TECHNICAL NOTE

Anterior ankle bony impingement with joint motion loss: The arthroscopic resection option

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KEYWORDS
Ankle stiffness; Anterior ankle impingement; Osteophytes; Ankle arthroscopy

Summary
Objectives: This study presents an arthroscopic surgery technique for the treatment of bony anterior ankle impingement with tibiotalar joint stiffness, and initial short-term results.
Surgical technique: All patients underwent the same arthroscopic technique, with anterior ankle synovectomy, osteophyte resection and extensive anterior capsuloligamentous structures release. Rehabilitation was immediately initiated.
Series: This was a retrospective series of 13 cases of bony ankle impingement associated with poorly tolerated range of motion restriction. At a mean 15 months’ follow-up, 10 out of 13 patients were satisfied or very satisfied with their result, and three were disappointed. Anterior impingement symptoms had entirely disappeared in 12 of the 13 cases. Five patients showed persistent deep pain. Mean dorsiflexion improved from 7° to 16° (p < 0.009) and mean plantar flexion from 20° to 34° (p < 0.004). Mean AOFAS score improved from 67/100 (54–80) to 87/100 (43–100) (p < 0.05).
Discussion: In the particular case of bony ankle impingement associated with poorly tolerated range of motion restriction, both pain and joint mobility can be improved by simple arthroscopic surgical techniques combining anterior synovectomy, extensive anterior capsuloligamentous release, large-scale osteophyte resection and malleolar groove release. Surgery should immediately be followed by a program of mobilization and rehabilitation in hospital, with pain management. Short-term results are encouraging, providing clear functional improvement and overall ankle mobility gain.
Level of evidence: Level IV, retrospective series.
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Introduction
Post-traumatic ankle stiffness may have a variety of causes (intra- or extra-articular); onset may be secondary to joint fracture or a capsuloligamentary ankle lesion. Stiffness may
be due both to soft-tissue retraction (capsuloligamentary and synovial fold fibrosis) and to osteophytes creating a bony buffer effect, reducing joint amplitude [1—5].

Anterior tibiotalar osteophytes may cause chronic pain by anterior impingement. They are usually due to repeated microtrauma but can also occur secondarily to joint fracture or sprain [6—8]. Following ankle trauma, some patients show a mixed pattern of anterior impingement pain associated with tibiotalar joint stiffness which may be poorly tolerated. Such cases mainly implicate osteophytes, and resection should theoretically improve both pain and mobility.

Arthroscopic treatment of bony anterior ankle impingement is now well described and provides clear functional benefit, eliminating chronic anterior pain [9—16]. In terms of tibiotalar mobility, results are less sure, however, and mobility often remains normal or subnormal.

The present study presents the arthroscopic technique for bony anterior ankle impingement with stiffness, with initial short-term results in terms of tibiotalar mobility and pain.

**Surgical technique**

All patients were operated on with the same protocol, under general or locoregional anesthesia and a popliteal catheter for postoperative analgesia. In 12 cases, the patient was in dorsal decubitus; in one case, lateral decubitus allowed anterior and posterior ankle arthroscopy. A pneumatic tourniquet was inflated to 300 mmHg at the root of the thigh. The equipment was the same in all cases, with a 4.5 mm scope at 30°, a motorized knife and bone rasp, an electric lancet knife and an arthropump with a ceiling set at 50 mmHg.

