


# Management of Neglected Congenital Talipes Equinovarus: A Report from Practical Experience in Sokoto, Nigeria

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## Abstract

**Background:** Early-presenting Congenital Talipes Equinovarus (CTEV) is usually corrected non-operatively with the Ponseti method, achieving excellent outcomes. Neglected CTEV (NCTEV), however, is challenging and often requires surgery. **Objectives:** These are to: 1) describe clinical profiles, reasons for neglect, and treatments among NCTEV presenting after walking age; 2) assess functional satisfaction, anatomical outcomes, and quality of life after treatment; 3) examine effects of age at presentation, deformity rigidity, and anaesthesia choice on outcomes; and 4) document common surgical complications. **Methods:** A retrospective descriptive cross-sectional review was conducted on NCTEV cases treated surgically at Usmanu Danfodiyo University Teaching Hospital, Sokoto (July 2018-June 2025). Patients included in the study were aged  $\geq 2$  years, had primary NCTEV with surgical treatment, complete records, and  $\geq 9$ -month follow-up. Exclusion criteria were incomplete data, secondary clubfoot, and non-surgical care. Data (demographics, causes of neglect, Pirani score, prior care, operative details, post-operative care, complications, outcomes like plantigrade foot, ambulation, and cosmesis) were extracted using a structured form and analysed in SPSS version 25 ( $p < 0.05$ ). Confidentiality was maintained; consent was waived per institutional ethics for retrospective studies. **Results:** Of 126 surgical clubfoot patients, 58 (46%) met criteria, aged 3 - 23 years

(mean = 13.9). Females were 65.5% (F:M = 1.9:1). A total of 103 feet were affected: 45 bilateral, 9 left, and 4 right. All presented with poor Pirani score ( $\geq 5.5$ ). All had abnormal gait: 62.1% crawled; 37.9% walked on the dorsum. Deformities included equinus, cavus, varus, and adduction, with rigid hypoplastic feet being common. Main reasons for neglect were multi-factorial, with poor awareness (82.8%), socioeconomic barriers (79.3%), insecurity (62.8%), and limited access to care (72.4%). All had initial but failed non-operative care and underwent surgery and by 6 months, all walked erect largely with support; by 9 months, all walked independently. Subarachnoid block was accepted by 67% ( $\geq 8$  years). Challenges included financial constraints (84.5%), long travel distance (63.8%), insecurity (69.0%) and low parental education (70.7%). Complications were infrequent and manageable. **Conclusion:** Tailored surgical management of NCTEV yields excellent functional and psychosocial outcomes. Age influences deformity severity and shared decision-making. Multi-factorial neglect necessitates early case finding, public education, and strengthened primary orthopaedic services to reduce NCTEV.

### Keywords

Surgical Management of Neglected Congenital Talipes Equinovarus, Congenital Talipes Equinovarus, Clubfoot, Ponseti Method, Surgical Outcomes, Functional Outcomes, Quality of Life, Subarachnoid (Spinal) Anaesthesia, Gait Restoration

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## 1. Introduction

Congenital Talipes Equinovarus (CTEV) is one of the commonest congenital musculoskeletal deformities, with an incidence of 1 to 2 per 1000 live births [1]. It is usually identified at birth. If presented and treated early and adequately, especially with the Ponseti method, the outcomes are often excellent, and the need for extensive surgical correction is avoided [2]. However, in low-resource settings, many cases are either untreated, inappropriately or poorly managed, leading to neglected CTEV.

Neglected CTEV, popularly called neglected clubfoot by multitude, refers to a congenital foot deformity that has not been adequately treated, unsuccessfully treated or has been left untreated beyond walking age (typically after 1 - 2 years of age) [1] [3].

