

# Clinical application of arthroscopy in the diagnosis and treatment of anterior impingement syndrome of the ankle joint in physical workers

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## ABSTRACT

**الأهداف:** تقييم التطبيق السريري لعملية تنظيف المفاصل أثناء تشخيص وعلاج المتلازمة الأمامية لانحشار مفصل الركبة بين العمال.

**الطريقة:** أُجريت هذه الدراسة الاسترجاعية في قسم تقويم العظام في المستشفى الأول التابع لجامعة هانغني بانغ، الصين وذلك خلال الفترة من مارس 2005م إلى ديسمبر 2011م. شملت الدراسة 17 حالة مصابة بالمتلازمة الأمامية لانحشار مفصل الركبة، وقد تم علاجها باستخدام تنظيف المفاصل. ولقد تمت متابعة هؤلاء المرضى بعد عملية التنظيف، كما تم استرجاع كافة التفاصيل السريرية لهم وكيفية سير المرض. وتم تقييم فعالية التشخيص من خلال مقياس الجمعية الأمريكية للركبة وخلف القدم، أما تحسن الألم فقد تم تقييمه باستخدام المقياس التمثيلي البصري.

**النتائج:** أشارت نتائج الدراسة إلى ظهور المتلازمة الأمامية الجنبية لانحشار مفصل الركبة لدى 11 مريض، والمتلازمة الأمامية الأنسية لانحشار مفصل الركبة لدى 4 مرضى، فيما ظهرت المتلازمة الأمامية لانحشار مفصل الركبة لدى مريضين وذلك باستخدام التنظيف المفصلي. ولقد قلت درجات المقياس التمثيلي البصري من 1.1-5.2، فيما زادت درجات مقياس الجمعية الأمريكية للركبة وخلف القدم من 76.4-95.8 بعد عملية التنظيف، وقد كان هناك اختلافاً واضحاً من الناحية الإحصائية بين درجات هذين المقياسين قبل وبعد عملية التنظيف. وقد كان تضرر الغضروف التابع من أهم المؤشرات الدالة على سوء سير المرض بعد العلاج.

**خاتمة:** أظهرت هذه الدراسة بأنه يمكن تحقيق نتائج مرضية بعد استخدام التنظيف لعلاج العمال المصابين بالمتلازمة الأمامية لانحشار مفصل الركبة. ويمكن التنبؤ بوجود تضرر الغضروف التابع الذي يعد من العوامل الدالة على سوء سير هذا المرض.

**Objective:** To evaluate the clinical application of arthroscopy in the diagnosis and treatment of anterior impingement syndrome of the ankle joint in physical workers.

**Methods:** A retrospective study was carried out at the Department of Orthopedics, the First Hospital affiliated to Nanhua University, Hengyang, China from March 2005 to December 2011. Seventeen cases of anterior impingement syndrome of the ankle joint were confirmed, and treated through arthroscopy. All these patients conformed to regular follow-up postoperatively, and clinical details, as well as postoperative prognosis were retrieved and analyzed retrospectively. The efficacy was evaluated by the American Orthopedic Foot and Ankle Society (AOFAS) hindfoot-ankle scoring system, and pain relief was assessed by visual analogue scoring (VAS).

**Results:** Anterolateral impingement syndrome was found in 11 patients, anteromedial impingement syndrome in 4, while anterior impingement syndrome in 2 via arthroscopic examination. The VAS was reduced from 5.2-1.1, and the AOFAS score was elevated from 76.4-95.8 postoperatively; both of which demonstrated statistical differences when compared to preoperative scores. It was also found that concomitant cartilage damage was an indicator of poor prognosis in arthroscopic treatment of impingement syndrome of the ankle joint.

**Conclusion:** Satisfactory results could be achieved for physical workers with anterior impingement syndrome treated by arthroscopy. As the cartilage damage is an indicator of poor prognosis, an early operation is advocated when the prognosis of anterior impingement syndrome is confirmed.

