17 Arthroscopic Treatment of Anterior Ankle Impingement

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17.1 Introduction

Ankle impingements are painful syndromes due to hyperplasic synovitis and fibrotic soft tissues being caught between the ankle and hindfoot bony surfaces during ankle motion. Basically anterior ankle impingements occur after injuries or supination trauma and can be localized either on the anteromedial or the antero-lateral part of the ankle joint. Diagnosis of ankle impingement is clinical: palpation associated to passive mobilization of the ankle reproduces the localized pain recognized by the patient. Local injection is an important step not only to confirm the diagnosis but also to definitely remove painful symptoms in some cases.

17.2 Distinction Between Anteromedial and Antero-lateral Ankle Impingement Syndrome (ALAIS)

Antero-lateral ankle impingement syndrome (ALAIS) manifests as anterior ankle pain at the talo-fibular groove. A distinction is classically made based on whether the impingement is due to bone or soft tissue [1–9]. Bony impingement is caused by osteophytes originating at the anterior tibial margin and talar neck [10]. However, whereas anteromedial ankle impingement syndrome usually involves tibial and talar osteophytes, ALAIS is usually due only to soft tissue interposition. The first report of ALAIS, written in 1950 by Wollin, describes joint invasion by a mass of connective tissue originating from the anterior talo-fibular ligament (ATFL) [11]. In 1991, Ferkel and Scranton provided further details on the pathophysiology of ALAIS [1]. The inciting event is an ankle sprain with injury to the ATFL. If ligament healing is incomplete, repeated ankle movements result in synovitis, followed by fibrosis with the development of a soft tissue mass, whose interposition in the joint space causes pain at the talo-fibular groove. Thus, pain due to ALAIS is extremely common and perhaps even inevitable after an ankle sprain, as the ATFL healing process is accompanied with local inflammation. However, the pain is expected to resolve within a few weeks after complete ATFL healing.

ALAIS is closely linked to ATFL injury and, in some patients, to chronic ankle instability. Rotational micro-instability of the ankle is challenging to document. Pain may be the only manifestation, with no objective evidence of laxity, and the presentation is then identical to that of ALAIS.

17.3 Diagnostic Strategy

Diagnosis of an anterior ankle impingement is clinical, and distinction is made with the localization of the pain at palpation: an anteromedial pain

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with osteophytes is an anteromedial ankle impingement and a bony impingement, whereas an antero-lateral pain without osteophyte at palpation is an antero-lateral soft tissue ankle impingement. The diagnosis of ALAIS rests on clinical findings. ALAIS should be considered in patients with persistent pain 6 months after appropriate treatment of an inversion ankle injury [12]. The reported frequency of ALAIS after ankle sprains is 1–2% but is no doubt considerably underestimated [12–14].

The clinical manifestations of ALAIS [1, 5, 15, 16] include range-of-motion limitation, a swelling in the antero-lateral groove, and a locking sensation or snapping during dorsiflexion and eversion of the foot. The best diagnostic test is the Molloy test, which is 94.8% sensitive and 88% specific for ALAIS [17]. The examiner places the foot in forced dorsiflexion while applying pressure to the antero-lateral groove (Fig. 17.1). The test is positive if this maneuver replicates the usual pain.

Fig. 17.1 Molloy test: the examiner applies pressure to the antero-lateral groove while moving the ankle into forced dorsiflexion

