

Original Article

Intramedullary nailing as osteosynthesis technique for the fibula in total ankle arthroplasty via lateral approach

Alberto de Castro Carrasco¹ , Patricia Dominguez Dorado¹ , Laura Anta Martínez¹ , Carmen Alvarez-Val¹ 

1. University Hospital Complex of Santiago de Compostela, Santiago de Compostela, Galicia, Spain.

Abstract

Objective: To describe a variation in the final osteosynthesis technique for total ankle replacement (TAR) implantation through lateral approach.

Methods: We retrospectively reviewed a series of cases dated between January 2022 and May 2023 in which intramedullary nailing was used as the osteosynthesis technique for the fibula during TAR implantation via lateral approach.

Results: In all cases, skin scarring and soft tissue recovery to baseline were achieved in one and a half month to three months. Consolidation of the fibula occurred at an average of three months. No material was removed in any of the cases to date. Finally, patients were satisfied, resuming their previous activities.

Conclusion: To our knowledge, this study is the first to investigate a modification of the osteosynthesis technique in the lateral approach to TAR. We believe the intramedullary nail for the fibula may be a useful tool to prevent soft tissue complications, requiring prospective and comparative studies to evaluate its efficacy.

Level of Evidence IV; Therapeutic Studies; Case Series.

Keywords: Total ankle replacement; Soft tissue complications; Osteosynthesis technique; Fibula.

Introduction

The advent of modern total ankle replacement (TAR) led to an exponential increase in the use of this emerging technology over the past two decades in the United States and abroad^(1,2). Although mechanical and instrumental design has improved with recent designs^(3,4), perioperative skin and soft tissue complications remain a concern^(5,6).

It has been reported that wound complications occur in 6.6% to 28% of patients after total ankle arthroplasty^(7,8). Soft tissue impairment following TAR, in the form of dehiscence or wound failure, may lead to potentially devastating consequences, such as periprosthetic infection, implant failure, and amputation, which is the most feared sequela.

The purpose of the present study is to describe a variation in the final osteosynthesis technique for TAR implantation through lateral approach. We hypothesize that using an intramedullary nail as osteosynthesis technique for the fibula in the lateral approach can reduce soft tissue problems and consequently decrease the current rate of related reintervention.

Methods

All TARs were performed at our institution, by foot and ankle surgeons with extensive experience in TAR. The most used TAR design at our center is the Trabecular Metal™ Total Ankle (Zimmer Biomet – Zimmer, Waesaw, Indiana, USA) via lateral approach. After obtaining institutional review board approval, we retrospectively reviewed a series of cases dated between January 2022 and May 2023 in which intramedullary nailing was used as the osteosynthesis technique for the fibula during TAR implantation via lateral approach. The intramedullary nail used was the fibular nail system by Acumed® (Hillsboro, Oregon) (Figure 1). The rest of the surgical technique was developed as described in protocols, with the use of an external fixator and intraoperative radiological control, only changing the final fibular synthesis technique.

This case series includes six patients with clinical follow-up of at least six months and at most one and a half year. Preoperative patient demographics, comorbidities, smoking

Study performed at the Hospital Complex of Santiago de Compostela, Santiago de Compostela, Galicia, Spain.

Correspondence: Alberto de Castro Carrasco. Av Medico Ballina, Pontevedra, Spain. 36005. **Email:** adc.alberto@gmail.com. **Conflicts of interest:** none. **Source of funding:** none. **Date received:** January 3, 2024. **Date accepted:** April 12, 2024. **Online:** April 30, 2024.

How to cite this article: Castro Carrasco A, Dominguez Dorado P, Anta Martínez L, Alvarez-Val C. Intramedullary nailing as osteosynthesis technique for the fibula in total ankle arthroplasty via lateral approach. *J Foot Ankle.* 2024;18(1):108-10.



status, American Society of Anesthesiologists (ASA) score, and body mass index (BMI) were analyzed.