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Anterior impingement syndrome (AIS) of the ankle joint can be induced by various reasons, such as entrapment of surrounding soft tissue and formation of talotibial osteophytes, which can result in painful disorders and joint dysfunction.<sup>1,2</sup> The disease is common in clinics with the main manifestations of ankle joint pain, swelling, and restricted motion of the joint. Although magnetic resonance imaging (MRI) can provide significant information for diagnosis, it has been proved that MRI is not a necessity.<sup>3-6</sup> Conservative treatment for anterior impingement syndrome of the ankle joint comprises of protection with orthosis, medication, intra-articular injection of steroids, however, the therapeutic effects by these means are reportedly unsatisfactory.<sup>7</sup> With the advancement of arthroscopic technique, a smart surgery could be employed to deal with disorders in the ankle joint, which is traditionally thought to be quite difficult for the narrow joint space and bypassing structures. Currently, operative treatments using specially-designed arthroscopy could achieve clearing and removal of entrapped tissue, and osteophyte for patients with remarkable symptoms. However, there are few reports concerning arthroscopic treatment of anterior impingement of the ankle joint in physical workers, and clinical results and prognosis are poorly revealed. A series of physical workers with anterior impingement syndrome of the ankle was treated consecutively through arthroscopy in our institute, and they conformed to regular follow-up postoperatively from March 2005 to May 2010. These patients had completed medical record and results of functional evaluation. The current research aimed to evaluate arthroscopic treatment of AIS in physical workers retrospectively.

**Methods.** This is a retrospective study designed to investigate the functional results of AIS treated by ankle arthroscopy. The study was conducted in the Department of Orthopedics, the First Hospital Affiliated to Nanhua University, Hengyang, China from March 2005 to December 2011. The ethics committee of our hospital has approved the study, and the patients have been informed that the material would be sent for possible publication.

**Clinical data.** There were 17 patients with completed clinical data for current study, and 10 of

them were porters, while 7 were mineworkers. There were 12 males and 5 females, with an average age of 36.8 years old (range; 16-50). The mechanism included inversion injury in 10 cases, eversion injury in 4 cases, and undefined reasons in 3. The duration of pain was from 7-61 months. The clinical manifestation was characterized by ankle joint pain, swelling, recurrence, and deterioration on activities regardless of the post-injury term. Physical examination showed swelling on anterolateral or anteromedial aspect with tenderness, and squat test positive. Within these 17 cases, there were 11 cases that had a limitation of ankle dorsiflexion. All patients underwent the conventional plain radiograph examination preoperatively, which disclosed intra-articular corpus liberum in one patient. The MRI in 15 patients disclosed soft tissue embedded in the ankle joint space, which showed low signal in T<sub>1</sub>WI, while high signal in T<sub>2</sub>WI. Four patients had signal change in articular cartilage of talus. Patients were included in current research if they met the following criteria: 1) having a job as a physical worker; 2) persistent pain in the anterolateral, anteromedial, or anterior aspect of the ankle; 3) unsatisfactory results following conservative treatment for the pain; and 4) with a postoperative follow-up of at least 12 months.

**Diagnosis.** All patients complained of pain, swelling in 12, and instability in 6. The pain is usually located at the anterior talotibial sulcus on forcible passive dorsiflexion of the ankle. Restricted plantar flexion and local swelling were valuable for clinical diagnosis as well. The diagnosis was confirmed by combination of clinical examination and radiological findings, which showed anterior tibial and occasionally corresponding talar neck exostoses. Although MRI was not a necessity, it was employed in 15 patients for detection of disorders in cartilage and soft tissue (Figure 1). All patients further confirmed the diagnosis of anterior impingement of the ankle joint in an alternative way, namely, intraoperative examination through arthroscopy.

