The Cunéo and Picot fracture-dislocation of the ankle. A Case Report and review of the literature

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Abstract

The Cunéo and Picot fracture-dislocation is an atypical trimalleolar fracture-dislocation of the ankle with unique anatomopathologic and radiographic features, which has not been reported in English literature. We report a case of a 42 year-old woman that was diagnosed a trimalleolar fracture-dislocation and treated surgically with an open reduction and osteosynthesis of the lateral and medial malleolus. At the one-month follow-up, X-rays showed secondary displacement of the medial malleolus requiring revision surgery. The patient complained of persisting pain, with X-rays showing no signs of apparent fracture displacement. A CT scan performed after hardware removal 10 months after trauma showed severe ankle arthritis and fracture malunion at the level

of the syndesmosis. The patient was retrospectively diagnosed with a Cunéo and Picot fracture-dislocation.

In our case report, the treatment of trimalleolar fractures is discussed, especially regarding the correct indication of synthesis of the posterior malleolus. Cunéo and Picot fractures are usually inherently unstable even if the posterior malleolar fragment may be small and can easily be recognized from standard X-ray. Whenever this type of fracture is not correctly recognized and managed by osteosynthesis of only the medial and lateral malleolus, clinical outcomes and radiographic follow-ups tend to be unsatisfactory. Fixation of the posterior malleolus is indicated in the management of Cunéo and Picot fractures.

Level of Clinical Evidence: 4

Key words: ankle, Cunéo, fracture, malleolus, osteosynthesis, Picot, posterior

Introduction

Ankle fractures represent a rather common pathology, with an incidence of approximately 187 fractures per 100,000 people each year in the U.S. [1]. Treatment indications of the lateral and medial malleolar fractures are well defined, however, the same cannot be said for posterior malleolar fractures, which can be seen in more than one third of ankle fractures and have been associated with generally poor outcomes [2-9]. Commonly used trauma guidelines usually state that posterior malleolar fractures that are larger than 25% of the articular tibial surface based on lateral X-ray of the ankle

require fixation [10]. This reference, however, is rather debatable, considering that the true dimension of the posterior malleolus fragment is quite difficult to assess using standard lateral X-rays [11]. Moreover, the role of the posterior malleolus as stabilizer of the ankle joint should not be exclusively based on the size of the fracture fragment but include other factors like associated lesions of the ankle mortise and syndesmosis [12-15].

Our case study is based on a patient with trimalleolar fracture dislocation of the ankle treated by osteosynthesis of the lateral and medial malleolus alone. The patient showed severe ankle arthritis after a ten-month follow-up. In a retrospective critical analysis of the patient and limited clinical outcomes after treatment, the patient was diagnosed with an atypical ankle fracture described in French literature as fracture-dislocation of Cunéo and Picot [16]. The biomechanics of this kind of fracture suggests fixation of the posterior malleolus. While absolute consensus does not exist in current literature regarding the type of posterior malleolus fracture that should be fixed, fracture-dislocations of Cunéo and Picot could represent a true indication for osteosynthesis of the posterior malleolus regardless the size of the fragment.

Fracture-dislocations of Cunéo and Picot

In 1923, the French surgeons Cunéo and Picot described a trimalleolar ankle fracture-dislocation with unique features. In this fracture, the posterior tibial margin extends from the medial malleolus to the syndesmosis laterally. The posterior tibial margin together with the postero-inferior tibio-fibular ligament (PITFL) and the fractured medial malleolus

stay together as a whole and maintain regular contact with the talus that is dislocated posteriorly [16].

The diagnosis of this specific fracture can be easily made from standard antero-posterior X-rays looking for three distinct overlying osteochondral lines (from distal to proximal: the anterior margin of the tibial pilon, the talar dome and the posterior marginal fragment as well as a doubled joint line of the medial malleolus) (Fig.1). Post reduction X-rays can be deceiving considering that the postero-medial fracture frequently tends to be reduced anatomically by ligamentotaxis provided by the postero-medial tendons [17]. In some cases, the postero-lateral side can remain displaced, which could easily be missed based on standard X-rays.