Surgery was performed by anterior ankle arthroscopy in all cases, using an anteromedial and anterolateral approach. One case required a second lateral approach; in one other case, posterior arthroscopy with a posteromedial and posterolateral approach was performed in the same step to manage posterior impingement. Anterior tibiotalar cleaning began with anterior synovectomy along the tibiotalar osteophytes in maximal dorsiflexion so as to relax the anterior capsule and withdraw the anterior tibial artery (Fig. 1). After partial synovectomy, the tibiotalar joint line was located; partial resection of tibiotalar osteophytes was frequently necessary to facilitate anterior exploration and increase the anterior work-space (Fig. 2). Once complete visualization of the joint line and osteophyte borders was achieved, synovectomy was continued along the osteophytes in maximal dorsiflexion. Anterior capsule release and detachment was then performed beyond the osteophytes, proximally along the anterior edge of the tibial pilon and distally along the talar neck (Fig. 3). Following this extensive capsule release, the osteophytes were completely resected, from their origin (anterior edge of the tibia, talar neck) and up to the joint line, to guarantee complete resection (Fig. 4). Synovectomy and capsule release were continued in the malleolar grooves until the malleolar tips were fully visualized, which required partial anterior sectioning of the collateral ligament (medial collateral ligamentous complex and anterior talofibular ligament) (Figs. 5 and 6). The joint was then assessed, and associated surgery (e.g., to treat an osteochondral defect, remove loose bodies or release the posterior tibiotalar capsule — in one case, by posterior arthroscopy) was performed if necessary. At end of surgery, the ankle was mobilized in planar and dorsi-flexion to assess the gain in amplitude. Drainage was not performed, and an
intra-articular ropivacaine injection was made prior to skin closure.

Postoperative course

Immediate weight-bearing was authorized if pain allowed. Rehabilitation was initiated immediately, within the hospital, under pain control by perineural block, and continued after discharge (in a rehab center in 3 cases).

Preliminary series

Patients (Table 1)

This was a retrospective series of patients presenting with bony anterior ankle impingement with tibiotalar joint stiffness, treated under arthroscopy.

Inclusion criteria were the presence of:

- anterior ankle impingement syndrome;
- poorly tolerated tibiotalar joint stiffness;
- anterior tibiotalar osteophytes.

The series excluded cases of: anterior ankle impingement with conserved tibiotalar mobility compared to the contralateral side, or stiffness that was described as well-tolerated on interview; anterior impingement without anterior osteophytes; tibiotalar stiffness without signs of anterior impingement; stiffness of non-articular or mixed origin; and evolved tibiotalar osteoarthritis (with complete joint-line impingement on standard X-ray).

Thirteen patients (7 females, 6 males), mean age 37 years (range: 16 to 59 years), were managed by this technique. Etiology was in all cases traumatic, with capsuloligamentary lesion (ankle sprain) in seven cases and joint fracture of the distal extremities of the two lower limb bones in six cases (5 bimalleolar fractures, including one open fracture, and one closed tibial pilon fracture). Mean time to surgery was 20 months (range: 3—72 months).

All patients had consulted for painful ankle stiffness and received initial medical treatment comprising rehabilitation and analgesics. Anterior intra-articular local anesthetic and corticosteroids were delivered in nine cases, giving transitory partial improvement in the symptoms of the anterior impingement. Clinical examination systematically found reduced joint amplitude in the affected as compared to the contralateral ankle. All patients presented with anterior ankle impingement syndrome with pain induced or heightened by anterior palpation in dorsiflexion of the tibiotalar joint. Three patients presented with associated deep ankle pain and one with additional associated posterior impingement syndrome.

