

## Case Report

## Bosworth fracture. An atypical case of irreducible ankle fracture-dislocation

Francisco Jose Martin-Somoza\*, David Ruiz Picazo,  
Jesús Amador Martínez Cabezuelo, Ana Verdejo González

*Department of Orthopaedics Surgery and Traumatology, Complejo Hospitalario Universitario de Albacete, Spain*

## ARTICLE INFO

## Keywords:

Bosworth fracture  
Irreducible fracture-dislocation  
Ankle  
Surgical treatment

## ABSTRACT

An irreducible ankle-fracture dislocation in which the proximal fibular shaft fragment locks behind the posterior tibial tubercle is defined as “The Bosworth injury”. Characteristically, this fracture is generally not reducible using closed methods. A high number of attempts can be counterproductive to get a good final functional result and it may also lead to the appearance of future complications. Although it is a recognized and published cause of irreducible ankle dislocation, it is an unusual and rare injury. The initial radiological diagnosis is difficult, usually going unnoticed, and it is frequently diagnosed during the surgical act, appreciating the retro-tibial position of the proximal fibular fragment. The present report is the first in the medical data to describe a case of Bosworth injury in a 32-week-old pregnant woman. The initial diagnosis went unnoticed. After unsuccessful closed reduction attempt, urgent surgical intervention was performed.

### Introduction

In 1947, Bosworth [1] published a report of 5 cases of an unusual ankle fracture-dislocation. In all of the cases, the proximal fibular shaft fragment was locked behind the posterior tibial tubercle. Bosworth fracture's diagnosis usually goes unnoticed, even after a complete radiological study [2,3]. Many published studies have stated the inability to visualize the retrotibial position of the proximal fibular shaft fragment until the surgical act [4].

Bosworth injury is known as an uncommon cause of closed reduction failure in ankle fracture-dislocations. Previous studies have described that repeated attempts of close reduction in these patients may not only increase patient's discomfort, but also enlarge tissue and cartilage damage, as well as worsen clinical outcomes in the medium-long term [5–7].

In this case report, we present the first published case of a Bosworth injury in a pregnant woman. Our aim is to review this infrequent pathology, as well as its injury mechanisms, radiological characteristics and treatment.

### Case report

A 34 year-old woman, who was 32 weeks pregnant, was seen at the emergency room for hitting her left ankle after falling down the stairs. As her personal medical history, she suffered from focal epilepsy controlled by the Neurology Department since she was a

\* Corresponding author at: Complejo Hospitalario Universitario de Albacete, Orthopedics and Traumatology Department, Hermanos Falcó 37, 02006 Albacete, Spain.

E-mail address: [uahisco\\_10@hotmail.com](mailto:uahisco_10@hotmail.com) (F.J. Martin-Somoza).

