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DIRECT FIXATION OF FRACTURES OF THE POSTERIOR MALLEOLUS THROUGH A POSTERO-MEDIAL APPROACH

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Abstract. Background and objective: *Fractures of the posterior malleolus have long been neglected in the past. The decision for their fixation should be based on plain lateral radiographs. Recent studies have emphasized the important biomechanical function of the posterior tibial ridge. This has caused a trend towards more aggressive surgical treatment. The aim of this study was to present our experience with the direct fixation of complex ankle fractures engaging the posterior malleolus. We also tried to clarify the advantages and limitations of the posterior-medial surgical approach.* ***Materials and Methods:*** *For a period of 1,5 years we have operated 14 patients with posterior malleolus fractures. Their average age was 51 years. Eight of the patients were male, the rest 6 were females. Fractures were classified according to Bartoníček classification system. All patients had type 3 fractures. Direct open reduction was performed in all cases. Posterior buttress plate was used for the fixation of the fracture. Bone grafting was found necessary in one case. Functional assessment was done according to the criteria of the AOFAS (American Orthopedic Foot and ankle score). Follow up was done for an average period of 10 months.* ***Results:*** *All fractures united for an average period of 9 weeks (8-10 weeks). Six patients achieved an excellent functional result, 5 – a good one and 3 had an average result. The average AOFAS rating score was 84,02 (54-100). The average range of motion was 38° (15°-50°). There were no deep infections or septic arthritis. Three ankles had superficial skin necrosis that healed without any additional procedures. One patient had prolonged and substantial swelling of the leg, despite of the routine antithrombotic prophylaxis. Five patients needed their fibular plates removed due to local irritation.* ***Conclusion:*** *The direct reduction and fixation of the posterior malleolus fractures allow anatomical restoration of the ankle mortise. This is a prerequisite for an optimal functional recovery and appears to be a safe treatment strategy.*

Key words: *posterior malleolus fracture, direct fixation, postero-medial approach*

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INTRODUCTION

Fractures of the posterior malleolus (PM) form a diverse group. Their oversimplified classification according to the size on a lateral X-ray image is based back on the article of Nelson and Jensen published in 1942 [1]. Despite the limited number of patients (just 8), their conclusions influenced the way of thinking of many trauma surgeons up to this day. Recent studies challenged the isolated importance

of articular involvement [2, 3]. They showed that the grade of dislocation, the articular incongruency and the tibio-talar subluxation, may influence the final outcome to a far greater extend. The biomechanical importance of the posterior tibial rim explains these findings. It not only contributes to the syndesmal stability, but also determines the tibio-talar kinematics [4, 5].

Those new findings justify the trend towards more aggressive treatment of PM fractures. This was the reason to alter our treatment algorithm. In the current article we discuss the rationale of these changes as well as our preliminary results.

