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ORIGINAL ARTICLE

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Prevalence of syndesmosis injuries associated with acute ligamentous injuries on magnetic resonance imaging

Prevalência de lesões da sindesmose associadas a lesões ligamentares agudas na ressonância magnética

Márcio Pinheiro de Souza[1], Marcos Vinicius Mota Garcia Moreno[1], Janice de Souza Guimarães[1], Marilton Jorge Torres Gomes[1], Túlio Eduardo Marçal Vieira[1], Claudio Sobral de Carvalho[2]

1. Clínica Ortopédica Traumatológica, Salvador, BA, Brazil.
2. Clínica Multimagem Salvador Canela, Salvador, BA, Brazil.

ABSTRACT

Objective: The aim of this study was to evaluate the prevalence of inferior tibiofibular syndesmosis injuries in patients with acute lateral ligament injuries found on complementary nuclear magnetic resonance imaging (MRI) performed in a diagnostic imaging clinic.

Methods: The images and medical reports of 429 ankle MRI examinations were evaluated from March to December 2017. After applying the exclusion criteria, 346 examinations were eliminated. Thus, a total of 93 MRI scans compatible with acute ankle ligament injuries were examined for associated syndesmosis injury.

Results: The presence of syndesmosis injury was observed in 8 patients (8.6%). In all individuals with syndesmosis injuries, the anterior fibulotalar ligament (AFTL) and the anterior inferior tibiofibular ligament (AITFL) were affected. The most common lesion in this type of injury was partial AFTL lesion (6 cases), followed by partial AITFL lesion (5 cases). Of the 93 MRI results evaluated, the lateral complex ligament most commonly affected was the AFTL, with 91 lesions, partial and total, which were present in 97.85% of the MRI examinations. Partial AFTL lesions were observed in 49 patients (52.68%), representing the most common lesion, and total AFTL lesions were observed in 42 patients (45.16%).

Conclusion: No increase was found in the prevalence of syndesmosis injuries associated with acute ligamentous injuries evaluated by MRI.

Level of Evidence IV; Therapeutic Studies; Case Series.

Keywords: Ankle joint; Ligaments/injury; Magnetic resonance imaging.

RESUMO

Objetivo: O estudo em questão visa avaliar a prevalência de lesões da sindesmose tíbio-fibular inferior em pacientes com lesões ligamentares laterais agudas verificados no exame complementar de ressonância nuclear magnética, realizados em uma clínica de diagnóstico por imagem.

Métodos: Foram avaliadas as imagens e os laudos médicos de 429 ressonâncias magnéticas (RM) de tornozelo, de março a dezembro de 2017. Após aplicados os critérios de exclusão, foram eliminados 346 exames. Assim, chegou-se ao número final de 93 exames de RM compatíveis com lesões ligamentares agudas de tornozelo, nos quais foi realizada busca por lesão associada da sindesmose.

Resultados: Observou-se a presença de injúria da sindesmose em 8 pacientes (8,6%). Em todos estes indivíduos com lesão da sindesmose foram identificadas afecções do ligamento fibulotalar anterior (LFTA) e do ligamento tíbio-fibular antero-inferior (LTFAI). A lesão mais comum nesse tipo de injúria, foi a lesão parcial do LFTA (6 casos), seguida da lesão parcial do LTFAI (5 casos). Dos 93 exames de ressonância magnética avaliados, o ligamento pertencente ao complexo lateral mais comumente afetado foi o ligamento fibulo-talar anterior (LFTA) com 91 lesões – entre parcial e total – estando presente em 97,85% das RM. Lesão parcial do LFTA foi vista em 49 pacientes (52,68%), sendo a lesão mais comum, e a lesão total do LFTA foi vista em 42 pacientes (45,16%).

Conclusão: Não houve aumento da prevalência de lesões da sindesmose associadas às lesões ligamentares agudas avaliadas pelo exame de ressonância magnética nuclear.

Nível de evidência IV; Estudos Terapêuticos; Série de Casos.

Descritores: Articulação do tornozelo; Ligamento/lesões; Imagem por ressonância magnética.

Work performed at the Clínica Ortopédica Traumatológica, Salvador, BA, Brazil.

