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ORIGINAL STUDY

Combined anterior talofibular ligament (ATFL) lesion and anterolateral syndesmotic impingement after ankle sprain trauma in runners

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Anterior inferior tibiofibular ligament (AITFL) lesion have been shown to result in proliferation of cicatricial tissue ; concomitant insufficiency of the anterior talofibular ligament (ATFL) and AITFL Lesion may cause anterolateral syndesmotic impingement in the ankle joint of runners.

Twenty-two runners with suspected syndesmotic impingement after ankle sprain were included in the study. An MRI of the ankle joint was performed followed by arthroscopy.

Arthroscopy revealed an ATFL lesion in 20 patients (87%) and anterolateral syndesmotic impingement in 17 patients (77%). An ATFL lesion was detected in all patients with anterolateral syndesmotic impingement. The sensitivity of MRI was 24% (4 patients) on detecting anterolateral syndesmotic impingement, and 25% (5 patients) on ATFL lesion.

A traumatic sprain of the ankle frequently results in a combined ATFL lesion and anterolateral syndesmotic impingement in runners. The abilities of MRI to detect this combined pathology are limited. Arthroscopy of the ankle joint should be performed.

Keywords : Syndesmotic impingement ; anterior talofibular ligament ; lateral ankle ligament ; ankle sprain ; arthroscopy.

Study Design : Case series ; level of evidence 4.

INTRODUCTION

Syndesmotic impingement is frequently preceded by an ankle sprain *(3,7,17)*. The painful impingement is associated with recurrent giving-way attacks in supination-inversion. In clinical routine it has been difficult to obtain diagnostic evidence of suspected anterolateral syndesmotic impingement and ATFL instability after an ankle sprain. Variations of intraarticular portions of the anterior syndesmosis, responsible for anterolateral syndesmotic impingement, have been described in several anatomical studies *(1-3)*.

Pretterklieber claims that these structures constitute an anterior meniscus, connected to the fibrous part of the joint capsule *(20)*.

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According to histological studies these tissue samples are clearly vascularized and contain synovial cells, resulting in substantial pain in the event of a lesion *(6,14)*. The release of cytokines due to injury to these structures leads to painful synovitis *(14-16)*.

Nikolopoulos et al.*(17)* identified the so-called accessory anteroinferior tibiofibular ligament as a separate ligament, whereas Basset et al. *(3)* introduced the term "distal fascicle of the AITFL". The prevalence of this anatomic structure varies between 22% and 92% *(1,3,17,21,25)*. Despite the fact that Bassett´s ligament can be visualized in the sagittal and axial plane, and almost its entire course on a single image in the coronal plane, Subhas N. et al. *(25)* noted that even altered Bassett's ligaments were missed on prospective MRI investigations prior to their detection in surgery. In a retrospective study the authors showed that patients with an abnormal Bassett's ligament at surgery have mostly thicker ligaments on MRI compared to controls, and also claimed that Bassett´s ligaments were routinely visualized in 89% of their cases on non-enhanced MRI of the ankle using standard protocols *(25)*.

An ankle sprain and its resulting hypertrophic fibrofatty tissue plays a main role in the anterolateral syndesmotic impingement syndrome *(2)*. Regrowth of a previously resected plica causing anterolateral impingement was demonstrated in animals and described by Lidtke and George *(14)*. Proliferative cicatricial tissue as a result of an AITFL lesion causing anterolateral impingement has been described in the past *(12)*. Anterolateral insertion of the AITFL fascicle was demonstrated at the anteromedial corner of the lateral malleolus. In many cases it cannot be distinguished from the proximal insertion of the ATFL (Figure 1).

This fact could be responsible for a combined lesion of ATFL and the AITFL in ankle sprains, and the anterolateral impingement effect *(1,6,7,9,11, 13,22,26)*. Increasing anterior talus drawer in plantar flexion in runners might be one of the reasons for a higher incidence of anterolateral syndesmotic impingement in case of ATFL instability.

