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Ankle Arthrodesis in a Resource-limited Country: Indications and Results in 26 Cases

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Abstract

Introduction: Ankle arthrodesis is a surgical technique used to treat end-stage ankle osteoarthritis. Several techniques are used and have shown satisfactory results. The aim of this study was to report the indications and results of arthrodesis performed in a resource-limited setting.

Method: We conducted a descriptive, retrospective study in three referral hospitals in the city of Yaounde. We included consenting patients who had undergone ankle arthrodesis. Parameters such as the approach, type of fixation, consolidation rate, complications, and functional results were analyzed.

Results: We surveyed 26 patients who underwent ankle arthrodesis surgery. The average age was 47.73 years. The sex ratio was 1.16 in favor of men. Arthrodesis was indicated in (n=5; 19.2%) cases of primary osteoarthritis, (n=19; 73.0%) cases of post-traumatic osteoarthritis, (n=1; 3.8%) case of external malleolus tumor, and (n=1; 3.84%) case of post-infectious osteoarthritis of the ankle. The anterior approach was the most commonly used (n=13; 50%), and cross-screwing was most frequent (n=10; 38%). The union rate was 92% with some complications such as infection (n=3; 11%), and pseudarthrosis (n=1; 4%). At the last follow-up evaluation, for the AOFAS score, we obtained 19.2% excellent results, 57.7% good results.

Conclusion: Ankle arthrodesis via arthrotomy is a technique suited to our environment and should be promoted because it offers satisfactory anatomical and functional results.

Keywords: Ankle; Osteoarthritis; Arthrodesis; Arthrotomy; Fractures; Injuries

Introduction

Ankle osteoarthritis is a degenerative disease affecting the tibiotalar joint. It is estimated that 1% of the adult population worldwide suffers from ankle osteoarthritis [1]. The most common etiology is traumatic, with other causes including rheumatoid arthritis, idiopathic arthritis, neuropathic arthritis, osteonecrosis, hemophilic arthritis, septic arthritis, and gout [2]. Among traumatic causes, malleolar fractures, ligament injuries, and tibial pilon fractures are the conditions most likely to lead to ankle osteoarthritis [3,4]. Early and midstage ankle osteoarthritis can be managed by joint preserving procedures, including intra-articular injections, open or arthroscopic debridement, supramalleolar osteotomies and distraction, interposition or allograft arthroplasties [5-9]. End-stage arthritis of the tibiotalar joint is a disabling condition that causes substantial functional impairment and decreased quality of life [10].

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In developing countries in sub-Saharan Africa, the lack of civic-mindedness among road users and the proliferation of motorized two-wheeled vehicles have led to an increase in the rate of ankle fractures and post-traumatic ankle osteoarthritis [11]. In the terminal stage of ankle osteoarthritis, treatment aimed at correcting sequelae deformities or achieving pain relief is necessary. Ankle arthroplasty and ankle arthrodesis are the two methods available to treat this condition. Open ankle arthrodesis seems to be the most suitable option in our environment as it is less expensive than arthroscopic arthrodesis and ankle arthroplasty, which is not yet available in our country. Several techniques have been described for ankle arthrodesis. This led us to ask ourselves what were the indications and results of arthrodesis performed in Yaounde. The aim of our work was to study the different arthrodesis techniques practiced in university hospitals in order to promote the one that offers the best results.

Method

Study design

This was a retrospective, descriptive and analytical longitudinal study. We conducted a multicenter study in three university hospitals over a six-year period from January 2018 to December 2023.

Patient selection

We included all consenting adult patients (>18 years of age) who had undergone ankle arthrodesis indicated for ankle osteoarthritis and whose medical records were complete.

Data collection

The following data were collected:

- Socio-demographic data: age, gender, socioeconomic status
- Radiological and clinical data: medical history (hypertension, diabetes, tumors, trauma, hemophilia, gout, inflammatory disease); presence of pain, deformity, and stage of osteoarthritis.
- Therapeutic data: approach, surgical technique used, type of implants, associated immobilization.
- Progressive data: consolidation time, occurrence of complications, functional assessment using the AOFAS (American Orthopedic Foot and Ankle Score).

