

Special Article

Total ankle arthroplasty in Brazil. Current aspects and future prospects

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Abstract

Total ankle arthroplasty as a surgical treatment option for end-stage ankle osteoarthritis has gained increasing prominence, especially in countries such as Brazil, where the technique is not yet widely disseminated due to various factors.

Level of Evidence V; Therapeutic Study; Expert Opinion.

Keywords: Ankle injuries/complications; Osteoarthritis/epidemiology; Arthroplasty, replacement, Ankle/epidemiology; Arthrodesis.

Introduction

Total ankle arthroplasty (TAA) for the treatment of end-stage ankle osteoarthritis (AOA) is well established. According to recent studies, there is currently no gold standard for the treatment of end-stage AOA⁽¹⁻³⁾, which represents around 1% of ankle pain symptoms in the adult population⁽⁴⁾. Several systematic review studies published recently demonstrate that, in addition to reducing pain and improving ankle range of motion, TAA has a survival rate of around 84% at 10 years of follow-up⁽¹⁾, especially in countries where arthroplasty is already widespread. Accordingly, both tibiotarsal arthrodesis and total ankle arthroplasty (TAA) are options, with good results, for the surgical treatment of AOA⁽⁵⁾. It is true that many issues still need to be resolved and are being studied, with these countries facing the current challenge of achieving social approval of total ankle arthroplasty.

The aim of this article is to carry out an updated review on total ankle arthroplasty in Brazil, reviewing some basic aspects and the main guidelines for the execution and consolidation of the technique.

In mid-2005, as a result of an alliance between two important foot and ankle departments in the state of São Paulo (Universidade de São Paulo and Escola Paulista de Medicina),

a series of ten cases were conducted with the Hintegra[®] prosthesis (Newdeal-France), with an average follow-up of four years until the publication of results in 2015⁽⁶⁾. Despite the good functional outcomes achieved, minor and major complications were recorded in 80% of subjects in the study⁽⁶⁾. At the time, arthrodesis was the gold standard for treating ankle osteoarthritis in Brazil, with acceptable results in the medium term⁽⁷⁾, despite the high rate of complications and degeneration of adjacent joints observed in long-term studies⁽⁵⁾. Therefore, many Brazilian orthopedists maintained ankle arthrodesis as the first treatment option for AOA. In addition, as the authors themselves mention in the study, the high cost of implants, the lack of training centers in the country, which makes it difficult to transpose the natural learning curve that the technique requires, around 50 cases, among other factors, meant the prosthesis ceased to be a viable option for the surgical treatment of AOA in Brazil.

Nevertheless, in the following years, some orthopedic surgeons in Brazil sought to improve this technique in other countries, managing to perform it in their respective hospitals, which were mostly private. Brazil does not have a single disease reporting center and procedures like some countries, such as England and Canada, nor does it have certification centers for performing the technique, as in the United States

Study performed at the Hospital das Clínicas, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil.

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and some European countries. Through information obtained from prosthesis manufacturers and distributors, at present Anvisa (Brazilian National Health Surveillance Agency) has granted authorization for the marketing of four types of prosthesis in Brazil:

Inbone II: (Wright Medical Technology - United States, Anvisa registration: 80491360042), Infinity: (Wright Medical Technology - United States, Anvisa registration: 80491360071), Taric: (Implantcast - Hamburg, Germany, Anvisa registration: 80454380015), and Zenith: (Corin, Cirencester, United Kingdom, Anvisa registration: 80012450017).

According to information from manufacturers, from 2005 to 2020, no more than 500 total ankle arthroplasties were performed in Brazil.

To enable us to transform the history of the ankle prosthesis into a reality in Brazil, certain precautions, such as the correct selection of patients, implant and location (adequate infrastructure), and especially medical staff training, are essential.

