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Case Report

Desarthrodesis of ankle and subtalar stabilization with a flexible system: a functional surgical proposal

Álvaro Santiago Guerrero Forero[1], Otilia Gallegos de la Torre[2], Luis A. Gómez Carlín[3]

1. Santana Medical Center, Bogotá D. C., Departamento Cundinamarca, Colombia.
2. Hospital H+ Querétaro, Santiago de Querétaro, Querétaro, México.
3. MedyArthros, Guadalajara, Jalisco, México.

Abstract

Patients who have undergone ankle arthrodesis frequently suffer from alterations in the adjacent joints and functional limitations. A 56-year-old female with a 22-year history of ankle arthrodesis underwent a conversion of ankle arthrodesis to total ankle replacement, followed by stabilization of the subtalar joint with a flexible system. The FAAM scale preoperative and eight-week postoperative scores were 39/100 and 88/100, respectively, and the SF-36 scale preoperative and eight-week postoperative scores were 37.52 and 73.61, respectively. In this case, ankle function was recovered after the conversion of ankle arthrodesis to total ankle replacement. With this technique, we obtained satisfactory functional results.

Level of Evidence V; Therapeutic Study, Expert Opinion.

Keywords: Ankle joint; Subtalar joint/surgery; Joint instability/surgery; Arthrodesis; Arthroplasty, replacement, ankle; Treatment Outcome.

Introduction

With arthrodesis of the ankle there is an increase in the mobility of the neighboring joints, which during the first year may cause an increase in subtalar joint movement of approximately 11°. Such an increment in movement, specifically in the posterior facet, can be the cause of early arthrosis[1,2]. Subtalar arthrosis is one of the most reported complications[1,3], however to our knowledge there are no reports about subtalar instability associated with arthrodesis of the ankle in the literature.

The subtalar joint together with the ankle make up the hindfoot functional unit, and thanks to its complex anatomy it plays a very important role in the regulation of the movements of the rest of the foot, since it has three facets and a complex ligament system that permits triaxial movement, i.e. inversion/eversion, flexion/extension and abduction/adduction[2,4]. The typical injury mechanism of subtalar instability is an acute trauma with forced inversion and dorsiflexion of the foot, however, a repetitive microtrauma of the talocalcaneal interosseous ligament can lead to chronic laxity and subsequent subtalar instability[5]. We assume that the hypermobility of said joint as a consequence of arthrodesis of the ankle may cause that repetitive microtrauma and the resulting subtalar instability that precedes subtalar arthrosis.

Different surgical proposals to give stability to the subtalar joint have been published, all focused on reconstruction of the different ligaments with auto-or allografts[4,6-8] and most of them are technically highly demanding and with long surgical times.

There is a wide range of surgical treatments to correct the complications resulting from tibiotalar arthrodesis, among them conversion of arthrodesis to total ankle arthroplasty[1,3]. The objective of our article is to present a subtalar stabilization technique with a flexible system in a patient who underwent conversion from tibiotalar arthrodesis to total ankle arthroplasty.

Study performed at the Santana Medical Center, Bogotá D. C., Departamento Cundinamarca, Colombia.

Correspondence: Álvaro Santiago Guerrero Forero. 7-14 119 St., Bogotá D. C., Departamento Cundinamarca, Colombia, Zip Code: 110111. **Conflicts of interest:** none. **Source of funding:** none. **Date received:** April 04, 2020. **Date accepted:** April 06, 2020. Online: April 30, 2020

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Case report

Female patient 56 years of age, with a history of ankle arthrodesis evolving over 22 years. She had pain, difficulty walking, an equinus foot deformity that was not passively reducible, hindfoot varus and compensatory genu recurvatum (Figure 1).

The radiographic examination showed complete consolidation of the ankle arthrodesis and neutral sagittal and coronal planes, and a dorsal osteophyte of the talonavicular joint and abnormal aperture of the subtalar joint in the sagittal projection (Figure 1).

