TREATMENT OF OPEN EXTRUDED FRACTURE NECK OF THE TALUS USING THE COMBINED METHOD OF EXTERNAL FIXATION MODIFIED FOR DYNAMIC ANKLE JOINT FIXATION AND KIRSCHNER WIRES

Božović Aleksandar,1, 2 Lalić Ivica,3 Petrović Dušan,1, 2 Jovanović Saša,2 Elek Zlatan,1, 2 Šipka Aleksandar,4, 5 Bojović Marko4, 5
1 University of Priština in Kosovska Mitrovica, Faculty of Medicine, Kosovska Mitrovica, Serbia
2 Clinical Hospital Center, Surgery Clinic, Kosovska Mitrovica, Serbia
3 University Business Academy in Novi Sad, Faculty of Pharmacy, Novi Sad, Serbia
4 University of Novi Sad, Faculty of Medicine in Novi Sad, Novi Sad, Serbia
5 Oncology Institute of Vojvodina, Sremska Kamenica – Novi Sad, Serbia

Abstract: Introduction: Open extruded fractures of the talus occur in 2% of talar fractures. These fractures are challenging for surgeons due to complications such as infection, nonunion, and arthritis. The most common treatment method is talus reimplantation and osteosynthesis.

Case report: A 19-year-old presented with an open extruded fracture of the right talus following a fall from a height of approximately 1 meter. The patient was transported to our hospital 1 hour after the incident. We established with the first clinical examination a laceration on the lateral side of the ankle measuring about 10 cm with a fracture of the neck of the talus and extrusion of the posterior part of the talus, lateral malleolus, and part of tibial pilon through the wound. The radiographs show a fracture of the neck of the talus and luxation (extrusion) of the posterior part of the talus (position in ankle joint) from the talocalcaneal without tarsus-metatarsus dislocation (Figure 1). We classified it as Hawkins II type talar fracture according to the modified classification of these injuries by Canale and Kelly (6).

After a short preoperative preparation and radiological diagnosis of the injury, the operative procedure was started within four hours of the patient’s admis-
extruded talus was repositioned under C-Arm fluoroscopy (Figure 2) and fixed with two Kirschner wires (Figure 3).

Figure 1. A - clinical and B - radiography images show approximately 10 cm laceration on the lateral aspect of the right ankle with a posterior talus, part of the tibial pilon, and lateral malleolus completely extruded through the skin.

Before the actual operation, two hours after admission to the hospital, the patient received antibiotic therapy (second-generation Cephalosporins and Aminoglycosides) as well as anti-tetanus protection. Under general anesthesia, we performed wound irrigation, debridement, and intraoperative swab collection. The extruded talus was repositioned under C-Arm fluoroscopy (Figure 2) and fixed with two Kirschner wires (Figure 3).

Figure 2. Excision of necrotic soft tissue (A) and reimplantation (B) of the talus.

After radiographic confirmation that the fragments of the talus were successfully brought to the anatomical position in both the ankle and talocalcaneal joints, we tested the movement and stability of the ankle joint fragments using C-Arm fluoroscopy. Following this assessment, we proceeded with the external fixation of the ankle joint in a neutral dorsiflexion position. This was achieved using the Mitkovic type M20 external fixator, which has been modified for rigid and dynamic external fixation of the ankle joint (Figure 4). The procedure concluded with wound drainage and closure.

Figure 3. Minimally percutaneous osteosynthesis of the talus with two Kirschner wires. A and B - Intraoperative look (shew), C - Anterior Posterior (AP) dorsoplantar radiograph view and D - lateral radiograph view.

Figure 4. Placement of Mitkovic-type external fixator M20 modified for rigid and dynamic ankle joint fixation.
The patient was verticalized on the 1st postoperative day and trained to walk using crutches. We prescribed a regimen of second-generation cephalosporin antibiotic therapy (Cefuroxime 4.5 g/day i.v.), aminoglycosides (Amikacin 4g/day i.v.) and Metronidazole (1.5 g/day i.v.) for 7 days. Thromboembolic prophylaxis was administered for 35 days, alongside analgesics for pain management. The patient remained hospitalized for 14 days until the sutures were removed, during which the wound healed without infection.

