

TALUS FRACTURES - CLINICAL OUTCOMES - CLOSED REDUCTION AND MINIMAL INVASIVE OSTEOSYNTHESIS VERSUS OPEN REDUCTION AND INTERNAL FIXATION

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Abstract

The purpose of this paper is to evaluate and compare the clinical outcomes of closed reduction with minimal invasive osteosynthesis with the ones of open reduction with internal fixation in talus fractures. In this study we used the Bucharest University Hospital, Department of Orthopaedics and Traumatology database. We retrospectively reviewed the records of 65 patients with 70 talus fractures, 5 of them were bilateral) managed in our department between 2010-2013. The 65 patients were divided into two groups. In the first group, there were 26 patients with 27 talus fractures who were treated by closed reduction under C-arm control followed by minimal invasive osteosynthesis. We compared the results with the ones of the second group of 39 patients who had 43 talus fractures who were treated by open reduction with internal fixation. The mean age was 32.5 years (range: 22-79) for the first group and 35.1 years (range: 20–85). The gender distribution was 15 males/11 females for the first group and 27 males/12 females for the second group. The average follow-up was 4 years (range 2-7.3years). To evaluate properly the clinical outcome, we determined the American Foot and Ankle Score at 3,6,12 months and every year after that and we recorded the complications for each case: avascular necrosis, tibiotalar osteoarthritis and talocalcanean osteoarthritis. By groups, the complications were: for Group 1: avascular necrosis – 2, tibiotalar osteoarthritis – 1, talocalcanean osteoarthritis - 3, and for Group 2: avascular necrosis – 4, tibiotalar osteoarthritis – 1, talocalcanean osteoarthritis – 4. Group 1 had an average value of the American Foot and Ankle Score at of 85.6 +/- 9.2 (extremes: 54-96) at 3 months, of 89.4+/-8.9 (extremes:61-97) at 6 months and of 94.5 +/-8.8 (extremes: 64-100) at 1 year, while in Group 2 the average value for the American Foot and Ankle Score was 73.9 +/- 9,6 (extremes: 50-91) at 3 months, 82.1+/-7,6 (extremes: 55-90) at 6 months and of 89.5 +/-8,7 (extremes: 60-94) at 1 year. Talar fractures are most commonly followed by complications as osteoarthritis of the adjacent joints and avascular necrosis of the talus. Tibiotalar and talocalcanean osteoarthritis are well tolerated by patients, and the postoperative recovery is considerably faster in the case of closed reduction with minimally invasive osteosynthesis.

Keywords: talus fracture, avascular necrosis, osteoarthritis, minimally invasive osteosynthesis

Introduction

Talus fractures are usually uncommon, and they tend to have a poor prognosis because of their global function for the ankle stability and the damages of the ankle articular surface. Talar fractures happen usually after high-energy injuries making most of the patients polytrauma cases [1].

X-rays and CT scan are required to assess the type of treatment needed for the talar fractures. Displaced fractures are very unstable and they require surgical treatment in order to have an anatomical reconstruction of the joints and a proper re-alignment.

The aim of this paper is to evaluate and compare the clinical outcomes of closed reduction with minimal invasive osteosynthesis with the ones of open reduction with internal fixation (ORIF) in talus fractures.

Material and methods

In this study we used the Bucharest University Hospital, Department of Orthopaedics and Traumatology database.

We retrospectively reviewed the records of 65 patients with 70 talus fractures (5 of them were bilateral) (Figure 1-3) managed in our department between 2010 and 2013. The 65 patients were divided into two groups according to the type of surgical treatment they underwent.



Figure 1 - Comminuted fracture of the body of talus – preoperative antero-posterior X-ray view



Figure 2 - Comminuted fracture of the body of talus – preoperative lateral X-ray view



Figure 3 - Comminuted fracture of the talus - CT scan



Figure 4 - Fracture of the talus with subtalar dislocation – preoperative (a) and postoperative X-ray views after minimally invasive screw fixation (b)

We used Hawkins classification for the talar neck fractures in order to properly give the indication for closed reduction with internal fixation versus open reduction with internal fixation.

In the first group, there were 26 patients with 27 talus fractures who were treated by closed reduction under C-arm control followed by minimal invasive osteosynthesis (Figure 4). We compared the results with the ones of the second group of 39 patients who had 43 talus fractures that were treated by open reduction with internal fixation (Figure 5,6).

