Distal tibial osteochondral injury: a case report and review of the literature

Lesão osteocondral central da tíbia distal. Relato de caso e revisão da literatura

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ABSTRACT

The treatment of osteochondral injurie sof the ankle has been studied for at least four decades. Lesions affecting the cartilage of the tibial plafond are uncommon because of the biomechanical characteristics of the tibia. Ankle arthroscopic debridement of the injury, followed by microdrilling or microfractures of the subchondral bone arethe most used treatment procedures. Cystic osteochondral injuries show better clinical results when treated with bone grafting. This study reviewed the literature on treatment of osteochondral injuries. We report a case of a cystic osteochondral injury affecting the distal tibia that was treated using an innovative technique. The autologous bone graft was obtained from the adjacent metaphyseal region and implanted in a retrograde manner. The technique is a viable option to avoid extended osteotomies.

Keywords:

Tibia/injuries; Tibia/pathology; Tibia/surgery; Magnetic resonance imaging; Case reports

RESUMO

O tratamento das lesões osteocondrais do tornozelo é motivo de estudo há pelo menos quatro décadas. Devido às características biomecânicas da tíbia distal, as lesões osteocondrais desta região são pouco frequentes. A artroscopia do tornozelo para o desbridamento da lesão, seguida de microperfurações ou microfraturas do osso subcondral, é o tratamento mais utilizado. As lesões osteocondrais císticas apresentam melhor desfecho clínico quando tratadas com enxerto ósseo. O objetivo deste estudo foi a revisão da literatura sobre o tema e o relato de um caso de lesão osteocondral cística da tíbia distal tratadopor uma técnica inovadora. O enxerto autólogo foi obtido a partir da região metafisária adjacente e introduzido de maneira retrógrada. A técnica se mostrou uma opção viável para evitar osteotomias extensas.

Descritores:

Tíbia/lesões; Tíbia/patologia; Tíbia/cirurgia; Imagem por ressonância magnética; Relatos de casos

INTRODUCTION

Osteochondral lesions that affect the ankle joint have been treated and studied routinely for at least four decades. Most published studies are about osteochondral lesions of the talus. On average, only one tibial osteochondral lesion is reported for every 14 to 20 osteochondral lesions of the talus.(1) Due to their higher rate of occurrence, talar injuries have been studied in depth, classified and received treatment algorithms. There have been few studies to date focusing on the diagnosis, classification, and treatment of distal tibial osteochondral lesions. Thus, their real incidence, etiology, anatomical characteristics, and optimal treatment have not yet been fully elucidated.

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Conflict of interest:
none reported.

Funding:
none reported

Received on:
September 13, 2016

Accepted on:
November 7, 2016

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The current trend is to use the same treatment algorithms applied to talar injuries for distal tibial lesions, although the biomechanical characteristics of the respective articular cartilages are known to be different.

As is the case in talar injuries, for a better clinical outcome, distal tibial lesions with large subchondral cysts should be grafted after debridement of the diseased cartilage. There are numerous bone grafting techniques, types of graft in use, and graft removal sites.

The aim of this study was to report the clinical and radiological results of a retrograde grafting technique used to treat a cystic osteochondral lesion affecting the central portion of the articular surface of the distal tibia, and to compare them with possible similar studies by means of a literature review on the subject.

CASE REPORT

During a medical appointment, a 47-year-old male patient who is an amateur tennis player reported pain in his right ankle that has lasted for about 10 years. The symptom started after a motorcycle crash, resulting in a severe sprain of this ankle and ipsilateral femoral fracture. The femur fracture was surgically treated using an intramedullary interlocking nail and healed without complications. The ankle sprain was initially treated with immobilization in long leg plaster cast for a period of 4 weeks, followed by functional immobilization (semi-rigid brace) and physiotherapy.

After initial treatment and complete consolidation of the femur fracture, the patient was able to resume his usual physical activities. However, pain and a sensation of instability in the right ankle have been present ever since. About 1 year ago, the ankle pain intensified and was accompanied by recurrent joint effusion, which was always aggravated by physical activity. The patient sought orthopedic medical care and underwent magnetic resonance imaging (MRI) of the ankle (Figures 1 to 3), which showed an osteochondral lesion in the central portion of the distal tibia, measuring approximately 1.0 x 0.9cm, associated with a subchondral cyst measuring approximately 0.8cm.