Neglected CTEV is characterized by a rigid complex three-dimensional deformity involving all four primary key components: ankle equinus, midfoot cavus, hind-foot varus and forefoot adductus and often complicated by a spectrum adaptive (secondary pathologies) bony and soft tissue changes such as hypoplasia of calf muscle, skin changes like scars, wounds, bunion, callusity, hyperpigmentation especially at the dorsum of the foot and knee especially if patient crawls to ambulate [4]. In many poor-resourced nations like Nigeria, especially in the Northern part of Nigeria where the study was carried out, delayed presentation is common with

a spectrum of factors such as socioeconomic barriers, poor access to early specialized (orthopaedic) care, poor awareness of the condition and its treatment, inadequate or failed initial treatment, socioeconomic and cultural factors [5]. These children when neglected, frequently walk on the dorsolateral aspect or dorsum of the foot with abnormal gait or inability to wear normal shoes while in very severe cases, they crawl, resulting in pain, callosities, and functional impairment, affecting mobility and quality of life, usually leads to long-term disability, difficulty in walking, psychological distress, and social stigma, especially in low-resource settings [6].

While the Ponseti method remains the gold standard for early treatment, several studies have shown its modified application can still be effective in some neglected cases, especially in children under 10 years [3]. However, rigid and longstanding deformities often necessitate surgical interventions such as posteromedial soft tissue release, tendon transfer, bony realignment (osteotomies), or the use of external fixators like the Ilizarov apparatus [7]. Surgical outcomes vary, and recurrence rates can be significant if biomechanical alignment is not fully corrected or maintained [8]. Therefore, a staged or multi-modal approach is frequently recommended, depending on deformity severity, patient age, and local expertise. The use of Ilizarov technique has progressively gained popularity as a limb-salvaging option for severe and complex deformities like NCTEV, by applying gradual correction through external fixation, this method allows simultaneous correction of all components of the deformity with lower neurovascular risk [9]. However, it is time-consuming, requires technical expertise, demands strict compliance and the expertise is largely scarce, especially in this part of the world where this study was carried out.

This study is to examine our experience in surgical management of NCTEV.

## 2. Methodology

This retrospective descriptive cross-sectional study evaluated the surgical management and outcomes of patients with Neglected Congenital Talipes Equinovarus (NCTEV) at the Department of Orthopaedics and Trauma, Usmanu Danfodiyo University Teaching Hospital, Sokoto, from July 2018 to June 2025. The study included patients aged  $\geq 2$  years diagnosed with NCTEV (defined as CTEV untreated or inadequately treated beyond walking age) who underwent surgery and had complete medical records with at least 9 months of follow-up. Patients with incomplete records, secondary clubfoot (e.g., due to neuromuscular or syndromic causes), or who received only non-surgical treatment were excluded.

Data were retrieved using a structured extraction form from surgical registers and medical records. Variables included demographic data (age, sex, laterality), causes of neglect, severity of deformity (Pirani score), previous interventions, surgical procedures (e.g., soft tissue release, tendon lengthening, osteotomy, triple arthrodesis), intraoperative findings, anesthesia type, and post-operative management. Outcomes assessed were functional and cosmetic results, complication rates (e.g., infection, recurrence), final correction status (e.g., plantigrade foot, painless

ambulation, shoe-ability), and duration of hospital stay.

Data were entered into Microsoft Excel and analyzed using SPSS version 25. Descriptive statistics (frequencies, percentages, means, standard deviations) were used. Categorical variables were presented as proportions; statistical significance was set at  $p < 0.05$ .

Patient confidentiality was strictly upheld, with no personal identifiers collected. As the study used existing data retrospectively, informed consent was waived according to institutional ethical guidelines.

### 3. Results

Out of 126 patients of surgically managed club feet within the study period, only 58 cases (46%) met the study inclusion criteria with age range of 3 to 23 years (mean age = 13.9 years). Of these 58 studied cases, 38 (65.5%) were females while 20 (34.5%) were males (F:M = 1.9:1), 45 cases were bilateral, 9 cases were left and 4 cases were right feet, making 103 feet (**Figure 1**). All presented with very poor Pirani score of 5.5 scores in 18.4% of the feet ( $n = 19$ ) and 6.0 scores in 81.6% of the feet ( $n = 84$ ). All the patients presented with abnormal gait, with 36 cases (62.1%) who had never walked erect but rather crawled to move from one place to the others while 22 cases (47.9%) walked with dorsum/dorsolateral aspects of the feet. All the patients presented with poorly developed, hypoplastic and rigid feet with spectrum of ankle equinus, midfoot cavus, hindfoot varus, forefoot adduction and varieties of adaptive bony and soft tissue changes, with the deformities mirroring each other in bilateral cases. All the patients complained of gross functional impairment; 41 cases (70.7%) have started experiencing stigmatization among their peers and 46 (79.3%) could not wear appropriate shoes at all due to the deformities.

