

Osteochondral lesions of the talus and the role of ankle arthroscopy

The options for treating OCL are numerous and a number of surgical procedures can be performed arthroscopically.

Maire-Clare Killen and **Rajiv Limaye** shed light on a path of treatment that is constantly evolving

Osteochondral lesion (OCL) is a term used to describe an injury or abnormality of the articular cartilage and underlying bone [1]. Osteochondral lesions of the talus are an increasingly recognised and diagnosed pathology and can often be difficult to treat. They are thought to occur in up to 70 per cent of acute ankle fractures or ligament injuries, with trauma being by far the most common underlying aetiology [2]. In patients without history of injury, several other factors have been implicated in the development of such lesions. These include congenital predisposition,

spontaneous osteonecrosis, ligamentous laxity, thromboembolic or endocrine disease and steroid treatment [3,4].

Forces acting across the tibio-talar joint are significantly higher in comparison with other joints; therefore, an articular injury can result in significant symptoms. The avascular nature of articular cartilage and the impaired healing potential can result in a lesion which progresses in size and severity if left untreated, with subsequent early ankle osteoarthritis [5,6].

Clinical presentation is usually non-specific to OCL and

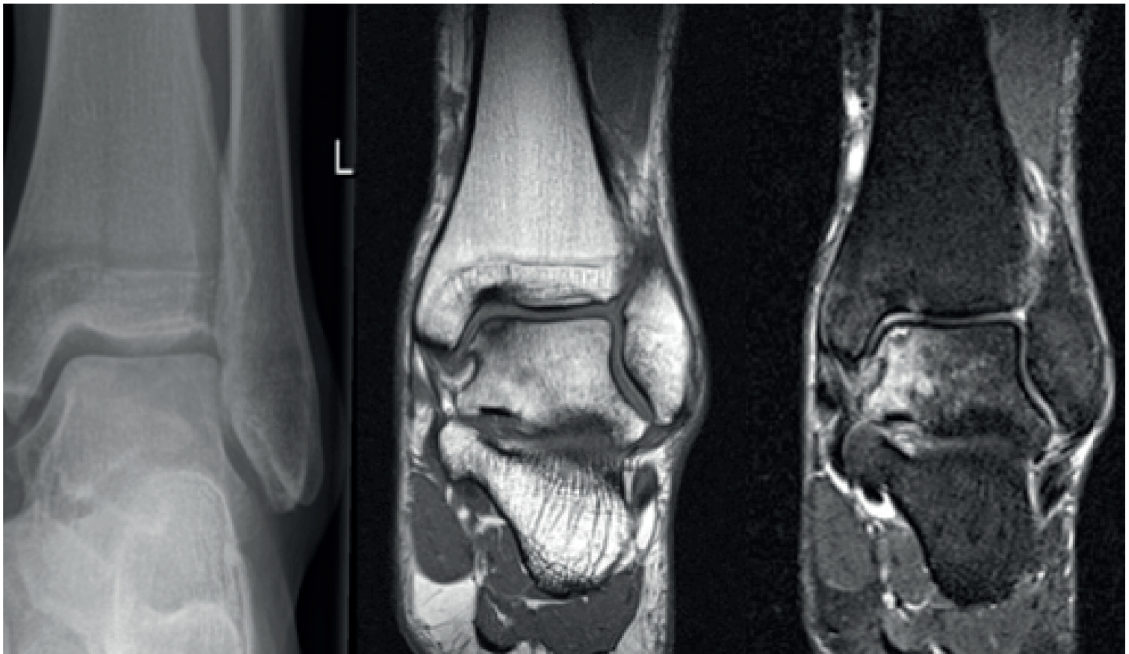


Figure 1: Ankle imaging of a 29-year-old patient presenting with persisting ankle pain and swelling following a rugby injury. Plain radiographs appear relatively normal, but MRI imaging demonstrates a grade III medial talar OCL. This patient subsequently underwent ankle arthroscopy, debridement of lesion and microfracture.

Table 1: Hepple classification of OCL of the talus based on MR imaging [13]

Stage	Findings
I	Articular cartilage injury only
IIA	Cartilage injury with bony fracture and oedema (flap, acute)
IIB	Cartilage injury with bony fracture and without bony oedema (chronic)
III	Detached, non-displaced bony fragment (fluid rim beneath fragment)
IV	Displaced fragment, uncovered subchondral bone
V	Subchondral cyst present

symptoms are similar to those of many other ankle pathologies. Patients will frequently present with ankle pain and limited range of motion, often following an injury. Persistent joint effusion and locking of the joint should prompt further investigation; however, the absence of such symptoms should not rule out the diagnosis [7–9].