A greater plantarflexion of the ankle joint and a higher knee flexion angle can often be seen at initial ground contact while running. This strike pattern is

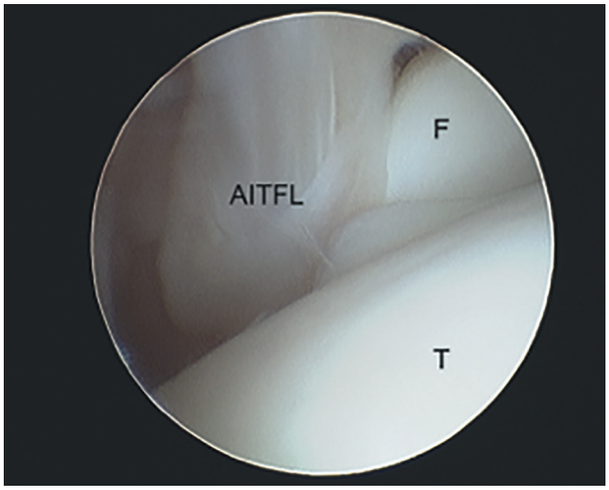

Fig. 1. — View from the anterocentral arthroscopic portal: AITFL (anterior inferior tibiofibular ligament, F : fibula, T : talus.

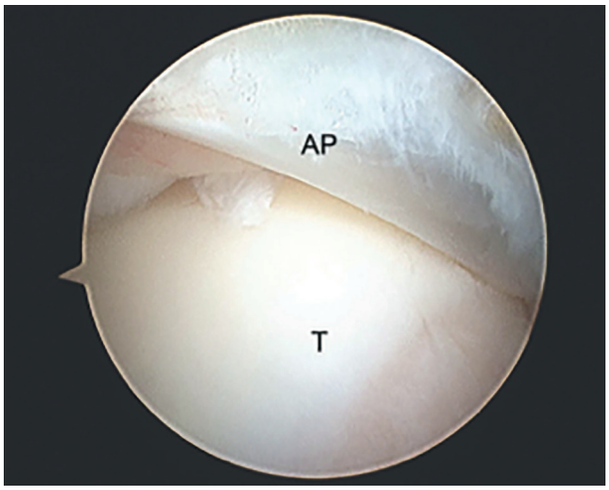

Fig. 2. — Anterolateral syndesmotic impingement. AP : anterolateral plica, T : talus.

believed to ensure better proportional distribution of energy loads and therefore improve suspension of increasing impact forces *(5)*. Increasing impact as well as a higher torque affecting the ankle joint at the beginning of stance phase could force the talus in an anterior drawer regarding translational movement.

Insufficiency of the ATFL results in an increased anterior talus drawer under load, which can be easily followed in arthroscopy.

Early contact between the talus and the distal fascicle of the AITFL may cause cartilage lesions in

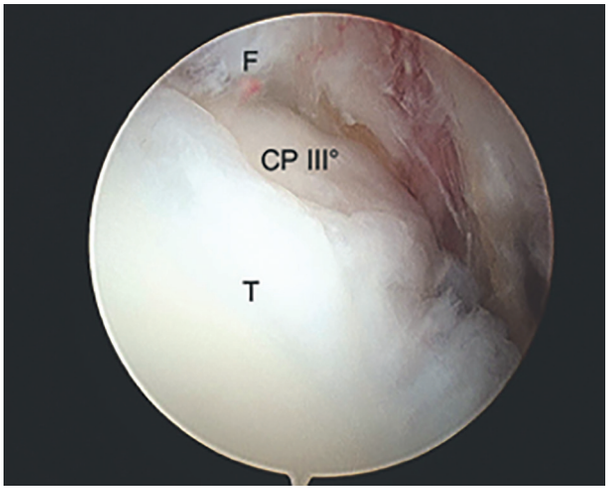

Fig. 3. — View of the anterolateral talus. Cartilage damage. CP III : grade III chondropathy, F : fibula, T : talus.

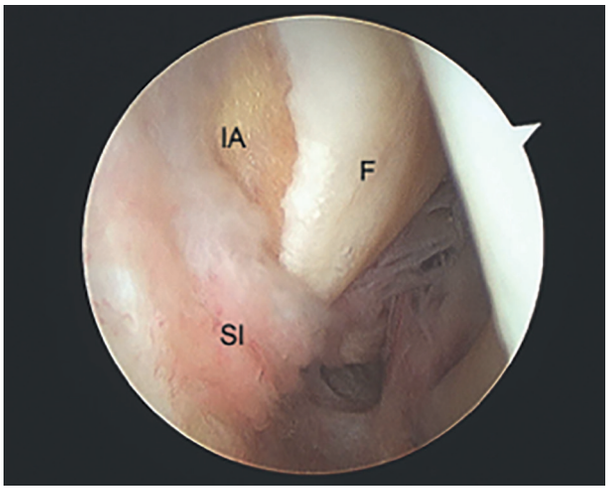

Fig. 4. — View in the anterolateral recess : IA : proximal avulsion of ATFL, F : fibula, SI : synovitis

the anterolateral talus (Figure 2, 3). An ATFL lesion has been reported in some patients with anterolateral syndesmotic impingement (Figure 4) *(27)*.

