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Case Report

Association of bilateral trans-syndesmotic lesion with logsplitter and syndesmosis instability with high ankle sprain in a young patient: a case report

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Abstract

Dislocated fractures of the ankle are frequently associated with ligament injuries; between 20% and 45% of injuries of the distal tibiofibular syndesmosis occur in 6% to 16% of patients without associated fracture. These lesions can occur by different mechanisms: abduction, external rotation and dorsiflexion (Danis-Webber C), pronation and external rotation Lauge-Hansen and by vertical shearing, the latter being little described in the literature. Clinical presentation includes pain, edema, instability, restricted dorsiflexion, and functional limitation support and gait. The most characteristic symptom is pain over the tibiofibular ligaments. On physical examination, diagnostic suspicion is based on the presence of pain, edema, ecchymosis, and deformity at the ankle level. Diagnostic tests include different clinical signs, conventional and stress radiography, computed tomography, magnetic resonance imaging and fluoroscopy under anesthesia, in some cases), arthroscopy, and intraoperative clinical tests. We present the clinical case of a 21-year-old female patient with right ankle dislocated fracture and bilateral injury of the distal tibiofibular syndesmosis following axial trauma to the lower limbs after a fall from a height of six meters.

Level of evidence IV.

Keywords: Ankle joint; Fracture dislocation; Ankle.

Introduction

Dislocated fractures of the ankle are associated with injuries of the distal tibiofibular syndesmosis, which can also occur in isolation, with or without osteochondral injuries, causing chronic pain, stiffness, and post-traumatic osteoarthritis. Depending on the trauma and type of fracture, syndesmosis injuries occur in 10%–15% of cases of Weber A fractures; in 17%–39%, of Weber B fractures; and in 21%–36%, of Weber C fractures[1,2]. The Lauge-Hansen classification describes the progression of bone and ligamentous injuries according to the trauma mechanism, fracture pattern, and the associated soft tissue injuries[3]. Injuries to the syndesmosis usually result from abduction, external rotation, and dorsiflexion of the ankle[4].

Tibiofibular syndesmosis is a fibrous joint stabilized by four ligaments: anterior inferior tibiofibular ligament (AITFL), which joins the tibia and distal fibula obliquely; posterior inferior tibiofibular ligament (PITFL), with a triangular arrangement between the tibial malleolus and fibula; interosseous ligament (IOL), which acts as a spring during dorsiflexion; and transverse ligament (TL), which joins the malleolar fossa of the fibula to the distal tibia. Together, they resist axial, rotational, and translational forces[5].

Clinical presentation of dislocated fractures includes pain, edema, instability, restricted dorsiflexion, and functional limitation during support and gait, with classic pain over the AITFL and PITFL[6]. These are associated with edema,

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ecchymosis, and deformity in the ankle. Clinical assessment is performed through the following tests:

- Compression test (squeeze test): compression of the proximal tibia and fibula; positive if it causes pain in the ankle, with sensitivity of 30% and specificity of 88%–93%.
- Pain on palpation over the AITFL: Sensitivity of 92% and specificity of 79%.
- Cotton test: lateral and medial force is applied to the talus with the ankle in neutral position; positive if translation is greater than that of the contralateral ankle, with sensitivity of 29% and specificity of 68%.
- Frick test: External rotation and forced dorsiflexion of the ankle with the knee flexed to 90º; positive if there is pain, with sensitivity of 30%–71% and specificity of 85%[5-7] (Figure 1).

Radiological diagnosis is made by means of anteroposterior (AP), lateral, and mortise radiographs in 20° internal rotation, as well as of stress radiographs in external rotation, varus and valgus, to evaluate the stability of the syndesmosis. The following are assessed: the tibiofibular clear space (TFCS), the distance between the lateral edge of the posterior malleolus and the medial edge of the fibula (less than 3 mm in AP and mortise), the tibiofibular overlap (TFO), the distance between the medial edge of the fibula and the lateral edge of the anterior tibial tubercle (greater than 6 mm in AP or > 2 mm in mortise), the medial clear space (MCS), and the distance between the lateral edge of the medial malleolus and the medial edge of the talus (≤ 3 mm)[2].