During his first appointment, the patient reported having undergone conservative treatment for approximately 8 months. During this period, he had 40 sessions of physical therapy, 2 intra-articular applications of sodium hyaluronate 25mg/2.5mL and took 1.5g glucosamine sulfate and 1.2g chondroitin sulfate on a daily basis for 6 months, with no success. Surgical treatment was proposed at this point.

The patient underwent ankle arthroscopy performed with 2.7-mm optics and 30° angulation, through anterior

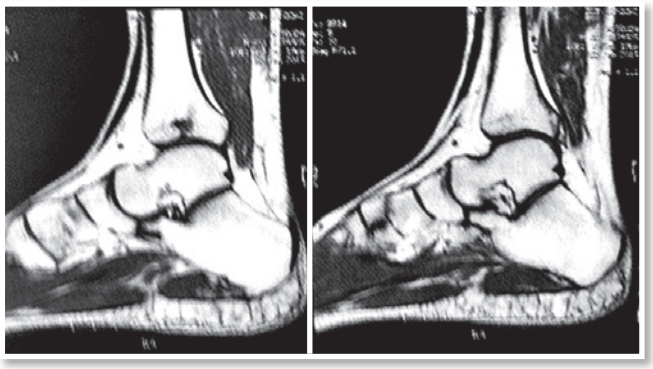

Figure 1 | Preoperative T1-weighted sagittal MRI.

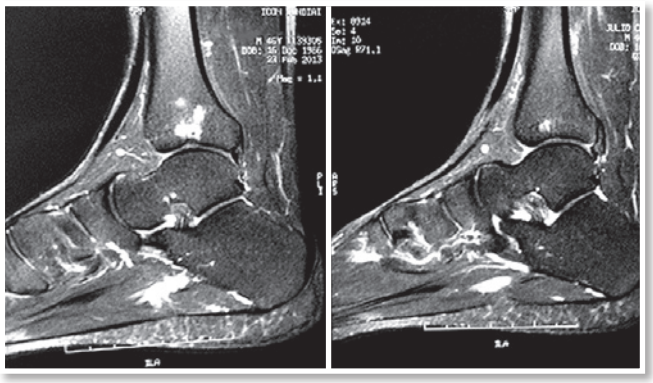

Figure 2 | Preoperative T2-weighted sagittal MRI.

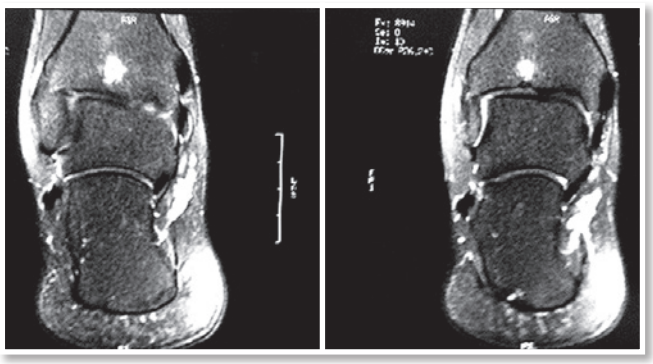

Figure 3 | Preoperative T2-weighted coronal MRI.

(anteromedial and anterolateral) portals with the aid of external skin traction, in order to better visualize the articular surface of the tibia. The osteochondral lesion was identified; the diseased cartilage was debrided using a 2.7mm shaver blade and mini curettes; and the subchondral cyst was exposed.

In the next step, we introduced a 1.5mm Kirschner wire percutaneously through the medial tibial cortex, directed

at the central portion of the medullary cavity, at an approximate angle of 60° to its articular surface in the frontal plane, until the wire was exteriorized through the cyst cavity and visualized through the arthroscope.

With the wire in position, we made a longitudinal incision of approximately 2.0cm on the medial surface of the ankle, from the point of introduction of the Kirschner wire.

The medial surface of the tibia was exposed in the subperiosteal plane. Using the Kirschner wire as a guide, we introduced a trephine (Osteochondral Autograft Transfer System - OATS, Small Joint, Arthrex®) with a diameter of 1.0cm, until it appeared externally on the articular surface under arthroscopic vision. Thus, we obtained a cylindrical plug of corticocancellous bone graft measuring approximately 4.0cm in length.

The graft was carefully removed from the trephine to preserve its anatomical integrity, and reintroduced into the tibial orifice created, which connected the medial tibial cortex to the tibiotarsal joint. Using a graft stamper, the plug was advanced toward the articular surface until it was viewed arthroscopically, filling the subchondral bone defect (Figure 4).

