Detection of the Tram Track Lesion in the Ankle Joint: Comparing 3.0-Tesla Magnetic Resonance Imaging and Arthroscopy

Dong Woo Shim, M.D., Sungjun Kim, M.D., Ph.D., Yeokgu Hwang, M.D., Yunjae Lee, M.D., Jin Woo Lee, M.D., Ph.D., and Seung Hwan Han, M.D., Ph.D.

Purpose: To show the effectiveness of magnetic resonance imaging (MRI) for the detection of tram track lesions in the ankle compared with ankle arthroscopy. **Methods:** We retrospectively assessed all patients who underwent arthroscopic ankle surgery between January 2013 and July 2015. Patients with anterior impingement spurs were included, but those with an osteochondral lesion or arthritis were excluded. Anterior ankle bony spurs on preoperative weight-bearing radiographs were scored using an impingement classification system. The 3.0-tesla MRIs were reviewed for tram track lesions (defined as focal high signal intensity along the talar dome cartilage surface on coronal views) and compared with arthroscopic findings. The cartilage defect grade at arthroscopy was stratified according to the International Cartilage Repair Society (ICRS) grading system. **Results:** Overall, 175 ankles in 170 patients were evaluated. Tram track lesions were identified on MRI in 14 ankles (8.0%) and at arthroscopy in 16 ankles (9.1%). The overall sensitivity of MRI for the detection of tram track lesions was 87.5% and the specificity was 100%. On plain weight-bearing radiographs, of the 16 patients with confirmed tram track lesions on arthroscopy, 4 patients had grade 1, 2 had grade 2, and 10 had grade 3 impingement spurs. Under the ICRS grading system, 4 patients had grade II, 4 had grade III, and 8 had grade IV cartilage defects at arthroscopy. On MRI, 2 patients had grade II (50% of arthroscopy), 4 had grade III (100% of arthroscopy), and 8 had grade IV defects (100% of arthroscopy). The impingement spur grade showed no significant correlation with the arthroscopic ICRS grade of the tram track lesion ($P = .609$). **Conclusion:** Tram track lesions can be confidently detected on MRI with high sensitivity and specificity. The impingement spur grade did not correlate with the severity of cartilage injury of the talar dome. **Level of Evidence:** Level III, diagnostic evaluation study.

An uncommon and distinctive cartilage lesion, a narrow longitudinal articular cartilage defect running from anterior to posterior, has occasionally been found during ankle arthroscopy. The lesion, which shows a longitudinal trough shape, relates to a large osteophyte projecting from the anterior aspect of the distal tibial articular margin. Furthermore, the underlying subchondral bone shows no cystic lesion or softening with varying degrees of cartilage defect. The length and depth of the trough vary according to the shape of the corresponding distal tibial osteophyte. The shape of this lesion is different from other cartilage lesions, such as osteochondral lesions, and has therefore been named a "tram track lesion."[1,2]

Although osteochondral lesions of the talus have been described and classified by various investigators according to radiographic findings or a combination of radiographic and magnetic resonance imaging (MRI) findings,[3-5] to our knowledge, there have been only a few previous studies related to the pathophysiology, diagnosis, clinical outcomes, and treatment of the tram track lesion.[1,2] Tram track lesions are typically not detected by preoperative computed tomography (CT) or MRI scans but are accidently detected during ankle arthroscopy.[1]

Thus, in the current study, by comparing arthroscopic findings and 3.0-tesla MRI findings based on our definition of the lesion, we investigated the effectiveness of MRI

From the Department of Orthopaedic Surgery, Catholic Kwandong University College of Medicine (D.W.S.), Seo-gu, Incheon; Department of Diagnostic Radiology (S.K., S.H.H.) and Department of Orthopaedic Surgery (Y.H., Y.L., J.W.L.), Yonsei University College of Medicine, Seoul, Republic of Korea.

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Address correspondence to Seung Hwan Han, M.D., Ph.D., Department of Orthopaedic Surgery, Yonsei University College of Medicine, 211 Eonju-ro, Gangnam-gu, Seoul 06273, Republic of Korea. E-mail: osmedic@yuhs.ac

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Table 1. Classification of Anterior Ankle Impingement

Grade	Characteristics
I	Synovial impingement; radiographs show up to 3-mm spur formation
II	Osteochondral reaction exostosis; radiographs manifest osseous spur formation greater than 3 mm in size, no talar spur is present
III	Significant exostosis with or without fragmentation, with secondary spur formation on the dorsum of the talus seen, often with fragmentation of osteophytes
IV	Pantalocrural arthritic destruction; radiographs suggest medial, lateral, or posterior degenerative, arthritic changes

for the detection of tram track lesions in the ankle compared with ankle arthroscopy. We hypothesized that newer and more powerful MRI would be informative enough to diagnose the tram track lesions efficiently.