Computed axial tomography, more sensitive and specific than radiography, allows the evaluation of the MCS and intra-articular fractures of the tibia, fibula, and posterior malleolus.

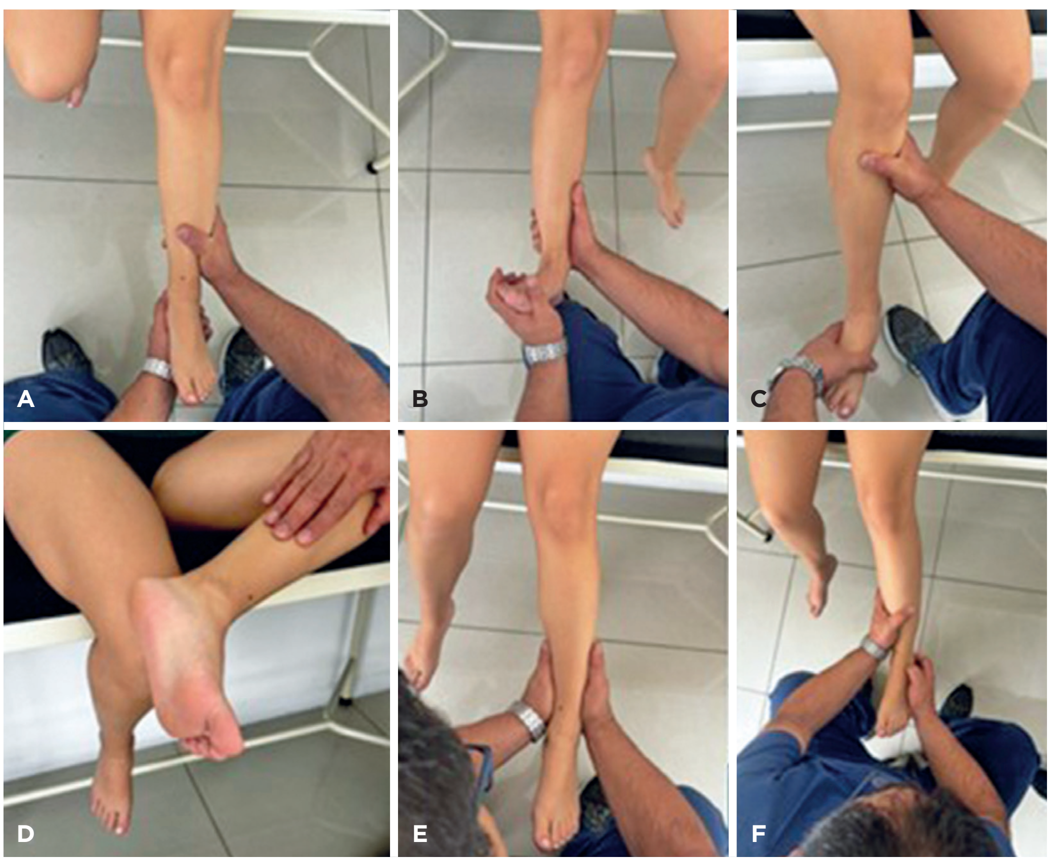

Figure 1. Diagnostic tests; **A** Cotton test: lateral and medial force is applied to the talus with the ankle in neutral position; Positive if translation is greater than that of the contralateral ankle. **B** Frick test: xternal rotation and forced dorsal flexion of the ankle with the knee flexed to 90º; positive if there is pain. **C** Kleiger test: in seated position, with the knee hanging in 90º, ankle relaxed; positive if there is pain at the site of the interosseous membrane, or medially. **D** Crossed-leg test: lower leg over the contralateral knee with the weight of the foot hanging. **E** Squeeze test: proximal fibula is compressed against the tibia to assess the integrity of the bone interosseous membrane and syndesmotic ligaments; pain occurs with fracture or diastasis and test is considered positive. **F** Fibula translation test: patient is positioned in a side-lying position, tibia is stabilized, and fibula is gently translated anteriorly and posteriorly – test is repeated on both legs. Anteroposterior mobilization of the fibula. A positive test produces pain over the anterior and posterior tibiofibular ligaments and interosseous membranes.