Methods

In all patients, passive tibiotalar joint amplitude was measured on manual goniometry, pre-operatively and at follow-up. Reported amplitude values were for the neutral position, with the tibiotalar joint at 90°. AOFAS ankle func-
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Table 1 Pre-operative clinical data.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Etiology</th>
<th>Interval (months)</th>
<th>Pain</th>
<th>Preop DF</th>
<th>Preop PF</th>
<th>Cartilage</th>
<th>Associated procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>F</td>
<td>Sprain</td>
<td>6</td>
<td>10</td>
<td>Anterior + deep</td>
<td>68</td>
<td>10</td>
<td>Grade I LB ablation</td>
</tr>
<tr>
<td>2</td>
<td>41</td>
<td>F</td>
<td>Sprain</td>
<td>18</td>
<td>10</td>
<td>Anterior</td>
<td>71</td>
<td>15</td>
<td>Grade I LB ablation</td>
</tr>
<tr>
<td>3</td>
<td>33</td>
<td>M</td>
<td>Sprain</td>
<td>3</td>
<td>40</td>
<td>Anterior + deep</td>
<td>54</td>
<td>30</td>
<td>Grade I OLT ablation</td>
</tr>
<tr>
<td>4</td>
<td>28</td>
<td>F</td>
<td>Sprain</td>
<td>12</td>
<td>0</td>
<td>Anterior</td>
<td>59</td>
<td>20</td>
<td>Grade I OLT ablation</td>
</tr>
<tr>
<td>5</td>
<td>54</td>
<td>M</td>
<td>Bimalleolar fracture</td>
<td>18</td>
<td>0</td>
<td>Anterior + deep</td>
<td>75</td>
<td>30</td>
<td>Grade I OLT ablation</td>
</tr>
<tr>
<td>6</td>
<td>26</td>
<td>F</td>
<td>Bimalleolar fracture</td>
<td>12</td>
<td>0</td>
<td>Anterior + deep</td>
<td>77</td>
<td>20</td>
<td>Grade I OLT ablation</td>
</tr>
<tr>
<td>7</td>
<td>51</td>
<td>M</td>
<td>Bimalleolar fracture</td>
<td>11</td>
<td>10</td>
<td>Anterior + deep</td>
<td>78</td>
<td>20</td>
<td>Grade I OLT ablation</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>F</td>
<td>Bimalleolar fracture</td>
<td>13</td>
<td>10</td>
<td>Anterior</td>
<td>76</td>
<td>20</td>
<td>Grade I OLT ablation</td>
</tr>
<tr>
<td>9</td>
<td>28</td>
<td>M</td>
<td>Bimalleolar fracture</td>
<td>15</td>
<td>10</td>
<td>Anterior</td>
<td>77</td>
<td>20</td>
<td>Grade I OLT ablation</td>
</tr>
<tr>
<td>10</td>
<td>32</td>
<td>M</td>
<td>Bimalleolar fracture</td>
<td>12</td>
<td>10</td>
<td>Anterior</td>
<td>76</td>
<td>20</td>
<td>Grade I OLT ablation</td>
</tr>
<tr>
<td>11</td>
<td>36</td>
<td>M</td>
<td>Bimalleolar fracture</td>
<td>13</td>
<td>10</td>
<td>Anterior</td>
<td>78</td>
<td>20</td>
<td>Grade I OLT ablation</td>
</tr>
</tbody>
</table>

F = female; M = male; Preop DF = pre-operative dorsiflexion (°); Preop PF = pre-operative plantar flexion (°); Cartilage = tibiotalar cartilage status on arthroscopic exploration on the Béguin and Locker classification [20]; LB ablation = ablation of loose bodies.

Figure 7 Evolution of dorsiflexion following arthroscopic surgery.

X-ray assessment comprised loaded AP and lateral ankle views for all patients, pre-operatively and at follow-up. Analysis concerned presence of osteophytes, osteoarthritis on Ahlbäck's classification [18] and osteochondral talar dome lesion on Doré and Rosset's FOG classification [19]. In four cases, assessment was completed by arthroscope and in one case by arthro-MRI. Anterior tibiotalar osteophytes were found in all cases, Ahlbäck grade-1 joint-line impingement in three cases and type-F osteochondral talar dome lesion in three cases.

Joint assessment classified tibiotalar cartilage according to Béguin and Locker [20]: cartilage was normal in six cases, with chondropathy in four (1 grade 2, 1 grade 3, and 2 grade 4). Type-F osteochondral talar dome lesion was visualized in three cases and treated by curettage.

Results (Table 2)

All patients were followed up, to a mean 15 months post-surgery (range: 12—25 months). One serious complication (immediate postoperative septic arthritis) was found; despite emergency arthroscopic lavage and adapted antibiotherapy, evolution proved unfavorable and arthrodesis was performed at one year. (This case has been excluded from analysis).

