Scientific Research Publishing

Open Journal of Orthopedics, 2023, 13, 41-49
https://www.scirp.org/journal/ojo
ISSN Online: 2164-3016
ISSN Print: 2164-3008

Neglected and Relapsed Clubfoot in Adults, the Functional Outcome of Acute Surgical Correction

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How to cite this paper: Nogdallah, S., Hassan, H.M., Khairy, A.M.M., Salih, D., Abd-Elmaged, H.M.A. and Fatooh, M. (2023) Neglected and Relapsed Clubfoot in Adults, the Functional Outcome of Acute Surgical Correction. *Open Journal of Orthopedics*, **13**, 41-49.
https://doi.org/10.4236/ojo.2023.132004

Received: January 8, 2023
Accepted: February 13, 2023
Published: February 16, 2023

Abstract

Background: Neglected clubfoot in this series is defined as untreated equino-cavo-adducto-varus in older children or adults. Relapsed clubfoot is the residual deformity that remains after single or multiple surgical interventions. Severely neglected clubfoot rarely exists today in developed countries, except in some emigrants from low- and middle-income countries. Acute surgical management with corrective mid-foot osteotomy and elongation of the Achilles tendon has an excellent functional outcome. **Objective:** To assess the functional outcome of acute correction of neglected Talipes-quinoa-varus deformity in adults. **Methods:** This is a cross-sectional, hospital–based multi-centric study. Forty patients were included in this study. Midfoot osteotomy and elongation of the Achilles tendon were performed on all patients. Data was collected using a questionnaire and the functional outcome has been assessed using the American Orthopedic Foot and Ankle Society Score (AOFAS). This score was measured before surgery and one year after surgery. **Results:** the mean age was 19.9 ± 4.7 years. Males were 25 (62.5%) and females were 15 (37.5%). The mean preoperative AOFAS score was 37.7 ± 7.1 (poor). This score improved to 80.7 ± 13.7 (good to excellent), two years after surgery. However, this indicates a significant change in the functional outcome after the operation (p value < 0.05). Excellent postoperative functional outcome was found among patients aged 18 - 23 years 18 (50%) p value: 0.021. The majority of patients 36 (90%) were fully satisfied with the operation, 2 (5%) partially satisfied and 2 (5%) were unsatisfied. **Conclusion:** acute correction of neglected and relapsed TEV with elongation of the Achilles tendon and

single midfoot osteotomy has excellent functional outcome as assessed by AOFAS Score. The satisfaction with this procedure is impressive. The younger age population showed better outcomes with this procedure.

Keywords

Neglected, Relapsed Clubfoot, Outcome, Acute Surgical Correction

1. Introduction

The ankle joint is made up of 3 bones (tibia-fibula-talus) that allow up and down movements. The subtalar sat below the ankle joint and allowed ide-to-side motions. Numerous ligaments (made of tough-movable tissues) surround the true ankle and subtalar joints—binding the bones of the legs to each other and those of the foot [1]. Neglected clubfoot is defined as untreated equino-cavo-adducto-varus in older children, or adults, untreated severe clubfoot rarely exists today in developed countries, except in some migrants from low- and middle-income countries (LMIC). However, in LMIC countries where there is incomplete access to modern medical care, as many as 50% of children worldwide with clubfeet receive no treatment [2]. The study of Kulkarni *et al.* [3] evaluated the outcome of the proposed surgical procedure in the correction of complex clubfoot deformities. On radiological assessment postoperatively optimal radiological values were achieved. After regular 18-month follow-ups, superficial infection and pin-track infection were noted in less than five patients. Shingade, *et al.* [4] evaluated the outcome of the management of neglected clubfoot. Follow-up ranged from 36 - 62 months (mean 44.07 ± 8.22 months). Of 77 feet, results were excellent in 41 (53.25%) feet, good in 28 (36.36%), fair in six (7.8%), and poor in two (2.6%) feet. The outcome of excellent and good results was statistically significantly higher in neglected feet as compared with relapsed feet (p ¼ 0.007). However, the surgical procedure had statistically good outcomes in relapsed feet along with neglected feet as well. In the study of Prasad *et al.* [5], they assessed the triple arthrodesis and posterior Tendoachilis lengthening for rigid neglected clubfoot deformities in adult patients, and its effects on clinical and radiological results. The AOFAS score in preoperative assessment rose from 36 (range: 26 to 52) to 90 (range: 86 to 94) in the postoperative follow-up period ($p < 0.0001$). Excellent outcome was found in 12 out of 16 feet, the rest 4 were good. Significant clinical improvement was obtained between preoperative and postoperative surgical periods significant improvements were observed in radiographic parameters. Radiographic angels' assessments were optimal to normal physiological limits [6]. On other hand, adults are less flexible than children thus correction of Talipes Equinovarus may require more extensive repair. Therefore, in this study, we ought to find out the functional outcome of Talipes Equinovarus in adults.