Fig. 17.2 X-rays lateral ankle view: anterior bony impingement

Anteroposterior and lateral radiographs of the ankle rule out bony impingement (Fig. 17.2) and osteochondroma and may provide suggestive evidence of an osteochondral lesion [18]. Ultrasonography documents the soft tissue impingement. A heterogeneous mass larger than 7 mm in diameter is visible at the antero-lateral corner of the ankle [19, 20]. The mass is hypervascular by Doppler ultrasonography. Performing the Molloy test during ultrasonography confirms the soft tissue impingement, with a mass bulging in the antero-lateral groove during ankle dorsiflexion, but fails to add to the physical examination (77% sensitivity and 55% specificity) [19]. Importantly, ultrasonography serves to guide the corticosteroid injection, which is crucial to both the diagnosis and the treatment of ALAIS [20, 21]. Computed tomography (CT) arthrography has 97% sensitivity and 71% specificity for ALAIS. Nodules may be visible in the antero-lateral groove, and the joint capsule contour may appear uneven. However, CT arthrography has little impact on therapeutic decision-making [22]. Magnetic resonance imaging (MRI) contributes little to the diagnosis of ALAIS. Sensitivity has ranged from 39 to 100% and specificity from 50 to 100% [23–28]. MR arthrography performs better, however, with 96% sensitivity and 97% specificity [29].

Liu et al. defined six clinical criteria for the diagnosis of ALAIS [4]: persistent antero-lateral pain after a sprain of the lateral collateral ligaments, antero-lateral effusion and swelling, recurrent tibio-talar pain after exercising, antero-lateral pain during dorsi- flexion with eversion, pain during single-leg squats, and absence of lateral laxity. Patients with at least five of these criteria were diagnosed with ALAIS [4]. These criteria require the elimination of ankle instability based on the absence of objective lateral laxity. They do not consider rotational micro-instability, which is difficult to establish clinically. The six criteria may be met in patients with true rotational micro-instability who have no symptoms other than those of ALAIS. The physical examination alone has 94% sensitivity and 75% specificity for the diagnosis of ALAIS [4, 30].

17.4 Arthroscopic Treatment

Anterior ankle impingement surgical treatment is performed as an arthroscopic procedure. The standard patient installation for anterior ankle arthroscopy is used, without joint distraction. Two portals are created, one anteromedial and the other antero-lateral. The arthroscope is 4.0 mm in diameter. The instruments (hook probe, 4.0-mm power shaver, power scalpel) are introduced through an antero-lateral portal created under direct visual guidance after insertion of a needle. The anterior part of the joint is cleared with the ankle in forced dorsiflexion until the anterior tibial margin, talar neck, and both malleoli are visible. The fibrous and inflammatory tissue is removed completely, to make the bony landmarks and any osteophytes clearly visible.

In patients with anteromedial bony impingement, an anterior synovectomy is first performed and then a complete resection of the tibial and talar osteophytes after complete visualization. Osteophyte resection is begun at the level of the origin of the bone spur (anterior tibial margin or talar neck) with a progression from its insertion to the articular surface: thus for a tibial osteophyte the resection is performed from proximal to distal, and for a talar osteophyte, the resection is performed from distal to proximal (Fig. 17.3a–c). With this technique a complete and flat resection of the osteophyte can be achieved without residual bone spur that can lead to a recurrent anterior ankle impingement syndrome (Fig. 17.4a, b). In case of malleolar osteophytes (at the tip and anterior margin of the medial malleolus), after resection of the osteophyte, a large resection of the anterior surface and tip of the medial malleolus is made in order to decrease the volume of the medial malleolus and avoid anteromedial remnant impingement in dorsiflexion and inversion.

In patients with ALAIS, arthroscopy may show several abnormalities, which are often present in combination: focal or extensive inflammation of the synovial membrane, which has a pinkish-purple hue; one or more bands of scar tissue, in some cases with a meniscoid appearance at the level of the distal band of the antero-inferior tibio-fibular ligament; osteophytes arising from the anterior margin of the distal tibia and neck of the talus, best seen with the ankle in forced dorsiflexion; ossifications at the anterior edge and tip of the lateral malleolus; and osteochondral loose bodies in the anterior talo-fibular groove.

The resection is started at the distal band of the anteroinferior tibio-fibular ligament in order to visualize this major anatomical landmark. The synovectomy is then extended to the antero-lateral corner of the ankle and, subsequently, to the anterior tibio-talar compartment and antero-lateral groove.