Correspondence: Márcio Pinheiro de Souza. Rua João das Botas, 28, Canela - CEP: 401140-160, Salvador, BA, Brazil. E-mail: marciowalker@hotmail.com

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INTRODUCTION

Ankle sprains are among the most common causes of orthopedic care in the emergency room[1]. The most common type of ankle sprain is lateral ligamentous injury, and at least one of the ligaments is affected in up to 80% of ankle sprains[1]. The so-called "high" ankle sprains or inferior tibiofibular syndesmosis injuries, which are much less common than lateral ligamentous injuries, are characterized by injury to the structures connecting the distal tibia to the distal fibula[1]. These structures include the anterior inferior tibiofibular ligament (AITFL), posterior inferior tibiofibular ligament (PITFL), transverse inferior tibiofibular ligament, interosseous ligament and interosseous membrane[1,2].

The trauma mechanisms that most commonly cause syndesmosis injuries often result from external rotation of the ankle combined with internal rotation of the leg, and eversion or hyper-dorsiflexion trauma are also possible[1,2]. These forces cause shearing and widening of the malleolar fork, damaging the distal tibiofibular joint[1,2].

Although less common, syndesmosis injuries have greater morbidity and require longer times for rehabilitation and complete return to typical and sports activities, in addition to being frequently initially undiagnosed[1]. An accurate physical examination is essential for the diagnosis of these injuries. Complementary imaging examinations, especially nuclear magnetic resonance imaging (MRI), are a tool to detail and confirm the diagnosis. MRI has increased the accuracy of the diagnosis of syndesmosis injuries, contributing to an increase in the number of detected injuries, earlier diagnosis and better treatment, and takes the characteristics of each patient into account[1,2].

The aim of the present study is to evaluate the prevalence of inferior tibiofibular syndesmosis injuries in patients with acute lateral ligamentous injuries found on the complementary MRI examinations performed in a diagnostic imaging clinic.

METHODS

This study was approved by the Research Ethics Committee with registration in the Brazil Platform under CAAE number: 93879918.8.0000.5606.

The images and medical reports from 429 MRI scans of the ankle performed from March to December of 2017, from the database of a private diagnostic imaging clinic, were evaluated.

The inclusion criteria were examinations found in the Picture Archiving and Communication System (PACS) (Carestream Health) using the keyword "ankle", which indicated the area of the body scanned during the examination.

The exclusion criteria were examinations without an available report; examinations without ligamentous injuries of the lateral complex and examinations of patients with old, healed injuries or injuries with chronic-degenerative changes. A total of 105 examinations were excluded because they did not have a report available in the PACS system, an additional 132 examinations were excluded because they showed no signs suggestive of ligamentous injuries of the lateral ankle complex, and a further 109 examinations were excluded because they showed previous lesions that were already healed or had signs of associated chronic-degenerative changes. Thus, a total of 93 MRI examinations compatible with acute ankle ligamentous injuries were obtained, based on the criterion of magnetic signal changes captured during complementary imaging examinations (Figure 1). The protocol for obtaining the images was as follows: T1-weighted sequence in the sa-

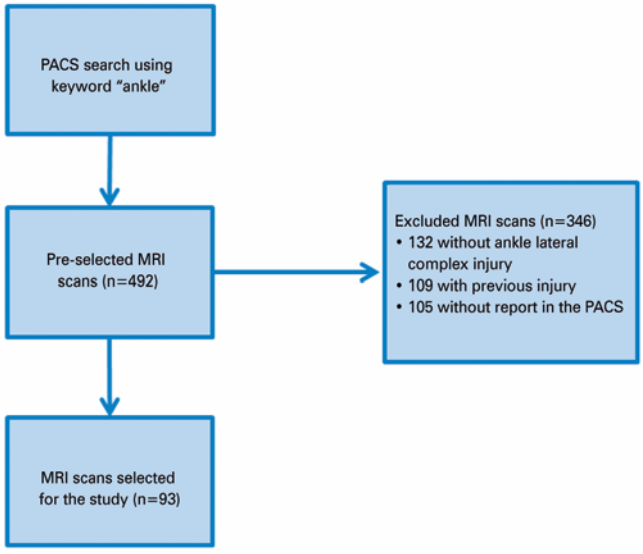
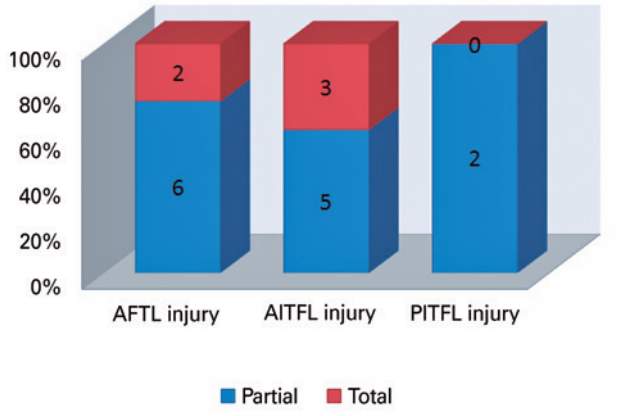


Figure 1. Flowchart of case selection.
Source: Author's personal archive.

gittal plane; T2-weighted sequence in the sagittal, axial, coronal and oblique coronal planes; and proton density (PD)-weighted sequence in the axial, coronal and oblique coronal planes.