Postoperatively, all patients were placed in a non-weight-bearing short-leg cast for four weeks. Thereafter, weight-bearing was allowed wearing a controlled ankle movement (CAM) walking boot as tolerated by patients, and all patients participated in a rehabilitation program. Clinical outcomes, including wound healing, fibular consolidation, and range of motion, were recorded. Similarly, outcomes were recorded in terms of patient satisfaction, residual pain, and return to previous baseline activity. Pain was assessed using a visual analog scale (VAS) ranging from 0 (no pain) to 100 (maximum pain).

Results

The average age in the six cases presented was 65 years (range 60 to 78), the average BMI was 29.5, and the smoking rate was zero. Five of the six cases had an ASA score of II, while the sixth patient was 78 years old and had an ASA score of III. Four of the six cases had two days of hospitalization, while the remaining two cases were hospitalized for 4 to 6 days solely due to poor pain control. In all cases, only one ischemia was required, so that in none of the cases the operation time exceed two hours.

In all cases, skin scarring and soft tissue recovery to baseline were achieved sometime between one and a half month and three months. None of the cases required additional

surgery, and only one case used a wearable negative pressure dressing (Avelle® - Convatec, Ciudad Autónoma de Buenos Aires, Argentina) for one week.

Consolidation of the fibula occurred at an average of three months. Only in one case did the consolidation of the fibula collapse. No complaints related to the osteosynthesis material were reported in any of the cases, and no material was removed in any of the cases to date. Finally, in all cases, patients were satisfied, achieving 20 grades of motion and resuming their previous activities.

Discussion

TAR has been increasing in popularity as an alternative to arthrodesis for the management of ankle arthritis^(9,10), but postoperative wound complications and soft tissue instability can be a challenging clinical scenario. The skin of the dorsal ankle can be unyielding because it has limited mobility after surgery; it is also thin and lacks significant muscle mass⁽¹¹⁾. For this reason, even minor wounds can expose the underlying tendons and neurovascular structures, which in turn can lead to deep infections and implant failure. On the other hand, intramedullary nailing is a minimally invasive technique that provides stable fixation and reduces the risk of soft tissue complications⁽¹²⁾. Therefore, in this report, we used this osteosynthesis technique with the aim of reducing the rate of soft tissue complications reported in literature. The main advantage of this technique is that it is not a plate with



Figure 1. Anteroposterior (A) and lateral (B) projections of Trabecular Metal™ TAR and fibular nail system postoperative control.

screws that protrudes on the skin and may cause discomfort, but an intramedullary system. This may be related to the fact that no patient in our series experienced discomfort with the osteosynthesis material, and none of these had to be removed. One of the concerns after osteotomy is nonunion. At follow-up three months after surgery, we confirmed bone union at the osteotomy site.

In addition, tourniquets are commonly used in foot and ankle surgery, and, although the time at which a tourniquet is applied has not been associated with serious wound complications in the foot and ankle, it has been widely discussed in total knee arthroplasty^(13,14). For this reason, Gross et al.⁽⁶⁾ advocate limiting tourniquet time. In this sense, the use of an intramedullary nail instead of an osteosynthesis plate did not lead to an increase in operative time, since none of the cases required a surgical procedure lasting more than two hours.


Regarding the smoking status, Known et al.⁽¹⁵⁾ published the first data showing an association between smoking and prolonged hospitalization after TAR. Whalen et al.⁽⁸⁾ studied 57 consecutive total ankle arthroplasties with a wound complication rate of 28%. Analysis of various risk factors included cardiovascular disease, peripheral vascular disease,

and a smoking history of more than 12 pack-years. In contrast, none of the patients in our case series were recorded as smokers, so smoking could be excluded as a cause of soft tissue complication and prolonged hospitalization in our series.

In the end, this study has several limitations. First, it is a retrospective study of a series of cases, with all the associated weaknesses. No control group was formed to allow comparison with other established forms or treatment tools. Finally, the population collected is heterogeneous in terms of age and level of previous activity; it is also a short series of patients.

Conclusions

To our knowledge, this study is the first to investigate a modification of the osteosynthesis technique in the lateral approach to TAR. We believe that the intramedullary nail for the fibula may be a useful tool to prevent soft tissue complications, requiring prospective and comparative studies to evaluate its efficacy.

