DOI: https://doi.org/10.30795/scijfootankle.2018.v12.779

ORIGINAL ARTICLE

Scientific Journal of the Foot & Ankle

Fixation of posterior malleolus fractures through posterior access in the ankle: case series

Fixação de fraturas do maléolo posterior por acesso posterior no tornozelo: série de casos

Vitor Yoshiura Masuda[1], Vinícius Felipe Pereira[1], Daniel Soares Baumfeld[2], Caroline Marques dos Santos Cavaleiro Cruel Neves[1], Caio Nery[1], Nacime Salomão Barbachan Mansur[1]

1. Universidade Federal de São Paulo, São Paulo, SP, Brazil.
2. Universidade Federal de Minas Gerais, Minas Gerais, MG, Brazil.

ABSTRACT

Objective: The aim of this study is to present the preliminary results of posterior malleolus fixation in a case series by evaluating clinical and radiographic outcomes as well as possible complications related to this approach.

Methods: This study involved a case series of 7 patients with posterior malleolus fractures, either isolated or associated with other tibiotarsal injuries, who were surgically treated and evaluated from January 2014 to December 2016 in one of the hospitals of our service. The patients were evaluated for consolidation, pain (Visual Analog Scale (VAS) score), function (American Foot and Ankle Society (AOFAS) score), surgical wound complications and joint degeneration in the postoperative period.

Results: The mean follow-up was 66 weeks. All patients presented clinical and radiographic consolidation of the fractures by the sixth week of the follow-up. The mean pain score according to the VAS was 1.5 and the mean AOFAS score was 92.5. At the end of follow-up, no clinical or radiographic evidence of joint degeneration was observed.

Conclusion: Posterior access is a viable alternative that provides good results with few complications for the treatment of posterior malleolus fractures.

Level of Evidence IV; Therapeutic Studies; Case Series.

Keywords: Ankle; Fracture fixation, internal; Surgical wound; Tibial fractures.

RESUMO

Objetivo: O presente estudo tem por objetivo apresentar resultados preliminares da fixação do maléolo posterior em uma série de casos, avaliando resultados clínicos e radiográficos, além das possíveis complicações referentes a essa abordagem.

Métodos: Série de casos de 7 pacientes com fraturas do maléolo posterior isoladas ou associadas a outras lesões da tibiotársica que foram operados e avaliados, no período de janeiro de 2014 a dezembro de 2016, em um dos hospitais do nosso serviço. Os pacientes foram avaliados quanto às consolidações, dor (EVA – Escala Visual Analógica), função (AOFAS *American Foot and Ankle Society Score*), complicações de ferida operatória e degeneração articular no pós-operatório.

Resultados: O seguimento médio foi de 66 semanas. Todos os pacientes apresentaram consolidação clínica e radiográfica das fraturas na sexta semana de seguimento. A avaliação de dor pelo escore EVA apresentou pontuação média de 1.5 e o score AOFAS de 92.5. Ao final do seguimento não se evidenciou nenhum caso de degeneração articular clínica ou radiográfica.

Conclusão: Conclui-se que o acesso posterior é uma alternativa viável com bons resultados para o tratamento de fraturas do maléolo posterior e sem complicações para a síntese do tornozelo.

Nível de Evidência IV; Estudos Terapêuticos; Série de Casos.

Descritores: Tornozelo; Fixação interna de fraturas; Ferida cirúrgica; Fraturas da tíbia.

Work performed at the Universidade Federal de São Paulo, São Paulo, SP, Brazil.

Correspondence: Vitor Yoshiura Masuda. Rua João Moura, 476 – apto 92 – Pinheiros. CEP: 05412-001 – São Paulo, SP, Brazil.
E-mail: vitor_masuda@yahoo.com.br

Conflict of Interest: None. **Funding Source:** None.
Date Received: March 15, 2018. **Date Accepted:** August 28, 2018. **Online on:** September 30, 2018.