<https://doi.org/10.1016/j.tcr.2020.100322>

Accepted 26 June 2020

Available online 27 June 2020

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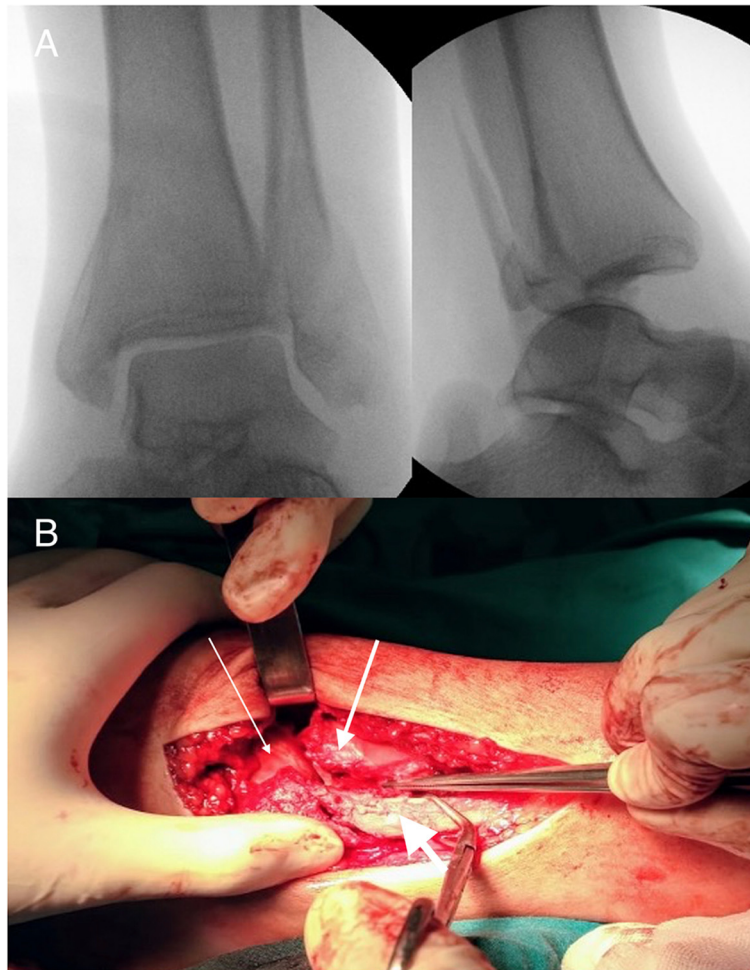
**Fig. 1.** A) Initial anterior-posterior (AP) and lateral (L) radiographs. Trimalleolar ankle fracture dislocation. The study has been altered by the patient's incapacity to maintain an adequate position. B) Control radiograph after the first closed reduction attempt. As we can observe, there's a persistent incongruity and the components of the fracture haven't moved from their original position, although classic reduction techniques have been performed.

teenager. During the clinical exam, important deformity with severe swelling and pain in both malleolus was observed. The neurovascular status of the foot was intact.

In the initial radiographs, the lesion was diagnosed as a left trimalleolar fracture-dislocation (Fig. 1). An attempt to reduce the ankle dislocation was made and a long leg plaster cast was applied afterwards. In the posterior radiological control (Fig. 1), we observed that the closed reduction had been unsuccessful. Since immediate surgery was an option, we decided not to attempt any more closed reductions, and we got the patient ready for an urgent surgical procedure.

The surgical procedure and its possible complications, both for the patient and her fetus, were explained to the patient. The patient accepted the risks, signed the informed consent and 2 g of intravenous cefazolin were prescribed as antibiotic prophylaxis.

Under spinal anaesthesia and left lower limb ischemia of 250 mm Hg, the patient was positioned in supine decubitus with both posterior and anterior abdominopelvic X-ray apron. Initially, we attempted a last closed reduction under fluoroscopic control (Fig. 2), with an unsuccessful result, so we performed an open reduction. In the first place, a lateral approach to the fibula was used, frankly observing the tibial facet of the distal tibiofibular joint (Fig. 2), as well as the complete breakage of both posterior and anterior syndesmoses and the displacement of the proximal fibular shaft fragment behind the posterior tibial tubercle. To achieve its reduction, a vigorous "lever mechanism" over the proximal fibular fragment was applied to unlock it from its retrotibial position.