RESULTS

In our sample, the presence of ligamentous injuries of the inferior tibiofibular syndesmosis was observed in 8 patients (8.6%). In all individuals with syndesmosis injury, injuries to the anterior fibulotalar ligament (AFTL) and AITFL were observed. The most common lesion in this type of injury was partial lesion of the AFTL (6 cases), followed by partial lesion of the AITFL (5 cases) (Figure 2). From the therapeutic perspective, all observed lesions were without enlargement of the malleolar fork and could be conservatively treated, with no need for surgical intervention for either the main injuries or the additional findings.



AFTL: anterior fibulotalar ligament; AITFL: anterior inferior tibiofibular ligament; PITFL: posterior inferior tibiofibular ligament.
Figure 2. Acute syndesmosis lesions.
Source: Prepared by the author based on the study results.

Of the 93 MRI examinations evaluated, the lateral complex ligament most commonly affected was the AFTL, with 91 lesions, including partial and total lesions, which were present in 97.85% of the MRI scans. Partial AFTL lesions were observed in 49 patients (52.68%) and were the most common lesion type, and AFTL lesions were observed in 42 patients (45.16%) (Figure 2).

The most common combined ligamentous injury involved the AFTL and the calcaneofibular ligament (CFL), with 39 occurrences (41.93%), followed by injury of the AFTL and the posterior talofibular ligament (PTFL), with 4 occurrences (4.3%).

Moreover, the presence of 1 case of isolated CFL injury, without involvement of the other ligaments, was also observed.

Combined injury of the three lateral complex ligaments (AFTL, CFL and PTFL) was present in only 2 patients and had no association with inferior tibiofibular syndesmosis injuries.

We also observed other injury types beyond lateral ligamentous injuries associated with syndesmosis injury, revealing a great variability in the results. Regarding the medial ligament complex, 4 cases of deltoid strain were observed. Bone edema in adjacent structures (medial malleolus and talus) was observed in 3 patients. Fractures were also included in the additional findings, presenting as follows: 1 case of posterior malleolus fracture, 1 case of lateral malleolus fracture, 1 case of tibial avulsion fracture (Tillaux-Chaput fracture), and fracture or osteochondral lesion of the talus. Subcutaneous edema and joint effusion were not considered additional findings due to their non-specificity (Table 1).

Table 1. Ligamentous injuries associated with syndesmosis injury

Ligamentous injuries	
Medial complex injury - deltoid strain	4 cases
Bone injuries	
Bone edema	3 cases
Posterior malleolus fracture	1 case
Lateral malleolus fracture	1 case
Tibial avulsion fracture	1 case
Osteochondral talus fracture	1 case

Source: Prepared by the author based on the study results.

DISCUSSION

Ankle joint injuries are extremely common, and sprains are among the main reasons for medical care[3-5]. Approximately 2 million visits to the emergency room due to ankle sprain are made each year in the United States, and data indicate an occurrence ratio of 1 sprain to 10,000 people daily worldwide[3-5]. Despite this high incidence, Banks et al. (2001)[6], Dubin et al. (2011)[7], Kellett (2011)[8] and Roemer et al. (2014)[9] demonstrated that only 1 to 10% of sprains cause injury to the syndesmosis complex[6-9]. Our results agree with the findings of previous studies, showing a prevalence rate of 8.6% of injuries of the tibiofibular syndesmosis associated with lateral ligament complex (LLC) lesions.

The involvement of the syndesmosis did not have a greater association with total ligamentous injuries of each component or injuries of all LLC ligaments. Thus, partial ligamentous injuries were more frequently associated with syndesmosis injuries, with partial rupture of the AFTL observed in 75% of the total cases of injury of the inferior tibiofibular syndesmosis. Milz et al.[10] previously reported that the association of syndesmosis sprains with lateral ankle sprains was not clear.