**Preoperative preparation.** Radiological examination to the ankle in anteroposterior and lateral view was necessary. Moreover, laboratory examination including blood cell count, anti-streptolysin O (ASO), rheumatic factor (RF), erythrocyte sedimentation ratio (ESR), and C-reactive protein (CRP) was employed preoperatively for the purpose of differentiated diagnosis. Conventional antifungal therapies were applied to dermatomycosis when necessary. Three days before the surgery, the patients started to soak their feet in diluted potassium permanganate for 20 minutes once or twice per day, and the toenails were trimmed on the operation day.

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**Surgical technique.** Under spinal or epidural anesthesia, the patient was positioned supine, and the upper leg was placed horizontally in a thigh holder with the leg hanging down. The pneumatic tourniquet on the proximal thigh was inflated after exsanguination. Similarly as previously reported, the operation was completed following the procedures.<sup>1,2,7</sup> Under continuous distal traction using bandages, the joint was distended with 30 ml of saline before making the classic anteromedial and anterolateral portals. There was an approximately 5 mm skin incision on the plane of ankle joint between the medial tibialis anterior muscle and lateral extensor digitorum muscle. It should be noted that just the dermis was incised, and subcutis was dissected with a small hemostat, in order to avoid damaging the subcutaneous structures. The joint was entered with a blunt trocar to protect the cartilage from scarring. An anterior synovectomy was carried out with a full-radius resector to get a panoramic view of the anterior joint borders, followed by the removal of the tibial bony spurs with a burr down to healthy bone. Working and viewing portals were switched to get the best exposure during the procedure (Figure 2). If there was a stripped or damaged cartilage, it was cauterized and trimmed with a gasification and plasma scalpel, and a hole was drilled on stripped articular surface using a 1.5 mm Kirschner pin. The motion degree was checked to evaluate the improvement intraoperatively, and then the ankle joint cavity was thoroughly rinsed, the surgical incision was sutured, and the limb was bandaged compressively with an elastic bandage. Postoperative management included local ice-compress, routine anti-infection, detumescence, and oral analgesia treatment for 3-7 days. On the third day after the operation, the bandage was removed, the wound was dressed, the joint cavity was flushed and injected with medical sodium hyaluronate.

**Clinical evaluation.** The operations were performed between March 2005 and May 2010. All patients were evaluated for 12 months, at least. Postoperative follow-up was 27.6 months on average (range; 12-52 months). Local pain and joint function were evaluated using visual analogue scoring (VAS) and American Orthopedic Foot and Ankle Society (AOFAS) scoring system. For VAS, no pain was presented as 0, while the most severe pain was recorded as 10. For AOFAS scoring system, 100 was considered the best functional results. As indicated previously, MRI is not a necessity for the diagnosis of impingement syndrome. Imaging evaluation was not routinely adopted postoperatively.

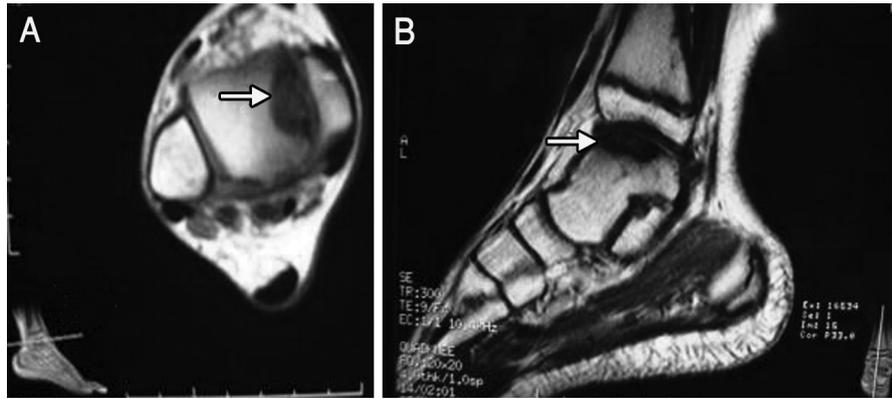
**Statistical analysis.** For statistical analysis, we used the Statistical Package for Social Sciences version 17.0

(SPSS Inc, Chicago, IL, USA). Pre- and post operative AOFAS and VAS scores were compared using Student t-test, and it was considered statistically significant when *P*-value was less than 0.05.