The reasons for neglect are multi-factorial among the patients (**Figure 2**) which include socioeconomic barriers (46 cases, 79.3%), poor access to orthopaedic care (42 cases, 72.4%), poor awareness of the condition and its treatment (48 cases, 82.8%), inadequate or failed initial treatment (9 cases, 15.5%), sociocultural factors with initial beliefs that there was no need for treatment (31 cases, 53.5%) and insecurity (40 cases, 69%). All patients had non-operative treatment attempt but no significant changes hence different types of surgical interventions (**Figure 3**) with surgeries performed in stages (**Figure 4**). At 6 weeks post-surgery, 27 patients (46.6%) could stand and walk with walking aids, while 31 patients (53.5%) still found it difficult to walk erect but with the aids. By the 6th month after surgical treatment, all the patients could stand and walk erect and 17 cases (25.9%) with canes to maintain confidence and by the 9th month, all were walking independently with normal or near normal gait. All the patients (including their parents and relatives) reported and claimed satisfaction after surgery and improved function and quality of life after wound healing, especially after 6 weeks of surgery ( $p < 0.0001$ ).

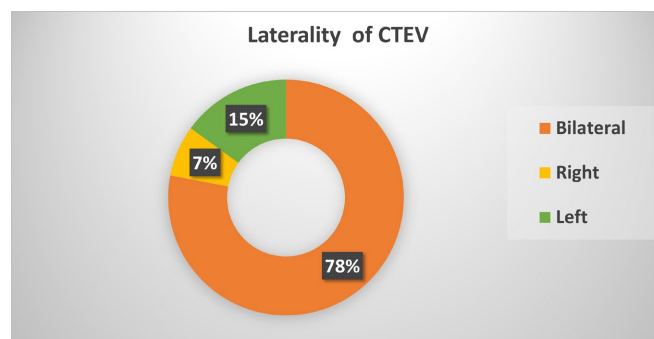
All the patients ( $n = 47$ , 81.0%) with ages of  $\geq 5$  years were fully participated in explaining the symptoms, well cooperated in physical examination, with the spectrum of eagerness to have their feet corrected and significant impute during in-

formed consent taking for surgical correction as well as anaesthetic options with those who were  $\geq 8$  years ( $n = 39$ , 67.0%) easily accepted subaracnoid block and cooperated during surgery by maintaining communication while others (33.0%) had general anesthesia.

Challenges of major concern during treatment were interwoven which included gross financial constraint with 49 cases (84.5%) been sponsored for treatment by individuals or various organizations, poor level of education by the parents (in 41 cases, 70.7%), long distance from place of resident to the hospital (37 patients, (63.8%) because they live in location of 150 to 500 km and more from the hospital).

The cumulative duration of hospital stay varied widely, between 4 days and 71 days (mean = 29 days), with 29 patients having multiple hospital admissions for stages of surgeries (**Figure 3**). The surgery duration (excluding anaesthesia time) per foot ranged between 29 and 73 minutes (mean 49.5 minutes). Out of the 103 feet, 7 (6.8%) had mild to moderate recurrent as a result of delayed weight bearing, which were re-operated with satisfactory outcome, 4 feet (3.9%) had superficial surgical site infections and were treated with wound dressing.

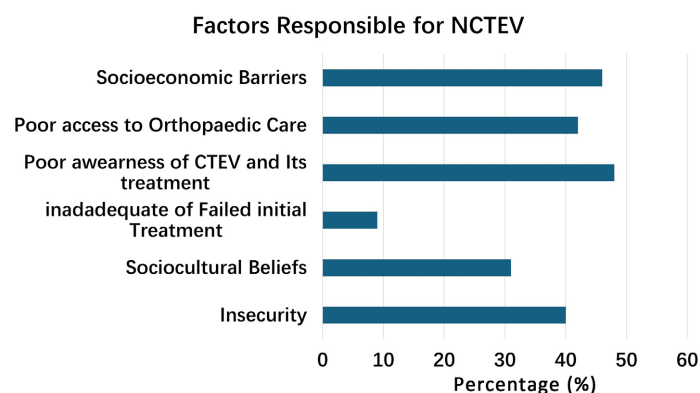
**Figure 1** shows laterality of NCTEV.