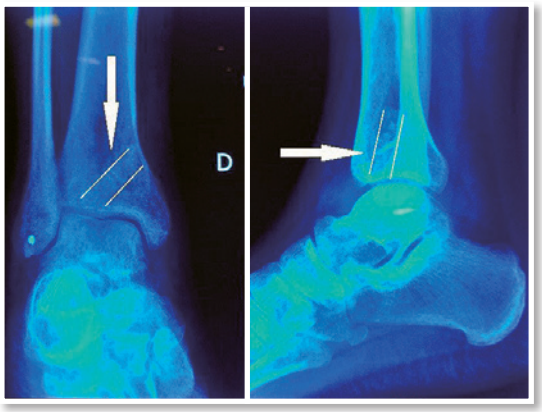

Figure 4 | Postoperative radiograph. White arrows indicate the bone plug.

The articular surface was evened off with the use of a delicate curette to avoid the formation of any projections that could damage the cartilage coating the talus. In the last stages of the operation, we also undertook lateral ankle ligament reconstruction using the modified Broström-Gould technique, fixed to the lateral malleolus with a 2.7mm metal anchor.

In the postoperative period, the patient was not allowed to bear any weight with the operated limb which was immobilized with a removable long robofoot boot for 6 weeks. Weight bearing was progressively permitted thereafter, and the patient was allowed full weight bearing after the eighth postoperative week.

Physiotherapeutic treatment was introduced from the fifth week to gain range of motion and strength, and exercises to improve proprioception began after the eighth week. The patient progressed without pain throughout the postoperative period. He was instructed to avoid low/high physical impact activities for 6 months. After this period, the patient underwent a further MRI (Figures 5 to 7), which showed complete healing of the osteochondral lesion, with formation of fibrocartilaginous tissue and a complete cured subchondral cyst. The images, however, still showed a pattern of bone marrow edema in the distal tibia, and there was the onset of a pattern of edema in the talar dome, which was not seen in the preoperative MRI. The latter finding may indicate that the fibrocartilaginous scar tissue of the tibial lesion causes greater friction on the talus cartilage.

Despite the radiological abnormalities, the patient remained asymptomatic until the last follow-up visit, held 2 years after the procedure, and had already started playing tennis again.

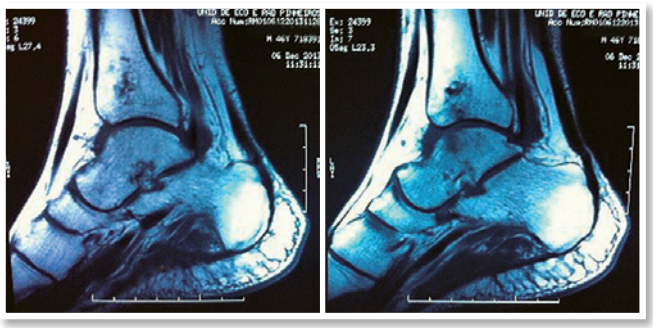

Figure 5 | Postoperative T1-weighted sagittal MRI.

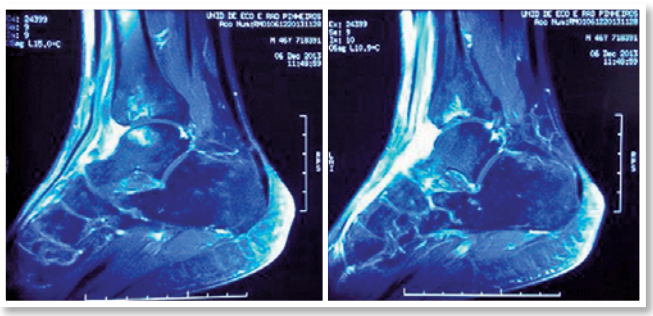

Figure 6 | Postoperative T2-weighted sagittal MRI.

