Available online at www.sciencedirect.com

ScienceDirect

Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology 7 (2017) 15–20
www.ap-smart.com

Original article

Accuracy of magnetic resonance imaging in diagnosing lateral ankle ligament injuries: A comparative study with surgical findings and timings of scans

Desmond Wei Tan*, Daniel Jing Wen Teh, Yu Han Chee

Department of Orthopaedic Surgery, National University Health System, Singapore

Received 15 June 2016; revised 12 September 2016; accepted 24 September 2016

Abstract

Objective: This study aimed to evaluate the accuracy of magnetic resonance imaging (MRI) in diagnosing lateral ankle ligament injuries and the effect of differences in time duration from injury to MRI.
Methods: Data were collected prospectively from 82 patients who underwent MRI and lateral ligament reconstruction, and were divided into either acute (≤3 months) or chronic (>3 months) group based on injury interval. Findings were classified as normal, partial, or complete tears of the anterior talofibular ligament (ATFL) and the calcaneofibular ligament (CFL). MRI results were compared with intraoperative findings and their accuracies were assessed using descriptive statistics.
Results: The accuracy of MRI for partial and complete tears of the ATFL was 74% and 79%, respectively, with sensitivity and specificity of 64% and 86% for partial tears, and 78% and 80% for complete tears, respectively. The accuracy of MRI was 66% and 88% for partial and complete tears of the CFL with a sensitivity and specificity of 41% and 87% for partial tears, and 61% and 95% for complete tears, respectively. A decrease in the MRI accuracy was observed in the chronic group.
Conclusion: MRI is accurate in diagnosing ATFL injuries. It is specific but not sensitive for CFL tears. The accuracy is higher in the acute setting of 3 months or less from time of injury to MRI.

Keywords: accuracy; ankle; ligaments; magnetic resonance imaging

Introduction

Ankle sprains are common injuries, and a significant risk factor for developing chronic ankle instability and pain.[1–4] Magnetic resonance imaging (MRI) is increasingly being utilized in assessing patients with residual symptoms after initial conservative treatment because of its superior soft-tissue resolution and good correlation with objective arthroscopic findings.[5] The lateral ligamentous complex is involved in the majority of ankle sprain injuries, and comprises the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), and the posterior talofibular ligament (PTFL).[1,6–8] The lateral complex hence remains the largest concern of orthopaedic surgeons for patients failing initial conservative treatment for acute ankle sprains and chronic ankle instability symptoms, especially in consideration of ligamentous tears.

Great variability exists in the accuracy of MRI, and the reliability of findings on MRI has not been confirmed.[9] One study noted an MRI accuracy of 80% in detecting osteochondral lesions in the talus and peroneus brevis tendon tears,[10] whereas another study reported a 19% detection rate of cartilage lesions found at surgery.[11] For the few studies that evaluated the lateral ankle ligamentous complex, significantly different sensitivities and specificities for detecting ATFL and CFL tears have been reported.[12,13] In addition, these studies had focused only on patients with chronic symptoms and

* Corresponding author. 1E Kent Ridge Road, 119228, Singapore.
E-mail address: desmond.nus@gmail.com (D.W. Tan).

http://dx.doi.org/10.1016/j.asmart.2016.09.003

injuries and there remains a paucity in the literature on the accuracy of MRI in the acute setting. An MRI scan of acutely injured ankle ligaments may demonstrate the presence of haemorrhage in the joint space and soft-tissue swelling over the lateral malleolus as well as high bone signal at ligament avulsion sites, which may be absent in patients with recurrent or chronic problems.[14] Hence, we hypothesized that the accuracy of MRI in the acute setting will be higher than in the chronic setting. Given the variability in the accuracy of ankle MRIs, it is difficult to justify its usage in identifying lateral ligamentous injuries due to the prohibitive costs of MRI and its eventual cost-effectiveness.[15]

The primary objective of this study was to evaluate the accuracy of MRI results in lateral ankle ligament injuries in comparison with intraoperative findings, which are used as the standard of reference. The secondary objective was to compare the accuracy of MRI between the acute and chronic groups of patients with ankle instability symptoms after injury. To the best of the authors' knowledge, this is the first study to date to evaluate the relationship between accuracy of MRI and timing of scans.