It also enables analyzing the tibiofibular line, which measures the distance between the center of the tibia and the cortices of the fibula; the angles between tangential lines of the tibial cortices; the medial edge of the fibula; and the morphology of tibial incisura breadth and depth and correlation with the fibula[1]. These measurements are compared with the contralateral extremity.

The ideal method to evaluate syndesmosis bony or chondrogenic lesions and the PITFL, AITFL, and IOL is MRI, with a sensitivity of 91% and specificity of 100%[7].

Pre- or intraoperative fluoroscopy includes the modified otton test, which detects an opening of > 2 mm, and the forced external rotation test (Frick test), diagnostic if the opening is ≥ 5 mm[8]. Syndesmosis instability is questioned and confirmed by arthroscopy. A complete joint examination needs to be carried out in search of associated injuries, such as medial instability, lateral instability, loose bodies, and osteochondral lesions. Upon finding such conditions, surgical treatment is necessary[9].

Case presentation

A 21-year-old female patient who had a six-meter fall while climbing presented with pain, deformity, edema, and functional limitation in the right ankle, in addition to pain and edema in the left ankle.

On admission, patient presented pain, ecchymosis, and deformity in the right ankle, with mild edema in the left ankle. Radiographs showed logsplitter injury (Lauge-Hansen, Weber C) and normal left ankle (Figure 2). Closed reduction and immobilization with posterior splint were performed on the right ankle (Figure 2 C), and bulky bandage was performed on the left ankle. Control radiograph showed adequate reduction. The CT scan showed residual lateral tibiotalar subluxation and increased MCS, indicating open reduction and internal fixation of the fibula with trans-syndesmotic fixation.

Given the persistence of pain and edema in the left ankle, a control radiograph showed an increase in the MCS. Fluoroscopy showed instability, and the CT scan confirmed this finding (Figure 3).

Open reduction of the right foot neck dislocation was performed, and the cotton test confirmed a syndesmosis lesion. Tibiofibular osteosynthesis with trans-syndesmotic fixation was performed using a minimally invasive technique (a distal and proximal incision is made, locating the subfascial platting without opening the fracture site). Fluoroscopy and stress tests of the left foot under anesthesia evidenced a compromised distal tibiofibular syndesmosis, and fixation was performed with two trans-syndesmotic screws (Figure 4). Control radiograph confirmed adequate fixation and reduction of the bilateral tibiotalar subluxation (Figure 5). Patient was discharged with analgesia, immobilization, and walking with crutches, without joint load. After two weeks, she tolerated standing with full mobility and support according to pain. Functional recovery, edema management, and proprioceptive reeducation were achieved through physical therapy. At 12 weeks, the osteosynthesis material was removed with adequate radiological control (Figures 6).