**Figure 1.** Laterality of NCTEV.

**Comments:** Bilateral cases were the commonest presentation.

**Figure 2** shows the interwoven multi-factorial reasons for neglected CTEV in the studied patients.



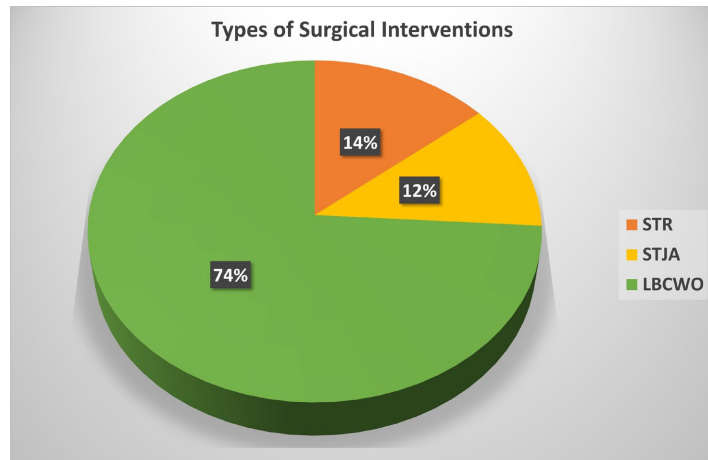
**Figure 2.** Multi-factorial reasons for NCTEV.

**Comments:**

1) All the patients have multiple factors implicated for neglect or late presentation for the care.

2) Poor awareness was indicated in 48 cases (82.8%).

**Figure 3** shows different types of surgical interventions.

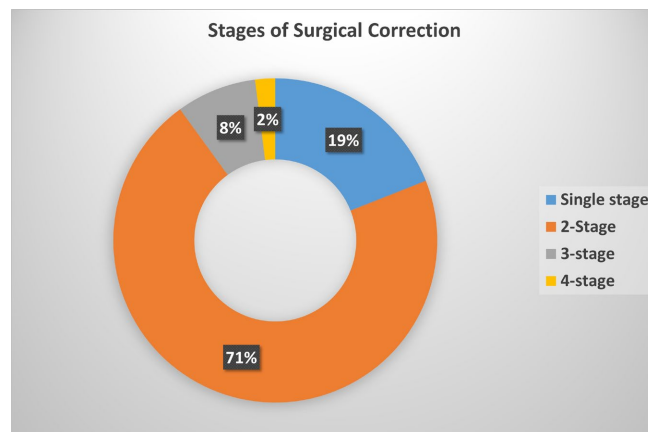


Note: Keys: STR = Soft Tissue Release (elongation of Achilles Tendon, Posterior medial release alone), STJA = Subtalar Joint Arthrodesis, LBCWO = Lateral Bases Closed Wedge Osteotomies of different types.

**Figure 3.** Types of surgical intervention.

**Comments:** Most (78%) of the cases had lateral bases closed wedge osteotomies of different types.

**Figure 4** shows the number of the stages for the surgeries.



**Figure 4.** Stages of surgical intervention.

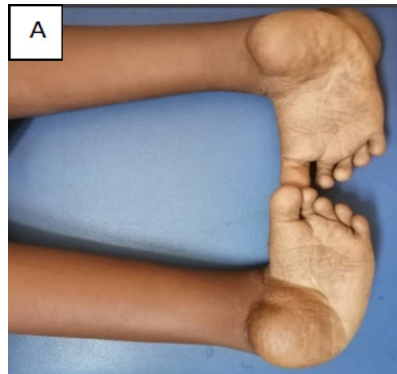
**Comments:**

1) Most Surgeries were done in 2 stages (71%).

2) All were done and stopped to be continued at next stage due to risks to neurovascular status.

The clinical photographs below show pre- and post-operative appearance of one of the patients.

**Patient A: 19-year-old girl with bilateral NCTEV.**





**Comments:**

A: The foot at presentation.