Patient assessment and selection

Thus, the first step is a good preoperative assessment of the candidate for total ankle arthroplasty. The patient's clinical evaluation begins with an examination of the alignment of the entire limb, followed by foot/hindfoot with the patient standing, sitting, and walking. Hindfoot alignment is essential to determine whether the hindfoot is in neutral position, or if there is any varus or valgus deformity that must be corrected in the same surgical procedure. Joint stability also needs to be considered, conducting stress and anterior drawer tests, determining the concomitant need for ligament releases or reconstructions. The assessment of pain in other joints and of mobility, especially of the subtalar joint, must be documented. Ankle range of motion should be assessed at the end, with maximum plantar flexion (around 30-35 degrees) and maximum dorsiflexion (around 10-15 degrees). It is known that an ankle range of motion (ROM) of around 25 degrees is required for activities of daily living, while a ROM of around 37 degrees is necessary for walking on sloping floors, climbing or descending stairs⁽⁸⁾. The decrease in dorsiflexion can usually be related to a bone block or shortening of the triceps surae complex, which may be lengthened during the surgery.

A radiological evaluation protocol must be requested next, including: conventional weight-bearing foot and ankle radiographs (AP, true AP and lateral ankle; AP, lateral foot), in addition to the Saltzman view, to determine inframalleolar and hindfoot alignment. Alignment of the distal part of the tibia and the tibiotarsal joint in the coronal plane must be measured through the distal tibial angle. The normal angle in the sagittal plane, formed by the long axis of the tibia and the joint line, is $80^{\circ} \pm 3^{\circ}$. An increase or decrease means recurvatum or antecurvatum, respectively. In the coronal plane, the tibiotalar angle is $89^{\circ} \pm 3^{\circ}$, with an increase or decrease signifying valgus or varus deformity, respectively. The request for tomography and magnetic resonance imaging is optional, and can provide additional information on the articular part (subchondral cysts and bone quality) and ligament (Figure 1).

Correct patient selection, especially for surgeons who are starting their learning curve, is essential to avoid poor outcomes. The ideal patients for beginners are those with degenerative ankle arthrosis, older than 65 years, who have not responded to conservative treatment, with good bone quality, good soft tissue conditions, neutral alignment of the joint, good stability, and some degree of ankle mobility (Figure 2). In this initial phase, surgeons should avoid operating on patients with a severe ankle deformity, such as varus or valgus greater than 10 degrees, or even severe foot deformities, such as severe pes planovalgus or pes cavus, which require surgical correction; obese patients or smokers; patients with poor bone quality due to routine use of corticosteroids, or even patients who engage in high-level sports activities, as the rates of complication in these patients, particularly aseptic loosening of the implants, are high⁽⁹⁾. Cases of primary or degenerative arthrosis are usually present in older patients (over 65 years), affecting the hips and knees more than the ankle itself. Post-traumatic arthrosis, on the other