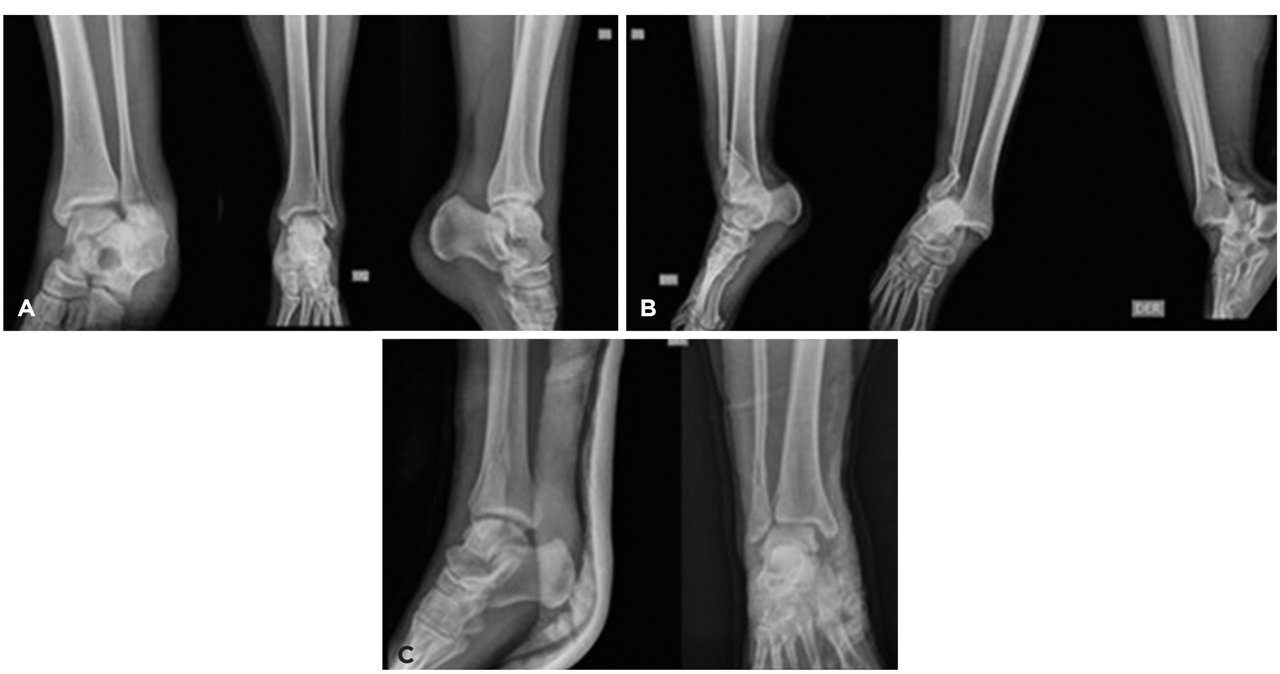

Figure 2. **A** Left lower limb admission radiograph. **B** Right lower limb admission radiograph.**C** Right lower limb postproduction.

Discussion

Syndesmosis lesions are frequently misdiagnosed or undetected. Suspicion is increased when he mechanism of injury is accompanied by diffused ankle pain, as in case of pain in both ankles[6].

Initial suspicion includes pain in the anterior external part of the leg with edema, ecchymosis, instability, and radiating pain on compression in the proximal part of the limb. Tests such as ankle valgus stress test, Frick test, squeeze test, and hook test are performed, with different sensitivities and

