Diagnostic guidelines for chronic ankle pain. From loose bodies to joint venture
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The anterior ankle impingement syndrome: diagnostic value of oblique radiographs


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Abstract

Background
The diagnostic value of an oblique radiograph in addition to a lateral radiograph, for detecting osteophytes in the anterior ankle impingement syndrome was evaluated in a prospective study. The hypothesis was that the application of a lateral radiograph is insufficient to detect osteophytes that are located in the anteromedial aspect of the ankle joint. Oblique anteromedial impingement (AMI) radiographs were hypothesized to be a relevant adjunct, because of their utility to detect these anteromedially located osteophytes.

Methods
The presence or absence of tibial and talar osteophytes on both radiographs was compared with the combined findings of CT, MRI scan and arthroscopic surgery. Estimates of test characteristics were obtained for 60 consecutive patients with an anterior ankle impingement syndrome.

Results
It was shown that the sensitivity of lateral radiographs for detecting anterior tibial and talar osteophytes was 40% and 32%, respectively (specificity, 70% and 82%). When the lateral radiograph was combined with an oblique AMI radiograph, these figures increased to 85% and 73%, respectively (specificity decreased to 45% and 68%). This increase was due to the high sensitivity of the oblique AMI radiographs for detecting anteromedial osteophytes (93% for tibial and 67% for talar osteophytes).

Conclusion
A lateral radiograph is insufficient to detect all anteriorly located osteophytes. An oblique AMI radiograph is a useful adjunct to routine radiographs and is recommended to detect anteromedial tibial and talar osteophytes.
Introduction

The anterior ankle impingement syndrome is a common cause of chronic ankle pain. Patients present with anterior ankle pain induced by activity, especially forced dorsiflexion. The pain is caused by compression in dorsiflexion of a soft tissue or bony impediment in between the anterior aspect of the distal tibia and the opposite talar neck. Physical examination reveals recognizable tenderness on palpation of the anterior aspect of the ankle joint with slightly limited painful forced dorsiflexion. The clinical differentiation between anterolateral and anteromedial impingement is generally accepted. Patients with chronic mechanical laxity in particular frequently display osteophytic formations and degenerative changes in the medial compartment of the ankle. Standard AP and lateral radiographs are used to detect the presence of these osteophytes. In patients with anterior talar and/or tibial spurs, these spurs are regarded as being the cause of the anterior impingement syndrome. Due to their location they lead to a “kissing” phenomenon and concomitant pinching of hypertrophic synovial tissue.

Because of the anteromedial notch, anteromedial osteophytes are undetected by standard radiographs in a substantial number of patients with anterior impingement complaints. In a cadaver study, it was shown that anteromedial tibial osteophytes up to 7.3 mm in size, originating from the anteromedial border, remain undetected due to superposition or overprojection of the more prominent anterolateral border of the distal tibia. Medially located talar osteophytes remain undetected due to overprojection or superposition of the lateral part of the talar neck and body. In these patients with clinical anterior ankle impingement syndrome, the diagnosis of soft tissue impingement will be made, despite the fact that anteromedial osteophytes, ossicles, or posttraumatic calcification may be present. Detection of the osteophytes is important for preoperative planning. Several authors have stated that surgical distinction between bony and soft tissue normal variants and pathologic conditions is difficult, because of subtle variations in joint anatomy. In patients with accompanying synovial reflections overlying the concealed osteophytes, anteromedial bony spurs are poorly visualized arthroscopically and can be missed. Radiographic classification of spur formation correlates with the outcome of surgery.

A new oblique radiograph was introduced to detect medially located tibial and talar osteophytes. In this oblique anteromedial impingement (AMI) view, the beam is tilted in a 45° craniocaudal direction with the leg in 30° external rotation and the foot in plantarflexion, in relation to the standard lateral radiograph position (Fig. 1).