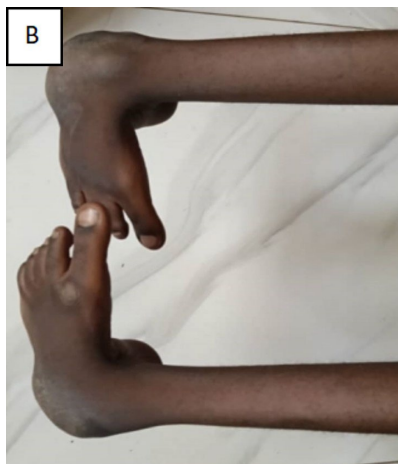
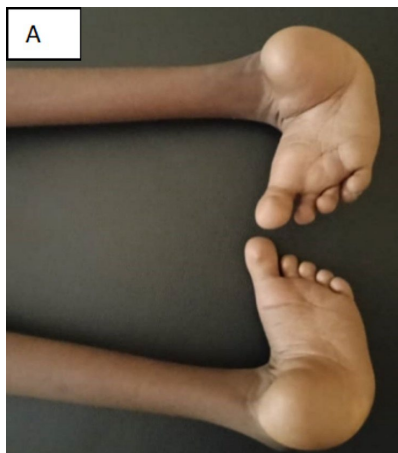
B: Patient ambulate by crawling at presentation or pre-operative ambulation by crawling.

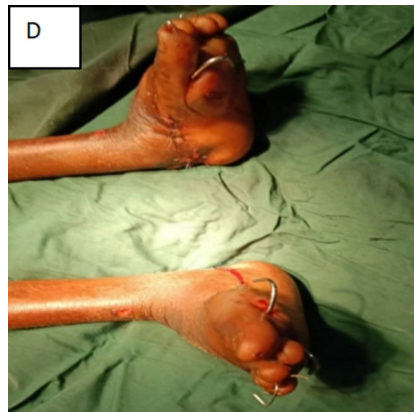
C: The foot after the first stage of correction of the left foot.

D: The feet after the first stage of both.

E: The feet after their second stage of correction.

**Patient B: 11-year-old girl with bilateral NCTEV.**





**Comment:** The clinical photograph at presentation (A & B), radiograph (C), and post-operative appearance after correction at a single stage (D, E).

#### 4. Discussion

This study underscores the substantial clinical, functional, and psychosocial impact of NCTEV in a resource-limited setting. Of 126 surgically managed clubfoot cases, 58 (46%) presented with neglected deformities, reflecting the continuing burden of late presentation in developing countries where early access to care remains limited [3] [6]. The mean age of 13.9 years demonstrates significant delays in intervention, consistent with reports that progressive soft-tissue fibrosis and bony remodeling reduce the effectiveness of conservative treatment when presentation is delayed [1]. The high rate of bilateral involvement (78%), exceeding the global prevalence of approximately 50% [2], likely reflects referral

bias and the tendency for severe, symmetrical deformities to reach tertiary centres.

The predominance of severe Pirani scores ( $\geq 5.5$  in all cases) indicates that most patients presented with rigid, complex deformities characterized by equinus, varus, cavus, and forefoot adduction. Such high scores mirror earlier reports that neglected clubfoot often presents with dense soft-tissue contractures and osseous deformity requiring extensive surgical correction [1] [10] [11]. These findings highlight the consequences of delayed presentation, poor health-seeking behaviour, poverty, and limited access to specialized paediatric orthopaedic services typical of low-income settings [3] [11].

Functional impairment was profound. Over 60% of patients were unable to ambulate upright, relying on crawling or walking on the dorsum of the foot, leading to muscular imbalance, callosities, and chronic pain. Psychosocial consequences were equally severe: 70% reported stigma, while nearly 80% were unable to wear conventional footwear. These findings align with previous literature showing that NCTEV imposes not only physical disability but also deep social and emotional distress, underscoring the importance of early detection, community education, and accessible treatment services.

Multiple factors contributed to neglect (**Figure 2**), including socioeconomic barriers (79.3%), poor access to orthopaedic care (72.4%), limited awareness of treatment options (82.8%), failed or inadequate initial treatment (15.5%), and sociocultural misconceptions (53.5%). These mirror the findings of Tindall *et al.*, who emphasized that public education, outreach, and health-system strengthening are essential to reduce neglected clubfoot [12]. All patients had previously attempted conservative care, yet none achieved correction, reinforcing that, once the optimal early window (infancy) is missed, surgery becomes the mainstay [13].