How to cite this article: Masuda VY, Pereira VF, Baumfeld DS, Neves CMSC, Nery C, Mansur NSB. Fixation of posterior malleolus fractures through posterior access in the ankle: Case series. Sci J Foot Ankle. 2018;12(3):193-8.

INTRODUCTION

Trimalleolar fractures are a complex injury of the ankle joint as they affect the tibial loading area and compromise tibiotarsal and distal tibiofibular stability. Deviation of the posterior malleolus in this type of fracture, which is called the Volkmann fragment, complicates treatment and contributes to an increased risk of unfavorable results[1,2].

Fractures of the posterior malleolus are associated with scientific controversies ranging from diagnosis, treatment indications, and long-term local joint repercussions. Their identification can vary from easy visualization on profile radiographs for large fragments to the need for complementary tomographic evaluation for small fragments or subtle deviations[2-4]. The presence of posterior malleolus fracture leads to questions regarding whether the injury should be fixed, with little consensus in the current literature. Fixation of the medial and lateral malleoli is routinely performed for posterior fractures compromising more than 25% of the anteroposterior diameter of the tibia[4-6].

Normally, reduction of the posterior malleolus after lateral malleolus fixation is expected due to its respective attachment to the posterior tibial-fibular ligament. The posterior malleolus is also frequently fixed with screws inserted in the anterior to posterior direction. This indirect form of fixation represents an early local approach since it becomes unfeasible in the absence of reduction[7]. In addition, situations in which correct noun may not occur are unusual.

Positioning in the supine position, which is typical for ankle fixation, facilitates access to the medial and lateral malleoli, but adequate evaluation and treatment of posterior malleolus fractures are more difficult. Alternatives in this situation include reduction and fixation using arthroscopic[8] or transmalleolar[9] techniques.

Posterolateral access allows visualization and direct reduction of fractures of the posterior tibial lip and fixation of fragments with screws and a posterior plate. In addition, such access allows treatment of the fibula using synthesis on its posterior side according to the anti-shear principle[7,10,11]. Other advantages of posterolateral access include easy access to small fragments or interposed structures, good soft tissue coverage provided by local structures, and the intermuscular plane of the access route[7,11]. In subacute or chronic cases, fractures can be directly debrided, allowing removal of the interposed callus or periosteum and facilitating anatomical reduction of the joint[7].

The current study presents preliminary results of fixation of the posterior malleolus in a case series by evaluating clinical and radiographic outcomes in addition to possible complications related to this approach.

METHODS

This study was approved by the Research Ethics Committee with registration in the Brazil Platform under CAAE number: 88071118.8.0000.5505.

A case series of 7 patients with posterior malleolus fractures, either isolated or associated with other tibiotarsal injuries (lateral malleolus fracture, posteromedial malleolus fracture, medial malleolus fracture, deltoid injury, and syndesmosis injury), was analyzed in this study.

We included patients who were surgically treated and evaluated from January 2014 to December 2016 in one of the hospitals of our service. Patients whose records were incomplete and did not allow data analysis were excluded from the study.

The patients were diagnosed with ankle fractures with involvement of the posterior malleolus and corresponding injuries on radiographs and exhibited deviation greater than 2 mm affecting the articular surface with possible impairment of tibiotarsal and distal tibiofibular stability. The patients were evaluated for consolidation, pain (Visual Analog Scale (VAS) score), function (American Foot and Ankle Society (AOFAS) score), surgical wound complications and joint degeneration in the postoperative period. The mean age of the patients was 53.85 years (26 years to 76 years).

Data from the patients' charts from January 2014 to December 2017 were collected at the hospital of our service. This information is confidential according to the researcher commitment form.