The aim of the present prospective study was to evaluate the diagnostic value of the oblique AMI view, in addition to the lateral view, in detecting osteophytes in the anterior ankle impingement syndrome. We hypothesized that in patients with an anterior ankle impingement syndrome:

1. Standard lateral radiographs are insufficient to detect all anterior ankle osteophytes, due to underdetection of anteromedial osteophytes.
The anterior ankle impingement syndrome

Fig. 1
A. 45/30 AMI ankle view: position of the foot relative to the x-ray beam. Starting from a standard lateral view, the x-ray beam is tilted into a 45° craniocaudal position with the lower extremity externally rotated 30°.

B. The patient is asked to place the foot in the maximal plantarflexed position. The heel is placed on a 2-cm-high shelf.

C. The x-ray beam is rotated 10° parallel to the anterior contour of the foot and ankle, and is centered just anterior to the lateral malleolus. A high-contrast mammography film is used (one-sided emulsion film). This film is underexposed to 50% of the normal value for a standard ankle radiograph.

2. Oblique (AMI) radiographs are a useful and relevant adjunct for imaging anterior ankle osteophytes.

3. In patients with a clinical anterolateral impingement lesion, lateral radiographs are sensitive enough to detect anterolateral osteophytes.

4. In patients with a clinical anteromedial impingement lesion, oblique (AMI) radiographs are sensitive enough to detect anteromedial osteophytes.
Materials and Methods

The study was part of a prospective study design of different diagnostic strategies in patients with chronic anterior ankle pain. It was approved by our medical ethical committee and the subjects included had given informed consent. All patients failed to respond to a minimum 6-month period of non-operative treatment. Patients were included if they presented with anterior ankle pain with painful dorsiflexion during or after activity, tenderness on palpation of part of the anterior joint line, swelling, and limited dorsiflexion. If at physical examination tenderness on palpation at the anterior joint line was predominantly located medial to the anterior tibial tendon, the diagnosis was anteromedial impingement. If tenderness on palpation at the anterior joint line was predominantly located lateral to the extensor digitorum longus tendon, the diagnosis was anterolateral impingement. Patients with both anteromedial and anterolateral palpation pain had combined anteromedial and anterolateral impingement. Sixty consecutive patients (36 men and 24 women) with an average age of 33 years (range, 18–68) were evaluated. The left ankle was involved in 26 patients and the right ankle in 34 patients. The average duration of the complaints was 1.3 years (0.5–8 years). Thirty-eight patients (63%) experienced one or more supination traumas. Forty-nine patients (82%) were involved in sports. On physical examination all patients had localized swelling or showed signs of local synovitis when compared to the unaffected ankle.

In all patients, standard AP and lateral weight bearing radiographs of both ankles, an AMI radiograph, a CT scan (Helical dual; Twin Flash, Elscint, Israel or MX Twin Flash, Picker, USA), and a MRI scan (1.5 Tesla; Vision System Siemens, Erlangen, Germany) were performed. All patients had arthroscopic surgery within 12 weeks after inclusion. The lateral and oblique radiographs were blinded and independently scored for the presence or absence of osteophytes on the tibia and/or talus by three experienced observers. The observers were not informed about the preoperative diagnosis. The AP and lateral radiographs were scored according to an osteoarthritic classification (Table 1). In case of disagreement, the radiographs were collectively discussed and consensus was reached.

All arthroscopic procedures were performed by the same surgeon as a day surgery procedure under spinal or general anaesthesia, as described in earlier reports. During arthroscopy, the distal tibia and talus were accurately inspected for presence or absence of osteophytes. Arthroscopic treatment consisted of removal of any soft tissue and/or bony impediments.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Classification of osteoarthritic changes of the ankle joint on plain radiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal joint or subchondral sclerosis</td>
</tr>
<tr>
<td>I</td>
<td>Osteophytes without joint space narrowing</td>
</tr>
<tr>
<td>II</td>
<td>Joint space narrowing with or without osteophytes</td>
</tr>
<tr>
<td>III</td>
<td>Subtotal or total disappearance or deformation of the joint line</td>
</tr>
</tbody>
</table>
Presence or absence of osteophytes was scored and compared to the findings on the lateral and oblique radiographs. Estimates of the sensitivity, specificity, positive predictive value, and negative predictive value were obtained for:

- The lateral radiographs for detecting anterior osteophytes;
- The combination of lateral and oblique AMI radiographs for detecting anterior osteophytes;
- The lateral radiographs for detecting anterolateral osteophytes; and
- The oblique AMI radiographs for detecting anteromedial osteophytes in patients with isolated anteromedial impingement.

