



(RESEARCH ARTICLE)



## Ankle arthrodesis in Awka, Nigeria: Indications and treatment with unlocked retrograde intramedullary nailing and other methods

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### Abstract

**Introduction:** Ankle arthrodesis is a key treatment for severe osteoarthritis, often preceding ankle arthroplasty. Nonsurgical options include lifestyle adjustments and NSAIDs, while surgical options range from debridement to arthrodesis. In Nigeria, ankle arthroplasty availability is limited, making arthrodesis the primary solution. Various techniques exist, with open and arthroscopic approaches yielding successful outcomes but varying in complexity and recovery. This study investigates the prevalence, treatment methods, and outcomes of ankle arthrodesis in Awka, Southeast Nigeria.

**Methodology:** The study, conducted in an Orthopaedic Hospital in Awka, Southeast Nigeria, was a prospective cohort study spanning five years (2017-2022). It included 33 patients with various ankle pathologies screened for suitability of ORIF or arthrodesis. Surgeries were conducted under aseptic conditions, utilizing unlocked retrograde intramedullary nails, a dynamic compression plate, and an external fixator. Patients maintained non-weight bearing until radiological union, with implants removed based on individual patient preference and informed consent.

**Results:** Thirty-three patients requiring ankle surgery, with a mean age of 41.44 years were seen between 2017 and 2021. The causes of ankle pathologies included road accidents being the predominant cause (45.5%). The treatment methods were ORIF with intramedullary nails, dynamic compression plates and screws, and an external fixator. ORIF with intramedullary nails was the most common (57.6%). There were 8 subjects who needed ankle arthrodesis, with a mean age of 54.0 years. The prevalence rate was found to be 24.2%. The failure rate was 12.5%.

**Conclusion:** Ankle arthrodesis proves pivotal for severe osteoarthritis, especially in regions with limited ankle arthroplasty access like Nigeria. The prevalence of arthrodesis is 24.5%. Intramedullary nails are very effective in achieving union. Compression plates and external fixators show good results. The failure rate of fixations was 12.5%.

**Keywords:** Ankle arthrodesis; Severe osteoarthritis; Surgical options; Treatment outcomes; Nigeria

### 1. Introduction

Ankle arthrodesis is one of the main treatments for severe osteoarthritis in its final stage, the second being an ankle arthroplasty.[1] The treatment of osteoarthritis of the ankle encompasses both nonsurgical and surgical approaches. Nonsurgical options involve lifestyle modifications such as activity limitation, along with the use of non-steroidal anti-inflammatory drugs (NSAIDs), and dietary supplements like glucosamine and grape seed extract.[2] Physical therapy can aid in movement training. Other interventions include modifying footwear with rocker bottom soles, utilizing assistive devices like canes or crutches, and employing orthotic devices such as locked ankle-foot orthosis (AFO) with a solid ankle cushion heel, custom-moulded leather ankle braces, or patellar tendon-bearing AFOs.

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In contrast, surgical treatments for severe osteoarthritis of the ankle include arthroscopic debridement, synovectomy, excision of impinging osteophytes, joint distraction, or arthrodesis. However, the effectiveness of debridement for advanced osteoarthritis of the ankle may be limited. Total ankle prosthetic replacement, while an option, comes with its share of complications and failures, including early loosening, deformities, malalignment of components, malleolar impingement, soft tissue imbalance, infection, and dislocation. Despite the growing interest in total ankle arthroplasty, ankle arthrodesis remains the primary surgical option for managing severe ankle arthrosis in most cases. [3,4,12]

In Nigeria, where ankle arthroplasty is not readily available both in expertise and prosthesis, ankle fusion becomes the only solution to end-stage severe ankle osteoarthritis and trauma with extensive joint compromise.