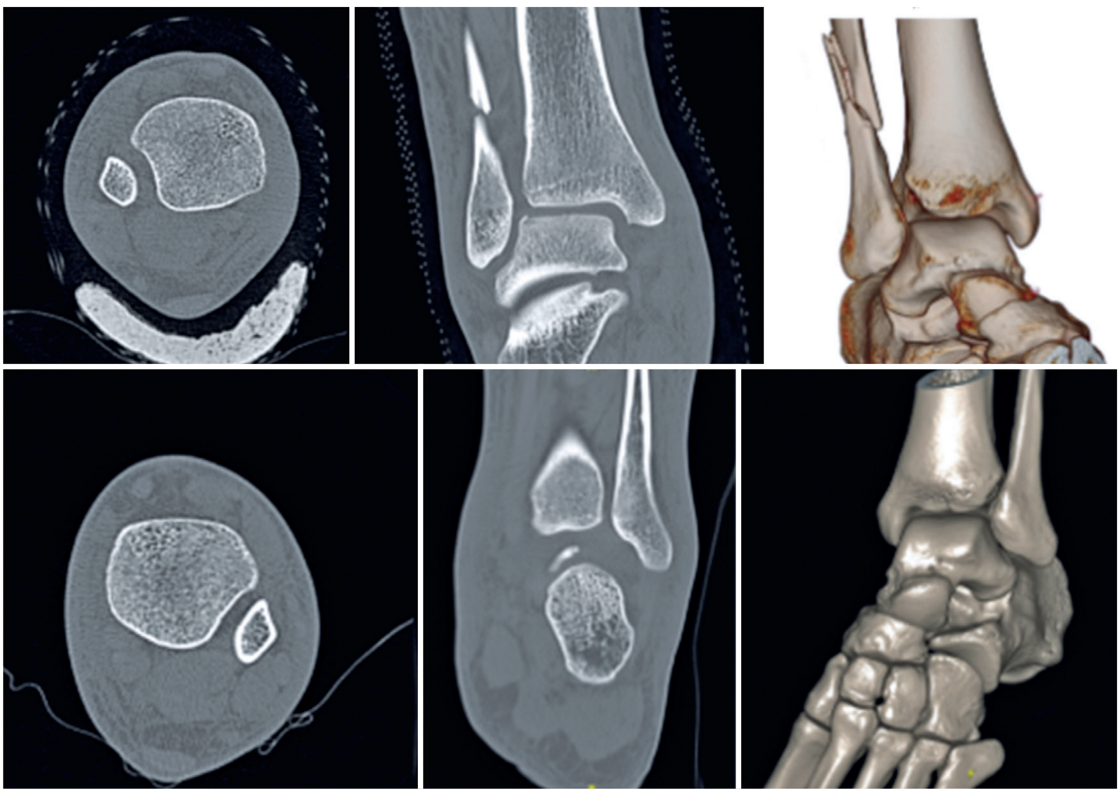

Figure 3. Axial, sagittal, and coronal evaluation with three-dimensional CT reconstruction allows determining the relationship between the tibial and distal fibula, as well as determining the size, breadth, and depth of the sigmoid cavity, its relationship with the fibula, and the presence of occult fractures, specifically posterior malleolus and osteochondral lesions that can be confirmed in the MRI.

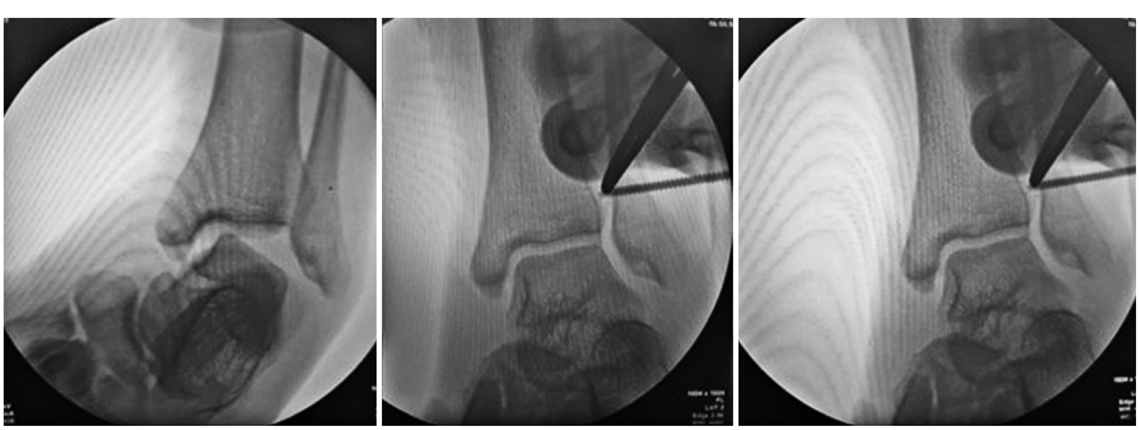

Figure 4. Intraoperative fluoroscopy assessment under anesthesia, left lower limb.

specificities[10]. In the case presented in this study, physical examination showed edema, ecchymosis, and deformity in the ankle, which increased the diagnostic suspicion.