Methods

We retrospectively assessed all patients who underwent arthroscopic ankle surgery for any reason, such as synovitis, accessory ossicle, or chronic lateral ankle instability, between January 2013 and July 2015. Patients with tibial plafond spurs were included in the study. Patients who had not undergone MRI were excluded. Patients with an osteochondral lesion of the talus or arthritis of the ankle were also excluded because they could mimic signal changes of ankle joint cartilage on MRI. This study was approved by the institutional review board.

A distinctive longitudinal trough in the talar dome from anterior to posterior was confirmed on arthroscopy of the ankle. The grade of the cartilage defect was stratified according to the International Cartilage Repair Society (ICRS) grading system in which macroscopically normal cartilage without notable defect is classified as ICRS 0, cartilage with an intact surface but fibrillation and/or slight softening or fissures is classified as ICRS I, a lesion extending deeper but involving less than 50% of the cartilage thickness is classified as ICRS II, a defect extending more than 50% of the cartilage thickness is classified as ICRS III, and full-thickness cartilage injury reaching the subchondral plate is classified as ICRS IV.[6] The ICRS grade was confirmed by 2 independent observers (D.W.S., S.H.H.).

Radiographs of each ankle were assessed to determine whether a bony spur was visible at the anterior tibial plafond. Preoperative weight-bearing radiographs were scored using the impingement classification system by Scranton et al. (Table 1). This classification was matched to the ICRS grading system used during arthroscopy to correlate the severity of spur formation with the cartilage defect. All MRI examinations were performed using one of the following 3.0-tesla scanners: Achieva (Philips Healthcare, Best, Netherlands) or Discovery MR750 (General Electric Healthcare, Milwaukee, WI). Images were obtained using a quadrature 8-channel foot and ankle coil with the ankle in a neutral position. For this study, images from coronal fat-suppressed T2-weighted sequences (repetition time, 2,500-4,800 milliseconds [ms]; echo time, 60-70 ms; matrix, 384-396 × 266-384, flip angle, 90°-110°; field of view, 150 mm; slice thickness, 3 mm; intersection gap, 0.3 mm) were analyzed. A longitudinal defect of the cartilage would lead to synovial fluid collection inside the defect, which can exhibit a focal area of high signal intensity along the talar dome cartilage surface that is observed in 2 or more consecutive images. This was interpreted as a tram track lesion. Associated bone marrow edema and subchondral sclerosis or cysts were evaluated together to rule out early-stage osteoarthritis. The location of the lesion was described as medial or lateral on coronal MRI. The radiographs and MRI images were independently interpreted for the purpose of this study. The reporting independent observers were musculoskeletal specialists who were blinded to the arthroscopic diagnosis of the tram track lesion when identifying the cartilage defect. The sensitivity and specificity of MRI for the detection of a tram track lesion were calculated using the arthroscopic findings as a reference standard.

The interobserver correlation coefficient was calculated to evaluate the reliability of the impingement classification, the ICRS grading system, and the identification of the lesion on MRI by the 2 independent observers (S.K., Y.L.). All patients underwent arthroscopic debridement, including the excision of osteophytes from the anterior margin of the distal tibial surface, using a motorized burr or punch. Patients with early-stage cartilage defects (ICRS grades I-III) underwent debridement of the cartilage defect only, and those with advanced-stage cartilage defects (ICRS grade IV) underwent additional microfracture.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS, version 21.0; IBM Corp., Armonk, NY) was used for all statistical analyses. Linear-by-linear association analysis was used to assess the relationship between the impingement spur grade and arthroscopic ICRS grade of the tram track lesions. The level of significance was set at $P < .05$. Interobserver reliability for the interpretation of the impingement classification, the ICRS grading system, and the detection of the lesion on MRI were evaluated using the interclass correlation coefficient.

Results

Arthroscopic surgeries were done on 335 ankles in 330 patients during the time span. One hundred forty-two ankles were excluded because they had osteochondral lesions and 4 ankles were absent of MRI. A total of 175 of the 189 ankles in 170 patients who had