The various surgical techniques for ankle arthrodesis, including open and arthroscopic approaches lead to successful outcomes, but reported results have shown variability due to differences in techniques, surgeon expertise, patient selection, and outcome measurements. Ankle arthrodesis should be approached cautiously, especially in young patients, highly active individuals, and those with advanced foot and ankle deformities. [1,6,8]

The goals of ankle arthrodesis are to alleviate pain and restore a stable, plantigrade foot for weight-bearing activities. Proper alignment after surgery is crucial, with slight valgus, neutral dorsiflexion, and slight external rotation desired. Limb length should also be carefully balanced to avoid gait abnormalities. [9,10,11]

Arthroscopic ankle arthrodesis is usually reserved for patients with minimal joint deformity, while open arthrodesis is preferred for moderate to severe deformities, allowing better visualization for alignment correction. Pre-operative assessment of forefoot balance is essential, and arthroscopic or open debridement with external fixation may be recommended for patients with significant malalignment, compromised skin, limb length discrepancies, or a history of infection. [6,12]

Various surgical techniques exist for ankle arthrodesis, categorized into open and arthroscopic approaches. The open approach offers easier correction of malalignment and facilitates the use of plates and bone grafts, but it also carries a higher risk of wound complications due to extensive soft tissue dissection. Arthroscopic ankle arthrodesis, although less invasive and associated with shorter recovery times, is indicated for patients with minimal deformity or higher risks of wound complications. [1,3,12,14]

Both internal and external fixation methods can be employed in ankle arthrodesis, each with its advantages. Internal fixation with screws, plates, or retrograde intramedullary nails has demonstrated successful outcomes, with screws being preferred for their simplicity and lower morbidity, although associated with higher non-union rates, especially in osteoporotic bone. Plates offer versatility but may increase infection risk due to extensive dissection. A combination of plates and screws may provide optimal stability, as demonstrated in recent biomechanical studies. Retrograde intramedullary arthrodesis is reserved for cases involving both the ankle and subtalar joints, although its use is limited due to the critical role of the subtalar joint in gait stability post-arthrodesis. [2,14,15,16, 17]

External fixation is typically reserved for complex cases involving significant bone defects, limb length discrepancies, poor bone quality, or active/inactive infection. However, outcomes with external fixation generally lag behind those with internal fixation. [2 18,19]. This study aimed to investigate the prevalence, use of unlocked retrograde intramedullary nails, and outcome of ankle arthrodesis in Awka, Southeast Nigeria.

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## 2. Methodology

This study was conducted in an Orthopaedic Hospital in Awka, Southeast Nigeria. The prospective cohort study included other studies, conceptualized and monitored with a general questionnaire, and recorded over a 5-year period between 2017 and 2022. Thirty-three patients presented with different ankle pathologies, including ankle fractures, infections, and severe osteoarthritis with ankle subluxation. All ankle presentations to our centre were screened for suitability of ORIF or arthrodesis. Those who were picked for fusion underwent surgeries under aseptic conditions.

Intramedullary nails, dynamic compression plates and an external fixator were used for the purpose of arthrodesis. The normal procedure for the application of external fixators and dynamic compression plates was observed during the surgeries. The intramedullary nail was passed through the anterior part of the calcaneum, through the talus and into the tibia. This was an unlocked retrograde nailing. All the nailing procedures were done same way. All the patients maintained non-weight bearing till radiological union was observed. The nails were removed before the patients would commence partial to full weight bearing. This applied to external fixators. The plates are not usually removed until the

patient either requests for it or there is any other reason for their removal. The patients are usually duly informed of the advantages and disadvantages, with full consent given for any path taken.

### 3. Results

**Table 1** shows the socio-demographic profile of the 33 patients with ankles requiring surgical intervention. The mean age of the subjects was 41.44 years, with a standard deviation of 18.9 years, ranging from 10 to 78 years. Most of the participants were male (60.6%), and the most common occupation was civil service (33.3%). Others included students (24.2%), individuals engaged in business (27.3%), and housewives (15.2%)

**Table 1** Socio-demographic characteristics of all ankle presentations.

Variable	Frequency (n)	Percentage (%)
<b>Mean Age (years)</b>	41.44 ± 18.9	10-78
<b>Gender</b>		
Male	20	60.6
Female	13	39.3
<b>Occupation</b>		
Student	8	24.2
Business	9	27.3
Civil Servants	11	33.3
Housewife	5	15.2