Plain radiographs are the first line investigation for suspected OCL, but may be normal in up to 50 per cent of cases [10]. In addition to standard ankle anteroposterior and lateral images, plantar-flexed and dorsiflexed views may identify additional posteromedial or anteromedial and anterolateral lesions respectively [3].

Magnetic resonance imaging is the investigation of choice for OCL and is able to delineate the size and severity of the lesion, as well as identifying additional ankle pathology (Figure 1).

Berndt and Hardy described a classification based on plain radiographs, graded from I to IV in order of increasing severity (Figure 2). Stage I is a subchondral compression injury; stage II involves a partially detached fragment; stage III describes a fragment which is detached but undisplaced; and stage IV is a fragment that is fully detached and displaced from the fracture bed [11]. Loomer later added stage V to describe the presence of a subchondral cyst [12].

Hepple subsequently developed a classification based on MRI findings, and this is summarised in Table 1 [13].

There are numerous treatments for OCL of the talus; the evidence base for these techniques is varied and constantly evolving. Ankle arthroscopy plays a major role in management of these lesions, whether this is for further assessment, debridement or definitive treatment.

The decision on which treatment is the most appropriate is largely dependent on the age and activity level of the patient, the presence and severity of the symptoms, as well as the size and location of the lesion.

Patients with small lesions and relatively few symptoms can often be initially managed with non-operative measures, including analgesia (particular anti-inflammatory medication) along with activity modification. The paediatric and adolescent population can also often be managed non-operatively with good outcomes. For larger and more symptomatic lesions, surgical

intervention is often required. Surgical techniques can be broadly sub-divided into restorative or reparative treatment, and biological augmentation as summarised in Figure 3.

Treatment of OCL

Despite the numerous treatment options available, the overall goals of any intervention for OCL remain the same. In the short term, the aim is to provide pain relief and restoration of normal activities. In the longer term, an effective treatment should provide long-term positive outcomes to give a well-functioning ankle joint and minimise the risk of the development of early osteoarthritis.

Arthroscopy plays a significant role in the detailed assessment and management of these lesions. Arthroscopic debridement prior to the definitive surgical procedure is commonplace and some of the procedures detailed below can be performed entirely arthroscopically.

Conservative management

A trial of non-operative management can be used for patients with small, low grade lesions and minimal symptoms. This involves a period of rest, activity modification, protected weight-bearing in some patients and anti-inflammatory medication.

Conservative treatment is thought to be most effective in the paediatric and adolescent population, whereas failure of non-operative measures has been reported to be as high as 50 per cent in adults [3,4].

Surgical management

There are numerous surgical treatment options available, both for patients who have persisting symptoms after non-operative measures, as well as those who have presented with lesions too large to be managed conservatively.

Surgical management can be broadly subdivided into reparative and replacement techniques, with the decision on which method to use being based on a combination of factors. The size of the lesion is the primary factor, but failure of previous treatments as well as the presence of any cyst in the talus must be taken into account [4,14,15].

The underlying evidence base for surgical management of OCL is varied; however, level I evidence to support long-term outcomes and efficacy is widely lacking.

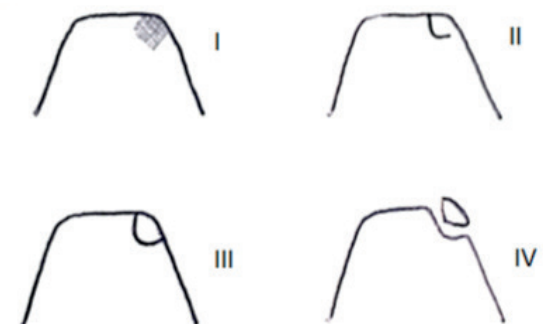


Figure 2: Berndt and Hardy radiographic classification [11].

Microfracture

Microfracture is a relatively well-established treatment for OCL. Bone marrow and growth factor stimulation from penetration of the subchondral bone and resulting bleeding leads to formation of new fibrocartilage. This new type I fibrocartilage has altered mechanical and physiological properties compared with the type II hyaline cartilage it replaces; it is thought to be more prone to degeneration in the longer-term [16].

Although often used as a first line surgical management for OCL, along with arthroscopy and debridement of the lesion, it is not usually indicated in larger lesions (greater than 1.5cm²) due to poorer outcomes [15,17].