The purpose of the present study was to determine the combined ATFL lesion and anterolateral syndesmotic impingement after ankle sprain trauma in runners and the role of MRI – compared to ankle arthroscopy – in detecting this combined pathology.

MATERIALS AND METHODS

Patients with typical snapping during foot roll-over or a popping phenomenon in dorsiflexion, with pain and tenderness in the anterolateral gutter, were considered eligible for the study. Twenty-two runners with an average age of 31.4 years (range, 21-46) were used in this study. Inclusion criteria consisted of suspected syndesmotic impingement, persisting pain in the anterolateral mortise in plantar flexion despite anti-inflammatory injections, a major ankle sprain in the six months preceding the observed symptoms and a weekly running mileage of at least 15 km. The clinical examination was performed by two experienced orthopedic surgeons, followed by MRI of the ankle joint. A 3.0 Tesla MR scanner (Magnetom Trio ; Siemens Medical Solutions, Erlangen, Germany) was used.

All MR images were obtained with an eight-channel high-resolution small field-of-view (FoV) imaging coil for the foot and ankle (Invivo, Gainesville, FL, USA). This dedicated phased array coil utilizes the capabilities of the eight-channel system, including parallel imaging. Owing to its boot-shaped design it slides down easily over the foot and the ankle, which can be fixed, and thus causes less motion artefacts. Patients were scanned with the ankle fixed in neutral position. The ATFL and the AITFL are best seen in the axial plane (T2- and T1-weighted) with the foot in neutral position. Two senior radiologists with experience in musculoskeletal imaging evaluated the images. Anterior arthroscopy of the talocrural joint was performed over an anterocentral, anterolateral and anteromedial portal to confirm the diagnosis and treat the patient's complaints with resection of impinging intraarticular syndesmotic tissue. Lateral and medial ligaments as well as the anterior and posterior syndesmosis were investigated concerning course, structure and stability. Abrasion of the anterolateral talus caused by intraarticular portions of AITFL, either in dorsiflexion or in plantarflexion, were interpreted as impingement. Avulsion of the proximal insertion of the ATFL, missing ligament tension in supination/inversion, rupture in the ligament course or the complete missing of the ligament in the pathway, were defined as ATFL lesion in arthroscopy and a plica causing anterolateral impingement was resected in the same session. A widening of the inferior tibiofibular joint by more than 3 mm while inserting a probe during

arthroscopic examination was interpreted as anterior syndesmotic instability *(8)*.

The sensitivity and specificity of the MRI was determined and correlated with the outcome of arthroscopy. The study was approved by the ethics committee of the medical university of Vienna and informed consent was obtained from all patients prior to enrolment in the study.

RESULTS

Twenty-two patients with suspected combined syndesmotic impingement and ATFL insufficiency underwent clinical examination. Arthroscopy of the ankle confirmed syndesmotic impingement during dorsiflexion and/or plantarflexion in 17 patients (77%), and an ATFL lesion in 20 patients (87%). A widening of the anterior inferior tibiofibular joint after plica resection was found in 6 out of 17 patients (35%) with syndesmotic impingement. The intraarticular portion of the PITFL (posterior inferior tibiofibular ligament) was intact in all patients during arthroscopic examination. (Table 1) Intraarticular Hämarthros as a primary complication after surgery was seen in 1 Patient and disappeared after 5 days. Cartilage laesions of the talus in the anterolateral gutter could be observed in 4 patients while performing arthroscopy. Giving-way attacks were reported in 4 cases in a period of 24 months after arthroscopy.

