Diagnostic guidelines for chronic ankle pain. From loose bodies to joint venture
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Systematic review of treatment strategies for osteochondral defects of the talar dome

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Abstract
The aim of this study was to summarize all eligible studies to compare the effectiveness of different treatment strategies for osteochondral defects (OCD) of the talus. Electronic databases from January 1966 to June 2000 were systematically screened. Based on our inclusion criteria, 39 studies describing the results of treatment strategies for OCD of the talus were included. No randomized clinical trials (RCTs) were identified. Fourteen studies described the results of non-operative treatment (NT), four the results of excision alone, ten the results of excision and curettage (EC), twenty-one the results of excision, curettage and drilling (ECD), two the results of cancellous bone grafting after EC, one the results of osteochondral transplantation, three the results of fixation, and one the results of retrograde drilling. The average success rate of NT was 45%. Comparison of different surgical procedures shows that the average highest success rate was reached by excision, curettage and drilling (ECD) (86%) followed by excision and curettage (EC) (78%) and excision alone (38%). Based on this systematic review we concluded that NT and excision alone are not to be recommended in treating talar OCD. Both EC and ECD have been shown to lead to a high percentage of good to excellent results. At present, ECD seems to be the most effective treatment strategy for osteochondral defects of the talus. However, due to great diversity in the articles and variability in treatment results, no definitive conclusions can be drawn. Further sufficiently powered, randomized clinical trials with uniform methodology and validated outcome measures should be initiated to compare the outcome of surgical strategies for OCD of the talus.
Introduction

An osteochondral defect (OCD) of the talus is defined as the separation of a fragment of articular cartilage, with or without subchondral bone.\(^1\)\(^-\)\(^3\) The knee is the most common location, but an OCD can involve any joint.

In 1856, Monro was the first to describe the presence of cartilaginous bodies of the ankle joint.\(^4\)

In 1888, König defined loose bodies of the knee joint as osteochondritis dissecans and suggested that these were the result of spontaneous necrosis.\(^3\) Since then, several aetiologies have been described: traumatic, embolic, hereditary, endocrine, developmental and idiopathic.\(^2\)\(^,\)\(^5\)\(^-\)\(^12\) In the ankle, the majority of osteochondral defects are associated with previous trauma.\(^6\)\(^,\)\(^13\) The currently most accepted classification by Berndt and Harty is based on the amount of displacement of the osteochondral fragment on plain X-rays of the ankle (Table 1).\(^2\)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A small area of compression of subchondral bone</td>
</tr>
<tr>
<td>II</td>
<td>A partially detached osteochondral fragment</td>
</tr>
<tr>
<td>III</td>
<td>A completely detached osteochondral fragment in the fragment bed</td>
</tr>
<tr>
<td>IV</td>
<td>A displaced osteochondral fragment</td>
</tr>
</tbody>
</table>

There are a large variety of treatment strategies for OCD: non-operative, excision of the fragment, excision and curettage with or without drilling, cancellous bone grafting, osteochondral transplantation, and fixation of the fragment. There are many different opinions on the best treatment for OCD.\(^6\)\(^,\)\(^9\)\(^-\)\(^14\)\(^-\)\(^22\) Protocols that have been suggested vary from treating all lesions non-operatively\(^9\) to treating only Berndt & Harty stage I non-operatively.\(^2\)\(^,\)\(^19\) Some authors base their treatment decisions on the size of the lesion: small lesions can be treated non-operatively, large (>1.5 cm) require surgery.\(^23\)

Surgical protocols vary according to personal preferences or are based on staging according to Berndt and Harty.\(^16\)\(^,\)\(^24\)\(^-\)\(^27\) Over the last decade, more operative procedures have been performed by means of arthroscopy.\(^23\) Recent studies focus on biological repair and regeneration of cartilage, using cultured or autologous chondrocytes,\(^28\) osteochondral grafts,\(^29\) periosteal and perichondral grafts.\(^30\)

According to the principles of evidence based medicine, the best medical care is provided by integrating the best external evidence as obtained from clinically relevant research, into daily practice. By combining relevant studies in a systematic review, the power and precision of estimates on results can be increased. The aim of this study was to summarize all eligible studies to compare the effectiveness of different treatment strategies for OCD of the talus. This review is an update of a previously published review.\(^31\)
Patient and Methods

Data sources
We screened the electronic databases MEDLINE (January 1966 – June 2000), EMBASE (January 1988 – May 2000), CINAHL (January 1982 – March 2000) and Current Contents (up to June 2000). As main keywords we used 'Arthroscopy; Ankle; Adult; Ankle Joint/in [Injuries]; Ankle Joint/su [Surgery]; Endoscopic; English Abstract; Fractures; Fractures/su [Surgery]; Human; Male; Female; Osteoarthritis/su [Surgery]; Osteochondritis Dissecans; Talus; Tibia.' No language limitations were imposed. The reference lists of all the articles selected were searched for additional articles.