2. Methodology

2.1. Study Design

Cross-sectional, hospital-based study.

2.2. Study Area

The study was conducted at Bashaer University Hospital and Future Hospital in Khartoum, Sudan. All surgeries were done by the same foot and ankle surgery team in both hospitals.

2.3. Study Duration

The study was conducted in the period from January 2020 to December 2020.

2.4. Study Population

Adult patients from both genders with neglected or relapsed clubfoot who underwent acute surgical correction were included in this study. Patients with poor soft tissue conditions or other foot deformities were excluded.

2.5. Sample Size and Sampling Technique

Total coverage of all patients who had neglected TEV and treated with acute surgical correction and meeting the inclusion criteria.

2.6. Data Collection and Analysis

Data were collected using a structured questionnaire including patient's demographic data, history, examination findings, and investigations this questionnaire is filled by the researcher. Collected questionnaires were revised for completeness and accuracy and clearance. Data were entered using the Statistical Package for Social Sciences (SPSS) version 26.0 for data analysis.

Descriptive terministic in terms of frequency tables with percentages and graphs. Chi-square test to assess associations, (p value of 0.05 or less is considered significant).

2.7. The Surgical Technique and Post-Operative Plan

Careful clinical and radiological assessment of patients is finished before surgery. Spinal anaesthesia was the choice in this series. Open elongation of the Achilles tendon is done through the medial para-median approach in the supine (**Figure 1**). The posterior capsule of the ankle joint is released by the same wound.

The lateral approach is done to expose the midfoot from the lateral side. The incision is in the line from the lateral malleolus to the 4th toe. Closing wedge osteotomy is done and based dorsally and laterally to correct the equinus and varus components of the deformity. The osteotomy takes place across the navicular, medial cuneiform, and cuboid bones with the excision of the articular surfaces of

these bones. The proximal line of the osteotomy goes through the navicular bone (taking the distal articular surface) and the cuboid. The distal line of the osteotomy passes across the three cuneiforms (involving the proximal articular surface) bones and the cuboid (Figure 2).

Correction is checked after each step and the final correction is fixed in place by bone staples.

Immobilization in plawas star cast was applied for three months followed by ankle foot orthosis for twelve months (Figure 3).

Several physiotherapy sessions were scheduled for all patients.

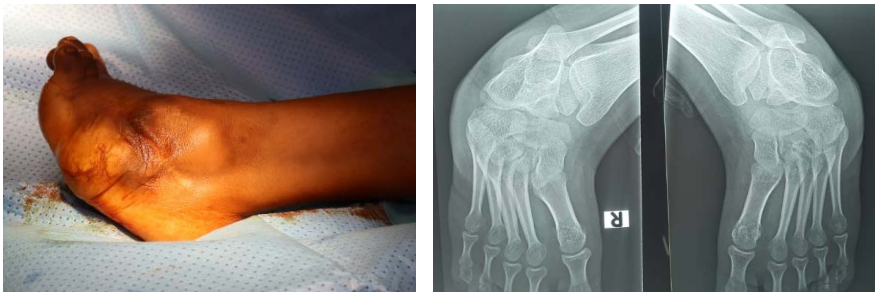

Figure 1. Show pre-operative clinical photo and X-ray.