Assessment criteria

Clinical and functional: This was done by scoring the AOFAS scores.

- Radiological criteria: Bone fusion was assessed by the absence of limping and radiographic examination of the ankle from the front and side, and/or CT scan.
- Overall: Will be given after calculating the various scores and taking into account several parameters such as: - Rate of bone healing without complications.
- Time to healing.
- Rate of return to normal walking without lameness or with slight lameness; walking distance, Lower limb length inequality.
- Rate of major complications: pseudarthrosis (nonunion), malunion, infection, implant fracture, etc.

Data analysis

The collected data were entered into Microsoft Excel 2021 and then imported and analyzed using SPSS (Statistical Package for Social Sciences) version 26.0. The results were presented in the form of tables and figures with comments. Qualitative variables were expressed as numbers and frequencies, while quantitative variables were expressed as means and standard deviations. To compare quantitative variables, Student's t-test for independent data was used in cases of normal distribution, or the Mann-Whitney U test for non-parametric data. To compare qualitative data, the Chi-square test or Fischer's exact test were used. Multivariate analysis by logistic regression was used to evaluate prognostic factors. A P-value of less than 0.05 was considered statistically significant. We used the AOFAS score to evaluate patient satisfaction.

Results

The series

Our series comprises 26 cases of ankle arthrodesis performed in three university hospitals in the city of Yaounde.

The average age was 47.73 years, with extremes between 24 and 75 years; 65.4% of our population was between [30 and 60] years of age. The 40-49 age group was the largest. (Figure 1).

Males were in the majority (n=14; 53.8%) compared to females (n= 12; 46.2%), giving a sex ratio of 1.167 in favor of males.

The left ankle was operated on in 9 patients, compared to 17 patients for the right ankle.

The lesion

Clinical data: In our series, pain was the main symptom in all patients, sometimes causing limping when walking. The following past medical histories were noted: smoking (n=1; 3.8%); hypertension (n=6; 23.7%); diabetes (n=3; 11.6%), and obesity (n=8; 30.7%).

Radiological data: Arthrodesis was indicated in (n=5; 19.2%) cases of primary osteoarthritis, (n=19; 73.0%) cases of post-traumatic osteoarthritis, (n=1; 3.8%) case of external malleolus tumor, and (n=1; 3.84%) case of post-infectious

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A B C

Figure 1: A- Benign tumor of the lateral malleolus, antero posterior and lateral views. B- Tumor resection + tibiotalar arthrodesis with cross-screw fixation (anteroposterior view). C- Tumor resection + tibiotalar arthrodesis with cross-screw fixation (lateral view).

osteoarthritis of the ankle (Figure 1).

In post-traumatic osteoarthritis, the etiologies were malleolar fractures (n=14; 73.7%), tibial pilon fractures (n=3; 15.8%), and ankle sprains (n=2; 10.5%) (Figure 2A).

The treatment.

The average time to treatment between arthrodesis and the initial injury in our series was 619.82 days (i.e., 88.54 weeks = 20 months, 1 week, 4 days)

The surgical approaches were single in (n=15; 56.7%) patients, including (n=13; 50%) anterior approaches, (n=1; 3.8%) lateral approach, and (n=1; 3.8%) medial approach. The approaches were mixed in (n=11; 42.3%) patients, of whom (n=7; 63.6%) had a mid-plantar approach and (n=4; 36.4%) had an anterolateral approach.

For the type of fixation, cross-screwing was the most commonly used fixation method in (n=10; 38%) patients, followed by retrograde nailing (n=6; 23%) and screw plate fixation (n=6; 23%) (See Table 1).

Table 1: Types of fixations.

