

Compromise of Adjacent Joints in Long-Term Evolution of Ankle Arthrodesis

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ABSTRACT

Introduction: Tibiotalar arthrodesis is an option in the treatment of ankle osteoarthritis in patients who do not respond to conservative measures. Its main disadvantage is the compromise of adjacent joints in the medium and long term. **Objective:** To determine the involvement of adjacent joints in the medium and long term and its impact on functional outcomes in patients with ankle arthrodesis. **Materials and Methods:** We evaluated a series of 11 patients, 6 females and 5 males. The initial diagnosis was post-traumatic osteoarthritis (9 cases), septic arthritis (1 case), and osteochondral lesion of the talus (1 case). The mean age at the time of surgery was 50 years. The mean follow-up was 9 years. The radiographic compromise of the adjacent joints was evaluated. The patients were functionally evaluated using the Visual Analog Pain Scale (VAS), the AOFAS scale (American Orthopedic Foot and Ankle Score), and a simple satisfaction questionnaire. **Results:** 10 patients (91%) presented with osteoarthritis of one of the adjacent joints. The average score on the VAS was 2.6, while on the AOFAS scale, it was 71. Nine patients reported being very satisfied, one was moderately satisfied, and one was dissatisfied. **Conclusion:** The involvement of adjacent joints is very frequent in the long term, but this does not have a direct impact on the patient's functional outcomes.

Keywords: Ankle osteoarthritis; ankle arthrodesis; adjacent joints.

Level of Evidence: IV

Compromiso de las articulaciones vecinas en la evolución alejada de la artrodesis de tobillo

RESUMEN

Introducción: La artrodesis tibiaostralagalina es una opción para tratar la artrosis de tobillo en pacientes que no responden a las medidas conservadoras. Su principal desventaja es el compromiso a mediano y largo plazo de las articulaciones vecinas. **Objetivo:** Determinar el compromiso de las articulaciones vecinas a mediano y largo plazo, y su impacto sobre los resultados funcionales en los pacientes con artrodesis de tobillo. **Materiales y Métodos:** Se evaluó a una serie de 11 pacientes (6 mujeres y 5 hombres). El diagnóstico inicial era artrosis postraumática (9 casos), artritis séptica (1 caso) y lesión osteocondral de astrágalo (1 caso). El promedio de edad al operarse era de 50 años. La media de seguimiento fue de 9 años. Se evaluó el compromiso radiográfico de las articulaciones vecinas. La función se valoró mediante la escala analógica visual para dolor, la escala de la AOFAS y un cuestionario simple de satisfacción. **Resultados:** Diez pacientes (91%) tenían artrosis en alguna de las articulaciones vecinas. El puntaje medio en la escala analógica visual fue de 2,6 y el de la escala de la AOFAS, de 71. Nueve refirieron estar muy satisfechos; uno, medianamente satisfecho y otro se manifestó insatisfecho. **Conclusión:** El compromiso de las articulaciones vecinas es muy frecuente a largo plazo, pero esto no repercute directamente en los resultados funcionales.

Palabras clave: Artrosis de tobillo; artrodesis de tobillo; articulaciones vecinas.

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INTRODUCTION

Degenerative involvement of the ankle joint usually manifests with pain, stiffness and functional impairment. The most frequent cause of this condition is post-traumatic osteoarthritis secondary to fractures of the ankle, tibial plafond, or talus. The average age of these patients is lower than that of those with osteoarthritis of other joints, such as the hip or knee.¹

In patients with isolated ankle osteoarthritis who no longer respond to conservative measures, the first challenge is the choice of the most appropriate surgical procedure for each patient.

Joint preservation surgeries, such as supramalleolar osteotomies and hindfoot osteotomies with or without soft-tissue procedures, have achieved good outcomes, but only in patients with partial joint damage and some alteration in the loading axis through the ankle.¹⁻⁴

When osteoarthritis is advanced, the prosthesis is presented as a good alternative and has the advantage of preserving much of the functionality of the ankle and affecting, to a lesser extent, the adjacent joints, mainly the subtalar and Chopart joints (talonavicular and calcaneocuboid).^{5,6} Despite this, it is not always the best option for our patients. Previous infection, poor soft tissue condition, major bone defects, and major dysfunction and instabilities are at least relative contraindications to ankle arthroplasty.⁷

For this reason, tibiotalar arthrodesis remains a very good therapeutic choice in these cases. Numerous studies have reported favorable outcomes, including pain reduction, an improved gait pattern, and a high level of patient satisfaction.^{8,9} Its main disadvantage is the overloading of adjacent joints that could compromise these outcomes in the medium to long term.