Study Selection: Inclusion and exclusion criteria
Two reviewers independently assessed the articles for inclusion. Agreement was needed for inclusion. In case of disagreement, the opinion of a third independent investigator was decisive. To prevent investigator bias, scoring of the manuscripts was blinded to author and institute. We included studies describing the results of the following treatment strategies: non-operative (NT), excision of the fragment, excision and curettage (EC), excision and curettage and drilling (ECD), cancellous bone grafting subsequent to EC, osteochondral transplantation and fixation. Studies were included only if there was a proper description of the treatment for OCD of the talus and a well defined outcome. Patients were excluded if the duration of follow-up was less than 6 months, if therapy was inadequately described or a combination of therapies were used, if they were under 18 or if only a single case-report was described. In the case of double publication the most extensive publication was selected.

Data Extraction
Successful treatment was defined as an excellent or good result at follow-up. If the success rate was not defined by the author, the results were integrated into the widely accepted scoring system of Thompson and Loomer. The proportion of the patient population treated successfully was noted and percentages were calculated. For each treatment strategy, study size weighted success rates were calculated.

Results
Description of studies
A total of 126 publications describing the results of treatment of talar OCDs could be identified. Eighty-seven studies had to be excluded due to inappropriate duration of follow-up (n=1), improper description or combination of therapies (n=37), age under 18 (n=2), non-interpretable results (n=34), single case report (n=11) and double publication (n=2).
No randomized clinical trials (RCTs) were found. Therefore the conventional measures of summarizing estimates of effectiveness could not be used. We used pooling of the estimates of the outcome in individual studies.

Of the 39 selected studies, 14 described the results of NT,\textsuperscript{5,6,16,24,32-41} 4 the results of excision alone,\textsuperscript{2,5,40,42} 10 the results of EC,\textsuperscript{2,16,23,24,27,33,37,43-45} 21 the results of ECD,\textsuperscript{1,5,6,15,25,26,32,38,39,42,46-56} 2 the results of usage of cancellous bone grafting after EC,\textsuperscript{15,56} 1 the results of osteochondral transplantation,\textsuperscript{57} 3 the results of fixation,\textsuperscript{1,40,58} and 1 the results of retrograde drilling.\textsuperscript{59}

**Population characteristics**

The total number of patients with OCD of the talus in the 39 studies included was 879. Of these 879 patients, 734 were included in the systemic review based on our criteria.

The average age was 26.9 years, 65% were male and 35% female. The majority (82%) of the patients were from the general population, the others were from the military population. Lesions were lateral in 42% and medial in 58%. A history of ankle trauma was reported in 76% of the cases. Lateral talar dome lesions were associated with previous ankle trauma in 93%. For medial dome lesions this figure was 61%.

**Therapies**

**NON-OPERATIVE TREATMENT (NT)**

The definition of NT of talar OCDs varied across publications. They were subdivided into two categories: (A) rest / restriction of (sport-) activities with or without application of non-steroid anti-inflammatory drugs (NSAID), and (B) cast immobilization for a minimum of three weeks up to four months. The considerations for treating patients non-operatively were: minor complaints,\textsuperscript{60} radiological Berndt and Harty stage I and II,\textsuperscript{16,24} and medial III lesions,\textsuperscript{16} or intact cartilage as determined by arthroscopy.\textsuperscript{33} The remaining publications did not give an exact description of the indication for NT.