Comparison between lateral and AMI radiographs in detecting osteophytes was evaluated with the McNemar test. Statistical significance was assumed for $p$ values of less than 0.05.

**Results**

**Patient Characteristics**

Based on clinical examination there were 27 anterolateral, 29 anteromedial, and four combined lesions. Range of dorsiflexion was diminished by an average of 7° (range, 3° – 18°) compared to the uninjured side. Eleven patients (18%) had a 1+ positive anterior drawer sign, but none of these patients had functional symptomatic instability.

According to the radiographic osteoarthritic ankle classification, there were 33 (55%) grade 0, 19 (32%) grade I, eight (13%) grade II, and no grade III lesions. During arthroscopic surgery, there were 30 anteromedial tibia, 24 anterolateral tibial, 21 anteromedial talar, and six anterolateral talar osteophytes detected (total 81 osteophytes). Anterior synovitis was present in all ankles.

**Test Characteristics**

The test characteristics for the lateral and AMI radiographs for detecting anterior located osteophytes are given in Table 2. The sensitivity was greater and the specificity lower, with

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Test characteristics for the lateral radiograph and the combination of lateral and oblique AMI radiographs, for detecting anterior tibial and talar osteophytes in 60 patients with anterior ankle impingement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiograph</td>
<td>Sensitivity</td>
</tr>
<tr>
<td>Tibial osteophytes</td>
<td></td>
</tr>
<tr>
<td>Lateral</td>
<td>0.40</td>
</tr>
<tr>
<td>Lateral and oblique</td>
<td>0.85</td>
</tr>
<tr>
<td>Talar osteophytes</td>
<td></td>
</tr>
<tr>
<td>Lateral</td>
<td>0.32</td>
</tr>
<tr>
<td>Lateral and oblique</td>
<td>0.73</td>
</tr>
</tbody>
</table>
the combination of lateral and oblique AMI radiographs, than lateral radiographs alone. The lateral radiographs were sensitive in detecting lateral tibial osteophytes in 58% of the ankles, with a specificity of 78% (Table 3). The sensitivity of the oblique radiographs for detecting anteromedial tibial and talar osteophytes was 93% and 67%, respectively (specificity 66% and 77%) (Table 3, Fig. 2). In 37 ankles with an isolated clinical anteromedial ankle

Table 3  Test characteristics for the lateral radiograph for detecting anterolateral osteophytes and oblique radiograph for detecting anteromedial osteophytes

<table>
<thead>
<tr>
<th>Radiograph</th>
<th>Location</th>
<th>Sensitivity</th>
<th>Specificity Predictive Value</th>
<th>Positive Predictive Value</th>
<th>Negative Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tibial osteophytes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral</td>
<td>Anterolateral</td>
<td>0.58</td>
<td>0.78</td>
<td>0.64</td>
<td>0.74</td>
</tr>
<tr>
<td>Oblique</td>
<td>Anteromedial</td>
<td>0.93</td>
<td>0.66</td>
<td>0.74</td>
<td>0.91</td>
</tr>
<tr>
<td>Talar osteophytes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral</td>
<td>Anterolateral</td>
<td>0.67</td>
<td>0.81</td>
<td>0.29</td>
<td>0.96</td>
</tr>
<tr>
<td>Oblique</td>
<td>Anteromedial</td>
<td>0.67</td>
<td>0.77</td>
<td>0.61</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Test characteristics are given for tibial and talar osteophytes in 60 patients with anterior ankle impingement.

