frequently injured. The aim of this study is to describe the performance of pantarsal arthrodesis using a customized titanium plate for application to the medial surface of the joint.

Case: An undefined breed dog, weighing 21.5 kg, was attended at the Veterinary Hospital of the Federal University of Lavras (UFLA) with history of trauma and injury in the right pelvic limb. After physical and radiographic examinations it was diagnosed with an exposed luxation of the tibiotarsal joint and tissue loss in the region. The tibiotarsal region was cleaned and a bandage was made daily until the first surgical procedure, which occurred five days later. Initially, it was treated without success with the use of a transarticular external fixator. Subsequently, pantarsal arthrodesis was performed using a customized titanium angled plate (Made by a private manufacturer based on the functional angulation of the tibiotarsal joint of the contralateral limb). The joint was accessed for exposure of the distal portion of the tibia, tarsal and metatarsals bones. Wear of the articular surfaces was performed and then the customized angulation plate for pantarsal arthrodesis was placed on the medial side of the joint. Bicortical drillings were performed, starting with the proximal orifice. According to the holes of the plate, five 3.5 mm diameter screws (four at the distal tibia and one at the tarsus) and four 2.7 mm diameter screws were used in the metatarsal bones. Two isolated 3.5 mm diameter screws were also used, one inserted through the tibiotarsal joint and another connecting the calcaneus to the distal tibia. Muscle fascia, subcutaneous tissue and skin sutures were performed in a conventional manner. In the postoperative period, surgical wound cleaning and partial activities restrictions were recommended for 30 days. After 10 and 45 days of the surgical procedure, the animal appeared for clinical and orthopedic reassessment. The patient showed functional support of the limb and the radiographic exams revealed a proliferative bone reaction in the interarticular regions.

Discussion: The present report describes the use of a specific type of plate for pantarsal arthrodesis that has gained prominence in international veterinary orthopedics and is increasingly being used. In Brazil, the angled plate for medial application still has limited manufacturing, and its importation entails high costs and delay in delivery, which makes difficult its use depending on the financial conditions of the owner and the possibility of waiting to perform the procedure. In the present report, 10 days after the surgical intervention, the animal already had partial support of the injured limb and surgical wound with good healing. In the orthopedic examination at 45 postoperative days, the animal showed satisfactory support and functional use of the member submitted to arthrodesis. It was concluded that the personalized plate for pantarsal arthrodesis proved to be a satisfactory method, which promoted adequate interarticular stability and favored bone proliferation and fusion.

Keywords: dislocation, tibiotarsal joint, traction injury.
INTRODUCTION

In dogs, tibiotarsal joint luxations or subluxations are mostly traumatic due to automobile accidents and are usually associated with malleolar fractures, collateral ligaments rupture and tissue loss [8]. The arthrodesis of the tibiotarsal joint, leaving it in a functional position, is considered a final solution for trauma cases with no repair ligament injuries, luxations without possibility of joint recovery and chronic joint diseases [6]. Arthrodesis is considered a limb salvage procedure in cases where other less radical surgical treatments were unsuccessful or had no indication of being used. Over the years, several techniques of arthrodesis have been described, but all procedures follow some basic principles, such as removal of the entire articular cartilage, rigid fixation at a functional support angle and application of spongy bone graft [5]. Pantarsal arthrodesis is considered the most appropriate procedure when arthrodesis of the tibiotarsal joint is required. Traditionally, pantarsal arthrodesis is performed with the use of a bone plate implanted on the cranial surface of the joint. The advances of the implant industry, in veterinary medicine, focus on the development of plates for application to the medial aspect of the joint, which improves the neutralization of the acting forces against the implant, avoiding the implant failure [1]. The aim of this report is to describe a pantarsal arthrodesis using a custom titanium plate for application on the medial surface of the joint, with the purpose of limb salvage in a dog after laceration injury caused by a car accident.

CASE

A dog of approximately six years old, weighing 21.5 kg, was brought to the Veterinary Hospital of the Federal University of Lavras (UFLA), with history of car accident approximately five hours before the examination. In the orthopedic exam, the left pelvic member was swollen and with increased pain sensitivity in the femoral region, while the right pelvic limb showed tibiotarsal joint luxation with exposure of the articular surfaces and periarticular soft tissue loss. Radiographic examination confirmed tibiotarsal luxation in the right pelvic limb (Figure 1) and presence of comminuted diaphyseal fracture in the left femur.