At the antero-lateral groove, the resection of synovial membrane and fibrous tissue should be stopped at the upper edge of the ATFL, which should be identified routinely. At this point, the risk is excessive extension of the synovectomy, with partial or complete resection of the ATFL, which would worsen any pre-existing instability and, even more importantly, result in persistent pain from ALAIS.

After starting the synovectomy, the crucial step in the arthroscopy procedure is a visual assessment of the antero-lateral groove with detection of any ATFL lesions. Following the anteroinferior tibio-fibular ligament in the medial-to-lateral direction leads to the ATFL, where any lesions can be assessed visually and with the probe [31, 32]. Distension of the ligament plane should be sought, as well as detachment from the malleolus (by inserting the hook between the anterior mal-

Fig. 17.3 (**a–c**) Arthroscopic technique of anterior ankle osteophyte resection from its implantation in the direction of the articular surface to achieve a complete resection

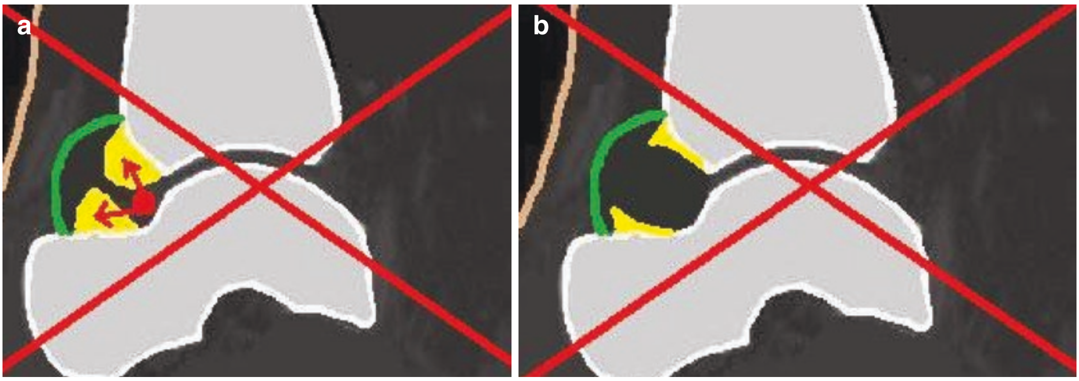

Fig. 17.4 (**a**, **b**) Bad technique of osteophyte resection (beginning at the joint line) with risk of residual osteophyte

leolar edge and the ATFL), talar avulsion, and a tear in the body of the ligament (which is less common). The quality of the residual ATFL should be assessed as thinned, discontinuous and irregular, or thick and strong [32]. Appropriate repair of any ATFL lesions seems reasonable [33].

17.5 Outcomes of Surgical Treatment: Literature Review

In early studies of arthroscopic methods for treating ALAIS, outcomes were good or excellent in over 60% of cases, with a complication rate ranging from 10 to 15% (nerve injury, superficial surgical-site infection) [4]. In more recent studies, the rate of good or excellent outcomes was 67–100%, and complications were considerably less common than with open surgery and in early studies of arthroscopic treatment [3, 5, 8, 34, 35]. Anterior bony impingement involving osteophytes had the best prognosis, with over 80% of good or excellent outcomes [3, 5, 9, 35–37]. Compared to open surgical treatment of ALAIS, the time to recovery is halved with arthroscopic treatment, and the time to sports resumption is decreased by about 1 month [35]. An important distinction is between isolated anterior impingement, in which a good outcome can be expected, and impingement due to osteophytes occurring as an early manifestation of tibio-talar cartilage degeneration, which has a more reserved prognosis. Tol et al. and van Dijk [27, 35] reported that the proportion of patients with good or excellent outcomes after arthroscopic treatment for anterior osteophytes was 82% when the joint space was intact compared to only 50% in the event of joint space narrowing. In the medium or long term, however, no progression of the cartilage lesions occurs after arthroscopic treatment for ALAIS, and about two-thirds of patients remain satisfied or very satisfied for many years despite experiencing functional impairments [35]. Furthermore, although the osteophytes recur within a few years after the arthroscopic procedure, most patients remain free of symptoms, indicating that the ankle pain is not caused by the osteophytes but, instead, by pinching of the synovial membrane and synovitis [35]. A multicenter study reported in 2007 identified three predictors of arthroscopic treatment failure in patients with ALAIS [36]: older age (mean age at surgery was 46 years in patients with poor outcomes and 34 years in those with good or excellent outcomes), longer trauma-to-surgery time (mean was 33 months in the group with poor outcomes and 20 months in the group with good or excellent outcomes), and cartilage damage (grade 2 lesions were present in 50% of patients with poor outcomes compared to only 18% of those with good or excellent outcomes).