Pin site care was performed twice a week while in the hospital, and subsequently at another medical institution. A wound swab revealed the presence of two bacteria: *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Despite this finding, we did not change the antibiotic therapy. Laboratory findings for inflammation remained within normal limits during the hospital stay. We also closely monitored clinical signs of wound healing and, based on this assessment, determined the appropriate duration of antibiotic therapy.

The external fixator was unlocked to allow movement in the ankle joint after 6 weeks, and the patient was referred to physical therapy, which included kinesiotherapy, electrotherapy, and pulsed magnetic field therapy. Partial weight-bearing of 10-20% was allowed after 8 weeks. At the 10-week mark post-trauma, ankle radiographs were taken to examine the Hawkins sign. After 12 weeks, the patient was permitted to bear 50% of their weight.

The Kirschner wires were removed after 12 weeks, and the fixator was removed under intravenous anesthesia after 18 weeks. Following this, the patient was referred for further physical therapy with a plan to gradually transition off crutches within two weeks and achieve full weight-bearing on the injured leg. There were no signs of deep infection around the pins.

The patient attended check-ups every two weeks initially, and after the removal of the fixator, every two months. Radiographic follow-ups were conducted up to 24 months postoperatively (Figure 5).

On the last radiographs, there were no signs of arthrosis in the ankle joint, and the talus healed in an excellent position. A radiographic examination showed no sign of avascular necrosis of the talus. The clinical findings of the ankle joint at the end of the treatment were excellent with optimal plantar flexion of 50° and with a restriction of ankle motions of 10° in dorsiflexion that did not significantly impair walking or normal daily activities (Figure 6).

DISCUSSION

Traumatic extrusion of the talus is a rare injury that occurs after high trauma energy. Exaggerated ankle plantar flexion with extreme subtalar supination causes dislocation and disruption of ligaments. Many treatment options are described in the literature, but none of them guarantee a successful result. Of course, there is no consensus about appropriate treatment (7). Not so long ago, talectomy with primary tibiotalocalcaneal arthrodesis was preferred over reimplantation.
(8). In his study, Issaoui suggested that completely extruded or grossly contaminated thallus should be replaced (9). Some authors, to reduce the risk of infection, delay reimplantation of the talus and use antibiotic cement in the form of talus while awaiting results. Immediate talus reimplantation and osteosynthesis are most often performed. After reimplantation osteosynthesis of the talus can be performed by ORIF (open reduction and internal fixation), percutaneous Kirschner wires, or external fixation (10). We decided to use the Mitkovic-type external fixator M20, modified for dynamic external fixation of the ankle joint (11, 12). In our case, respecting all operational postulates treatment of an open fracture, using antibiotics and anti-tetanus protection, surgical debridement, and using external fixation very carefully, we reduced the risk of infection and avascular necrosis.

Otherwise, external fixation can be a definitive method of treatment, although often in practice it is temporary (13). In our case, we used the method of external fixation as a definitive method of treatment, with additional stabilization by percutaneous Kirschner wires.

The use of antibiotics in the case of an open fracture is long-term and lasts at least 2 weeks. The combination advised initially is similar to that for other open fractures (14). We used triple antibiotic therapy for two weeks. We had no wound infection.

The pin site care that we implemented was by the standard recommendations for pins site care (15).

The mean healing time of a talus neck fracture in this type of fracture is 10-12 weeks on average (16). In our case, talus union was visible on radiographs at about 14 weeks, but we kept the external fixator for another 4 weeks as a precaution.

Of course, the percentage of occurrence of avascular necrosis of the talus is of great concern to the surgeon. Unfortunately, that is hard to predict today. The most important and only indicator of revascularization of the talus which is observed on conventional radiographs, 6 to 12 weeks after the injury is the Hawkins sign. We had Hawkins sign on the control radiographs in that period. Most authors agree that the follow-up time for patients with a talus fracture is about 2 years (17). In our case, no avascular necrosis occurred 24 months after the operation.

The functional results of the treatment of open and extruded fractures of the talus neck in our case correspond to the results of the treatment described in the literature (18, 19). In the literature, there are no clearly defined treatment guidelines for this injury. The first choice of treatment which showed good and promising functional results is the reimplantation of fractured talus and osteosynthesis. Recent studies recommend that immediate reimplantation of extruded talus in open fracture is the safest procedure with a very favorable treatment effect (18, 19).