Types of Fixations	Effective (n=26)	Percentage (%)
Screwing	10	38
Side screw plate + screw fastening	6	23
Retrograde nailing	6	23
External fixator +Pin	2	8
Screw fixation + Pin	1	4
Screw fixation+plate+Pin	1	4

A B C

Figure 2: A-Neglected bilateral malleolar fracture. B-Tibiotalar arthrodesis + Screw plate fixation of lateral malleolus. C-Consolidated tibiotalar arthrodesis (front view).

Arthrodesis involved the tibio-talocalcaneal region in (n=19; 73.1%) cases and the tibio-talar joint in (n=7; 26.9%) cases (Figure 2B).

The associated treatments were bone grafting in (n=3; 11.5%) cases, postoperative immobilization with a cast in twenty-five patients. The average duration of immobilization was 51.84 days, with extremes ranging from 24 to 120 days. Only 21 patients underwent postoperative rehabilitation, ranging from 21 to 120 days with an average of 51.36 days.

The overall consolidation rate (Figure 2C) was therefore 92% with an average time of 126 days, ranging from 90 to 244 days. We had (n=21; 81%) patients who had good consolidation, (n=3; 11%) patients with poor consolidation, and (n=2; 8%) patients with pseudarthrosis.

The complications were dominated by infection (n=4; 15%) cases, (n=3; 11%) cases of unsightly scarring, (n=2; 8%) cases of hematoma, and (n=1; 4%) case of pseudarthrosis. Sixteen (62%) of the patients had uncomplicated outcomes.

In terms of alignment, we had (n=2; 7.7%) cases of misaligned ankles.

Functional evaluation

The AOFAS allowed us to rate the degree of satisfaction of the patients in our series. For the AOFAS score, we obtained 19.2% excellent results, 57.7% good results, 11.5% average results, and 11.5% poor results (see Table 2).

Table 2: Results score AOFAS.

Score AOFAS	Effective (n=26)	Percentage (%)
Très bon	5	19,2
Bon	15	57,7
Moyen	3	11,5
Mauvais	3	11,5

The average time to return to work was 102.04 days, with extremes of 30 and 183 days.

Discussion

The overall results of our study showed that ankle arthrodesis by arthrotomy is the technique practiced in Yaounde hospitals. It was more indicated in end-stage post-traumatic osteoarthritis, and neglected bimalleolar fractures or poorly treated tibial pilon fractures were the causes. The anterior approach and screw fixation were the most commonly used techniques. These results can be discussed in light of the literature.

Ankle arthrodesis was indicated in the majority of patients in our series who presented with symptomatic ankle

osteoarthritis in the terminal stage. This is the indication most commonly agreed upon by the majority of authors [12-14]. With regard to the etiology of osteoarthritis, we found a rate of 73% of trauma with neglected bimalleolar fractures accounting for 73.6%. Our results are similar to those reported in the literature. This is the case for Sane et al. [15] and Jard et al. [16], who reported cases of post-traumatic osteoarthritis in their series in 11 (100%) and 28 (84.85%) patients, respectively. Indeed, the occurrence of ankle osteoarthritis in patients with ankle trauma is largely determined, on the one hand, by the failure to restore perfect anatomy during initial fracture osteosynthesis [17] and, on the other hand, by the natural progression of chondral lesions.

The diversity and multitude of surgical approaches to the ankle creates a bias in its interpretation, as it depends on several factors: the surgeon's habits, the indication, and the technique used. However, the arthrotomy approach is the most commonly used in the majority of studies [18]. In our series, single approaches were more common (56.7%) than mixed approaches (42.3%). Among these, the anterior approach was the most commonly used in our patients (n=13, 50%). Several authors [15,19-23] prefer the anterior approach because it provides a better view of the ankle joint and allows for easy fixation with plates or screws. It also preserves the lateral malleolus in case a subsequent conversion to a total ankle replacement is considered [20]. Other authors, such as Balaji et al. [21], Kim JG et al. [24] and Lee HJ et al. [25] used the lateral transfibular approach during arthrodesis. This choice may be motivated by the fact that the transfibular approach offers a better view of the posterior and anterior articular surfaces of the tibia and talus. It also allows the use of a fragment of the fibula as a graft, which spares the patient an incision at the iliac crest [26-28]. Our choice of the lateral transfibular approach was motivated by the desire to treat the malleolus tumor (excision) at the same time before proceeding with ankle arthrodesis. The posterior approach, although rarely used, has been described by some authors during arthrodesis [29]. These authors worked on patients with complex tibial pilon fractures in whom osteosynthesis was no longer possible. The mixed anterolateral approach was used in our series to correct exaggerated deformities of the lateral malleolus due to the initial ankle trauma.