A 2008 report of 105 patients demonstrated a 100 per cent success rate of microfracture in patients with lesions smaller than 15mm, whereas poorer outcomes were observed with lesions of increasing size. In the group with lesions larger than 20mm, a 100 per cent failure rate was observed [17].

Despite promising short- to medium-term outcomes for smaller lesions, the long-term efficacy of microfracture is still debated. A 2010 Cochrane review has emphasised the need for level I evidence, comparing microfracture with other surgical procedures in order to identify the most appropriate patient group for this treatment [18].

Osteochondral autografts

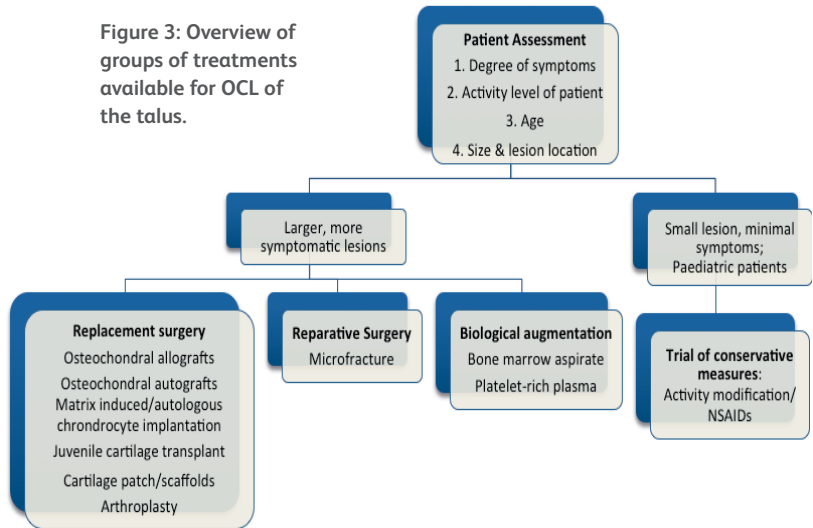
Autologous osteochondral transplantation (AOT) involves transplanting hyaline tissue with similar biomechanical properties, most often harvested from a non-weight bearing portion of the knee.

AOT can be used for larger and higher-grade lesions with cyst formation, as well as for treatment of patients who have failed to improve with microfracture.

One prospective randomised study of 33 ankles comparing AOT with microfracture and chondroplasty demonstrated no significant difference in functional scoring at 12 and 24 months [19]. Patients in all groups did however show significant improvements in their scores at their 12 month follow-up, with continued improvement at 24 months. A systematic review described similar positive results, with 87 per cent of 243 patients reporting good or excellent outcomes [4].

AOT is not without problems: it can be a technically challenging procedure, it is an open procedure and may need medial malleolar or fibular osteotomy for medial and lateral talar dome defects respectively [21,22]. Problems with donor site morbidity and incongruence between the graft and surrounding cartilage have also been documented [20,22,23].

Figure 3: Overview of groups of treatments available for OCL of the talus.



Osteochondral allografts

This is a similar surgical technique to AOT, but involves harvesting a graft of cartilage and bone from a cadaver. It is then measured and cut to fit the size of the defect [14].

This technique has the advantage of being able to provide a more specific graft to accommodate the defect following arthroscopic debridement, and avoids complications related to donor site morbidity [24]; however, disease transmission, limited availability and declining chondrocyte viability with frozen specimens are problems with this procedure [14].

As with most emerging treatments, high-level evidence is lacking, but provisional data suggests positive short-term outcomes, with allografts being a viable treatment option for large lesions not suitable for other surgical intervention [24].

Particulated juvenile articular cartilage

This is a relatively new technique involving the implantation of juvenile cartilage allograft from donors aged 13 or younger; it can be performed as an entirely arthroscopic procedure. These grafts have the advantage over adult allografts in that they contain chondrocytes with the ability to multiply and form new hyaline cartilage, and subsequently have a greater ability to integrate with the surrounding tissue [25,26].

Early studies have shown promising results, with excellent early to mid-term functional outcomes. Success is thought to be better in younger patients due to their increased chondrogenic potential and better quality subchondral bone [25].

More information and evidence will be required in order to demonstrate specific indications and long-term outcomes.

Autologous chondrocyte implantation

Both autologous chondrocyte implantation (ACI) and matrix induced autologous chondrocyte transplantation (MACI) are two-stage reparative techniques.