As many of the tests performed were positive, next step were imaging studies. Mortise (20° internal rotation), AP, and lateral radiographs allow evaluation of the tibia-fibula relationship, detecting fractures and displacements. Supportive, stress, and intraoperative fluoroscopic radiographs confirm the diagnosis. In this case, the right ankle radiograph allowed diagnosis, but the persistence of pain in the left ankle and the lack of CT findings led to an intraoperative stress test which confirmed the diagnosis.

Computed tomography allows evaluating the sigmoid cavity of the fibula, the tibiofibular congruence, and the size of the Chaput tubercle, as well as verifying the postoperative reduction[8]. The standard for diagnosing lesions of syndes-

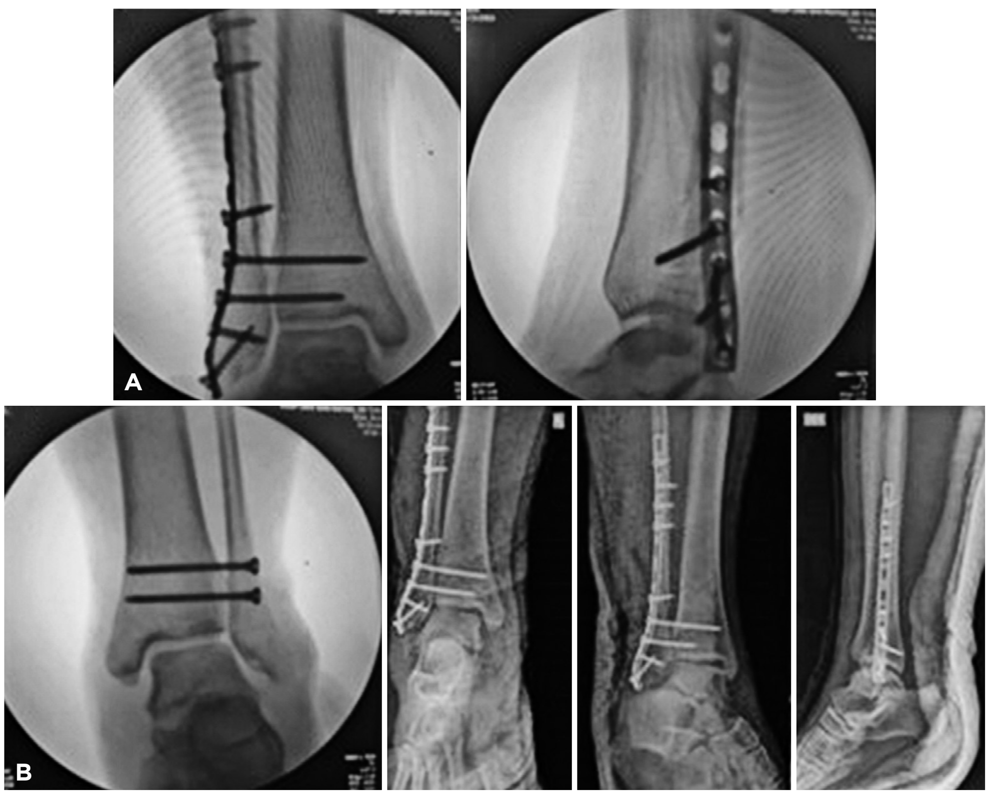

Figure 5. **A** Postoperative right foot neck anteroposterior and lateral views. **B** Postoperative left foot neck anteroposterior view.