Surgical procedures were individualized according to severity and rigidity, including soft-tissue releases ( $n = 14$ ), subtalar joint arthrodesis ( $n = 12$ ), and postero-lateral closing-wedge osteotomies ( $n = 76$ ). This tailored approach aligns with El-Sayed's principle that treatment must match deformity rigidity and patient age [14]. All cases demonstrated classical CTEV pathology, requiring combined correction to achieve plantigrade alignment.

Despite the technical challenges, functional and cosmetic outcomes were satisfactory. Patients reported improved ambulation, gait, and self-confidence. Post-operative follow-up showed progressive recovery with 46.6% walking with support at six weeks, all ambulant at six months, and independent gait in all by nine months. These findings corroborate earlier studies showing that, although early mobility may be limited, structured rehabilitation yields substantial long-term improvement [2] [11].

Age at presentation, deformity rigidity, informed consent, and anaesthetic choice significantly influenced outcomes. Rigidity increased with age, consistent with the natural progression of untreated CTEV into fixed equinocavovarus deformity with

hypoplastic bones and dense contractures [1] [15]. Older children ( $\geq 5$  years) were more cooperative during evaluation and consent, and most (67%) accepted subarachnoid block, allowing safe and cost-effective anaesthesia suitable for resource-limited environments [16] [17]. Younger or anxious patients required general anaesthesia. This observation demonstrates that age influences not only deformity rigidity but also the range of anaesthetic options available. All patients achieved plantigrade, functional feet within nine months, consistent with prior studies reporting favourable outcomes after failed conservative management in older children [6]. High satisfaction and active engagement among older patients further highlight the psychosocial benefits of surgical correction, including improved self-esteem and reintegration into normal activities.

Despite satisfactory outcomes, systemic challenges persisted. Financial hardship was the dominant barrier, with 84.5% requiring external sponsorship for treatment. This aligns with previous studies identifying cost as a major obstacle even for non-operative methods such as Ponseti casting [2] [6]. Low parental education (70.7%) limited understanding of deformity and treatment necessity, while geographical inaccessibility (58.6%) hindered timely presentation and follow-up. Many families traveled over 150 km for care, incurring additional indirect costs. Together, poverty, poor health literacy, and distance form a triad perpetuating neglect. Addressing these challenges demands decentralization of orthopaedic services, financial support mechanisms, and community-based education to improve early detection and adherence.

Hospital stay ranged from 4 - 71 days (mean = 29 days), with nearly half requiring multiple admissions for staged correction or rehabilitation. Prolonged hospitalization in NCTEV has been reported elsewhere and reflects the complexity of neglected deformities, post-operative care needs, and socioeconomic discharge constraints [14]. Mean operative time per foot was 49.5 minutes, comparable to published averages for rigid clubfoot surgery [18], confirming that efficient surgery is achievable even in low-resource settings with careful planning and experience.

Proprioceptive deficits were seen in 25.5% of patients, especially those with longstanding deformities, but improved progressively with rehabilitation, consistent with literature linking proprioceptive recovery to adaptive neuromuscular retraining [15] [19]. Post-operative complications were minimal and manageable, underscoring the safety and efficacy of the adopted techniques.

Although not used in this cohort, the Ilizarov external fixator offers a valuable option for correcting severe, rigid, or relapsed NCTEV by allowing gradual, multi-planar correction through distraction histogenesis [20]. However, its application remains limited in North-West Nigeria due to high cost, inadequate infrastructure, and lack of trained personnel. Expanding Ilizarov expertise and availability would enhance outcomes for complex cases, though comparable success can still be achieved using conventional single or staged surgical correction, as shown in this series.

## 5. Conclusion

The study demonstrates that, despite socioeconomic and infrastructural challenges, surgical management of NCTEV in low-resource settings yields excellent functional, cosmetic, and psychosocial outcomes when supported by structured rehabilitation and patient engagement. Addressing the root causes of neglect, like poverty, poor awareness, and limited access to specialized care, requires coordinated policy reform, decentralization of services, and community education. Timely surgical correction not only restores mobility but also transforms lives through enhanced dignity, participation, and societal reintegration.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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