Arthroscopic treatment of ALAIS is extremely effective in relieving the anterior ankle pain, allowing a return to previous activities, providing a good subjective outcome, and improving range of motion. Mobility can be maximized by extensive capsule and ligament release combined with extensive resection of any anterior osteophytes [37]. The low complication rate is among the main advantages of arthroscopic treatment. Proper arthroscopic technique must be followed to avoid injury to nerves and tendons.

In a recent systematic review of arthroscopic treatment for anterior ankle impingement syndrome, outcomes did not differ significantly between antero-lateral and anteromedial impingement, bony and soft tissue impingement, or impingement with versus without concomitant lesions [38]. The main published studies pooled all types of anterior ankle impingement and thus provided no specific data on ALAIS.

17.6 Concept of Rotational Ankle Micro-instability

Rotational ankle micro-instability is defined as any combination of chronic ankle instability symptoms with no objective evidence of forced varus or anterior-drawer laxity. The symptoms may consist of recurrent ankle sprains, weakness of the ankle, ankle pain and instability, and manifestations of ALAIS. No anterior or lateral laxity is found upon physical examination or imaging studies. Use of the term "functional instability" to designate this presentation, as opposed to "mechanical instability" (with objective laxity), in the English-language literature adds to the confusion. In a study by Takao et al. of 14 patients with functional instability, arthroscopy consistently showed lesions of the ATFL (partial fibrosis, $n = 9$; total fibrosis, $n = 3$; and detachment, $n = 2$) [39]. More recently, Vega et al. reported findings in 38 patients with ALAIS and functional instability who underwent arthroscopic surgery [40]. Only half the patients had evidence of synovitis. However, proximal detachment and fibrosis of the ATFL were noted in 60% and 50% of patients, respectively. These recent data confirm the very high prevalence of ATFL lesions in patients with ALAIS. Most of the studies reporting outcomes in patients treated for ALAIS did not consider micro-instability, which is a recent concept. Thus, for many years, ALAIS was described under the assumption that the absence of objective laxity ruled out ankle instability. Although outcomes of anterior ankle impingement overall are generally described as good, the data are less clear for ALAIS. Most importantly, although the symptoms of ALAIS originate in ATFL lesions, the treatment and outcome of these are only very rarely discussed in the literature [1]. This underestimation of the close intertwining between ATFL lesions and ALAIS is probably ascribable to the definition of ALAIS, which excludes ankle instability, and to the techniques used early in the development of anterior ankle arthroscopy (traction, 2.7-mm arthroscope).

Advances in ankle arthroscopy have improved the ability to explore the talo-fibular groove and lateral ligament complex, thus providing new insight into the pathophysiology of ALAIS by demonstrating the key role for ATFL lesions and shedding light on the concept of rotational micro-instability. A new arthroscopic classification of chronic lesions of ATFL in chronic ankle instability has recently been published showing that for early stages of lesions (stage 1 = ATFL distension, stage 2 = ATFL avulsion) it creates a rotational ankle micro-instability with symptoms of ALAIS [41, 42]. This new knowledge has directly affected the therapeutic strategy by supporting the addition of ATFL repair procedures (as appropriate for the observed lesions) in addition to antero-lateral synovectomy. Prospective multicenter studies are under way with the goal of gaining further knowledge about ALAIS and rotational ankle micro-instability and of obtaining details on outcomes.

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