With these clinical-radiographic findings, a decision was made to perform surgery to convert the tibiotalar arthrodesis to a total ankle arthroplasty with a primary fixed-bearing insert prosthesis of anatomical design, flexible stabilization of the subtalar joint and periarticular arthroplastic remodeling, including resection of the talonavicular joint osteophyte.

Description of the surgery

Under local anesthesia, in dorsal decubitus and pneumatic ischemia, a dorsal approach to the ankle is performed, the extensor retinaculum is incised, medial retraction of the anterior tibial tendon and lateral retraction of the extensor digitorum longus together with the anterior tibial neurovascular bundle are performed; identification of the distal end of the tibia and the lateral and medial malleoli; next, with the distal access expansion, the talus neck and the talonavicular joint are identified. Under fluoroscopic vision, the level of what would correspond to the tibiotalar joint and the medial and lateral ankle gutters are identified. Placement of the external guide for sequential cuts is performed. Placement of the guide devices and recreation of the tibiotalar space and the lateral and medial gutters with an oscillating saw. The height corresponding to the talar dome is established and a cut is made with the oscillating saw. Extraction of the bone block and removal of the periarticular capsule until there is evidence of passive mobility of the neoarticulation (Figure 2). The device is coupled to define the size of the tibial component through which perforations are made for its pegs. Placement of probes to define the size of the talar component and the fixed insert. Placement of guide for posterior cut of the talus, which is performed with the oscillating saw and anterior sequential cuts, which are performed with the drill for this purpose.

Definitive implant of the total ankle prosthesis and fluoroscopic verification of the position of its components.

An osteophyte of the talonavicular joint is identified. Arthroplastic remodeling and verification of the viability of the remaining cartilage.

Manipulation of the neck and head of the talus is performed, reducing the normal aperture of the subtalar joint and fitting the talus together with the navicular bone in anatomical form. Having accomplished the objective of peritalar stabilization manually, it is fixed definitively with a flexible system of the TightRope® (Arthrex, Inc, Naples, FL) type guiding it from