At last follow-up, 10 of the 13 patients were satisfied or very satisfied with their result; three were disappointed. Anterior impingement symptoms had totally resolved in 12 of the 13 cases. Five patients reported persistent deep pain (including the three patients reporting deep pain preoperatively). Mean mobility in dorsiflexion increased from 7° pre-operatively (range, −10° to 15°) to 16° postoperatively (range, 0° to 30°) (p < 0.009) (Fig. 7). Mean mobility in plantar flexion increased from 20° pre-operatively (range, 0° to 40°) to 34° postoperatively (range, 20° to 40°) (p < 0.004) (Fig. 8). Mean global AOFAS score increased from 67/100 (range, 54—80) pre-operatively to 87/100 (range, 43—100) postoperatively (p < 0.05). Mean AOFAS score for tibiotalar mobility increased from 4/8 (range, 0—8) pre-operatively to 7.6/8 (range, 4—8) postoperatively (p < 0.05). Mean AOFAS pain score increased from 22/40...
**Table 2** Clinical results.

<table>
<thead>
<tr>
<th>Patient</th>
<th>FU (months)</th>
<th>Pain</th>
<th>Postop DF</th>
<th>Postop PF</th>
<th>Postop AOFAS</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>Deep</td>
<td>5</td>
<td>20</td>
<td>43</td>
<td>Disappointed</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>0</td>
<td>10</td>
<td>20</td>
<td>87</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>Deep</td>
<td>15</td>
<td>40</td>
<td>67</td>
<td>Disappointed</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>0</td>
<td>30</td>
<td>40</td>
<td>84</td>
<td>Satisfied</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>Deep</td>
<td>10</td>
<td>40</td>
<td>86</td>
<td>Satisfied</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>100</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>0</td>
<td>15</td>
<td>20</td>
<td>91</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>Deep</td>
<td>10</td>
<td>40</td>
<td>84</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>9</td>
<td>15</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>100</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Disappointed (arthrodesis at 1 yr)</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>0</td>
<td>30</td>
<td>30</td>
<td>100</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>100</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>13</td>
<td>12</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>100</td>
<td>Satisfied</td>
</tr>
</tbody>
</table>

Postop DF = postoperative dorsiflexion (°); Postop PF = postoperative plantar flexion (°); Postop AOFAS = postoperative AOFAS score (/100); NA = not applicable.

**Figure 8** Evolution of plantar flexion following arthroscopic surgery.

(range, 0—30) pre-operatively to 32/40 (range, 20—40) post-operatively (p < 0.05). X-ray assessment at last follow-up found no alteration in joint-line thickness and no recurrence of osteophytes on standard AP and lateral ankle views (Figs. 9 and 10).

**Discussion**

Anterior ankle impingement is a syndrome featuring anterior ankle pain. Diagnosis is clinical, based on anterior pain reported at interview and on palpation and forced dorsiflexion. Joint effusion and limited tibiotalar mobility are not consistent features [1—3, 6—8, 21]. Infiltration is a true diagnostic test and may in some cases fully resolve symptoms [8]. Anterior impingement may be of osseous origin or due to interposition of soft tissue [3, 7—11, 14, 21, 22]. Bony anterior impingement involves bone spurs or osteophytes on the anterior edge of the tibia and talar neck on lateral ankle X-ray views [9, 14]. Van Dijk et al. [23] demonstrated the interest of an oblique incidence in external rotation to reveal anteromedial osteophytes.

The osteophytes are located on the edge of the anterior joint surface cartilage, within the capsular envelope, where...
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...they develop secondarily to joint fracture, supine trauma or iterative microtrauma [8]. In bony anterior ankle impingement syndrome, pain is probably not due to the osteophytes as such but to impingement of inflammatory tissue (synovitis, fibrosis) between tibial and talar osteophytes. In some cases of bony anterior ankle impingement, there may be considerable tibiotalar stiffening, usually predominating on dorsiflexion but sometimes on dorsi- and plantar flexion as a whole. Anterior tibiotalar osteophytes may cause this stiffness, creating an anterior bony buffer that limits dorsiflexion and increases anterior capsule traction and thus limits plantar flexion.