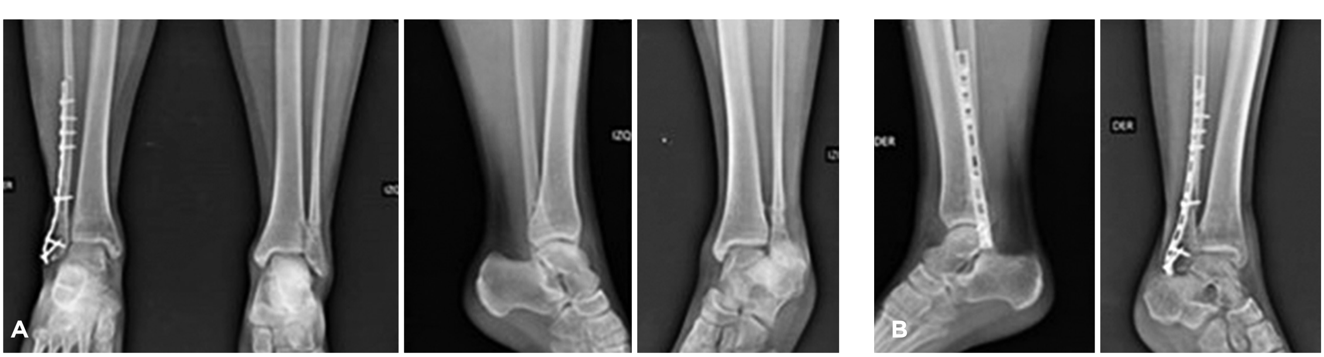

Figure 6. Control radiograph at 12 weeks. **A** Front and right foot neck. **B** Left foot neck.

mosis is MRI, especially for the anteroinferior (100% sensitivity, 94% specificity) and posteroinferior (100% sensitivity and specificity) tibiofemoral ligaments[7].

Lesions of the syndesmosis can be treated conservatively or surgically. Grade I lesions are treated with immobilization for six weeks, followed by rehabilitation. High ankle sprain tends to be slower and more painful, requiring significantly more time for proper recovery. Grade II and Grade III injuries require surgical treatment, which includes closed or open reduction and transitional fixation of the syndesmosis. The combination of dislocation with trans-syndesmotic lesions is an indication for surgery. The use of trans-syndesmotic screws is standard, although complications such as loosening and the need for additional intervention may occur. Dynamic implants such as endobuttons allow a less rigid fixation, favoring physiological movement without compromising stability, although they may present complications with the suture[11]. Endobuttonsprovid a reliable fixation without restricting movement, being as effective as screws[11]. Despite its advantages, for cost-effectiveness issues, endobutton fixation is not our first choice to perform dynamic stabilization.

Postoperative care includes removal of osteosynthesis material between weeks 8 and 12, joint load restriction, assisted passive and active mobility, lymphatic drainage, edema management, and proprioceptive reeducation, as well as muscle strengthening and stretching for adequate rehabilitation[11].

Syndesmosis injuries and high-grade knee sprains have frequently been associated with syndesmosis instability, generally being underdiagnosed. The syndesmotic ligament injury instability parameters guide the decision-making between operative and nonoperative treatment. Clinical diagnosis has limited evidence, clinical test shows low accuracy, and radiologic test has low sensitivity, interobserver correlation, and specificity. Both CT and MRI have more sensitivity and specificity in diagnostics. Intraoperative stress views and arthroscopy confirm lesions, associated injuries, such as medial instability and lateral instability, loose bodies, and osteochondral lesions. Conditions, surgical treatment. Advancements in clinical assessment and imaging diagnosis are necessary for obtaining a correct diagnosis when injury and instability are suspected. Better understanding of anatomykinematics, and mechanism of injury is necessary to determine the best treatment. The choice of implant depends on the configuration of the injury and syndesmotic behavior; surgical stabilization is ideal in different planes, setting the tibiofibular interactions to conditions close to the native state.

It is important to evaluate the influence of industry in inducing the use of dynamic endobutton fixation versus trans-syndesmotic screw fixation. We believe that prospective and multicenter controlled clinical studies analyzing the advantages of each with a larger sample size are needed. The understanding of vertical shear as a mechanism of trauma is insufficient and requires greater knowledge and dissemination.

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