The tibiotarsal region was cleaned and a bandage was made daily until the first surgical procedure, which occurred five days later. Initially, in order to promote joint stability, a transarticular external skeletal fixation was performed, maintaining the tibiotarsal joint positioned in support angulation, and the joint surfaces were preserved. The femur fracture of the contralateral limb was reduced and stabilized with association of a neutralization plate and a blocked stalk. After two postoperative months, the wounds were completely healed, and the external skeletal fixation system showed instability due to loosening of the pins. The external fixator was removed, but periarticular fibrosis did not provide the expected joint stability, mainly in the region of the medial collateral ligament rupture. There was also radiographic evidence of degenerative joint disease. Thus, pantarsal arthrodesis was performed using a custom made titanium plate, based on the functional angulation of the tibiotarsal joint of the contralateral limb. This plate was developed to be implanted on the medial surface of the joint.

The patient underwent the second surgical procedure. The joint was accessed by an incision in the medial region of the limb that extended from the distal third of the tibia to the middle third of the metatarsal bones. Subcutaneous tissue division was then performed, and musculature and tendons were carefully separated for exposure of the distal portion of the tibia, tarsal and metatarsals bones. Wear of the
articulard surfaces was performed with the help of an orthopedic drill and a bone file, and then the customized angulation plate for pantarsal arthrodesis was placed on the medial side of the joint. Respecting the location and diameter of the plate holes, bicortical drillings were performed, starting with the proximal orifice. According to the holes of the plate, five 3.5 mm diameter screws¹ (four at the distal tibia and one at the tarsus) and four 2.7 mm diameter screws¹ were used in the metatarsal bones. Two isolated 3.5 mm diameter screws¹ were also used, one inserted through the tibiotarsal joint and another connecting the calcaneus to the distal tibia. Next, a spongy bone graft was collected from the medial surface of the proximal tibia and inserted into the joint spaces. Muscle fascia, subcutaneous tissue and skin sutures were performed in a conventional manner.

In the postoperative period, surgical wound cleaning and partial activities restrictions were recommended for 30 days. After 10 days of the surgical procedure, the animal appeared for clinical and orthopedic reassessment. The animal was again evaluated by means of orthopedic and radiographic examinations at 45 days postoperatively (Figures 2 and 3).

DISCUSSION

According to McKee et al. [3], customized plates applied medially or laterally are a great alternative for pantarsal arthrodesis compared to the plates used on the dorsal or plantar surface of the limb. The authors also report that the medial or lateral access to the distal third of the tibia is more adequate in comparison to the dorsal access. Another positive aspect is that the application of the plate on the medial surface is biomechanically superior when compared to the application on the dorsal surface. In the dorsal surface the plate undergoes more intense flexing forces, which predisposes to failure of the implant. Plates fixed to the plantar surface inhibit tensile forces and lead to adequate stabilization, but access to this site is complicated by tendinous and neurovascular structures [4].

Regardless the stabilization method used the basic principles of arthrodesis should be applied, such as total removal of the articular cartilage, adequate contact between the ends of the bones and a rigid fixation [7]. All these principles were applied in the present case, which corroborates the results obtained.

![Figure 2. Radiographic image in craniocaudal projection at 45 days after the pantarsal arthrodesis surgery with the use of a titanium plate on the medial surface of the joint. Observe proliferative bone reaction in the tibiotarsal interarticular region.](image-url)
or postoperative complications were observed as reported by Roch et al. [6] that described non-healing of the surgical wound, plantar necrosis, contamination, implant failure and plate exposure.

According to Clarke and Pink [1], the performance of pantarsal arthrodesis with angled plate application results in favorable prognosis in the majority of patients agreeing with the results found in this report. The satisfactory result presented with this type of plate also demonstrates the need to expand the options of orthopedic implants offered by the national industry.

It is concluded that the angled plate of medial application for pantarsal arthrodesis promotes adequate interarticular stability, which favors bone proliferation and fusion. The pantarsal plate was effective, being of relatively easy surgical application and presenting good prognosis in relation to the functional return of the affected limb. There are not many case reports about this technique that describes good results or complications. Since these luxation lesions are relatively common and tibiotarsal arthrodesis is frequently needed it is important to increase the number of available material and publications under this topic in order to improve veterinary practice.

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Declaration of interest. The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

REFERENCES