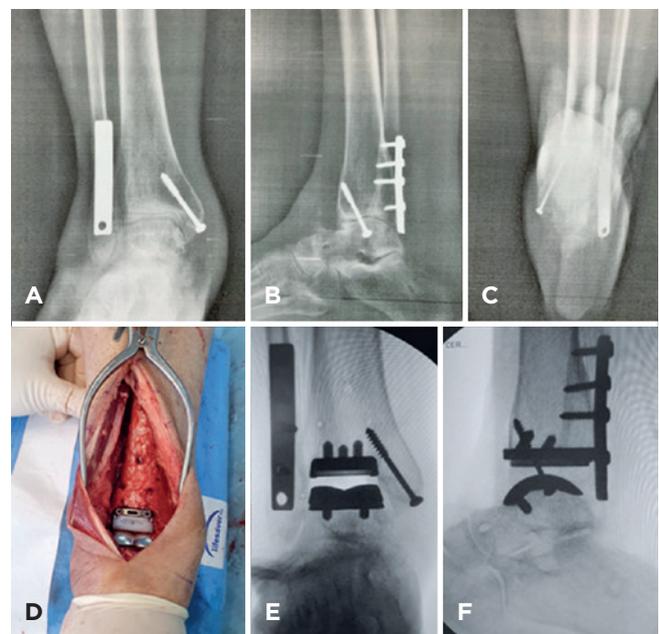


Figure 1. "Ideal case". 63-year-old patient, five years after osteosynthesis of the right ankle, ankle arthrosis with dorsiflexion block, without comorbidities. A. AP ankle radiograph showing a reduction in ankle joint space and good alignment in the coronal plane; B: Lateral ankle radiograph showing ankle arthrosis, the presence of an anterior osteophyte with dorsiflexion block. C. Saltzman radiograph showing good hindfoot alignment. D: Intraoperative image after implantation of the ankle prosthesis (Infinity[®]). D. Fluoroscope image in AP view of the ankle with good implant alignment and restoration of the joint line. E and F. Fluoroscope image in lateral view of the ankle with good implant alignment and positioning.

hand, is more prevalent in the ankles of young patients (under 50 years of age), where implant longevity is a factor to be weighed, since these patients are more active and tend to experience more “wear and tear” of the implants, with a higher revision rate.⁽¹⁾ However, Demetracopoulos et al.⁽¹⁰⁾ not only found similar rates among young and elderly patients undergoing TAA, but also verified that young patients, under 55 years of age, coped with the revision better than older patients, probably due to the improvement in quality of life conferred by arthroplasty, as suggested by the study.

In addition to the factors commented on for correct patient selection, there are also absolute contraindications⁽¹⁾, which include cases with acute or chronic infection, with or without osteomyelitis, extensive talar osteonecrosis (greater than one third), neuromuscular disorders, neuroarthropathies (e.g., Charcot foot), and patients with ligament instabilities or deformities that cannot be corrected intraoperatively. In these cases, ankle arthrodesis should be suggested.

Choice of implant

Once the patient has been properly assessed and arthroplasty indicated, the choice of implant is the next step. As already mentioned, in Brazil there are four implant options, of which two are mobile-bearing implants (Taric® and Zenith®), or considered three-component implants (tibial component, talar component, and polyethylene), and two are fixed-bearing implants (Inbone II® and Infinity®), in which the polyethylene is fixed to the tibial component. Of these, only Inbone II has a modular intramedullary nail in the tibial component, and the talar component is of the flat type, different from the others, where the talar component is of the resurfacing type, i.e., follows the curvature of the talar domes. The Inbone II prosthesis is more constricted than the others and can be used in some primary prosthesis revision cases and in poor

bone quality cases. According to Nunley et al.⁽¹¹⁾, there are no differences in functional outcomes or implant survival rates with respect to polyethylene mobility or lack of mobility. In this level I study, reoperations were more frequent with mobile-bearing implants, used more often for treating minor complications, such as removing the impact or treating cysts, than for replacing the implant.

Infrastructure and surgical technique

Some points concerning the hospital infrastructure and surgical technique are important. In addition to standard and desirable care for all orthopedic procedures, such as antibiotic prophylaxis, some points are essential to avoid post-arthroplasty infection, which, although widely published, is not yet well established, and may vary from 2 to 14%⁽¹²⁾. Accordingly, measures must begin with the preparation and correct selection of the patient, preoperative planning and training of the entire surgical team (doctors, nurses and technicians). A step-by-step review with all team members before the start of the procedure, in addition to increasing involvement, also makes it easier to obtain images and, consequently, carry out the procedure. The use of disposable surgical gowns and ventilated protective devices for face protection are desirable, as they prevent contamination of the medical team and of the surgical field. Regarding the surgical technique, all prosthetic options available in Brazil are to be implanted through an anterior approach, with the posterior approach reserved for some exceptional cases. In this anterior approach the surgeon must identify and repair the superficial fibular nerve, and enter the gap between the extensor hallucis longus tendon and the anterior tibial tendon, avoiding opening the sheath of the latter. In the deep plane, the neurovascular pedicle must be identified and detached laterally, together with the extensor tendons (Figure 3).