Clinical outcomes can prove to be limiting, due to improper union at the syndesmosis or secondary displacement caused by the inherent instability of the fracture, leading to catastrophic failure of treatment. In order to provide a rigid osteosynthesis of the posterior malleolus in this kind of fracture, anatomic reduction at the syndesmotic joint as well as stability of fixation can prove to be the treatment of choice.

Case Report

A 42 year old woman had a motorcycle accident in September 2013 sustaining a trauma of her left ankle. She was in good health and worked as a hairdresser. She was diagnosed with a closed trimalleolar fracture-dislocation (Fig.2). Surgical treatment included open reduction and osteosynthesis of the lateral and medial malleolus. The posterior malleolus apparently was well reduced and was not fixed surgically. A circular

plaster cast was applied post-operatively based on the habitual management of these patients of the surgeon and apparently not due to instability (Fig.3).

At 1 month follow-up, X-rays showed secondary displacement of the medial malleolus (Fig.4). A revision of the osteosynthesis on the medial side was performed (Fig.5). The patient continued to complain of persisting pain even after several months after treatment, while follow-up X-rays showed no signs of apparent fracture displacement or osteosynthesis failure. A CT scan was performed after hardware removal 10 months after trauma, which showed severe ankle arthritis and fracture malunion at the level of the syndesmosis (Fig.6).

Discussion

Fractures of the posterior malleolus were first described by Cooper [18] in 1822, however, the optimal management of these fractures remains debatable in current literature. Gardner et al [19] interviewed 401 trauma and foot-and-ankle surgeons and assessed preferred treatment in posterior malleolus fractures: 56% chose “stability and other factors (not size of the fragment)” as an operative criteria; 97% based surgical treatment on a fragment larger than 50% of the articular surface determined from lateral X-rays; and, only 29% would fix a fragment that was 25% of the articular surface.

The ankle joint has osseous constraints (medial malleolus, lateral malleolus and posterior malleolus) and ligamentous constraints (sindesmotic complex composed of the antero-inferiour tibio-fibular ligament (AITFL), PITFL and interosseous ligament). Macko et al [20] showed that a one millimeter talar shift reduces contact area within the ankle mortise by 42%. During fracture of the posterior malleolus, the rupture of the

PITFL is pathognomic. Ogilvie-Harris performed a study regarding ligamentous restraints of the ankle in cadavers [21], which showed that section of PITFL caused loss of 42% of the stability of the syndesmotic complex. The residual instability of an untreated posterior malleolar fracture can lead to an overload of the ankle with early degenerative changes of the joint.

Hartford et al [22] assessed changes in tibiotalar contact area after osteotomy of the posterior malleolus in a cadaveric study, which showed that fragments larger than 33% of the total joint surface were associated with significant loss of joint surface contact area. The study also reported that section of the deltoid ligament didn't change results. In a systematic review on posterior malleolar fracture management, Odak et al [23] showed no correlation between fragment size and clinical outcomes. Ankle fractures with a posterior malleolar fragment were generally associated with poor results. Treatment results seemed to be influenced by the degree of initial displacement, quality of fracture reduction and by the residual talar subluxation after ankle fixation. Raasch [24] reported that ankle fractures with a posterior malleolar fragment larger than 30% subluxed only when associated with a peroneal malleolus fracture and section of the AITFL. This means that the fibula and the AITFL are primary restraints to talar subluxation.

The fracture-dislocation of Cunéo and Picot is typically associated with fracture of the peroneal malleolus and rupture of the AITFL. This type of fracture is inherently unstable, even if the posterior malleolar fragment size is smaller than 25% of the articular surface (Fig.1). The study by Clare [25] reported that the posterior malleolus acts as a restraint against posterior translation of the talus, and fractures involving

approximately 25% of the articular surface will result in posterior instability, requiring fixation. A general concern is the reliability of making this measurement from a standard lateral X-ray [26]. Ebraheim [27] showed that the radiographic incidence that best assesses the posterior malleolar fragment is a lateral X-ray with the ankle in 50° of external rotation. The fracture line, however, is highly variable and the determination of the fragment size is poorly achieved by X-ray analysis when compared to CT [28].