**Table 2** Treatment methods of all ankle presentations

Treatment Method	Frequency (n)	Percentage (%)
ORIF	19	57.6
The scotch casting of non-displaced fractures	5	15.2
Arthrodesis	8	24.2
External Fixation	1	3.0

**Table 3** Demographic Characteristics of Patients Undergoing Ankle Arthrodesis

	Frequency	Percentage
<b>Mean Age (years)</b>	54.0 ± 21.15	18-78
<b>Gender</b>		
Female	5	62.5
Male	3	37.5
<b>Occupation</b>		
Civil Servant	4	50.0
Housewife	1	12.5
Business	2	25.0
Student	1	12.5
<b>Marital Status</b>		
Married	7	87.5
Single	1	12.5

Table 3 illustrates the demographic profile of the eight subjects who underwent ankle fusion. The mean age of the subjects was 54.0 years, with a standard deviation of 21.15 years, ranging from 18 to 78 years. Females constituted the majority, accounting for 62.5% of the subjects, while males represented 37.5%. In terms of occupation, civil servants comprised the largest proportion (50.0%), followed by individuals engaged in business (25.0%), students (12.5%), and housewives (12.5%). Most of the participants were married (87.5%), with a smaller percentage being single (12.5%).

**Table 4** Aetiology and Patient Outcomes Following Ankle Fusion

	Frequency	Percentage
<b>What Was the Reason for The Fusion?</b>		
Open Infected Ankle	3	37.5
Trauma with Damaged Joint Surfaces	2	25.0
End stage ankle Arthritis with deformity	1	12.5
Paralysis with flail ankle	1	12.5
Gunshot injury with severe ankle damage	1	12.5
<b>Did the Patients Readily Accept the Surgery after counselling?</b>		
Yes	8	100.0
<b>Which Type of Implant Was Used for The Fusion?</b>		
Intramedullary Nail	6	75
Plate And Screw	1	12.5
External fixators Supported with cast	1	12.5
<b>Outcome of Arthrodesis</b>		
Solid union	7	87.5
Failed Arthrodesis	1	12.5
<b>Satisfied with outcome</b>		
Yes	7	87.5
No	1	12.5

Table 4 offers valuable insights into various aspects of ankle fusion surgeries, encompassing reasons for surgery, patient acceptance, types of implants utilized, fusion outcomes, and patient satisfaction.

### 3.1. Reasons for Surgery

A spectrum of these conditions necessitated ankle arthrodesis:

- Open Infected Ankle: This emerged as the most prevalent reason, with 3 cases (37.5%).
- Trauma with Damaged Joint Surfaces: 2 cases (25.0%).
- End-stage Ankle Arthritis with Deformity: 1 case (12.5%).
- Paralysis with Flail Ankle: 1 case (12.5%).
- Gunshot Injury with Severe Ankle Damage: 1 case (12.5%).

The diversity of conditions underscores the complexity of cases that necessitate ankle fusion surgery, ranging from infectious to traumatic and degenerative aetiologies.

### 3.2. Patient Acceptance of Surgery

A high acceptance rate of 87.5% post-counselling indicates patients' readiness to undergo surgery. This signifies effective communication and counselling practices, ensuring patients are well-informed and consenting to the procedure.

### 3.3. Types of Implants Used

The majority of cases (75%) employed intramedullary nails, indicating a preference or suitability for ankle fusion procedures within this cohort. Additionally, plate and screw fixation and external fixators were utilized in 12.5% of cases each, reflecting the diversity of surgical approaches tailored to individual patient needs.

### 3.4. Outcome of Arthrodesis

**Solid Union:** This outcome was achieved in 87.5% of cases, indicating successful fusion. It is crucial for restoring stability and functionality to the ankle joint, alleviating pain, and improving overall quality of life.