Fig. 2  A 19-year-old female with post-traumatic anteromedial ankle pain. On investigation there was anteromedial swelling, tenderness to palpation, and dorsiflexion limited to 10° compared with 18° on the uninvolved side.

The standard lateral view (A) shows no abnormality. The oblique view (B) shows spurs both on the anteromedial distal tibia (upper arrow) and medial talar neck (lower arrow) as well as an ossicle (open arrow). This medially located loose body and medially located osteophytes were successfully removed by arthroscopic surgery.
impingement, the lateral radiographs were negative in 27 ankles. In this group, out of 32 anteromedial tibial osteophytes there were 22 false-negative lateral radiographs (69%), compared to two false-negative AMI radiographs (6%).

**Discussion**

Anterior tibiotalar osteophytes can result in anterior ankle pain with limited and painful dorsiflexion. Standard lateral radiographs are generally used to detect the presence of these osteophytes. In our 60 patients, the standard lateral projection was, however, capable of detecting only 40% of the tibial and 32% of the talar osteophytes. It has been postulated that the anteromedial tibial contour and notch could influence the detection of anteromedially located osteophytes with the application of the standard lateral radiograph. With the combination of AMI radiographs, the percentage of detected tibial and talar osteophytes increased to 85% and 73%, respectively, due to the high sensitivity of the AMI radiographs for detecting anteromedial osteophytes (specificity, 93% and 67%). In our 37 patients with anteromedial impingement, there were 32 (86%) anteromedial bony impingement lesions. On the lateral radiograph, 22 (69%) of the 32 osteophytes were missed on the standard radiographs. The AMI radiograph showed 30 (94%) of the 32 osteophytes. We conclude that the AMI radiograph is a useful adjunct to routine radiographs. These AMI radiographs have a high accuracy for detecting anteromedially located osteophytes. Osteophytes that were located anterolaterally were detected by a lateral radiograph in 58% of the cases. The reason that some of these lateral osteophytes were missed could be caused by small variations in positioning of the ankle during radiograph taking. The consequence of missing these osteophytes is that these patients would be diagnosed as having a soft tissue impingement lesion. This could influence the therapeutic decision making. It has been postulated that in patients with an anterior ankle impingement syndrome, the cause of pain is the osteophytes itself, but it is the inflamed synovial tissue and/or hypertrophic scar tissue that is compressed between the osteophytes in forced dorsiflexion. It could be argued therefore, that arthroscopic excision of the soft tissue impediment alone would be sufficient to relieve the pain. Resection of the soft tissue component may, however, result in haematoma formation, inflammation, and formation of new scar tissue that can act as a new impediment. The presence of osteophytes will result in a reduced anterior joint space. Compression of this new scar tissue impediment may be more likely to take place in such a situation. For this reason, it is important to remove all osteophytes, to restore the anterior joint space and to diminish the chance of recurrence of impingement symptoms.

During the past decade, helical CT and MRI scans in patients with chronic ankle pain have been increasingly used. Their diagnostic value is thought to be higher than plain radiographs and they are recommended after a non-diagnostic series of standard ankle
radiographs. These imaging techniques cost more and are not widely available, as well as being more time consuming for the patient. The advantage of the oblique AMI radiograph in detecting medial osteophytes is its low cost, less complex technology, and usefulness as an adjunct to routine radiographs. One can speculate whether it can compete with the CT and MRI scan regarding sensitivity, specificity, and interpretation dependency. These factors are currently being analyzed and interpreted in the same cohort of patients.

Detection of a bony impediment in a symptomatic patient is helpful to understand and explain the cause of pain for both the physician and the patient. Absence of clear radiographic evidence of bony abnormality makes it difficult for the physician to plan arthroscopic surgery, since he has to rely only on his clinical diagnosis. Seeking confirmatory evidence of the clinical diagnosis by routine investigations is important for the physician. When arthroscopic surgery is planned and performed, osteophytes can be missed, due to secondary accompanying synovial reflections overlying the concealed osteophytes. Detection of these osteophytes is therefore important.

Acknowledgement
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References