Materials and methods

Study design

In this institutional review board-approved study (Reference number: nuh/2014-00019), data were collected prospectively for patients who underwent lateral ligament reconstruction surgery at a high-volume tertiary institution from January 2012 to December 2014. The inclusion criteria were patients who (1) had a history of acute ankle sprain injury; (2) had residual symptoms of pain, swelling, or instability after conservative treatment including rest, analgesia, ankle guard, and physiotherapy for at least 6 weeks; (3) had positive clinical findings suggestive of ligamentous injury such as positive anterior drawer test and/or talar tilt test; (4) were evaluated with MRI prior to surgery as part of the departmental protocol and as an objective supportive investigation; and (5) subsequently underwent reconstruction of the ATFL and/or the CFL via a modified Broström procedure. The exclusion criteria were (1) previous ankle surgeries; (2) previously diagnosed ankle ligament tears prior to current presentation; (3) new injury from time of MRI to surgery; (4) no MRI was performed prior to surgery due to reasons such as severe trauma or open injuries; and (5) presence of other injuries detected on MRI other than ATFL/CFL tears. The indications for surgery were (1) persistence of symptoms after at least 6 weeks of conservative treatment; and (2) presence of ligamentous tear on MRI; or (3) positive anterior drawer/talar tilt test if MRI is negative. The patients were divided into *acute* or *chronic* groups arbitrarily. *Acute* was defined by an interval of 3 months or less from time of injury to time of MRI, whereas *chronic* was defined as an interval of more than 3 months. A sample of convenience was used.

Table 1
Patient characteristics.

Characteristics	Total ($n = 82$)	Acute ($n = 40$)	Chronic ($n = 42$)	p
Age (y), mean (range)	25.3 (17–48)	25.8 (17–47)	24.8 (17–48)	0.285
Sex				0.408
Male, *n* (%)	71 (87)	35 (87)	36 (86)	
Female, *n* (%)	11 (13)	5 (13)	6 (14)	
Race				0.210
Chinese, *n* (%)	59 (72)	30 (75)	29 (69)	
Malay, *n* (%)	14 (17)	3 (8)	11 (26)	
Indian, *n* (%)	6 (7)	4 (10)	2 (5)	
Others, *n* (%)	3 (4)	3 (8)	0 (0)	
Body mass index, (kg/m^2), mean ± standard deviation	25.0 ± 5.3	23.9 ± 4.6	26.1 ± 5.6	0.091

Radiological investigations

MRI was obtained from the institutional radiology provider. Patients without MR images at consultation were referred for MRI noting the history of lateral ankle instability. All patients had an MRI with a 3.0-T magnet, and MRI scans were performed without contrast or arthrogram. All MRI results were interpreted by the same team of fellowship-trained radiologists. We reviewed the original radiologist's MRI report and verified it with the MRI images itself, and recorded the assessment of the ligaments, separating the results of the ATFL and CFL.

Outcome measurements

Results were classified as normal, partial tear, or complete tear as described by Joshy et al.[16] Partial tear was defined as partial adhesion of the ligament fibres and a coarse cut fibre surface with intact continuity. Complete tear was defined as definite discontinuity of the ligament and adhesion of adjacent tissue.[14,17] Patients with both ATFL and CFL injuries were analysed as two distinct injuries. The MRI results were compared with the operative findings, which were used as the standard of reference. All surgeries were performed by two experienced foot and ankle surgeons. The ATFL and CFL were routinely assessed intraoperatively.

Statistical analysis

Patient characteristics were analysed descriptively. Mean and standard deviation were reported for numerical variables, whereas the number of patients and percentages were reported for categorical variables. Performance of MRI was assessed using descriptive statistics to generate sensitivity, specificity, and positive predictive and negative predictive values with 95% confidence intervals. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, IL, USA).

Results

Patient characteristics

A total of 114 patients underwent lateral ankle ligament reconstruction from January 2012 to December 2014, of which