In what regards the type of talar fractures there were 20 neck fractures, 2 head fractures and 5 fractures of the talar body in the first group and 31 neck fractures, 4 body fractures, 2 talar process fractures and 6 highly comminuted fractures.

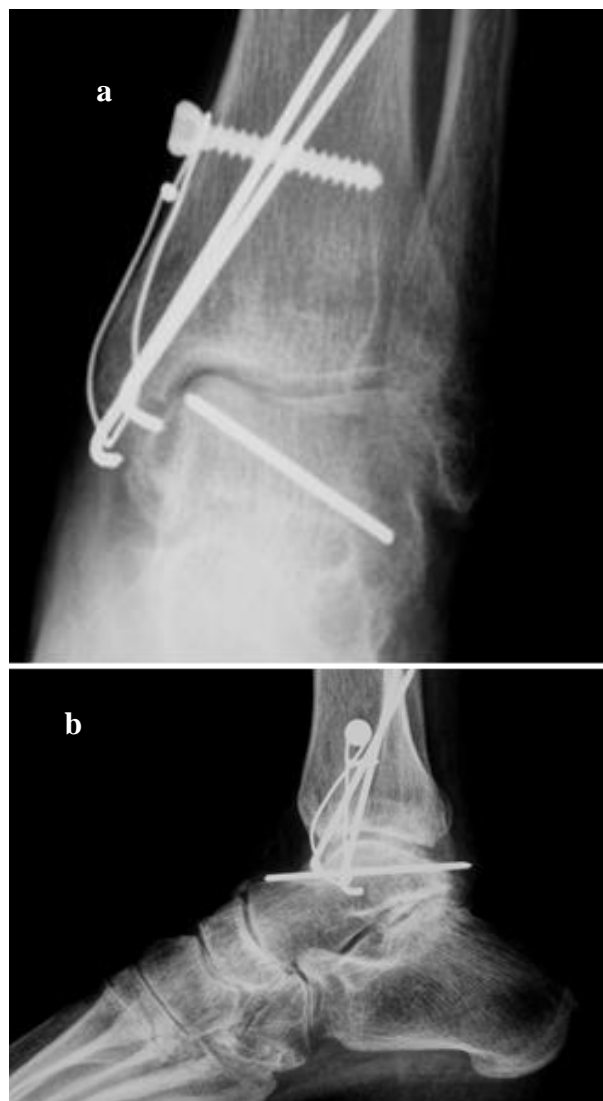


Figure 5 - Postoperative X-rays after ORIF with tibial transmalleolar approach

According to Hawkins's classification we had 18 Type II fractures and 2 Type III fractures in group 1 and in group 2 there were 10 Type II fractures, 19 Type III fractures and 2 Type IV fractures.

The mean age was 32.5 years (range: 22-79) for the first group and 35.1 years (range: 20-85) for the second group.

The gender distribution was 15 males (57.69 %)/ 11 females (42.31%) for the first group and 27 males (69.23%) / 12 females (30.77%) for the second group.

All of them were immobilised in a non-weight-bearing cast in neutral alignment for 4-8 weeks accordingly to the type of fracture, bone quality and fixation stability and started progressive weight-bearing and physical therapy after that. All temporary K-wires were removed between 3 and 6 months.



Figure 6 - Displaced talus fracture: preoperative lateral x-ray view (a); postoperative lateral x-ray view (b); 6 months after surgery lateral x-ray view (c)

For a proper evaluation of the clinical outcomes, we determined the American Foot and Ankle Score for each patient at 3,6,12 months and every year after that [2]. Through

this scoring system we evaluated pain, function and alignment of the ankle joint. In terms of points, 50 were given for full function, 40 points for pain and 10 points for alignment. To quantify the range of motion of the subtalar joint, the ankle was evaluated in neutral position. Generally, an AOFAS score between 90-100 points is considered excellent, a score between 75-89 good, values between 50-74 fair and a score <50 shows a poor ankle function.

The complications recorded for each case were:

- avascular necrosis,
- tibiotalar osteoarthritis,
- talocalcaneal osteoarthritis.

Avascular necrosis (AVN) of the talar body is a complication quite specific that occurs after fractures of the neck and body of the talus. In most of the cases it is due to an interruption of the blood supply. AVN can be diagnosed after 4-6 postoperative weeks by the appearance of a radiopaque image of the talar body on plain radiographs. The “Hawkins sign” is a radiolucent zone, visible in antero-posterior view or on lateral radiographs that appears at 4-8 weeks after trauma in the subchondral cortex and suggests bone remodelling [3]. It is considered a good indicator for the viability of the talar bone, however, the absence of this sign is not necessarily a predictor for a worse prognosis.