In a study with 22 years of follow-up, Coester et al. observed that ankle arthrodesis is associated with premature osteoarthritis of the foot joints, although it decreases pain and improves function.¹⁰ Hendrickx et al. described that osteoarthritic involvement of adjacent joints is evident, but its clinical and functional impact is not.¹¹

Our hypothesis is that, while it is frequent in the distant progression of ankle arthrodesis to see involvement of adjacent joints in imaging assessments, this has no direct impact on the patients' clinical status.

The aim of this study was to determine the involvement of adjacent joints in the medium and long term, and its impact on functional outcomes in patients with ankle arthrodesis.

MATERIALS AND METHODS

A retrospective, observational study was carried out to evaluate a series of follow-up patients treated by our team. The senior surgeon's medical records file was examined for patients who had undergone tibiotalar arthrodesis between 2000 and 2022. Those with isolated ankle arthrodesis and a minimum follow-up of three years were included. Exclusion criteria were: arthrodesis of another joint or other lesion in the homolateral midfoot and hindfoot, follow-up <3 years, lack of presurgical radiographic imaging, and any congenital deformity, neuropathy or arthropathy.

Involvement of adjacent joints was assessed with anteroposterior and lateral radiographs of the homolateral midfoot and hindfoot. Neither the knee nor the contralateral foot were evaluated. All had preoperative and postoperative radiographs of the last control. Involvement was assessed with the Kellgren and Moore scale, which consists of five grades: grade 1, normal, no signs of osteoarthritis; grade 2, doubtful, minimal osteophytes; grade 3, minimal, osteophytes with normal joint space; grade 4, moderate, moderate narrowing of joint space; grade 5, severe, marked narrowing of joint space with subchondral sclerosis.¹² In the last control, function was assessed by questioning and a thorough physical examination, also using the visual analog scale (VAS), the *American Orthopaedic Foot and Ankle Society* (AOFAS) scale and a simple satisfaction questionnaire (they were asked how they felt about the treatment performed: dissatisfied, moderately satisfied or very satisfied).

RESULTS

Sixty-three ankle arthrodeses were analyzed in 63 patients; 29 could not be located or did not consent to be included in the study; nine had no pre-surgical radiographs; five had an associated lesion in the homolateral rearfoot or midfoot; two, poliomyelitis; six, less than three years of follow-up; and one died.

The sample consisted of 11 patients (6 women and 5 men). The initial diagnosis was post-traumatic osteoarthritis (9 cases), septic arthritis (1 case) and osteochondral injury of the talus (1 case). The mean age at surgery was 50 years (standard deviation [SD] = 15.47). The mean follow-up was 9 years (SD = 6.15).

Ten patients (91%) had osteoarthritis in one of the neighboring joints, whereas the remaining one did not (he had the shortest follow-up, 3 years). Ten (91%) had subtalar joint involvement and four (36%) had Chopart joint involvement (Figure 1).



Figure 1. Weight-bearing radiographs of the left ankle 6 months after ankle arthrodesis, AP view (A) and lateral view (B). Secondary osteoarthritis affecting the subtalar joint, but not the Chopart joint. Clinical images of the same patient from the front (C) and back (D).



Figure 2. Weight-bearing radiographs of the right ankle 12 years after ankle arthrodesis, lateral view (A) and AP view (B). Secondary osteoarthritis in the subtalar and Chopart joints. Clinical images of the same patient from the front (C) and back (D).

The mean AOFAS scale score was 71 (SD = 16.86), with a minimum of 26 and a maximum of 92. It should be noted that the maximum value for a patient with ankle arthrodesis is 92, as the scale gives 8 points for normal or slightly decreased ankle range of motion ($>30^\circ$).

Nine patients reported being very satisfied with the treatment; one was moderately satisfied and another was dissatisfied. The latter evolved with pseudarthrosis that was not revised by the patient's own decision. Two presented metatarsalgia due to an exaggerated equinus in the arthrodesis and had to undergo a revision, the evolution was favorable. One patient presented with a 3 cm shortening of the operated lower limb that was mildly symptomatic and treated with a shoe enhancement. Osteosynthesis material was removed in one patient because of pain and their evolution was favorable (Figure 2, Table).

Table. Patient data.