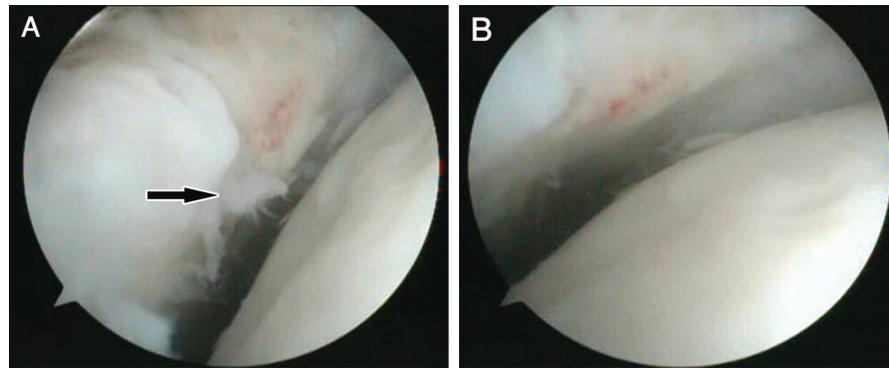
**Results.** All patients with preliminary diagnosis of anterior impingement of the ankle were confirmed though arthroscopic examination. Within 17 cases of anterior impingements, it was found that 11 cases were anterolateral impingement actually, and 4 cases were anteromedial impingement, while 2 cases were anterior impingement (Figure 3). Furthermore, it was revealed that 4 patients had concomitant talar cartilage damage. All patients were followed up for 12-52 months (mean 27.6 months). The pain had been significantly relieved, the swelling subsided, and the maximum range of motion improved, which led the quality of life and locomotion function to improve remarkably. Using the AOFAS hindfoot-ankle score system, the average score was elevated from 76.4±13.4 to 95.8±5.9 points finally, and the VAS score was reduced from 5.2±0.8 to 1.1±1.6 (Table 1). There were statistical differences when preoperative AOFAS and VAS scores were compared to postoperative values (*p*=0.000 for both, Student t-test). For patients with cartilage damage, which was often located on the talus, the improvements of AOFAS and VAS were smaller than those with healthy cartilage. Therefore, it was considered that cartilage damage was a predictor of poor prognosis in patients with anterior impingement syndrome of the ankle.

**Complications.** One patient had mild anterior numbness postoperatively, probably due to pressure on the superficial nerve. There were no other complications intra- and post-operatively.