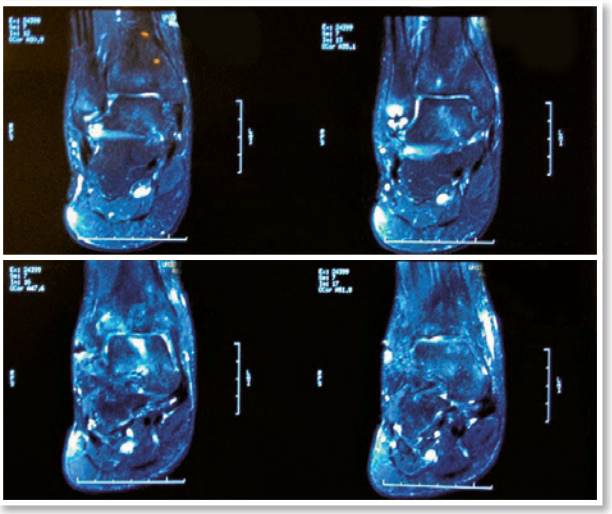

Figure 7 | Postoperative T2-weighted coronal MRI.

DISCUSSION

Osteochondral lesions have been studied since the late 19th century. It is estimated that only 4% of all osteochondral lesions affect the ankle, and among these, the rate of lesions in the distal tibia ranges from 2.5% to 5 %, according to the studies with the largest sample groups.[1] The low rate can be attributed to the fact that the distal articular cartilage of the tibia is stiffer and thicker than that of the talus. In addition, the concave outlines of the distal tibia may protect its cartilage from the levels of mechanical stress experienced by the talar dome.[2] Most patients are in their forties and there is no preference in terms of sex or laterality. In most cases, patients report a previous traumatic episode involving the affected ankle.

The first study of ankle arthroscopy was published by Plank[3] in 1978, but it was only in 1985 that Parisien[4] described the diagnosis and the arthroscopic treatment of two cases of osteochondral lesion of the distal tibia in their series of 15 cases treated between 1979 and 1983. Research in the MEDLINE, LILACS, and PubMed databases resulted in only 11 studies focusing on osteochondral lesions of the distal tibia published so far. Except for the study by Mologne and Ferkel,[1] with 23 cases, most publications address case reports. In this study, the authors observed that, in 35% of cases, there was an association between tibial and talus injuries.

Only one study[5] sought to characterize the most frequent location of these lesions. The articular surface of the distal tibia was mapped and divided into nine different zones. The lesions were distributed homogeneously, with no predilection for any of the zones. The mean area of the lesions was 38mm^2, with a slight prevalence in the centromedial (23%) and anteromedial (19%) regions. Most patients complain of poorly localized pain in the ankle region, aggravated by physical activity, which may or may not be associated with joint effusion.

Radiography is not very useful in the diagnosis, although it may show prominent bone fragments or cystic lesions. MRI has excellent sensitivity, yet the bone edema accompanying the lesions sometimes hinders the measurement and perfect characterization of cystic lesions. Tomography is the best test for determining lesion size and morphology. Technetium-99m bone scintigraphy can also be used, but needs MRI for confirmation.[6]

Regarding treatment, all the studies show that attempts at immobilization, the use of crutches, chondroprotectors, and physiotherapy have little or no benefit – except for children and adolescents with symptoms of osteochondritis dissecans.

Currently, for most authors, the treatment of tibial lesions follows the same principles and algorithms developed for talus lesions. The surgical treatment used most often is ankle arthroscopy for the debridement of the lesion, and the creation of microfractures or microperforations.[7] It is a fact that this treatment, when successful, does not bring about the formation of a new hyaline cartilage to coat the lesion, but instead produces fibrocartilage. As in the talus, it is unclear whether this fibrocartilaginous reparative tissue of the tibial plafond will withstand the high pressures imposed on the ankle joint in the long run.

Long-term studies with the aid of MRI could more effectively assess the relationship between the lesion characteristics and the integrity of the reparative tissue. The persistence of subchondral edema may indicate the formation of poor quality reparative tissue, which still allows the influx of synovial fluid into the subchondral bone.[8]

In this scenario, autologous chondrocyte transplantation appears as a treatment option designed to promote the healing of lesions with the regeneration of hyaline cartilage. Treatment is carried out in two stages. In the first procedure, a fragment of hyaline cartilage is collected from a healthy donor area (usually from the knee). Chondrocytes from this fragment are prepared and cultivated in the laboratory. In the second stage, the volume of cells obtained in the culture is applied to the previously prepared bed of the osteochondral lesion.[9]

Talus lesions accompanied by large subchondral cysts have a better clinical result when grafted. Regarding the graft to be used, this may be of autologous bone, usually

taken from the iliac crest, homologous graft or synthetic plugs. Pearce et al.[10] reported good results in a case of a distal tibial lesion treated with a synthetic osteochondral plug graft. Miskaet al.[11] published a satisfactory result in a cystic lesion treated with autologous corticocancellous graft of iliac bone covered by collagen matrix. Only one study[12] uses the retrograde grafting technique similar to the one used in our patient. The graft, however, consisted of an osteochondral plug taken from the knee.