Fourteen studies, 201 patients in total, described the results of NT for OCD. In 91 of the 201 patients (45%) treatment was reported to be successful. The range of success rates was 0-100%. In the majority of studies the duration of symptoms prior to institution of NT was either unreported or ranged from sub-acute to acute (<6 weeks) to chronic (>6 weeks). Only one study described the results of solely acute lesions.\textsuperscript{6} In 6 patients with acute lesions, treated by 4-6 weeks non-weight bearing immobilization followed by progressive weight bearing for 2-8 weeks, no good or excellent results were reported. The outcome of NT in solely chronic lesions (> 6 weeks) was described in three studies.\textsuperscript{33,34,58} All chronic lesions were treated by rest or restricting (sports-) activities. The average success rate in the 3 studies was 56% (5/9). The results of 17 patients treated by rest or restriction of activities were described in 7 studies.\textsuperscript{5,16,34,36,39,40} The success rate of this type of treatment was 59%. Immobilization between 3 weeks and 4 months in 131 patients resulted in 41% good/excellent results.\textsuperscript{5,6,24,31,36-39,41}
SURGICAL TREATMENT

Until the mid-eighties, surgical treatment of talar OCDs consisted of open procedures. In posteromedially located OCDs most surgeons performed an osteotomy of the medial malleolus, to identify and treat the lesion. The introduction of arthroscopy has led to less invasive operative procedures.

In the included studies, the considerations for treating patients surgically were failure of NT, or presence of more advanced lesions: acute or chronic radiographic Berndt and Harty stage II – IV lesions, acute, or chronic stage III and IV lesions. Pritsch based surgical indication on arthroscopic appearance of a frayed cartilage aspect. Surgical treatment options are excision, EC, ECD, cancellous bone grafting, osteochondral transplantation or fixation.

Excision

In this technique the separated fragment is excised. The results of open surgical treatment of OCD by excision alone were reported in four studies, for a total of 39 patients. In 15 of the 39 patients (38%) the treatment was reported to be successful. The success rate in the four studies varied from 30-100%.

Excision and Curettage (EC)

In this technique the loose body is excised and surrounding necrotic subchondral tissue is curetted using either open or arthroscopic technique. Ten studies, a total of 126 patients, reported the results of OCD treatment by EC. In 96 of the 126 patients (76%) treatment was reported to be successful. The success rate varied from 53-100%. The success rates for open procedures and arthroscopy were 63% (31/49) and 84% (65/77) respectively.

Excision, Curettage and drilling (ECD)

In this technique, following excision and curettage, holes are drilled in the subchondral bone to enhance vascularization of the repair process. This type of treatment should not be confused with the term multiple drilling of intact soft cartilage. A total of 21 studies, for a total of 272 patients, described the results by ECD. In 234 of the 272 patients (86%) treatment was reported to be successful. The success rate varied from 33-100%. The success rates for open procedures and arthroscopy were 84% (92/109) and 87% (142/163) respectively.

Cancellous Bone Grafting

In this technique, after EC the defect that remains is filled with autologous cancellous bone. Two publications reported the results of OCD treatment by this technique. In 28 of the 33 patients (85%) treatment was reported to be successful.
Osteochondral transplantation

In this technique, autologous grafts are obtained from the ipsilateral knee. The grafts are compressed, contoured and inserted into the talar defect using the press-fit technique. One study described the results of 36 patients treated by osteochondral transplantation. Defects up to 10 mm were treated arthroscopically. Good/excellent results were achieved in 34 patients (94%). Morbidity at the donor knee joint was not seen.

Fixation

In this technique the loose fragment is not removed but fixed to the underlying bone by either a screw, pin, rod or fibrin glue. Three publications, a total of 11 patients, described the results of this treatment for OCD. Most patients were operated on within 4 months. The studies described only open procedures. In 8 of the 11 patients (73%) treatment was reported to be successful. The success rate varied from 40-100%.

Retrograde drilling

With this technique, the lesion is treated by arthroscopic drilling through the sinus tarsi. One publication, describing 16 patients, was included. In 13 of the 16 patients (81%) treatment was reported to be successful.

Discussion

This review summarizes a total of 39 studies which describe treatment strategies for OCD. There were no RCTs in this group. There was great diversity in the trials concerning patient characteristics, staging of the defect, duration of follow-up and outcome measures. A relatively large number of patients were treated non-operatively, by excision, by EC or by ECD. The number of patients subjected to fixation of the detached fragment, cancellous bone grafting after curetage and drilling, osteochondral transplantation and retrograde drilling is too limited for a reliable interpretation of the results. Therefore, no definitive conclusions can be drawn and no recommendations will be made concerning these techniques.