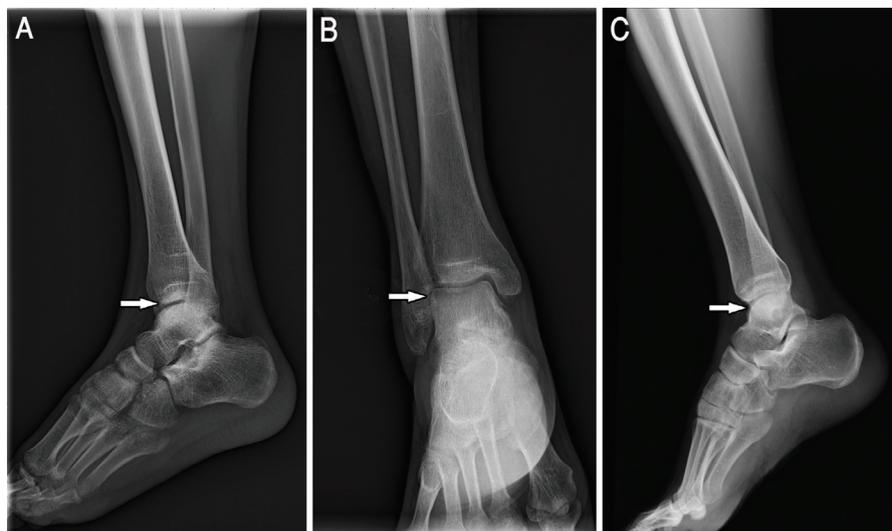
**Discussion.** The ankle joint is the largest bearing hinge joint, and prone to injury during daily work in workers. When the inversion ankle sprain occurs, the vulnerable lower tibiofibular ligament and anterior talofibular ligament tear might occur.<sup>8,9</sup> As a result, the fibrosis scar formation would be induced in late, which might interfere the motion of ankle joint and irritate painful dysfunction. Based on the anatomy of pathogenesis, anterolateral impingements syndrome of ankle joint was named in clinic. While for pronated eversion injury, the deep layer fibers of the triangular ligament are prone to be injured, and its late occurrence of scarring, or small avulsion fracture embedded into tibiofibular joint, which can lead to anteromedial impingements syndrome. Both disorders are called soft tissue impingement syndrome of the ankle. However, when ankle dorsiflexion sprain occurs, the distal tibia



**Figure 1** - A magnetic resonance imaging (MRI) examination of the ankle joint: A) in horizontal plane, high signal in lateral talus indicates that edema is present, which suggests that cartilage damage is involved (arrow); and B) in sagittal, anterior edema of the talus is obvious.



**Figure 2** - Arthroscopic visualization of the ankle joint: A) before debridement, anteromedial aspect of the ankle joint shows soft tissue synovial hyperplasia (arrow); and B) a post-debridement view of the ankle joint shows nothing remains of the soft tissue impingement.



**Figure 3** - Plain radiographs of 3 kinds of anterior impingement syndrome showing: A) anteromedial impingement; B) anterolateral impingement; and C) anterior impingement (arrows).

**Table 1** - Description of the case series in subjects included in a study carried out in the Department of Orthopedics, the First Hospital affiliated to Nanhua University, Hengyang, China.

Patient number	Age	Gender	Side affected	Duration of pain, months	Arthroscopic findings		Follow-up (months)	VAS		AOFAS	
					Impinging lesion	Cartilage damage		Pre-op	Post-op	Pre-op	Post-op
1	27	Male	L	14	Scaring	Absent	18	5	1	81	96
2	31	Male	L	11	Soft tissue sprain	Absent	12	4	0	65	100
3	49	Female	L	52	Osteophyte	Present	24	5	4	70	82
4	16	Male	R	12	Soft tissue sprain	Absent	30	5	0	74	100
5	37	Male	R	25	Soft tissue sprain	Absent	18	6	1	90	100
6	49	Male	L	38	Osteophyte	Absent	24	4	0	86	100
7	46	Male	R	26	Osteophyte	Absent	36	5	0	82	100
8	50	Male	R	44	Osteophyte	Present	44	6	4	38	88
9	50	Female	R	61	Osteophyte	Absent	16	6	0	86	96
10	33	Female	R	18	Scaring	Absent	14	5	0	86	98
11	41	Male	R	24	Ossicle	Present	20	5	3	90	90
12	29	Female	L	9	Soft tissue sprain	Absent	42	6	0	81	100
13	32	Male	R	24	Ossicle	Absent	52	7	1	67	97
14	47	Male	L	42	Osteophyte	Present	42	5	4	60	85
15	43	Male	L	22	Soft tissue sprain	Absent	36	4	0	88	100
16	21	Male	R	7	Soft tissue sprain	Absent	30	5	0	74	100
17	25	Female	L	18	Scaring	Absent	12	6	0	80	96
Mean±SD	36.8±11.0			26.3±5.8			27.6±12.5	5.2±0.8	1.1±1.6	76.4±13.4	95.8±5.9
<i>P</i> -value									<0.001		<0.001