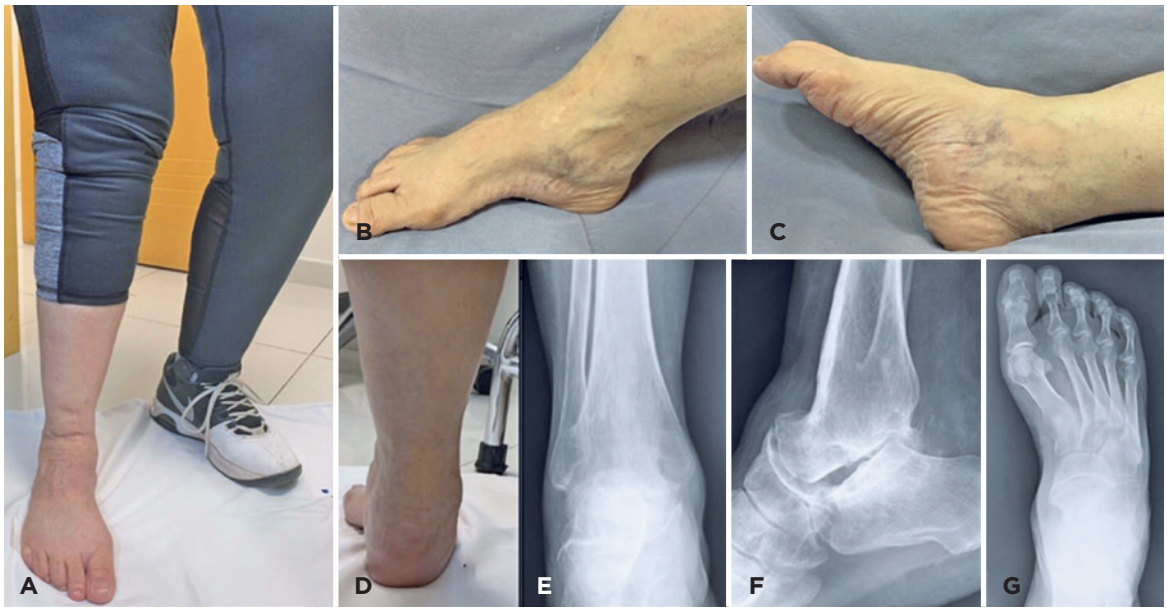

Figure 1. A. Patient standing with both feet on the ground with an equinus foot and compensatory genu recurvatum. B and C. Foot at rest. D. Posterior aspect of the foot with support on the varus. E. Anteroposterior radiograph of the ankle with consolidated arthrodesis. F. Lateral radiograph of the ankle showing an increase in the subtalar joint space. G. Dorsoplantar radiograph of the foot with adduction of the forefoot and incipient arthrosic changes.

the neck of the talus in its dorsal aspect, via the posterior facet of the subtalar joint and in its most anterior part, terminating in the posterior cortical and plantar part of the heel.

Satisfactory tests of tibiotalar and hindfoot stability are conducted under fluoroscopic control (Figure 3). Removal of the pneumatic ischemia, flushing and hemostasis, closure of the extensor retinaculum with separate sutures and closure of the subcutaneous cell tissue and the skin with anti-tension sutures. Immobilization with a bulky splint in the neutral position.

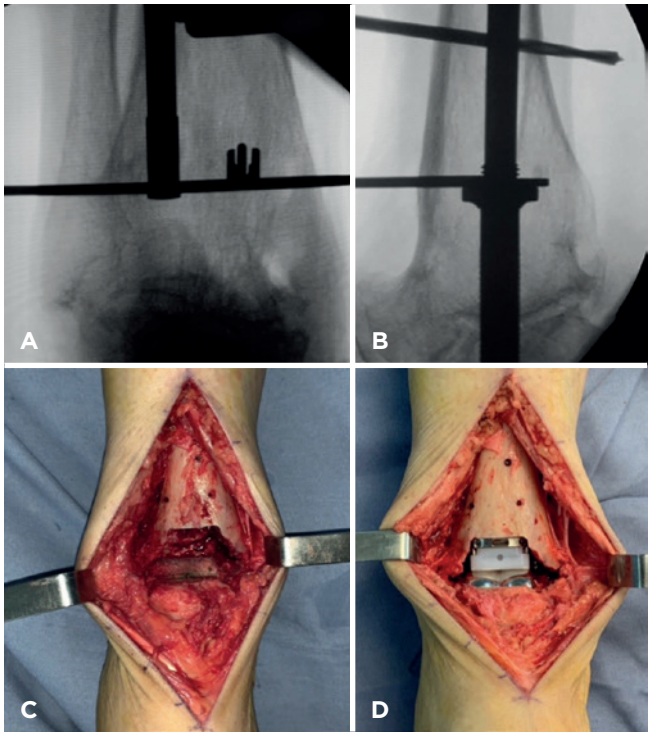

Figure 2. A and B. Fluoroscopic view of the guide to define the height of the cut for desarthrodesis. C. Neoarticulaction. D. placement of the definitive prosthetic elements.

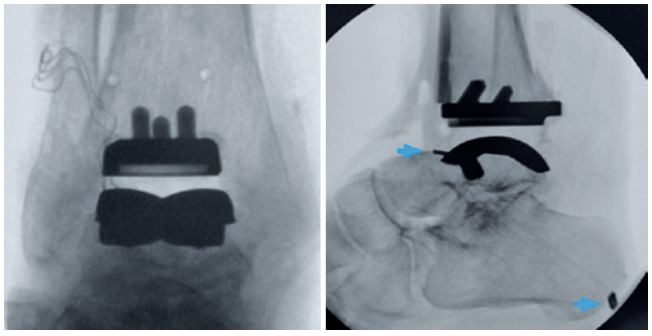

Figure 3. Fluoroscopic view with the definitive implants showing the tibiotalar neoarticulation, talonavicular and subtalar joints in anatomical position, the latter stabilized with the flexible system (the arrows indicate system plates).