The average success-rate of NT (45%) is low compared to surgical intervention. Comparison of different surgical procedures shows a wide range of success rates. The highest average success rate was reached by ECD (86%; range 33-100), followed by EC (78%; range 53-100) and excision alone (38%; range 30-100). After subdivision into open and arthroscopic procedures these percentages are 84% and 87% for ECD, and 63% and 86% for EC. Lateral lesions were associated with a history of ankle trauma in 93% and medial lesions in 61% of cases. These percentages support the postulation that ankle trauma is a major cause in the formation of both lateral and medial talar dome lesions. A pre-1983 review of the literature
showed comparable results, with a history of trauma in 98% of patients with lateral dome lesions and in 70% of those with medial dome lesions.\(^6\) When interpreting the outcome we encountered some difficulties that have to be taken into account. A large number of studies could not be included due to improper description of type of treatment or outcome. Based on these deficiencies even within studies patients were excluded. The resulting lower number of selected patients might have influenced the reliability of interpretation of the results.

As no RCTs could be included in this review incomparability of baseline characteristics (age, sex, stage of OCD) may be implied. Therefore, caution should be applied in interpreting the outcome and comparing the effectiveness of the different procedures.

In some studies the outcome was not classified into clear categories (poor-fair-good-excellent). These results were then adapted to fit the widely accepted scoring system of Thompson and Loomer.\(^32\) Of nine studies, only two were suitable only two were suitable for fitting the results into this classification.\(^34,35\) These two studies were selected because they gave an accurate description of the items necessary for classification. By using this selection procedure we have tried to minimize the subjectivity and observer bias.

Comparison of different surgical procedures within studies shows that the outcome of ECD is likely to be superior to excision alone.\(^5,42\) These findings are consistent with pooled results. No studies are available comparing ECD with EC. Therefore, no definitive evidence is available to compare the effectiveness of these two types of surgical intervention.

Radiological classification varied widely. Only six authors based their decision for selection of a specific treatment on staging according to Berndt and Harty.\(^21,24,25,27,33\) Therefore, no separate analysis was performed for treatment according to radiological classification. We do not feel this is a drawback because the value of preoperative radiological staging is probably of minor value, since it hardly correlates with intraoperative findings.\(^50\) This demonstrates its shortcomings as a guide for treatment. Intraoperative staging of the defect would be more appropriate.\(^24,26\)

Between and within studies there were great differences in type and duration of NT with a wide range (0-100%) of reported success rates. It varies from no treatment\(^38,39\) to plaster cast immobilization for 3 months.\(^16\) All these non-operative strategies will probably have their specific influence on the outcome, but cannot disguise the overall low success rate. We subdivided the NT-group into 2 categories: (A) rest or restriction of (sports-) activities (17 patients), or (B) immobilization for periods of 3 weeks to 4 months (131 patients). The success rates were 59% and 41% respectively. These percentages are too low to recommend NT.

A substantial number of surgically treated lesions were resistant to NT.\(^2,6,23,31,35,37,38,40,41,43-45,53\) These failures of NT are not recorded in the overall low success rate of NT. Taking this into account, the moderate success rate of NT may well even be overestimated.

The calculated overall success rate of surgical intervention (75%) is comparable with the
percentage reported in a review until 1983. However, this percentage is achieved by different surgical techniques with different success rates. For the individual surgeon the practical value of the average success rate of surgical intervention is therefore of limited value in choosing a specific surgical method. We have subdivided the surgical techniques in order to compare their individual effectiveness. Elsewhere in this study a separate analysis shows that ECD is associated with the highest percentage of good/excellent results (86%).

Several clinical trials focusing on biological repair and regeneration can be expected in the near future. These new techniques using cultured or autologous chondrocytes, osteochondral grafts, cartilage transplantation, periosteal and perichondral grafts should prove their value in treatment of OCD of the talus and compete with the high success rate of 86% of current procedures including arthroscopy. The results of cancellous bone grafting and osteochondral transplantation are encouraging. However, as of yet, too few qualitative studies on patients treated by these techniques are available to be able to draw any firm conclusions.

This systematic review shows substantial variability in baseline characteristics, methodology and results between studies. At present, treatment by excision, curettage and drilling is most widely used and seems to be the most effective treatment strategy for osteochondral defects of the talus. To draw definitive conclusions on the most optimal treatment strategy, sufficiently powered, randomized clinical trials with uniform methodology and validated outcome measures should be initiated.
References