The articular capsule must be incised longitudinally and preserved for closure after the procedure. The entire joint must be visualized, with good exposure of the medial malleolus and about 8cm from the distal third of the tibia (Figure 3).

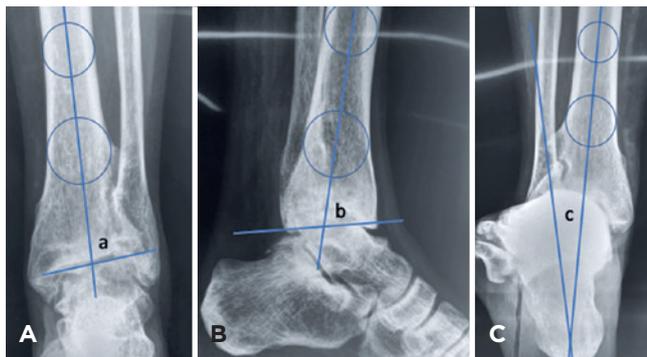


Figure 2. Preoperative radiographic evaluation. A. AP ankle radiograph with measurement of the tibiotalar angle. B. Lateral ankle radiograph with measurement of the distal tibial angle, slope. C. Radiograph in Saltzman view with measurement of the tibial angle with the long axis of the calcaneus. Note: Radiographs should preferably be taken under weight-bearing conditions.

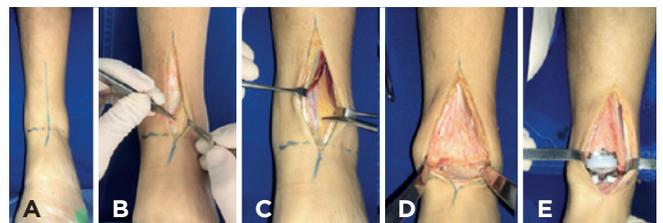


Figure 3. Anterior approach. A. Marking of the anterior approach on the ankle measuring approximately 10 cm across the joint line. B. Identification of the superficial fibular nerve. C. Deep plane with identification of the neurovascular pedicle. D. Exposure of the entire joint with good visualization of the joint and medial malleolus. E. Image showing the implants (Inbone II®).

The correct positioning of the image intensifier device, with the ankle always placed in the center of the screen, either in AP or lateral view, facilitates the correct positioning of the cutting guides and consequently, the correct sizing and positioning of the implants. At the end, joint stability and range of motion must be assessed, and additional procedures undertaken to ensure neutral hindfoot alignment, joint stability, and a functional range of motion, with at least 10-15 degrees of dorsiflexion and 20-30 degrees of plantar flexion of the ankle. A suction drain is not normally used. The articular capsule, the extensor retinacula, and the dorsal fascia, must be sutured with separate stitches. Subcutaneous layer and skin are closed carefully to avoid trauma to the skin. A bulky dressing is applied together with a plaster cast splint, keeping the ankle at 90 degrees.

Postoperative period and follow-up

In the postoperative period, most authors recommend immobilization of the limb for six weeks, with the main purpose of protecting soft tissues and achieving implant-bone integration. Walking can be encouraged with the use of two crutches with partial weight-bearing on the operated limb, and with the use of a walking boot. After the stitches are removed, which should occur after approximately three weeks, some degree of assisted passive mobility should be initiated. Antithrombotic agents are administered during the immobilization period⁽¹³⁾. Once the first six weeks have elapsed, the patient undergoes a clinical and radiological examination (Figure 4). Depending on the patient's progress, a more intense physiotherapy program is instituted for the following purposes: encouraging the patient to walk, gradual increase in weight-bearing, proprioception exercises, gain in active

and passive ankle mobility with stretching and strengthening of the sural triceps, in addition to measures to reduce lymphedema, such as lymphatic drainage and daytime use of compression stockings. The resumption of low-impact physical activities such as walking, swimming and cycling, is encouraged soon after the patient starts full weight-bearing without the help of crutches or use of a walking boot. According to the most recent studies, total ankle arthroplasty promotes an increase in ankle range of motion when compared to the preoperative period, which is more evident one year after surgery⁽¹⁴⁾. The development of new physiotherapy protocols, with an earlier start of activities and a better follow-up of these patients in the postoperative period, will probably promote the maintenance of the degrees of movement achieved during the surgery, but which is often lost in the first postoperative weeks⁽¹⁴⁾.