The first postoperative control to review the surgical wound takes place seven days after the intervention. Removal of the bandages two weeks following surgery. Progressive support is permitted, protected with a removable boot in the neutral position. Physical therapy is initiated in the third week to improve gait pattern, ranges of motion, balance, proprioception and strengthening.

Results

The tools to measure the state of health can be classified into two large groups: generic and specific. The former are independent of the diagnosis and can be used in various types of patient and populations. In the SF-36 Health Survey or SF-36, its items detect both positive and negative states of physical and mental health in 8 dimensions.[9] The Foot and Ankle Ability Measure, FAAM, is a tool to evaluate the physical function of patients with musculoskeletal pathology in the legs, ankles and/or feet, on a scale of 0 to 100.[5]

The patient was assessed pre- and postoperatively with the SF-36 and Foot and Ankle Ability Measure (FAAM), obtaining SF-36 scores of 37.52 and 73.61 and FAAM scores of 39/100 and 88/100, respectively.

Discussion

We recommend a functional surgical proposal for the ankle and hindfoot joints, by means of a joint preservation surgery. It will be difficult for ankle movement to reach normal ranges following desarthrodesis and a limited active tibiotalar range of movement (22° to 24°)[1] is expected. In addition, in the immediate postoperative period these movements will be mainly passive flexion and extension during the mid swing of the gait cycle and as a response to the ground reaction force during full support, a situation that will make a difference in biomechanics when walking, preventing genu recurvatum and exaggerated flexion of the hip in the first swing of the cycle. Markus Preis reported movements in his desarthrodesis case series with 5-year follow-up of 23° ± 7° (dorsiflexion of 8.5° ± 3° and plantar flexion of 15° ± 5°), further emphasizing that those patients who had fixed equinus achieved dorsiflexion of at least 5°[3].

Fusion of any hindfoot joint will always affect the neighboring joints because they are mechanically linked[10], which is why the most functional alternative is sought when choosing treatment. When exploring the subtalar joint, no cartilage damage was found on the joint surface, so a decision to stabilize was made. The treatment options for subtalar instability are focused on the reconstruction of the lateral ligament complex of the ankle (especially the calcaneofibular ligament) or the subtalar ligaments. Many of these techniques involve the weakening of the secondary ankle stabilizers (e.g. peroneus brevis tendon) and wear to bone structures (e.g. talus) from tunnels that are created during the said reconstruction[4]. A viable solution for subtalar instability is a flexible fixation system, which in addition to providing stability, allows movement, which is extremely important for the accommodation of the foot on uneven terrain.

In the talonavicular joint, the dorsal osteophyte was resected, eliminating the mechanical stop that was preventing normal accommodation of the talus within the navicular bone, thereby recovering the plantigrade position of the foot and correcting equinus and forefoot adduction. After exploring the joint surface, it was discovered that approximately 75% of the cartilage was still preserved. This joint (talonavicular), also called the "key to movement", is considered the most important in the hindfoot because it has the greatest effect on the neighboring joints[10]. Therefore, once its stability was confirmed, a decision was made not to arthrodese it.

To reiterate, we believe that functional treatment in patients with pathology of the foot is the best option. In our patient, we observed satisfactory passive mobility results starting in the immediate postoperative period, having a favorable effect on the biomechanics of gait, which in turn improved both her physical and mental health considerably, which should be the main objective of any treatment.

Conclusion

Our surgical technique for subtalar stabilization in ankle desarthrodesis presents favorable immediate and short-term results.

Authors' contributions: Each author contributed individually and significantly to the development of this article: ASGF *(https://orcid.org/0000-0003-0296-5263) conceived and planned the activities that led to the study, performed the surgery, participated in the review process, approved the final version; OGT* (https://orcid.org/0000-0001-7651-1841) wrote the article, interpreted the results of the study, participated in the review process and approved the final version; LAGC *(https://orcid.org/0000-0002-0812-2497) assisted in the surgery, follow-up of the patient and participated in the review process. *ORCID (Open Researcher and Contributor ID).

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