Surgical technique

The patient is placed in the prone position with a cushion placed under the affected leg (Figure 1). A longi-

tudinal incision is made in the distal posterolateral region of the leg in the center of the space between the Achilles tendon and the fibula[6,10,11]. Identification and protection of the sural nerve and the small saphenous vein should be prioritized since this nerve runs from the central to the lateral side of the Achilles tendon at approximately 10mm from the insertion of this tendon in the calcaneus[12]. The surgeon should be aware that the anatomy of the sural nerve is variable and exercise appropriate caution, with meticulous blunt soft tissue dissection to avoid injury and the formation of local neuromas[13].

The posterior fascia of the leg is opened, and the flexor hallucis longus tendon and muscle are identified. These structures are elevated from the posterior aspect of the tibia, allowing access to the posterior malleolus[10]. Preservation of the posterior tibiofibular ligament and its capsular insertions and insertions in the bone fragment is critical. The fragment should be opened in book form for direct inspection of the joint. Local fixation can be performed with a posterior plate, which provides an anti-shear stop (preferred in our service), or screws placed in the posterior to anterior direction according to the need for stabilization and the size of the fragment (Figures 2, 3 and 4)[6,7,10,11]. Posterior malleolus fracture must be treated before other lesions for better articular manipulation and visualization and for fluoroscopic verification of reduction without interference from other implants.

The proximal fascia of the fibular tendons is opened longitudinally following the incision (the distal retinaculum is kept intact), and these tendons can be removed medially or laterally, allowing identification and evaluation of fibular fractures[6]. Such fractures are usually fixed with

Figure 1. Prone position and posterolateral access, at the time of syndesmosis reduction.
Source: Author's personal archive.

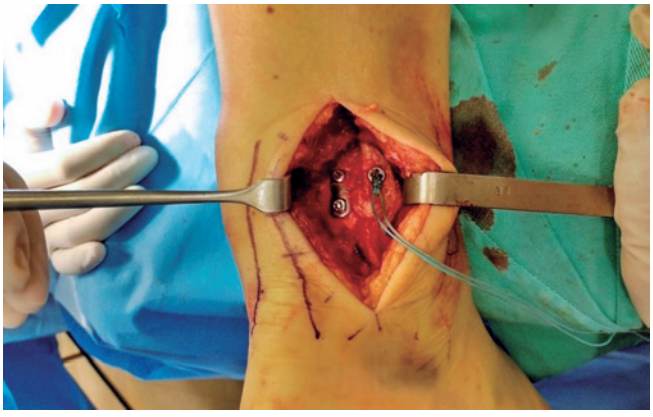

Figure 2. Posterolateral access, reduction and fixation of the posterior malleolus with a posterior plate, and stabilization of the syndesmosis.
Source: Author's personal archive.

Figure 3. Preoperative radiograph of ankle fracture.
Source: Author's personal archive.

a plate and cortical screws from posterior to anterior, with the plate placed under the anti-shear principle (Figure 2). However, this construction may vary according to the fracture pattern and comminution observed[14].

For fractures of the posteromedial component of the posterior malleolus, a new posteromedial access approach can be used. Despite slightly more difficulty, this approach also allows access to simple fractures of the medial malleolus or injuries of the deltoid complex. The procedure is concluded by suturing in layers, focusing on closure of the fibular muscle fascia. Dressing is followed by postoperative immobilization with a long-leg orthosis. The patient is instructed to avoid weight-bearing but to engage in early mobilization until the third week. Then, progressive partial weight-bearing with a boot is initiated. Physical therapy is performed from the first week to the fifth month after surgery.

Figure 4. Postoperative radiograph, fixation of the posterior malleolus through posterolateral access. This patient also received a posteromedial incision for treatment of the medial component of the posterior malleolus.
Source: Author's personal archive.

RESULTS

According to Table 1, five female and two male patients were included in the case series. Four patients had fractures on the left side and three had fractures on the right side. The mean VAS pain score was 1.5 (1.6-3) and the mean AOFAS score was 92.5 (80-100). The mean follow-up time was 15.4 months (6-36 months). All patients presented clinical and radiographic consolidation of the fractures at the sixth week (4 to 8 weeks) of the follow-up.