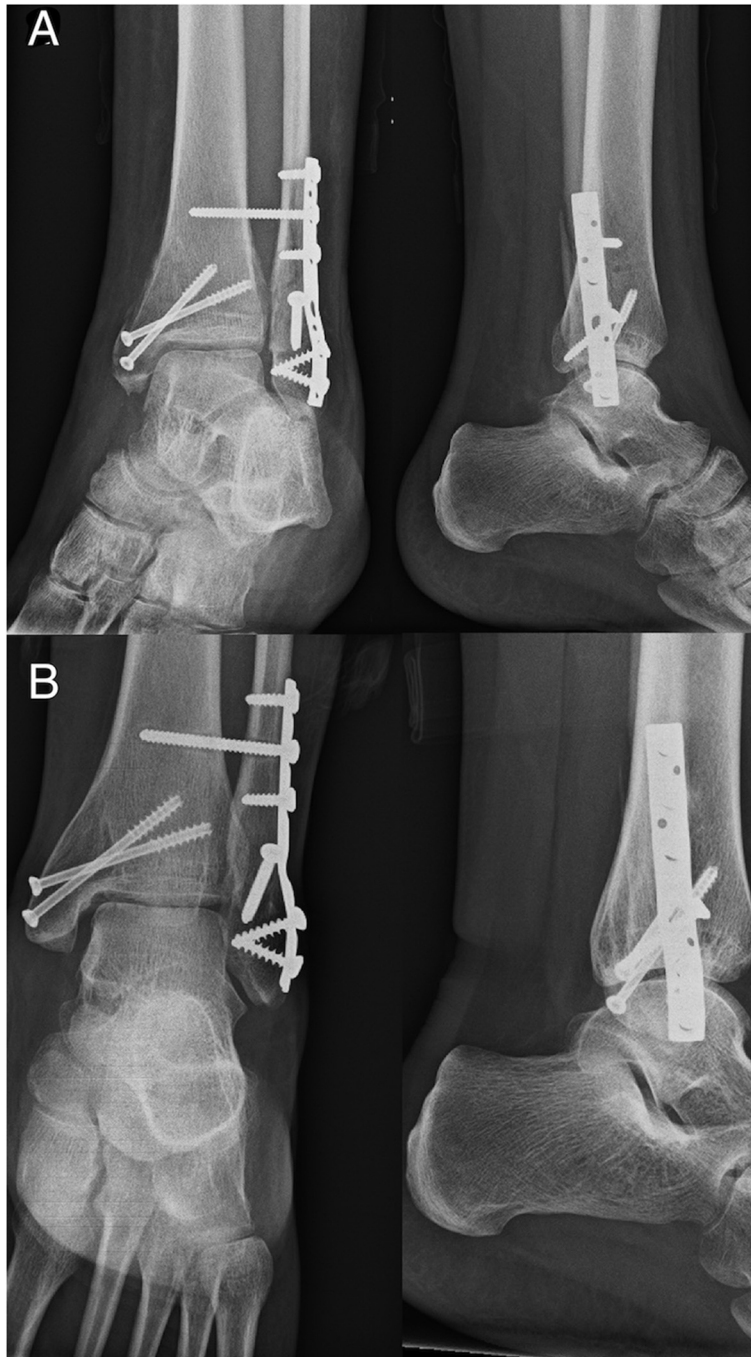


**Fig. 2.** A) Fluoroscopic images after the second closed reduction attempt in the operating theatre. Unsuccessful reduction. B) Articular surface of the distal tibiofibular joint (intermediate thickness arrow). Proximal fibular shaft entrapped behind the tibia (thick arrow). Talus (thin arrow).

Once the fracture was reduced, an internal fixation with one cortical interfragmentary screw and a seven-hole one-third tubular plate was performed. Since the distal tibiofibular syndesmosis was found unstable, we also used a tricortical syndesmotic screw. Once the fibular fracture was stabilized, the tibial malleolus fracture was spontaneously reduced, not being necessary to perform an open reduction, and it was fixed using two cannulated screws. After checking its stability under the fluoroscope, both the syndesmosis and the anterior capsule were sutured.

After the surgery, the ankle joint was immobilized using a long leg plaster cast. The postoperative period was uneventful and the patient was discharged from the hospital the following day. Ten days after the surgery, the patient came for a clinical review to our medical office, where we removed the plaster cast and checked the good state of the wound and soft tissues, starting flexion-extension non-weight exercises and sending the patient to the Rehabilitation Unit to start physiotherapy. Before coming back to our office for the second time, the patient was in hospital in the Obstetrics and Gynaecology Unit where she underwent an elective caesarean section at 37 weeks. The postoperative period was positive.

Six weeks after the surgery, slight inflammation and pain persisted, mostly during bipedestation. Due to the patient's situation (breastfeeding), we decided not to remove the transyndesmotic screw, and we allowed partial load of the ankle using walking sticks and Calm-Walker like orthosis. Three months after the surgery, the patient's mobility had improved, being able to walk using just one stick, with a pain decrease and the radiograph didn't show any differences compared to the previous one (Fig. 3). Clinically, the patient referred scar dysesthesia, a 10° dorsiflexion limitation and felt mild discomfort around the fibular osteosynthesis. A conservative treatment was decided in the meantime and to carry on with the rehabilitation treatment. Nowadays, eighteen months after the surgery, the patient presents a slight dorsiflexion limitation, has no limp or functional limitation to carry out her daily life, and has been back to work with no further problems.