The average follow-up was 4 years (range 2-7.3years).

Results

In the first Group only 1 patient developed avascular necrosis while in the second group 4 of them did.

In terms of tibiotalar osteoarthritis, this complication was found in 2 patients from Group 1 and 1 patient from Group 2.

Talocalcaneal osteoarthritis was a more frequent complication for both groups, having 3 patients in Group 1 and 4 patients in Group 2 who developed this condition.

The average American Foot and Ankle Score evaluation score for Group 1 was 85.6 +/- 9.2 (extremes: 54-96) at 3 months, of 89.4 +/- 8.9 (extremes: 61-97) at 6 months and of 94.5 +/- 8.8 (extremes: 64-100) at 1 year.

Group 2 had an average value for the American Foot and Ankle Score of 73.9 +/- 9.6 (extremes: 50-91) at 3 months, 82.1 +/- 7.6 (extremes: 55-90) at 6 months and of 89.5 +/- 8.7 (extremes: 60-94) at 1 year.

The differences were statistically significant at 3 months after surgery ($p < 0.05$), but weren't statistically significant at 6 and 12 months ($p > 0.05$) after surgery.

Discussions

The talus connects the foot and the leg and helps transfer weight and pressure all over the ankle joint being largely covered by articular cartilage. Fractures of the head, neck or body can result in abnormal motion of the ankle, subtalar and transverse tarsal joints injuries and result in deformity, loss of motion or chronic pain.

The blood supply comes from the dorsalis pedis artery, the artery of the sinus tarsi and the artery of the sinus canal [4]. The dorsalis pedis artery is the principal blood vessel for the head and neck. A branch of the peroneal artery and a branch of the dorsalis pedis artery form the artery of the sinus tarsi, which supplies the lateral half of the talar body. The artery of the sinus canal comes from a branch of the posterior tibial artery and it gives deltoid branches that are usually for the medial third of the talar body. Even so, the main blood supply for the body of the talus is the artery of the tarsal canal. This artery is a branch of the posterior tibial artery, which enters the tarsal canal and continues to sinus tarsi, where it anastomoses with the artery of the sinus tarsi, forming a vascular sling. It gives arterial branches that enter talus from internal and inferior side.

The blood supply sources of the talus are limited because the talus doesn't have any muscular insertion and most of its surface is covered by articular cartilage [5].

AVN is very likely to be influenced by the degree of displacement. Even if the results in the literature vary quite a lot, there seem to be a correlation between fracture dislocation and AVN.

Tibiotalar osteoarthritis and talocalcaneal osteoarthritis are complications that generally affect patients that suffered from talar

bone/neck fractures. However, because of the lack of criteria and different follow-up period, literature shows prevalence that varies between 16%-100%. Even so, only a part of the patients who have radiographic signs of osteoarthritis develop symptoms.

The ankle stiffness improved considerably in the first year after surgery. Crucial are the first 6 weeks after the removal of the cast immobilization [6].

The postoperative short and long-term complications are influenced by patient – related factors like: type of fracture, the degree of displacement, operative management, and patient compliance.

The results of this study can be correlated with the ones described in the literature [7].

Conclusions

Talar fractures are most commonly followed by complications as osteoarthritis of the adjacent joints (19.23% in group 1 and 12.82% for group 2) and avascular necrosis of the talus (3.84% for group 1 and 10.25% for group 2).

Tibiotalar and talocalcaneal osteoarthritis are well tolerated by patients. According to our study, the postoperative recovery is considerably faster in the case of closed reduction with minimal invasive osteosynthesis than in fractures treated with open reduction with internal fixation giving patients higher chances for optimal rehabilitation.

In case of non-displaced or minimally displaced fractures of the talar neck, only an interruption of the intraosseous arteries can occur, without rupturing the main blood vessels, giving Hawkins fracture Type I and II less chances to develop AVN than in the highly comminuted and displaced neck fractures. Therefore, optimal reduction within the fracture may realign the blood vessels, while a proper fixation will help revascularization and reduce the risk of AVN. In non-displaced or minimally displaced fractures of the talus, the vessels can be elongated or concussed; an early reduction and fixation will prevent the thrombosis and permanent lesions of these arteries, making the timing an important factor for all types of talus fractures.

Closed reduction with internal fixation had better results and clinical outcome than ORIF in our study, but the difference wasn't statistically significant.

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