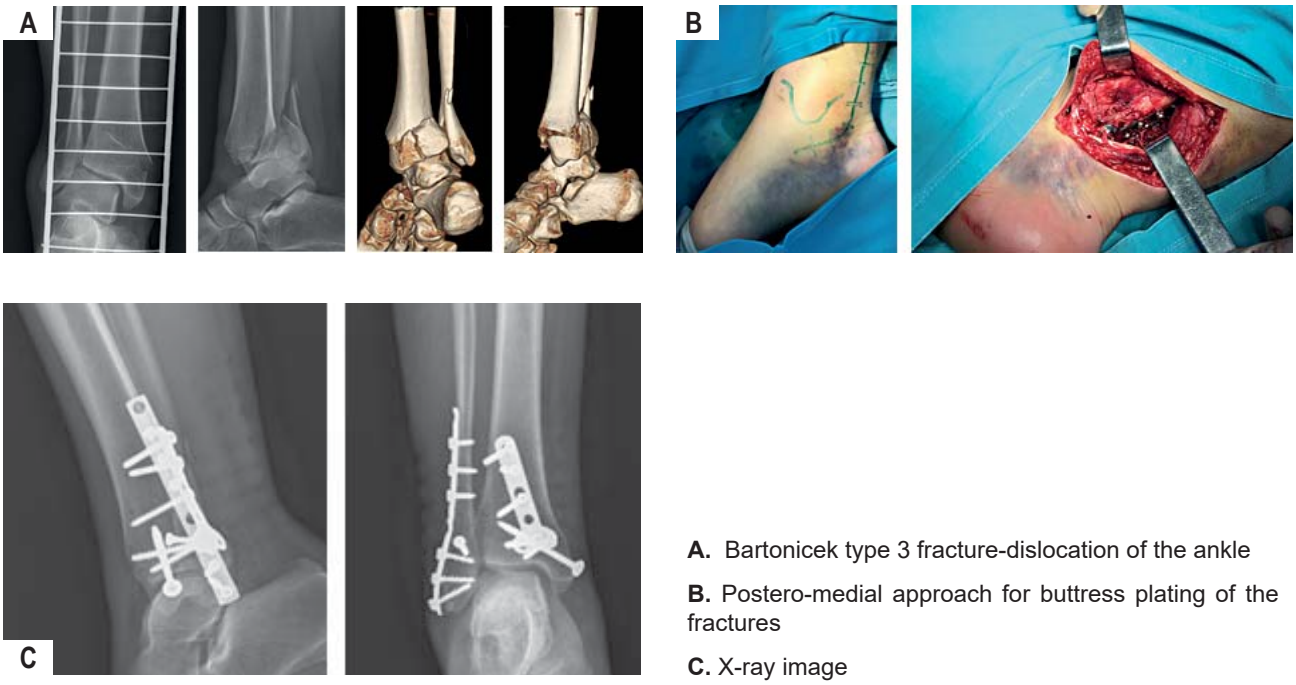
MATERIALS AND METHODS

For a period of 2 years (2018-2020) we operated 14 patients with posterior malleolus (PM) fractures. The average patient's age was 51 years. Eight of the patients were males, the rest 6 were females. Fractures were classified according to Bartoníček classification system [6]. This classification is based on recent biomechanical studies and has the advantage to guide the treatment process. It divides the PM fractures into 5 groups, on the basis of their CT scan morphology. The first group comprises PM fractures out of the fibular incisura. The second group includes single fragment PM fractures that involve the fibular incisura. The postero-medial PM fractures form the third group. The postero-lateral PM fractures comprise the fourth group. The last (fifth) group is formed by the osteoporotic irregular PM fractures. All of the included patients had a type 3 PM fracture.

Direct open reduction was performed, if the fibular incisura was involved in the fracture, if there was a marked posterior luxation of the joint, or there were intercalated articular fragments.

All fractures were treated through the postero-medial approach. The patients were in a supine position. The calf was flexed in a figure of 4 position. The skin incision was placed medially to the Achilles tendon and curved around the medial malleolus. Its length was determined by the metaphyseal component of the fracture. Deep dissection depended on fracture morphology. The interval between flexor hallucis longus and the tibial artery was uncovered, if a better approach to the lateral tibial portion was needed. More often, we preferred the access between the tendons of m.tibialis posterior and flexor digitorum longus. In those cases the tibial artery and nerve were not visualized. If there were intercalated fragments, the PM was mobilized like an open book, in order to achieve perfect articular reduction. It was then closed and fixed provisionally with K wires. After the reduction was verified in a lateral X-ray projection, the definitive fixation was completed by a posterior buttress plate (Figure 1). Bone grafting was found indicated in one case.

In order to fix the medial malleolus, a separate interval was developed in front of the tibialis posterior tendon. Lag screws or Weber dynamic fixation carried through the stabilization (Figure 1). The fibular fracture was reduced and fixed in a usual manner, through a lateral approach. The syndesmosis was visually inspected and tested at this time. Standard tricortical syndesmosis screws were used if necessary.



A. Bartonicek type 3 fracture-dislocation of the ankle

B. Postero-medial approach for buttress plating of the fractures

C. X-ray image

Fig. 1

After the operation the leg was splinted for a period of 14 days. After this period of time rehabilitation was started according to the guidelines described by Mindova [7]. Touch weight bearing was immediately allowed. After the second month it progressed gradually until the patients could place their full body weight on the fractured leg.