**Fig. 3.** A) X-ray image four weeks after surgery. B) Control radiograph one year after the surgery. We can observe fracture consolidation with good joint congruence.

### Discussion

The most frequent cause of irreducibility in ankle fracture-dislocations is the interposition of soft tissues in between fragments. In 1947, Bosworth described a less frequent cause, characterized by the lock of the proximal fibular shaft fragment behind the posterior tibial tubercle. Since the 1950s, more than 60 cases of this pathology have been published, with their own particularities. Recently, Bartonicek et al. [3] published a report of six cases in which a patient presented an intact fibula associated to a retrotibial dislocation. Taking into account the specifics of our case, it's well known that, during pregnancy, women undergo weight, shape and hormonal changes that are associated to musculoskeletal consequences, including an increase of lumbar lordosis and joint laxity, which could

consequently lead to failure and instability of weight-bearing joints (hip, knee and ankle) [8]. On the other hand, fluoroscope is needed to perform surgery. It's well known that radiation injuries depend on the dose of exposure and the gestation stage in which the exposition occurs [10]. Our patient was on the third trimester of pregnancy, so the fetal risk of radiation damage was very low. Nevertheless, a collimator was used to minimize the use of fluoroscopy as well as a double shield to protect the woman.

So far no radiological persistent characteristics have been described that could be helpful for the surgeon to recognise the nature of the injury. Therefore, we think that radiological signs of this lesion aren't easy to identify, but there are some clues that could put us on track to diagnose this injury: an increase in the medial joint space, an overlap of the proximal fibular fragment over the distal tibia in the anteroposterior projection and a posterior displacement of the fibula in the lateral projection [11]. Khan and Borton introduced a new radiological sign that could be used as an indicator in Bosworth injuries: the "Axilla sign" [12]. This sign was described as a cortical density in the axilla of the medial tibial plafond because of the medial permanent rotation of the tibia. To avoid difficulties understanding the configuration of the fracture, many authors support the use of a computerized tomography (CT) [6,7]. In our case, a series of factors led to urgent surgery: the impossibility to achieve a close reduction, our patient's pregnancy, the availability of an operating theatre and a positive preoperative exam.

Bosworth fracture is characteristically irreducible using closed techniques, owing to a fixed dislocation of the proximal fibular fragment posterior to the lateral ridge of the tibia. Hence, an early open reduction is necessary to minimize further complications. During surgery, it is convenient to apply a vigorous "lever mechanism" between tibia and fibula in order to achieve the reduction of the distal tibiofibular joint. Because of the characteristics of this lesion and the instability risk, we decided to use a tricortical transyndesmal screw to protect the breakage of the interosseous membrane. Many authors recommend the removal of the transyndesmal screw 6–8 weeks after the surgery to allow progressive weight-bearing of the operated limb [2,3]. In our case, surgery to remove the transyndesmal screw was proposed to the patient who, due to her concomitant condition (breastfeeding), decided to postpone it.

Complications such as cutaneous necrosis, superficial infection, compartmental syndrome, avascular necrosis of astragalus, joint stiffness, lesion of the superficial fibular nerve and secondary arthrosis, can appear more frequently in the Bosworth injury than in any other type of ankle fracture-dislocation. The delay for surgical reduction or repetitive close reduction attempts are risk factors for obtaining poor results and a higher risk of complications [9].

In conclusion, Bosworth injury is an uncommon condition that should be taken into account in the differential diagnosis of irreducible ankle fracture-dislocations. It is often misdiagnosed in initial radiographs, usually going unnoticed until the surgical act. In order to minimize complications and to obtain a good functional result, an early diagnosis and open reduction is very important, as well as to limit the number of closed reduction attempts.

## Declaration of competing interest

The authors declare no conflict of interest.

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