Authors' contributions: Each author contributed individually and significantly to the development of this article: ACC *(<https://orcid.org/0000-0002-6827-8688>) Conceived and planned the activity that led to the study, wrote the article, participated in the review process; PDD *(<https://orcid.org/0009-0004-8393-901X>) Data collection, bibliographic review; LAM *(<https://orcid.org/0000-0002-4196-5218>) Formatting of the article, bibliographic review; CAV *(<https://orcid.org/0009-0008-1417-5529>) Interpreted the results of the study, participated in the review process; Performed the surgeries; data collection, statistical analysis. All authors read and approved the final manuscript. *ORCID (Open Researcher and Contributor ID) 

References

- Nwachukwu BU, McLawhorn AS, Simon MS, Hamid KS, Demetracopoulos CA, Deland JT, et al. Management of end-stage ankle arthritis: cost-utility analysis using direct and indirect costs. *J Bone Joint Surg Am.* 2015;97(14):1159-72.
- Pugely AJ, Lu X, Amendola A, Callaghan JJ, Martin CT, Cram P. Trends in the use of total ankle replacement and ankle arthrodesis in the United States Medicare population. *Foot Ankle Int.* 2014;35(3):207-15.
- Reinders J, von Stillfried F, Altan E, Sonntag R, Heitzmann DW, Kretzer JP. Force-controlled dynamic wear testing of total ankle replacements. *Acta Biomater.* 2015;12:332-40.
- Haytmanek CTJr, Gross C, Easley ME, Nunley JA. Radiographic outcomes of a mobile-bearing total ankle replacement. *Foot Ankle Int.* 2015;36(9):1038-44.
- Gross CE, Garcia R, Adams SB, DeOrio JK, Easley ME, Nunley JA2nd. Soft tissue reconstruction after total ankle arthroplasty. *Foot Ankle Int.* 2016;37(5):522-7.
- Gross CE, Hamid KS, Green C, Easley ME, DeOrio JK, Nunley JA. Operative Wound Complications Following Total Ankle Arthroplasty. *Foot Ankle Int.* 2017 Apr;38(4):360-66.
- Glazebrook MA, Arsenault K, Dunbar RM. Evidence-based classification of complications in total ankle arthroplasty. *Foot Ankle Int.* 2009;30(10):945-9.
- Whalen JL, Spelsberg SC, Murray P. Wound breakdown after total ankle arthroplasty. *Foot Ankle Int.* 2010;31(4):301-5.
- Gougoulis N, Khanna A, Maffulli N. How successful are current ankle replacements? A systematic review of the literature. *Clin Orthop Relat Res.* 2010;468(1):199-208.
- Roukis TS, Prissel MA. Registry data trends of total ankle replacement use. *J Foot Ankle Surg.* 2013;52(6):728-35.
- Cho EH, Garcia R, Pien I, Thomas S, Levin LS, Hollenbeck ST. An algorithmic approach for managing orthopaedic surgical wounds of the foot and ankle. *Clin Orthop Relat Res.* 2014;472(6):1921-9.
- Aslum Y, Bedin B, Roger T, Charissoux JL, Arnaud JP, Mabit C. Internal fixation of the fibula in ankle fractures a prospective, randomized and comparative study: plating versus nailing. *Orthop Traumatol Surg Res* 2014;100(4 Suppl):S255-9.
- Irving GA, Noakes TD. The protective role of local hypothermia in tourniquet-induced ischaemia of muscle. *J Bone Joint Surg Br.* 1985;67(2):297-301.
- Newman RJ. Metabolic effects of tourniquet ischaemia studied by nuclear magnetic resonance spectroscopy. *J Bone Joint Surg Br.* 1984;66(3):434-40.
- Kwon NF, Danilkowicz RM, Kim J, Grimm NL, Adams SB. Short-Term Complications Following Total Ankle Arthroplasty and Associated Risk Factors: A NSQIP Database Analysis. *Foot Ankle Spec.* 2023;16(3):214-20.