At the end of the follow-up, no evidence of joint degeneration was noted, and clinical symptoms of arthrosis were correlated with radiographic findings. Although only early results were available for the cases with a shorter follow-up, the cases with a longer follow-up presented similar results.

Only one minor complication, superficial wound dehiscence, was reported, which was treated with dressings and closed on the seventh week without compromising the final functional and clinical result.

DISCUSSION

Few studies have directly addressed the results of using posterolateral access to treat ankle fractures. In 1974, Miller[15] reported 5 cases of internal fixation of the posterior malleolus through posterolateral access, with few details regarding the technique and the outcomes of his patients.

Table 1. Patient characteristics

Patient	Sex	Laterality	VAS	AOFAS	Follow-up (months)	Associated procedure
1	F	Left	1.6	87	6	Syndesmosis fixation
2	F	Left	2	80	7	Fixation of the medial malleolus by a posteromedial route
3	F	Right	1	97	9	Syndesmosis fixation and fixation of the medial malleolus by a posteromedial route
4	M	Left	2	97	6	Fixation of the medial malleolus by a posteromedial route
5	M	Right	3	90	36	-
6	F	Right	1	97	8	Fixation of the medial malleolus and repair of the deltoid ligament
7	F	Left	0	100	36	-

Source: Prepared by the author based on the results of the study.

Subsequently, Heim[16] reported a larger case series of 60 patients treated for trimalleolar fractures; only 16 patients were surgically treated using posterior access, and this technique was noted to be potentially useful for small fragments, but no details regarding the results of the patients were provided. In a more recent report, Carmont and Davies[10] describe the similarity of this technique used in the ankle to the use of volar access to the wrist, but no cases or results were reported. The results of the present study are similar to those obtained by Abdelgwad et al.[11] with regard to scarring and the occurrence of few local complications. In their study, Abdelgawad et al.[11] evaluated 10 patients with a minimum follow-up of 2 months, and no local dehiscence or signs of infection were observed. Additionally, complete consolidation was noted in all patients by the fourth postoperative month.

Anatomical reduction of joint surfaces is a basic principle in the surgical treatment of fractures considering that joint irregularities affect the biomechanics of the joint and can lead to joint degeneration. Accordingly, fractures of the posterior malleolus should be treated pursuant to the same principle since they affect the distal articular surface of the tibia. Thus, anatomical reduction should be performed whenever possible, regardless of the technique used. For fractures of the posterior malleolus, complete reduction using the standard indirect technique with screws placed from anterior to posterior has been reported to be performed in only 27% of cases, with a reduction rate of 83% by direct visualization[17]. The posterior approach allows objective visualization of the posterior malleolus, enabling removal of interposed callus or periosteum and management of talar chondral damage or injuries due to impaction of the tibial plafond, which are important when surgical treatment is delayed and early consolidation prevents mobilization of the fragment to the appropriate position[6,7].

The posterior approach also allows placement of additional fixation to the posterior malleolus, such as a plate to counteract the shear forces occurring at this site during weight discharge (Figure 4). Fixation of small fragments of the posterior malleolus can create a more stable construction and assist in syndesmosis stabilization, thus facilitating patient rehabilitation[7].

Despite the favorable results associated with this technique, caution should be exercised during its execution, especially in dissection and protection of the sural nerve[6,10]. Positioning of a posterior plate in the fibula can cause friction symptoms in the fibular tendons, necessitating subsequent removal of the fixation. One of the disadvantages of this technique is greater difficulty in treating medial injuries and in approaching possible associated lesions of the hindfoot and midfoot[6,7].

CONCLUSION

Posterior access is a viable alternative that provides favorable results for the treatment of posterior malleolus fractures and can be considered a feasible technique with few complications for ankle fixation.