**Failed Arthrodesis:** This was noted in 1 case (12.5%), suggesting unsuccessful fusion. Such instances may necessitate further intervention or treatment to achieve the desired outcome.

### 3.5. Patient Satisfaction with Outcome:

The majority of patients (87.5%) reported satisfaction with the surgical outcome, reflecting positive experiences and outcomes. However, one patient (12.5%) expressed dissatisfaction with the outcome.

### 3.6. Prevalence of Ankle Arthrodesis

The research examined the occurrence of ankle fusion in 33 different ankle presentations and revealed a prevalence rate of 24.2%.

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## 4. Discussion

This finding provides comprehensive overview of ankle pathologies requiring surgical intervention in an Orthopaedic Centre in Southeast Nigeria conducted between 2017 and 2021. The demographics are that of the patients, causes of ankle pathologies, treatment methods employed, outcomes of ankle fusion surgeries, and patient satisfaction rates.

Table 1 provides insights into the demographic profile of patients with all ankle presentations, showing eight, while Table 2 shows the treatment methods for ankle presentations. It highlighted those eight patients who underwent arthrodesis over the 5-year period, making it a prevalence of 24.5% .

Table 3 provides the demographics of patients undergoing ankle arthrodesis. The mean age of subjects undergoing ankle fusion was 54.0 years, with females constituting the majority (62.5%). These ages were similar to middle-aged patients, as noted by Yinusa et al. and Obiegbu et al. but contrary to their male-to-female ratio, which is almost equal. [20,21] Civil servants comprised the most significant proportion in terms of occupation (50.0%), followed by individuals engaged in business, students, and housewives. Most participants were married (87.5%), indicating the potential impact of ankle pathologies on daily activities and quality of life.

The outcomes of ankle fusion surgeries presented in Table 4 indicate a high acceptance rate among patients post-counselling (87.5%). Most cases utilized intramedullary nails (75%), with plate and screw fixation and external fixators employed in 12.5% of cases each. Solid union was achieved in 87.5% of cases, reflecting successful fusion outcomes. However, one case (12.5%) experienced failed arthrodesis, necessitating further intervention. Patient satisfaction with the surgical outcome was high (87.5%), highlighting the effectiveness of ankle fusion in improving patients' quality of life. The outcome finding is similar to findings by other authors in Nigeria. However, our union rate of 87.5% is superior union rate to similar studies around the same region, but Ajibade et al. 2011, had a better outcome of 90%. [22]

The literature review corroborates the findings of the research, emphasizing ankle arthrodesis as a primary surgical option for severe ankle osteoarthritis and trauma in regions with limited access to ankle arthroplasty. [ 3,4,6,8,12]

The surgical techniques for ankle fusion, including open and arthroscopic approaches, have shown successful outcomes but may vary based on surgeon expertise, patient selection, and outcome measurements. All our surgeries were done through the open method; Intramedullary nailing formed 75% of all surgeries. This was done with an unlocked retrograde calcaneo-talo-tibia nail with very good outcome. Jehan et al. who used only intramedullary nails, got a very

union outcomes like ours, showing intramedullary nails are a very good device for ankle arthrodesis.[23] Proper alignment and stability post-surgery were noted in 7 cases while deformity was seen in the failed case. Other fixation methods, such as screws and plates and an external fixators, were used in one patient each and had a good outcome. Intramedullary nails have demonstrated successful outcomes but unlocked nail has proved to be as effective in ankle arthrodesis.

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## 5. Conclusion

Ankle arthrodesis proves pivotal for severe osteoarthritis, especially in regions with limited ankle arthroplasty access like Nigeria. The prevalence of arthrodesis is 24.5%. Unlocked retrograde Intramedullary nails are very effective in achieving union. Compression plates and external fixators show good result. The failure rate for this study was 12.5%.

This study contributes to the existing literature by providing insights into the prevalence, treatment methods, and outcomes of ankle arthrodesis in Nigeria, enhancing our understanding of ankle pathologies and their management strategies in this region.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

### *Statement of informed consent*

All the patients freely gave consent for the procedures.

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