RESULTS

All of the fractures united for an average period of 9 weeks (range 8-10). The average follow-up period was 10 months (6-20). Functional rating was done according to the criteria of the American Orthopeadic Foot and Ankle Society AOFAS [8]. A maximum of 100 points were awarded in two categories: objective assessment (pain, stability, ROM) and functional assessment (ability to walk on rough surfaces and to climb stairs). A total of six patients achieved an excellent score, five had a good one and the rest had an average score. The overall score was 84,02 (54-100). The average range of motion was 38° (15°-50°).

At the time of their final follow up, eleven patients had no pain and three reported only minor pain. Three patients could walk less than a kilometer, two needed a cane.

All patients returned to their previous occupation.

Complications

There were no serious intraoperative complications, deep infections, septic arthritis or thrombophlebitis. Three patients had superficial skin necrosis along the surgical incision, which healed without any additional procedures.

One patient had significant swelling (that lasted till the sixth month). The functional recovery was impeded and took significantly longer. There might have been some smaller venous thrombosis that couldn't be diagnosed.

Five patients had their fibular plates removed due to local irritation.

DISCUSSION

How important is he posterior malleolus? Removal of up to 50% of PM didn't alter ankle stability [9], nor did the contact pressure increase [10]. Papachristou found that during normal ROM it didn't bear any weight [11]. In an experimental and clinical investigation, Gardner established that a fracture of the PM didn't disturb the posterior syndesmosis ligament and that fixing of the fractures can restore ankle stability [12].

When the PM is left to heal in a dislocated position, the contact stress shifts antero-medially, which may lead to articular degeneration in the future [5]. Bartoníček considers that PM is the main syndesmosis stabilization structure, so he treated those fractures as syndesmotic lesions [13].

The unique shape of the talus and ankle mortise allow the foot to both adapt to the irregular surfaces and transfer the load of the body. In order for this interaction to take place, the intact syndesmosis is of paramount importance.

In the distant 1940 Nelson и Jansen classified the fractures of PM as minimal (below 1/3 of the articular surface on lateral projection) and classical (involving more than 1/3 of the articular surface). They recommended fixing only the latter ones [1]. Their oversimplified recommendations influenced the treatment protocols for many decades. Magid warned that the exact assessment of PM fracture morphology and size on a single lateral X-ray is not always possible or accurate [14]. Placing a fibular plate makes this task almost impossible, since it is X-ray positive and is usually superimposed on the PM fracture line. Yao recommended a CT-scan in every PM fracture [15]. Bartoníček is perhaps the most quoted author in regard of the PM fracture treatment and theory. He considered the involvement of the fibular incisura as a primary indication for an open reduction. It can be reliable assessed only on a CT-scan [13]. In a large prospective study, Shi et al. compared the results after either direct or indirect fixation of the PM fractures. In all of the cases the fractures involved more than 25% of the articular surface. A total of 116 cases were followed up. The results showed that the direct fixation may lead to better anatomical and functional results [16].

The direct posterior approach is not without limitations. The surgical dissection is increased and so is the surgical time. In our study, the postero-medial approach did not imply changing the patient's position and allowed simultaneous fixation of both the posterior and medial malleolus fractures. Bartonicek type 3 fractures, with or without intercalated articular fragments, were ideally indicated. Another important indication was the involvement of the fibular incisura, that is usually accompanied by posterior luxation (instability) of the ankle. In those fractures the most favorable position of the buttress plate is on the posterior cortex. This can only be achieved through a direct approach.

If the medial malleolus was intact we preferred the postero-lateral approach, which made possible the fixation of the fibular fracture through a single incision.

We experienced three cases of skin necrosis, that presented a potential risk for deep infection. The most

probable reason for this complication is the extended surgical dissection needed to properly reduce the PM fracture. In the best scenario the plate is positioned deep on the posterior surface of the tibia and is covered by muscles and tendons, so the probability for bacterial contamination is low. In all of the cases the wounds healed without further complications.

CONCLUSION

Our results showed that the direct postero-medial approach is safe and effective. It allows precise anatomical reduction of the PM fracture and biomechanically optimal placement of the plate. This is an obligatory prerequisite for an optimal and predictable functional recovery.

On the basis of our experience we recommend direct fixation of the PM fractures which run through the fibular incisura and are complicated with posterior luxation of the ankle.

Disclosure summary: *The authors have nothing to disclose.*

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