n	Gender	Age (years)	Initial diagnosis	Osteoarthritis 1	Complications	Revision	Follow-up (years)	Osteoarthritis 2	AOFAS Scale	VAS	Satisfaction
1	F	76	Post-traumatic osteoarthritis	Grade 1	Metatarsalgia	Yes	12	Grade 4 (ST) and Grade 4 (Chopart)	71	4	Very satisfied
2	F	61	Post-traumatic osteoarthritis	Grade 1	Metatarsalgia	Yes	22	Grade 4 (ST) and Grade 1 (Chopart)	74	3	Very satisfied
3	M	71	Post-traumatic osteoarthritis	Grade 1	Pseudarthrosis	No	4	Grade 5 (ST) and Grade 1 (Chopart)	26	7	Dissatisfied
4	M	44	Post-traumatic osteoarthritis	Grade 1	Shortening 3 cm	No	18	Grade 5 (ST) and Grade 1 (Chopart)	66	2	Moderately satisfied
5	F	56	Post-traumatic osteoarthritis	Grade 1	No	No	15	Grade 4 (ST) and Grade 2 (Chopart)	66	5	Very satisfied
6	F	76	Post-traumatic osteoarthritis	Grade 1	No	No	3	Grade 1	92	0	Very satisfied
7	F	60	Post-traumatic osteoarthritis	Grade 1	No	No	6	Grade 4 (ST) and Grade 1 (Chopart)	79	2	Very satisfied
8	M	34	Post-traumatic osteoarthritis	Grade 1	No	No	8	Grade 4 (ST) and Grade 1 (Chopart)	74	3	Very satisfied
9	M	57	Septic arthritis	Grade 3 (ST) and Grade 1 (Chopart)	No	No	4	Grade 5 (ST) and Grade 2 (Chopart)	65	3	Very satisfied
10	F	57	OLT Complication	Grade 1	No	No	5	Grade 2 (ST) and Grade 1 (Chopart)	89	0	Very satisfied
11	M	64	Post-traumatic osteoarthritis	Grade 1 (ST) and Grade 1 (Chopart)	No	No	6	Grade 4 (ST) and Grade 2 (Chopart)	84	0	Very satisfied

References: F (Female), M (Male), OLT (Osteochondral Lesion of the Talus), ST (Subtalar), Osteoarthritis 1 (Osteoarthritis of adjacent joints prior to arthrodesis), Osteoarthritis 2 (Osteoarthritis of adjacent joints post arthrodesis).

DISCUSSION

In this series, 91% of patients had secondary osteoarthritis of the subtalar joint and 36% of patients had secondary osteoarthritis of the Chopart joint (talonavicular and calcaneocuboid joints).

Ankle arthrodesis continues to be a very good therapeutic alternative for patients with advanced osteoarthritis who do not respond to conservative measures. The advantages of this procedure are well known. It is a reproducible and reliable technique thanks to its extensive dissemination in the literature over several years.¹³⁻¹⁵ It allows correction of alignment defects in the same procedure.^{16,17} It can be indicated if there is a previous infection and the soft tissue condition is poor.¹⁸ It has high consolidation rates.^{8,19} The patient retains good gait biomechanics, with good functional outcomes and high rates of patient satisfaction.²⁰

The main disadvantages observed are the involvement of the joints near the ankle, which would be overloaded, with the consequent risk of osteoarthritis in the medium or long term. The subtalar and Chopart joints would be the most affected by a lack of range of motion and load absorption in a healthy ankle.

But this does not appear to be directly related to functional outcomes. The mean VAS was 2.6 and the AOFAS scale score was 71. In addition, nine (82%) reported being very satisfied with the outcome of the treatment.

In a similar study, Said et al.²¹ reported good to excellent outcomes at 7.5 years in 18 of 22 patients (82%), despite the fact that 17 of them (94%) had subtalar joint stiffness. These authors concluded that functional compromise is minimal.

In their series of 12 patients with 18 years of follow-up, Mazur et al.¹³ found that all had radiographic signs of secondary osteoarthritis in the subtalar and midtarsal joints, but noted that these changes were not directly related to symptoms.

In their study of 37 patients with a 25-year follow-up, Jackson and Glasgow²² observed radiographic signs of Chopart joint osteoarthritis in 22 patients (59%) and subtalar joint stiffness in all.

There is limited published data on the rate of arthrodesis of any adjacent joints following ankle arthrodesis for pain. In our series, it was not necessary for any patient. In a series of 185 patients with eight years of follow-up, Kerkhoff et al.²⁰ reported subtalar arthrodesis in four patients (2%) because of pain confirmed with previous infiltration.

The main strength of this study is the follow-up time that allows us to analyze the clinical and remote radiographic evolution of patients with ankle arthrodesis. Its weakness is that it includes a relatively small sample of 11 patients for an initial population of 63, which implies a bias due to the loss of patients (82%).

The results of this study are similar to those already published on the subject and we conclude that midfoot and hindfoot joint involvement (stiffness and osteoarthritis) is very frequent in the medium and long-term evolution of patients with ankle arthrodesis.^{23,24} This incidence is close to 100%. Nonetheless, it has little direct bearing on the clinical progression of patients who, for the most part, have low-grade pain, acceptable function, and a high satisfaction rate.

CONCLUSION

Ankle arthrodesis can be considered a good treatment alternative for patients with severe and isolated tibiotalar osteoarthritis.

Conflict of interest: The authors declare no conflicts of interest.

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