Regarding the association with fractures, studies on the topic describe the positive association between ankle syndesmosis injuries and malleolar or bimalleolar fractures, and the reverse is also true; thus, malleolar injuries should raise suspicion of syndesmosis injuries[11-15]. Hunt et al.[16] describe as uncommon the absence of fractures in cases of complete ligamentous injury. Our study found this association in 25% of cases. The most well-known example of syndesmosis injuries associated with high fibular fractures (of its proximal 1/3) is the Maisonneuve injury, which is associated with a pronation or supination and external rotation mechanism[11-13]. One of the possible reasons for the absence of this specific injury in our study is that the MRI examinations included in the evaluation according to the inclusion criteria were performed for evaluation of the ankle joint only and could conceal the so-called "high" fractures of the fibula or proximal fractures[14,15].

In our study, the observed prevalence rate of partial injury of the AITFL was 62.5% or 5 of the 8 patients who presented injury of the syndesmosis complex. Thus, for the observed dislocations resulting from the injury examined by the study, all indicated conservative and non-interventional treatment as the best therapeutic option. Possibly, the main cause of this pattern is that patients with syndesmosis injuries requiring surgery were correctly diagnosed early at the time of initial treatment, either by the association of concomitant dislocated fractures or due to the presence of findings on conventional radiographic examinations, which left no doubt as to the best therapeutic option.

We thus reiterate that malleolar fractures at or above the syndesmosis should be suspected and routinely examined and screened for confirmation. Preoperatively, the squeeze test through laterolateral compression of the leg can confirm the presence of syndesmosis injuries and proximal fibular fracture association[16-18]. During surgery, Cotton's test (fibular translation) is imperative, where a fibular mobilization maneuver is performed with a hook, and its positivity is confirmed by observing abnormal anteroposterior translation or movement of the fibula with respect to the tibia[16,18].

Regarding the associated injuries, 4 patients (50%) presented associated syndesmosis injury and deltoid ligament strain. This finding indicates that the deep portion of this ligament is a secondary stabilizer of the inferior tibiofibular syndesmosis, and therefore, it may indicate syndesmosis injury as well as present a simultaneous lesion in addition to the aforementioned injuries, either in acute or chronic events[2,17,18].

According to Kellet[8], Haraguchi and Armiger[13], Reid[19] and Lynch and Renström[20], the AFTL is most commonly damaged in injuries to the inferior ankle ligament complex, in isolation or not[21]. Switaj et al.[15] stated that MRI has 100% sensitivity and 94% specificity to identify injury of this ligament[15]. The present study, which employed an examination with high diagnostic capacity, found a prevalence very similar to that reported in the literature, both for the most common injury (AFTL) and for the other associations mentioned here.

The limitations of this study include the selection bias due to the possibility of an increased prevalence of injuries in patients undergoing MRI of the ankle relative to the sites not available for this examination. The tool in question was not used as a complementary diagnostic method for each patient. Rather, a database was accessed and screened for the main injury investigated. In contrast, the data may also have been underestimated because patients with malleolar fractures associated with syndesmosis injuries may have been submitted to or indicated for surgical treatment at the time of initial care, without the need for an MRI examination because of the nature of the injury or because the conventional radiographs were sufficient for this finding. Another limitation of the study is related to the method because it is a cross-sectional observational study with a direct approach to the complementary examinations, which reduces the capacity for epidemiological analysis and analysis of variables in a more enriching manner.

CONCLUSION

The investigation of MRI examinations did not increase the prevalence of syndesmosis injuries associated with acute ligamentous lesions, which remained consistent with the prevalence and pattern observed in previous studies. However, a prospective longitudinal study with a larger number of participants and more analyzable variables is necessary to obtain more detailed knowledge about the prevalence and other characteristics of inferior tibiofibular syndesmosis injuries of the tibiotarsal joint.

Authors' contributions: Each author contributed individually and significantly to the development of this article: MPS *(https://orcid.org/0000-0002-6076-661X) wrote the article, interpreted the results of the study, participated in the review process; MVM *(https://orcid.org/0000-0002-7320-9628) conceived and planned the activities that led to the study, wrote the article, interpreted the results of the study and approved the final version; JZG *(https://orcid.org/0000-0001-5996-6641) conceived and planned the activities that led to the study, wrote the article and participated in the review process; MJTG *(https://orcid.org/0000-0003-4068-2598) wrote the article, interpreted the results of the study and participated in the review process; TEMV *(https://orcid.org/0000-0002-9162-5908) wrote the article, interpreted the results of the study and participated in the review process; CSC *(https://orcid.org/0000-0002-5459-716X) wrote the article, participated in the process of analysis and review of magnetic resonance images and their respective reports. *ORCID (Open Researcher and Contributor ID).

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