Table 1 — Patient data and affected structures according to arthroscopical

Examination	
Patients (n=22)	
Age (years)	21-46
Affected structures (n)	
ATFL	20
PITFL	0
ASI	17
Syndesmotic widening	6
Cartilage laesions	4
Complications (n)	
Intraarticular haemarthros	1
Consistent GW attacks	4
Impaired wound repair	0
ATFL anterior tibiofibular ligament, *PITFL* posterior inferior tibiofibular ligament,	
ASI anterolateral syndesmotic impingement, *GW* giving-way attacks	

Sensitivity

The sensitivity of MRI was determined by the proportion of patients with positive results on MRI and arthroscopy compared to all patients with positive results on arthroscopy ; estimates and lower and upper 95% confidence limits are reported. The sensitivity of MRI compared to arthroscopy in regard of an ATFL lesion was as low as 25%, with 5 positive cases. The sensitivity of MRI in regard of anterolateral syndesmotic impingement was 24%, with 4 positive cases. (Figure 5)

Specificity

The specificity of MRI was determined by the proportion of patients with negative results on MRI compared to all patients with negative results on arthroscopy ; estimates and lower and upper 95% confidence limits are reported. The specificity of MRI, compared to arthroscopy, in detecting an ATFL lesion as well as anterolateral syndesmotic impingement is 100% (Figure 5).

DISCUSSION

The most notable finding in our study was the combined presence of an ATFL Lesion and anterolateral syndesmotic impingement after ankle sprain in runners. The ATFL Lesion resulting in an increased talus drawer in plantar flexion and early contact between the anterolateral talus and the distal fascicle of the AITFL was detected by arthroscopy in a high number of patients. An ATFL lesion was observed in all patients with anterolateral Syndesmotic Impingement. Instability of the anterior inferior tibiofibular joint after plica resection was only increased in a low number of patients. The sensitivity of MRI in detecting ATFL lesion as well as syndesmotic impingement was unsatisfactory.

The limited abilities of MRI in demonstrating the above mentioned pathologies has been mentioned

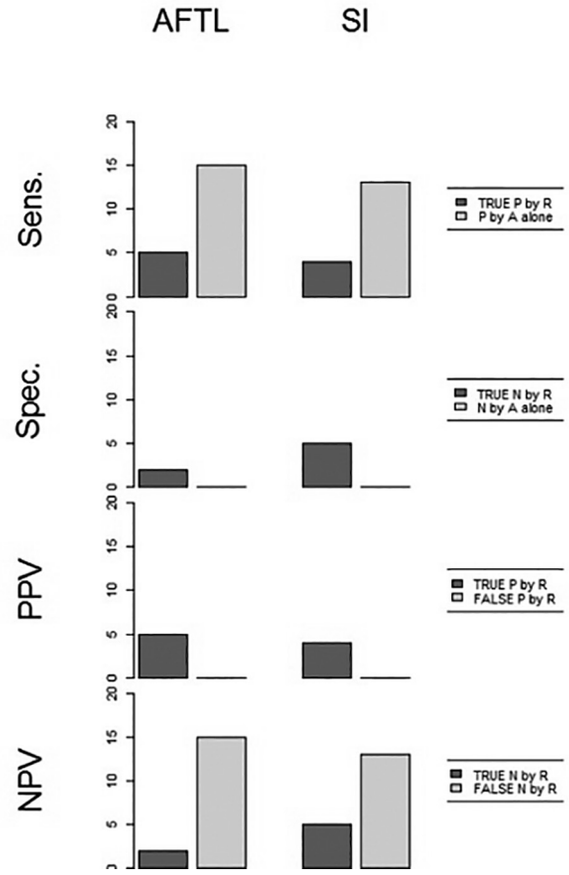

Fig. 5. — The sensitivity, specificity, positive and negative predictive value of radiology are shown by comparison with the results of arthroscopy. *Sensitivity* : True positive results of radiology, shown as green bars, are contrasted with false negatives, i.e. results identified as positive by arthroscopy but not by radiology. *Specificity* : True negative results of radiology, shown as green bars, are contrasted with false positives, i.e. results identified as negative by arthroscopy but not by radiology. Positive predictive value (PPV) : True positive results of radiology, shown as green bars, are contrasted with false positives, i.e. results identified as negative by arthroscopy and as positive by radiology. *Negative predictive value (NPV)* : True negative results of radiology, shown as green bars, are contrasted with false negatives, i.e. results identified as positive by arthroscopy and as negative by radiology.