In ACI, the first stage of the procedure involves identification and biopsy of healthy native articular cartilage, which is then enzymically digested. The chondrocytes are isolated, cultured and implanted into the defect in a second stage [27]. A 2012 meta-analysis of the ACI procedure demonstrated an overall success rate in 213 patients of 89.9 per cent [28].

MACI is similar to ACI but involves chondrocytes being embedded within a matrix, made up of one of a number of materials; type I or III collagen, polyglycolic acid and hyaluronan have been described in the literature. MACI has the advantage of being able to secure the graft with fibrin sealant [4,29,30].

Studies of the MACI technique have been promising; Giannini et al. described a series of 46 patients treated arthroscopically, with significant improvement in functional scores at 36 months. Second look arthroscopy was performed in three patients in the group and demonstrated the regeneration of hyaline-like cartilage [31].

Cartilage patches and scaffolds

Several types of cartilage patches have been described in the literature, and can be used either as an adjunct to ACI/MACI, or as a primary procedure. Recently, significant developments in the materials used have resulted in an effective method to provide chondrocyte cover following transplant, to act as a scaffold for chondrocyte impregnation or to provide cover for the defect itself [32,33].

A recent development, currently being evaluated in an open, prospective clinical study examining the treatment of focal chondral defects of the femoro-tibial compartment, and femoral trochlea of the knee joint, is a bio-resorbable implant comprising a base membrane with a collagen matrix infused with a fermentative source sodium hyaluronate.

The two-layer bioresorbable matrix is indicated for surgical implantation to cover articular defects following surgical debridement and stabilisation of the margins of the lesion, where it purportedly promotes haemostasis and protects the underlying tissue. It can be used with or without microfracture. The postulated benefits of the implant are deemed to emanate from the leveraging of the body's natural repair mechanism, essentially mimicking the properties of the native extracellular matrix of the host tissue. It is hypothesised that the patch will promote superior hyaline-like cartilage formation rather than fibrocartilage repair at the defect site. This product has demonstrated successful outcomes, as determined by high-resolution MRI evaluation, in the knee. Upcoming studies of the implant for treatment of OCL in the talus will hopefully replicate these results.

Concentrated bone marrow aspirate

Bone marrow contains mesenchymal stem cells with the ability to differentiate into chondrocytes, as well as haematopoietic cells which can differentiate into platelets, containing growth factors. It is thought that this combination may result in improved differentiation of fibrocartilage to hyaline cartilage as well as increased remodelling of the involved subchondral bone [34].

The procedure involves aspiration of bone marrow, usually from the iliac crest and then concentrated with a centrifuge to isolate

the desired cells. The concentrate is then injected into the defect under arthroscopic visualisation. The main role of concentrated bone marrow is as an adjunct to restorative surgical techniques, where it is used to either bathe the harvested graft or to fill the donor site [21].

Platelet-rich plasma

Platelet rich plasma (PRP) is an autologous blood product, thought to promote cartilage regeneration due to the high quantity of growth factors in a concentrated sample of platelets. In addition, PRP may improve the quality of synovial fluid and exhibit anti-inflammatory properties. It is thought that intra-articular injection will result in pain relief and improved function [36].

A 2009 quasi-randomised controlled trial of 32 patients compared the short-term efficacy of PRP with that of hyaluronic acid. There was a significant improvement in all functional scores in the PRP group compared with the hyaluronic acid group, except in the VAS scoring. More research will be needed to investigate longer-term outcomes and optimal frequency of injections [37].

Talar hemiarthroplasty

Using a metallic prosthesis for OCL of the talus was first described in 2010 for a defect of the medial talar dome in a cadaver [38]. The authors of this study have since published the clinical outcome of one case with good improvement in functional scores and return to sports after one year. They recommend the use of such implants in cases of large defects with failure of other surgical techniques [39].

Further larger series and long-term outcomes will be needed before recommendations can be used for routine clinical use.

Conclusion

Osteochondral lesions of the talus are an increasingly recognised pathology of the ankle joint and can lead to significant complications if not treated appropriately.

The treatment options are numerous and constantly evolving, with no well-established evidence base to determine which, if any, are superior. What is known is that arthroscopy provides a vital role in formal intra-operative assessment and debridement prior to performing one of a number of definitive surgical techniques. At present, a number of surgical treatments can be performed arthroscopically, and it is likely that more complex procedures and techniques will be developed in order to be performed in this way in the future.

Each patient should be treated on an individual basis taking into account their symptoms and activity levels, as well as the nature of the lesion prior to determining the best treatment. More research is needed in order to develop a better knowledge and evidence base on which treatment is best.

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