**CONCLUSIONS**

In conclusion, in our case, by observing all the principles of treating an open fracture, using antibiotics, anti-tetanus protection, irrigation, debridement of the wound, repositioning of the talus, and fixation with the method of external fixation and additional Kirschner wires, we obtained a good anatomical and functional result treatment. Certainly, this type of treatment does not exclude arthrodesis or arthroplasty of the ankle joint. The success of such treatment supports our therapeutic choice. We had no side effects such as avascular necrosis, infection, or talar collapse, achieving a good functional outcome with a relatively less invasive procedure contributing to a better quality of life for the patient.

**Abbreviations**

**AP** - Anterior Posterior

**ORIF** - Open reduction and internal fixation

**Conflicts of Interest:** The authors declare no conflict of interest.

**Funding:** This research received no external funding.

**Author Contributions:** All authors have made substantial contributions to all parts of the manuscript. Also, all authors have read and agreed to the published version of the manuscript.

**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was not required, as this was a case report.

**Informed Consent Statement:** Written informed consent was obtained from the patient for the publication of this report.

**Data Availability Statement:** All data generated or analyzed for this report are included in the published article.

**NOTE:** Artificial intelligence was not used as a tool in this study.

**Licensing:** This work is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) License.
Sažetak

LEČENJE OTVORENOG EKSTRUDIRANOG PRELOMA VRATA TALUSA KOMBINOVANOM METodom SPOLJAŠNJE FIKSACIJE MODIFIKOVANE ZA DINAMIČKU FIKSACIJU SKOČNOG ZGLOBA I KIRSCHNEROVIM IGLAMA

Božović Aleksandar,1,2 Lalić Ivica,3 Petrović Dušan,1,2 Jovanović Saša,2 Elek Zlatan,1,2 Šipka Aleksandar,4,5 Bojović Marko6,5

1 Univerzitet u Pristini sa privremenim sedištem u Kosovskoj Mitrovici, Medicinski fakultet, Kosovska Mitrovica, Srbija
2 Kliničko bolnički centar, Klinika za hirurgiju, Kosovska Mitrovica, Srbija
3 Univerzitet Privredna akademija u Novom Sadu, Farmaceutski fakultet, Novi Sad, Srbija
4 Univerzitet u Novom Sadu, Medicinski fakultet Novi Sad, Novi Sad, Srbija
5 Institut za onkologiju Vojvodine, Sremska Kamenica-Novis Sad, Srbija

Uvod: Otvoreni ekstrudirani prelom talusa predstavlja 2% od svih preloma talusa. Zbog brojnih komplikacija (infekcija, nesrastanje, artritis) predstavlja veliki izazov za hirurga. Najčešće korišćen metode lečenja je implantiacija talusa i osteosinteza.


Zaključak: Lečenje ove povrede predstavlja veliki izazov za hirurga. Spoljna fiksacija može biti izabrana kao metoda lečenja otvorenenog lutakijca preloma talusa.

Ključne reči: slučajni padovi, skočni zglob, Kirschnerove igle, spoljni fiksatori, talus.

REFERENCES


*Accepted papers are articles in press that have gone through due peer review process and have been accepted for publication by the Editorial Board of Sanamed. The final text of the article may be changed before the final publication. Accepted papers can already be cited using the year of online publication and the DOI, as follows: the author’s last name and initial of the first name, article title, journal title, online first publication month and year, and the DOI. When the final article is assigned to volumes/issues of the journal, the Article in Press version will be removed and the final version will appear in the associated published volumes/issues of the journal. The date the article was made available online first will be carried over.

**How to cite this article:** Božović A, Lalić I, Petrović D, Jovanović S, Elek Z, Šipka A, Bojović M. Treatment of open extruded fracture neck of the talus using the combined method of external fixation modified for dynamic ankle joint fixation and Kirschner wires. Online First, Jun 2024. doi: 10.5937/sanamed0-50563.

**Correspondence to / Autor za korespondenciju:**
Marko Bojović
University of Novi Sad, Faculty of Medicine in Novi Sad, Novi Sad, Serbia
E-mail:marko.bojovic@mf.uns.ac.rs
ORCID: 0000-0002-4304-8974