Authors' Contributions: Each author contributed individually and significantly to the development of this article: VYM *(https://orcid.org/0000-0002-4676-2954) conceived and planned the activities that led to the study, performed the statistical analysis, interpreted the study results, wrote the article and approved the final version; VFF *(https://orcid.org/0000-0002-1005-6089) performed the surgeries, participated in the review process and approved the final version; DSB *(https://orcid.org/0000-0001-5404-2132) performed the surgeries, participated in the review process and approved the final version; CMSCN *(https://orcid.org/0000-0002-1710-8187) performed the surgeries, participated in the review process and approved the final version; CN *(https://orcid.org/0000-0002-9286-1750) conceived and planned the activities that led to the study, performed the surgeries, participated in the review process and approved the final version; NSBM *(https://orcid.org/0000-0003-1067-727X) performed the surgeries, participated in the review process and approved the final version. *ORCID (Open Researcher and Contributor ID).

REFERENCES

1. Jaskulka RA, Ittner G, Schedl R. Fractures of the posterior tibial margin: their role in the prognosis of malleolar fractures. J Trauma. 1989;29(11):1565-70.
2. Bartonícek J, Rammelt S, Kostlivy K, Vanecek V, Klika D, Tresl I. Anatomy and classification of the posterior tibial fragment in ankle fractures. Arch Orthop Trauma Surg. 2015;135(4):505-16.
3. Büchler L, Tannast M, Bonel HM, Weber M. Reliability of radiologic assessment of the fracture anatomy at the posterior tibial plafond in malleolar fractures. J Orthop Trauma. 2009;23(3):208-12.
4. Haraguchi N, Haruyama H, Toga H, Kato F. Pathoanatomy of posterior malleolar fractures of the ankle. J Bone Joint Surg Am. 2006;88(5):1085-92.
5. Mingo RJ, López DL, Galeote JE, Martinez CC. Ankle fractures with posterior malleolar fragment: management and results. J Foot Ankle Surg. 2011;50(2):141-5.
6. Benthien RA. The posterolateral approach to the posterior malleolus: an alternative surgical strategy for unstable trimalleolar ankle fractures. Techniques in Orthopaedics. 2014;29.1: 8-12.
7. Talbot M, Steenblock TR, Cole PA. Posterolateral approach for open reduction and internal fixation of trimalleolar ankle fractures. Can J Surg. 2005;48(6):487-90.
8. Holt ES. Arthroscopic visualization of the tibial plafond during posterior malleolar fracture fixation. Foot Ankle Int. 1994;15(4):206-8.
9. Warner WC, Farber LA. Trimalleolar fractures. South Med J 1965; 58:1292-5.
10. Carmont MR, Davies MB. Buttress plate stabilization of posterior malleolar ankle fractures: a familiar technique through an unfamiliar approach. Curr Orthop. 2008;22(5):359-64.
11. Abdelgawad AA, Kadous A, Kanlic E. Posterolateral approach for treatment of posterior malleolus fracture of the ankle. J Foot Ankle Surg. 2011;50(5):607-11.
12. Webb J, Moorjani N, Radford M. Anatomy of the sural nerve and its relation to the Achilles tendon. Foot Ankle Int. 2000;21(6):475-7.
13. Lawrence SJ, Botte MJ. The sural nerve in the foot and ankle: an anatomic study with clinical and surgical implications. Foot Ankle Int. 1994;15(9):490-4.
14. Schaffer JJ, Manoli A II. The antiglide plate for distal fibular fixation. A biomechanical comparison with fixation with a lateral plate. J Bone Joint Surg Am. 1987r;69(4):596-604.
15. Miller AJ. Posterior malleolar fractures. J Bone Joint Surg Br 1974; 56B:508–512.
16. Heim UF. Trimalleolar fractures: late results after fixation of the posterior fragment. Orthopedics. 1989;12(8):1053-9.
17. Huber M, Stutz P, Gerber C. Open reduction and internal fixation of the posterior malleolus with a posterior antiglide plate using a postero-lateral approach: a preliminary report. J Foot Ankle Surg. 1996;2(2):95-103.