Clinical and radiological reevaluations are performed at 3, 6 and 12 months after surgery and annually thereafter. Careful observation of the maintenance of implant positioning in subsequent radiographs, formation of subchondral bone cysts, radiolucent lines around the tibial and talar components, fractures due to malleolar insufficiency, presence of heterotopic ossification or osseous impact in the gutters, must be investigated and combined with the patient's clinical evaluation at each return visit. The decision to undertake revision surgery must be taken early, always with an attempt at prosthesis salvage⁽¹⁵⁾. According to recent studies, TAA survival rates range from 70-90% at 10 years⁽¹⁾, with variations related to the learning curve and the design of some implants⁽¹⁶⁾.

Final message

Currently, there is no gold standard for the treatment of end-stage ankle osteoarthritis. Treatment options that promote pain reduction, reestablish function and improve patients' quality of life will be increasingly sought after by physicians and patients. Correct patient/implant selection and the physician's self-assessment to undertake total ankle arthroplasty in an appropriate hospital setting, will make it easier for this technique to "mature" in a safe and responsible way in Brazil, to achieve social approval, and to produce results similar to those of countries where its use is already widespread.

Acknowledgements

Leap of faith!

Leaving my academic, professional, family and social life behind to spend one year in New York City was a tough decision for a 45-year-old orthopedic foot and ankle surgeon. Even knowing that I would be spending a year at the best and most reputable orthopedic hospital in the world (HSS), I was terrified and reluctant to face the challenge.

Now back in my beloved Ribeirao Preto, I am able to realize just how fantastic and unique that opportunity was. I had the chance to learn the details of multiple total ankle replace-

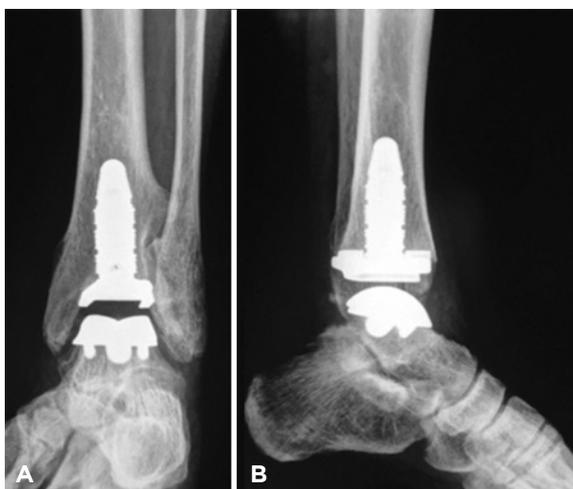


Figure 4. Radiographs six weeks after TAA surgery (Inbone II®). A. AP non-weight-bearing ankle radiography showing good implant alignment and positioning, in addition to the free spaces in the medial and lateral gutters. B. Lateral ankle radiograph with good implant alignment and positioning.

ment implants and techniques from the experts. Constantine Demetracopoulos, Jonathan Deland, Scott Ellis, please accept my heartfelt gratitude for the invaluable opportunity and the intense and profound training. Thanks to you, I now feel more confident and prepared to apply what I have learned for the good of Brazilian patients with end-stage ankle arthritis.

I would strongly recommend international experiences to all my colleagues, even for old dogs like me. We can definitely learn new tricks!

During this very critical period of the COVID-19 pandemic throughout the world, but especially in New York City, my thoughts go out to you New Yorkers, who so warmly welcomed me last year.

Thanks again for everything and take care!

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