by several authors *(4,8,10,18,19,24,25)*. Variations in the dimensions of the anterolateral plica appear to play a major role in the diagnosis of syndesmotic impingement and could be one reason for lower sensitivity of MRI in our study. The length of the anterolateral plica is reported to vary between 10 and 24 mm ; it is 1 to 2 mm thick and 3 to 7 mm wide *(1,3)*. Akseki et al. *(1)* suspected spatial widening to be a predisposing factor and associated the higher risk of impingement with the increase in the length and width of the plica. In a retrospective study Subhas, N., et al. *(25)* showed that patients with an abnormal Bassett's ligament at surgery have mostly thicker ligaments on MRI compared to controls. Moreover, the data obtained by Robinson P et al. *(23)* support the role of MR arthrography in confirming the presence of soft-tissue scarring and demonstrating its extent in patients with anterolateral impingement prior to arthroscopy. However, the role of the ATFL lesion as a predisposing factor for syndesmotic impingement in runners has not been clearly defined earlier. Far distal and anterolateral fibular insertion of the AITFL near to the ATFL could be responsible for a combined lesion of the ATFL and AITFL in ankle sprain trauma *(1,6,7,9,11,13,22,26)*.

A major ankle sprain in the six months preceding the observed symptoms was reported for all patients in the present study. Anterolateral impingement was triggered in dorsi- and/or plantarflexion on clinical examination. Dorsiflexion of the ankle joint provoking anterolateral syndesmotic impingement has been described in previous studies *(1,7,9,13,22)*. Widening of the ankle mortise with posterior glide and external rotation of the lateral malleolus in dorsiflexion and increased extension on the anterolateral plica could be one explanation for this phenomenon *(2)*. In this setting similar symptoms caused by abrasion of the anterolateral talus in plantar flexion secondary to syndesmotic impingement could be rightly interpreted as impingement.

A plica causing anterolateral impingement was resected in arthroscopy (Figure 6). Reconstruction of the ATFL and stabilization of the AITFL was not performed in any patient. Postoperatively, after a brief period of pain-adapted weightbearing the patients were scheduled to undergo physiotherapy. A specific coordinative and proprioceptive therapy program was used. The large majority of patients could return to sports after three months. Giving-way attacks were reported in 4 cases in a period of 24 months after arthroscopy. Those patients could be treated nonoperatively by undergoing physiotherapy.

The limitations of the present study are the small number of patients and the absence of a control

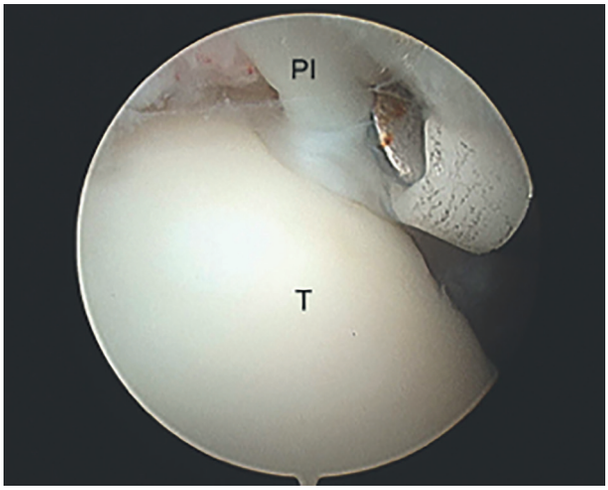

Fig. 6. — Resection of the anterolateral plica. Pl : plica, T : talus

group. Retrospective arthroscopic studies including patients with and without a lesion of the ATFL will be necessary to analyze the insufficiency of the ATFL and its role as a predisposing factor in anterolateral impingement syndrome, especially in runners.

Furthermore, the dimensions of the anterolateral plica, especially in cases of existing cartilage defects in the anterolateral talus, should be considered. Tissue samples should be taken and subjected to histological investigation in order to detect scar tissue proliferation of the AITFL after ankle sprain trauma

CONCLUSION

Impression is given that ATFL Lesions and anterolateral syndesmotic impingement are equally frequent after ankle sprain trauma in runners. Associated AITFL instability is seldom recognized in arthroscopic investigation. The sensitivity of MRI in detecting anterolateral syndesmotic impingement and an ATFL lesion is poor. Arthrography of the talocrural joint should be considered in cases of suspected combined syndesmotic impingement and ATFL lesion.

An arthroscopy of the ankle joint is essential to achieve reliable evidence of both, anterolateral impingement as well as an ATFL lesion and subsequent institute appropriate treatment in the same session. Stabilising surgery for ATFL and AITFL is only indicated in cases of chronic instability in the ankle joint despite proprioceptive therapy.

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