Arthroscopic management of anterior ankle impingement provides considerable functional benefit, with resolution of or marked decrease in anterior pain. The main published series show 67% to 100% good or excellent results [3,6,8–10,14,16,24–26]. The presence of osteophytes in bony anterior impingement would seem to be of good prognosis, with more than 80% good or excellent results in some series [8,10–14,16,26]. According to Scranton et al. [9], however, results correlate with osteophyte size and location. According to Tol and van Dijk [8], arthroscopy provides 82% good or excellent results in case of anterior osteophytes without joint space narrowing, compared to only 50% in case of joint space narrowing. A distinction is thus to be made between bony anterior impingement with “isolated” osteophytes, which is of good prognosis under arthroscopy, and bony anterior impingement in which osteophytes are the early sign of degenerative tibiotalar cartilage lesion, where prognosis is more reserved. Bonnin and Bouysset [27] reported better results for osteophyte resection without associated chondral lesion than in trauma sequelae.

Arthroscopic management of anterior ankle impingement seems to be very effective in terms of anterior pain, resumption of activity and subjective evaluation; the effect on ankle mobility, however, would seem to be more limited and is often badly reported [8,9,11,14,26]. Anterior impingement, whether bony or by soft tissue interposition, is essentially an anterior ankle pain syndrome: joint stiffening is not a consistent feature (found in 66 out of 139 cases in the French Arthroscopy Society symposium series of 1998) and may be limited and well-tolerated, which accounts for the variability in results with respect to this symptom [14]. In the French Arthroscopy Society symposium series of arthroscopic management of bony anterior ankle impingement, stiffness resolved in only 28.7% of cases, was unchanged in 23.4% and worsened in 2.6% [14]. Ogilvie et al. [11] reported modest gain in mobility with arthroscopic management of bony anterior ankle impingement, and only in dorsiflexion, which improved by 9° (similarly to the present series) whereas plantar flexion was unchanged.

The arthroscopy described here seeks both to manage the anterior impingement (with anterior synovectomy and osteophyte resection) and to improve tibiotalar mobility (by extensive osteophyte resection to remove the bony anterior buffer restricting dorsiflexion and by anterior capsule-ligamentary detachment and resection, proximally and distally, to improve plantar flexion). More aggressive than synovectomy and isolated osteophyte resection as recommended for anterior ankle impingement, this procedure significantly improved mobility in both dorsi- and plantar flexion (by 9° and 14°, respectively, at last follow-up). Being limited to the anterior compartment and malleolar grooves, the procedure is technically simpler than actual arthroscopic ankle arthrotomy, which requires an anterior and posterior approach. Ankle arthrotomy provides greater gain in mobility, especially in dorsiflexion, by anterior and posterior capsulo-ligamentary release [28–30]. With the present technique however, if stiffness persists in dorsiflexion despite the anterior procedure, arthrotomy can be completed by posterior release under endoscopy, with reinstallation in ventral or, in as our case, lateral decubitus. Postoperative management with perineural catheter is essential for immediate remobilization and efficient resumption of rehabilitation during the first postoperative days. Intensive rehabilitation is integral to the treatment design, preventing postoperative loss of joint amplitude and enabling rapid recovery of walking and normal ankle function.

The present study is limited by the small series, with varying etiology (joint fracture sequelae, osteochondral lesions, ligament trauma sequelae), and short follow-up: over the longer term there may be greater loss of mobility, especially in case of degenerative osteochondral lesion. However, this simple procedure, by anterior arthroscopy, provides significant rapid functional benefit in terms of both anterior impingement pain and stiffness, and should be reserved for bony anterior impingement with poorly tolerated stiffness.

Conclusion

Arthroscopic management of anterior ankle impingement was very effective in terms of pain but often less so in terms of stiffness. Some patients, however, complain not only of their anterior impingement pain but equally of ankle stiffness. In the particular case of bony anterior impingement with poorly tolerated stiffness, both pain and joint mobility can be improved by simple arthroscopic surgery associating anterior synovectomy, extensive anterior capsulo-ligamentary release and large-scale osteophyte resection. Surgery should be followed by immediate mobilization and in-hospital rehabilitation with control of pain. Short-term results were encouraging, providing clear functional benefit and gain in overall ankle mobility.

Conflict of interest

None.

References