The study by Haraguchi et al [29] determined 3 different fracture patterns regarding the posterior malleolar fragment based on CT scans, which included: type 1 (67%) or posterolateral oblique type corresponding to the typical Volkman fragment; type 2 (19%) was the medial extension type; and, type 3 (14%) was defined as the small shell type. The fracture of Cunéo and Picot can be classified as a Hamaguchi type 2 or type 3 with the posterior malleolar fracture line extending from the medial malleolus to the syndesmosis. Type 2 and type 3 fractures have a fracture pattern that is more complex in terms of geometry of the fracture line that take on a more irregular “dented” course in addition to associated lesions, which can include comminuted medial and lateral malleolar fractures. When it comes to fragment size, Hamaguchi type 1 tend to be generally larger than type 2 and 3. This shows that fragment size alone should not be used as the sole criteria when deciding on operative fixation of the posterior malleolus (Figs.1).

The specific diagnosis of the ankle fracture-dislocation of Cunéo and Picot can be made from standard X-rays. CT scans, however, can be considered for a better analysis of the posterior malleolar fragment, by providing a precise definition of the size

of fragment, fracture pattern, cartilage comminution and articular congruency at the syndesmotic joint.

The Cunéo and Picot fracture-dislocation typically show specific characteristics, such as a significant degree of initial displacement of the posterior malleolus together with the talus at the moment of trauma and a rupture of the AITFL with associated fracture of the fibula. These patients usually show ankle instability and poor clinical outcomes if treated inappropriately.

The fracture line of the posterior fragment in the axial plane involves structures from the medial malleolus to the syndesmosis, thus making it reasonable to fixate the posterior malleolus. Fixation of the medial malleolus alone may be insufficient to guarantee reduction and stability of the posterior fragment that forms a continuum with the medial malleolus itself. Fracture extension from the medial to lateral side may dictate indication for surgical fixation, considering that indirect fracture reduction in the posterolateral side of the malleolus is not predictable and may lead to joint incongruency and subsequent talar subluxation at the syndesmotic joint, evolving in premature arthritis. An accurate understanding of the fracture pattern is imperative when dealing with ankle traumatology, especially with trimalleolar fracture types. The fracture-dislocation of Cunéo and Picot was masterfully described in 1923, however, has never been reported in current English literature. This type of fracture-dislocation can easily be recognizable from standard X-rays. Proper diagnosis is important to insure appropriate treatment. True indications for these types of lesions involve fixation of the posterior malleolus.

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Figure 1

X-rays of a 34 year old male showing a fracture-dislocation of Cunéo and Picot. (a) On the anteroposterior (AP) view presence of the 3 characteristic osteochondral lines: posterior fragment (green line), talar dome (yellow line) and anterior tibia (red line). (b) CT scan after closed reduction of the dislocation showing significant articular step-off of the posterior fragment, posterior talar subluxation and malreduction of the posterior fragment with articular incongruity at the syndesmosis (c). In the axial view the posterior fragment appears to be smaller than 25% of the complete tibial articular surface. (d) X-rays after open reduction and internal fixation (ORIF) of the posterior and lateral malleolus through a postero-lateral approach and medial approach for the medial malleolus.

Figure 2

X-rays (AP+lateral) of a 42 year old woman with a closed trimalleolar ankle fracture-dislocation after a motorcycle accident.

Figure 3

X-rays (AP+lateral) after ORIF of the lateral and medial malleolus.

Figure 4

X-rays (AP+lateral) 1 month after surgery showing secondary fracture displacement of the medial malleolus and talar subluxation.

Figure 5

X-rays (AP+lateral) after revision surgery of the medial malleolus (1 month after trauma) showing slight residual talar subluxation on the AP view and apparent joint congruency on the lateral view.

Figure 6

CT scan after hardware removal 10 months after trauma showing severe ankle arthritis (a,b). In the axial view (c) malunion at the postero-lateral side of the posterior malleolus

at the syndesmotic joint. The postero-medial side seems well reduced due to

ligamentotaxis provided by the postero-medial tendons.