SD - standard deviation; VAS - visual analogue scoring; AOFAS - American Orthopedic Foot and Ankle Society; op - operation

and talar neck cartilage can be damaged to formate the osteophyte, which might induce the anterior impingements syndrome. The main symptoms include ankle pain, usually following acute injuries, but plain x-ray cannot disclose any fracture or joint dislocation. Although ice-compression and stabilization treatment may relieve the pain and swelling, persistent or recurrent symptoms might occur. The disease might be confirmed through MRI examination or arthroscopy. The MRI can show signal changes of articular cartilage, embedded soft tissue impact into the cavity,<sup>10</sup> which is beneficial for preoperative diagnosis and differentiation from other ankle disorders, such as gout. Although previous studies<sup>3,6</sup> indicated that the MRI was not necessary for the diagnosis of impingement syndrome, we found that information provided by MRI was helpful for a completed understanding of the disease, especially when cartilage was involved. In our 17 patients, MRI was carried out in 15 (88.2%), and the results were consistent with observation during arthroscopic examination.

With the development of arthroscopic surgery and understanding of foot-ankle injuries, the application of ankle arthroscopy has been widely used in the diagnosis and management of ankle disorders.<sup>11-16</sup> The surgical technique possesses the advantages of fewer invasions,

less blood loss, and clear appearance of intra-ankle pathological changes. Intraoperative examination through arthroscopy could be recorded, which would be helpful for patients to understand the disease, and to conform to regular functional exercise postoperatively.

It has been reported that satisfactory results could be achieved when the anterior, anterolateral impingement of the ankle is treated by ankle arthroscopy, with a prognosis better than the conservative treatment or intra-articular injection of drugs. However, it should be noted that the space of the ankle joint is quite narrow, which might induce damage and breaking of arthroscopy instruments. Therefore, it is critical to manage this in a gentle manner.

Neurovascular bundle and muscle tendon travels around the anteromedial and anterolateral insertions, which should be carefully protected. The ankle joint is firstly irrigated with saline thoroughly, and then, the vessel and tendon become visible when the skin is illuminated by cold light. As the neighboring tissue might be injured when the intraoperative use of surgical instruments, such as resector, the tool bit should be positioned medially to the articular space, which is irrigated by saline continuously to maintain a clear field, as well as to prevent soft tissue damage induced by high temperature.

For patients with simple impingement syndrome, local pain and swelling could be relieved obviously when the pathogenic tissue in the joint is removed thoroughly. However, when patients are concomitant with cartilage defect and avulsion, multiple small holes are made in the site after clearance of the articular surface, for stimulating the regeneration of fibrous cartilage.

In our patients, 4 of them with cartilage avulsion had a poor prognosis when compared to those without cartilage damage. It is speculated that cartilage damage has a close relationship with disease duration; therefore, an early operation is advocated when an anterior impingement of the ankle is confirmed. Although it has been reported that impingement syndrome of the ankle could be satisfactorily treated by arthroscopy in athletes and ballet dancers,<sup>17,18</sup> for physical workers, similar results could be achieved uneventfully according to our study. However, it should be noted that deformities of the other foot can affect the AOFAS score result.<sup>19</sup>

The limitation of our study was the small number of patients due to the rarity of the disease. For very young adults, postoperative follow-up had better to be prolonged for further analysis. Although satisfactory outcomes have been achieved for AIS treated by arthroscopy, randomized controlled and multicentric study has to be designed in the future, to reflect the value of arthroscopic diagnosis and management for AIS in a wider range of population.

In conclusion, the ankle arthroscopic debridement can act as effective armamentarium in treating the anterior ankle impingement syndrome in physical workers. An early operation is advocated for the prognosis would become poor when a cartilage damage is present.

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