Regarding the possibility of using allografts, only the study published by Chapman and Mann[13] reports a tibial lesion treated with an allograft from the subtalar articular portion of the talus, with a satisfactory result.

The age group of our patient, the history of trauma, the physical examination, and imaging findings, and the unfavorable clinical progress with conservative treatment, corroborate the data obtained from the literature.

In this case, the location of the osteochondral lesion of cystic appearance in the center of the tibial plafond rendered anterograde grafting via the arthroscopic route impracticable. Extensive osteotomy of the distal portion of the tibia would be necessary for direct access to the lesion, increasing the risk of complications such as fractures, pseudarthrosis, and postoperative joint degeneration. Therefore, we opted for a technique that would preserve the anatomical integrity of the ankle, avoiding osteotomy. The retrograde graft made from a bone plug removed from the metaphysic adjacent to the lesion, although devoid of a cartilaginous surface, proved effective.

The review of the literature on the topic concluded that, to date, the technique used is unprecedented and has not been described in any other study. However, a longer follow-up time is necessary to be certain that the improvement of symptoms is definitive.

CONCLUSION

Osteochondral lesions of the distal articular surface of the tibia are uncommon and depending on their location and characteristics, the treatment is challenging.

In the case reported here, the treatment of the lesion of cystic characteristics affecting the central portion of the distal tibia, carried out in a retrograde manner using a bone graft, has shown itself to be a viable, reproducible alternative with excellent results so far.

REFERENCES

1. Mologne TS, Ferkel RD. Arthroscopic treatment of osteochondral lesions of the distal tibia. Foot Ankle Int. 2007;28(8):865-72.
2. Bauer M, Johnson K, LindénB. Osteochondritis dissecans of the ankle: A 20-year follow-up study. J Bone Joint Surg Br. 1987;69(1):93-6.
3. Plank E. [Arthroscopy of the ankle joint]. 1978;(131):245-51. German.
4. Parisien JS. Diagnostic and operative arthroscopy of the ankle technique and indications.Bull HospJt Dis Orthop Inst. 1985;45(1):38-47.
5. Elias I, Raikin SM,Schweitzer ME,Besser MP, Morrison WB,Zoga AC. Osteochondral lesions of the distal tibial plafond: localization and morphologic characteristics with an anatomical grid. Foot Ankle Int. 2009;30(6):524-9.
6. Sopov V, Liberson A, Groshar D. Bilateral distal tibial osteochondral lesion: a case report. Foot Ankle Int. 2001;22(11):901-4.
7. Cuttica DJ, Smith WB. Hyer CF, Philbin TM, Berlet GC. Arthroscopic treatment of osteochondral lesions of the tibial plafond. Foot Ankle Int. 2012;33(8):662-8.
8. Ross KA, Hannon CP, Deyer TW, Smyth NA, Hogan M, Do HT, et al. Functional and MRI outcomes after arthroscopic microfracture for treatment of osteochondral lesions of the distal tibial plafond. J Bone Joint Surg Am. 2014;96(20):1708-15.
9. Nakamae A, Engebretsen L, Peterson L. Autologous chondrocyte transplantatios for the treatment of massive cartilage lesion of the distal tibia: a case report with 8-year follow-up. Knee Surg Sports Traumatol Arthrosc. 2007;15(12):1469-72.
10. Pearce CJ, Lutz MJ, Mitchell A, Calder JD. Treatment of a distal tibia osteochondral lesion with a synthetic osteochondral plug: a case report. Foot Ankle Int.2009;30(9):900-3.
11. Miska M,Wiewiorski M,Valderrabano V. Reconstruction of a large osteochondral lesion of the distal tibia with an iliac crest graft and autologous matrix-induced chondrogenesis (AMIC): a case report. J Foot Ankle Surg. 2012;51(5):680-3.
12. Ueblacker P,Burkart A,Imhoff AB. Retrograde cartilage transplantation on the proximal and distal tibia. Arthroscopy.2004;20(1):73-8.
13. Chapman CB, Mann JA. Distal tibial osteochondral lesion treated with osteochondral allografting: A case report. Foot Ankle Int. 2005; 26(11):997-1000.