Several types of implants were used during arthrodesis in our series. Cross-screwing alone was the most common technique (n=10; 38%), followed by cross-screwing combined with lateral plate and screws (n=6; 23%) and retrograde intramedullary nailing (n=6; 23%). Partially threaded cancellous screws are the least expensive and most readily available fixation method in our working environment. Our results for cross-screwing are similar to those reported by A. Sane et al., who use the cross-screwing technique for the same reasons [15]. Coetzee et al. [23] prefer fixation with plates and screws, even though this technique is more invasive than the others, because they believe it offers optimal stability during relaxation osteotomies + arthrodesis or during arthrodesis alone. Zelle et al. [29] used anatomical ankle plates in their series and achieved a satisfactory rate of bone fusion with a low complication rate. They worked on arthrodesis after complex tibial pilon fractures.

The overall consolidation rate in our series was 92% with a mean time of 126 days, ranging from 90 to 244 days. This high rate is similar to those reported in the literature regardless of the approach used [12]. This is evidence that ankle arthrodesis via arthrotomy is well tolerated and offers better results. However, comparative studies have shown higher consolidation rates depending on the type of fixation used. This is the case of Goetzmann et al. (C1,24), who showed a higher consolidation rate in patients who used three screws for fixation compared to those who used three screws. Others have proven the superiority of plates and screws over screw (only) fixation [31,32] (C3, 41-45).

The outcome was marked by the occurrence of complications. We recorded (n=4; 15%) cases of infection, (n=3; 11%) cases of unsightly scarring, (n=2; 8%) cases of hematoma, and (n=1; 4%) case of pseudarthrosis. Sixteen (62%) patients had uncomplicated outcomes. The majority of authors reported complications in their series. We had four cases of infection, or 15%. This rate is significantly higher than those reported by Stein B.M et al. [12], who had a variable rate of between 4-8% depending on the approach and type of fixation. This may be due to the fact that in sub-Saharan Africa, patients tend to seek out traditional healers for indigenous treatments. These healers often perform scarifications, thus creating entry points for infection. This may also be explained by the fact that we had 23% mixed approaches (lateral and medial), which increases the risk of infection due to the large exposure of the arthrodesis site. We had only one case of septic pseudarthrosis. This patient had persistent infection after a complex open fracture of the tibial pilon, for which he had undergone arthrodesis. The occurrence of hematoma is due to the lack of systematic drainage of arthrodesis in our series.

In terms of function, the AOFAS score is the one used in most series for patient assessment [32,33]. It was very good in (n=5; 19.2%) patients and good in (n=15; 57.5%) patients, for a total of 20 out of 26 patients with a score greater than or equal to 80. This means that ankle arthrodesis is a procedure that is well tolerated by patients. Our results are similar to those reported by Sane et al. [15], who found satisfactory results in their series.

Conclusion

Tibiotalar ankle arthrodesis via arthrotomy is a simple and reproducible surgical technique for treating end-stage

ankle osteoarthritis. The anterior surgical approach and screw fixation are most commonly used in our setting. It offers satisfactory results with a 92% union rate, a low complication rate dominated by infection, and better functional outcomes. This technique should be widely adopted in resource-limited countries such as ours.

Conflicts of interest: None.

Authors Contribution: Muluem OK - Concept and design, surgery; Fonkoue L- Surgery; Koagne MJL – Literature search, collection, and analyses of the published report; Ngo Yamben MA, Nyankoue FM - Review,Handy ED - Final approval of the article.

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