Osteochondral defects of the talus: surgical treatment and rehabilitation

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Abstract

Differenti osteocondrali dell’astragalo: trattamento chirurgico e riabilitazione

Un difetto osteocondrale dell’astragalo è una lesione a carico della cartilagine talare e dell’osso subcondrale, che causa dolore profondo a carico dell’articolazione tibio-tarsica e/o l’assenza dell’apparato articolare, rigidezza, sensazione di blocco e gonfiore. La visualizzazione di questo tipo di lesione non è sempre possibile utilizzando la radiologia tradizionale, ma sono spesso necessari per riconoscerla esami di secondo livello come TAC o RMN. Il trattamento iniziale è conservativo. Le possibilità di trattamento chirurgico includono il “debridement”, il “corettage”, la sti- molazione midollare, la fissazione del frammento, transpatti ossei, artrove- stizzazioni, autotrasferimenti. Questo articolo di revisione fornisce una visione di insieme delle attuali tecniche chirurgiche nel trattamento delle lesioni osteocondrali dell’astragalo.

Introduction

An osteochondral defect (OCD) of the talus is a lesion of the talar cartilage and subchondral bone. It is mostly caused by a (single or multiple) traumatic event, leading to partial or com- plete detachment of the fragment [1]. An OCD can either heal and remain asymptomatic or progress to deep ankle pain on weight-bearing, with or without subchondral bone cyst formation. The deep ankle pain is more probably caused by high fluid pressure during activity, resulting in stimulation of the subchondral bone nerves underneath the cartilage defect [2]. Other possible symptoms are: limited range of motion, stiffness, locking and swelling. In this article, we provide an overview of the (surgical) treatment options, with special emphasis on post- operative rehabilitation and return to sports.

Clinical presentation

A differentiation has to be made between acute and chronic situation [3]. In the acute situa- tion, symptoms of an OCD of the talus are often unrecognized since the swelling and pain from the lateral ligament lesion pre- vail. In patients with an isolated ligamentous ankle injury these symptoms usually resolve after functional treatment within two to three weeks. If symptoms have not resolved within 4-6 weeks, an OCD must be sus- pected.

Chronic lesions typically pres- ent as persistent deep ankle pain, during or after activity, after a minor history of an inversion in- jury of the ankle. Reactive swelling or stiffness may be pres- ent, but absence of swelling, locking or catching does not rule out an OCD. Most patients demonstrate a normal range of motion with absence of recog- nizable tenderness on palpation and absence of swelling.

Diagnosis

Plain radiographs should be the initial investigation of a suspect- ed OCD of the talus, after careful history taking and physical ex- amination of the ankle. These consist of weight-bearing antero- posterior (mortise) and lateral views of both ankles. If the radi- ographs do not reveal any pathol- ogy or show no area of radioolu- cency, the OCD may sometimes become apparent in a later stage. A posteriorlateral or postero- lateral defect may be revealed by a healee mortise view with the an- kle in planar flexion. The combi- nation of medical history, physi- cal examination and radiography has a sensitivity and specificity of respectively 59% and 91% [4]. Additional imaging consists of magnetic resonance imaging (MRI) or computed tomography (CT), which have a similar accu- racy (Fig. 1) [4]. A CT-scan is es- pecially useful in preoperative planning, as it can define the ex- act location and size of the lesion [5,6].

Classification

The most frequently used classi- fication was introduced by Berndt and Harty in 1959, based on anatomic studies in cadaver limbs demonstrating the etiological mechanism of transchondral frac- ture of the lateral talar dome [7]. The Berndt and Harty classification di- vides OCD in four stages: stage I is a small compression frac- ture, stage II an incomplete avul- sion of a osteochondral fragment, stage III a complete fragment avulsion without displacement and stage IV represents a dis- placed osteochondral fragment. As CT-scans are increasingly used in the preoperative work-up, a CT-classification was introduced, based on the Berndt and Harty classification [8]. In this classifi- cation, the stage V lesion repre- sents an OCD with a radiolucent defect [9].

Surgical treatment

Treatment strategies for OCDs of the ankle have substantially in- creased over the last decade [1]. Conservative treatment is the first step of the treatment of a sympto- matic OCD. This may consist of non-steroidal anti-inflammatory drugs (NSAIDs), restriction of (sporting) activities, rest and/or cast immobilisation. The aim of conservative treatment strategies is to unload the damaged carti- lage, allowing decrease of edema and prevention of necrosis. A (partially) detached OCD frag- ment can also heal to the sur- rounding bone. The results of non-surgical treatment strategies vary between 20 to 69% [1]. Surgical treatment is grossly based on one of three principles [5]:

• debridement and bone marrow stimulation (BMS), with or without loose body removal. The BMS can consist of mi- crofracturing, drilling and abra- sion arthroplasty
• securing a lesion to the talar subchondral bone. In- terconnection radiography leads to the subchondral bone. In- terconnection radiography leads to the subchondral bone. In- terconnection radiography leads to the subchondral bone. In-
• development or replacement of hyaline cartilage, using osteo- chondral autograft transfer (OAT), autografts or allografts, autologous chondrocyte implantation (ACI).

Surgical approach

The preferred approach for most OCDs is by means of anterior arthroscopy [10]. If a posterior OCD cannot be reached by means of an anterior approach (in the fully plantar flexed position) a two-port hindfoot approach can be performed (Fig. 2) [11]. As a rule, OCDs in the anterior part of the poste- rior half of the talus can be reached with an anterior arthroscopy if plantar flexion is unlimited. Both approaches offer the advantages of outpatient treat- ment and have the advantages of less postoperative morbidity, faster and more functional rehabilita- tion and earlier return to sports [10,12]. Alternatively, an arthro- tony with or without medial malleolar osteotomy could be per- formed [13,14]. In posteriorly lat- eral located OCDs, a fibular osteotomy provides the best open exposure [15].

Excision, corettage and bone marrow stimulation

For this procedure all unstable cartilage is excised and underly- ing necrotic bone is removed. Un- derlying cysts are opened and evacuated. After this debridement, multiple connections with the subchondral bone are created with drilling or microfracturing.

Fig. 1. A coronal (a) and sagittal (b) CT-scan of the ankle of a 16-year-old woman with posterior inter- malleolar osteotomy could be per- formed to reach the os trigonum and the OCD (c).

Fig. 2. A coronal (a) and sagittal (b) CT-scan of the ankle of a 16-year-old woman with posterior inter- malleolar osteotomy could be per- formed to reach the os trigonum and the OCD (c).

Fig. 3. A medially located OCD of the talus was diagnosed in a 29-year-old woman. An anterior arthroscopy was performed. A microfracture awl was used (a) to create multiple openings into the sub- chondral bone. During lavageing of the tourniquet, sufficient haemorrhage in the defect is checked (b).

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The aim of OATS is to restore the articular surface with hyaline cartilage. A medial malleolar osteotomy is usually first performed. After curettage of the unstable cartilage and underlying necrotic bone to create a sharply defined defect, osteochondral grafts are harvested from the ipsilateral ankle (one or more plugs of a lesser-weight-bearing area are taken). The plugs are inserted in the recipient site in the following way: drilling (3.4 mm deeper than the length of the plug), countersinking, and cementing to the bone. OATS and ACI are regarded as the second treatment of choice, after BMS [1].

Autologous chondrocyte implantation (ACI) is a relatively new technique, introduced by Grelsamer [1990] and further developed in a focal OCD preferably more than 1.5 cm in diameter. If a subchondral cyst is present, autologous bone could be used to fill up the base of the defect (i.e. the “sandwich technique”) [25]. The aim of ACI is to regenerate the articular cartilage with a high percentage of hyaline-like cartilage. After a biopsy of healthy (knee) cartilage, chondrocytes are isolated by filtration and cultured in vitro. After a culture medium period of 11-21 days, an autograft is harvested. A perforation of the articular cartilage is performed over the debrided OCD and the cultivated chondrocytes are injected beneath the perforated flap. The success rate of ACI is 76% with a range of 70 to 92% [1], but long-term results are needed to evaluate the efficacy of the treatment. Furthermore, possible disadvantages are: high costs, two-stage surgery and insufficient graft integration [26,27].

Novel implantation technique
To treat patients with a large OCD of the medial talar dome a novel OATS device with a hemiimplant (HemiCAP®) has been developed. The set of 15 offset sizes allows for a perfect fit of the implant after debridement and return to sports after surgical treatment of OCDs, we adopt the following useful guideline:

- after debridement and BMS, partial weight-bearing (eggshell) is allowed for the first four weeks. After these first four weeks, we allow full weight-bearing in patients with central or posterior lesions up to 1.5 cm. Larger and more complex lesions require partial weight-bearing up to six weeks. Postoperative active plantar flexion and dorsiflexion are encouraged. Running on even ground is permitted after 12 weeks [5]. Full return to normal and sporting activities is usually possible after four to six months after surgery [17].

- in a randomized study on OCDs including OATS, eight weeks of non-weight-bearing were recommended for patients. Partial weight-bearing is allowed only for the first four weeks. Patients were allowed to return to activities after 12 weeks. Full weight-bearing allowed for the first four weeks, partial weight-bearing allowed for three weeks is to be allowed for the first four weeks. Postoperative active motion is limited to a range of motion of 90°. pitcher motion, throwing and pitching are usually possible after 4 to 6 months after surgery. Return to high-level sports is permitted after 12 months [5]. Furthermore, it has to be taken into account that after every surgical treatment of OCDs rehabilitation is not only directed at protected mobilization but also at strengthening and proprioceptive activity.

Because of the challenge to achieve early return to sports in OCD patients, electromagnetic fields (PEMFs) were introduced. In a study on 16 patients with pulsated electromagnetic fields (PEMFs) were introduced. In our institution a trial was started to investigate the effectiveness of PEMFs in the rehabilitation period after arthroscopic treatment of OCDs [32]. PEMFs could possibly improve bone and cartilage regeneration and could possibly suppress postoperative inflammation. Because they aim at providing a continuous application the PEMFs are placed around the surgical area. In a study 8 out of 10 patients were able to return to competitive sports after OCD treatment. The PEMFs were used in combination with a clinical examination.

Conclusions
An osteochondral defect (OCD) of the talus is a lesion of the talus cartilage and subchondral bone and often leads to subchondral bone cysts, associated with deep ankle pain on weight-bearing. Only few trials studied postoperative weight-bearing, immobilization and rehabilitation after surgical sports activities is usually possible after 4 to 6 months after debridement and microfracturing. Secondary procedures like OATS and ACI might require a longer time to return to full sporting activities, up to 1 year.

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References