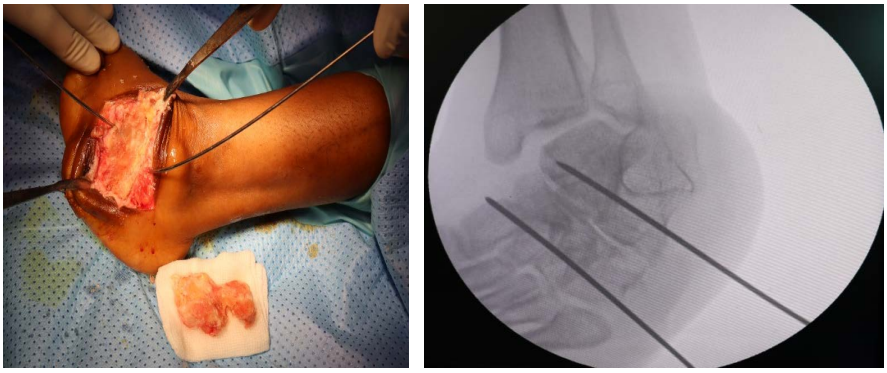

Figure 2. Shows an intraoperative clinical photo and X-ray.

Figure 3. Shows the final correction.

3. Result

Forty patients were included in this study. In the age group (18 - 23) years there were 17 patients (42.5%), while 13 patients (32.5%) were between (24 - 34) years and 10 (25%) aged 35 - 45 years. The mean age was 19.9 ± 4.7 years. Most of the participants were males 25 (62.5%) and females 15 (37.5%) with male to female ratio of 1.7:1. The mean duration of follow-up was 28.3 months. In the majority of the patients 26 (65%), no co-morbidities were reported. The reported co-morbidities were neuromuscular disorders 7 (17.5%), diabetes mellitus 4 (10%), and hypertension 3 (7.5).

The correction was bilateral in 16 candidates (40%), the right side was affected in 16 patients (40%) and the left side was included in 8 patients (20%).

Postoperative complications were: ankle pain 3 (7.5%), wound dehiscence 2 (5%), recurrence 2 (5%), and nerve injury 1 (2.5%) (Table 1).

The majority of the patients 36 (90%) were fully satisfied with the operation, 2 (5%) partially satisfied and 2 (5%) were not satisfied. In all patients preoperative AOFAS score [7] was poor. After surgery, excellent scores were reported by 24 (60%), good 7 (17.5%), fair 6 (15%), and poor 3 (7.5%) (Table 2).

The mean value of the preoperative AOFAS score was 37.7 ± 7.1 (within the poor level) and increased after surgery to 80.7 ± 13.7 (within good to excellent level) which indicates a significant change in the functional outcome after the operation (p value < 0.05).

Table 1. The frequency of postoperative complications.

Postoperative complications	Yes		No		TOTAL	
	N	%	N	%	N	%
Ankle pain	3	7.5	37	92.5	40	100%
Wound infection	2	5	38	95	40	100%
Recurrence	2	5	38	95	40	100%
Nerve injury	1	25	39	97.5	40	100%

Table 2. Preoperative and postoperative functional outcome (AOFAS score).

Preoperative AOFAS score	**N**	**%**
<60 poor	40	100.0
TOTAL	40	100.0
POST operative AOFAS score	**N**	**%**
Poor 60>	3	7.5
Fair 69 - 60	6	15.0
Good 79 - 70	7	17.5
Excellent 92 - 80	24	60.0
Total	40	100.0

There was a significant statistical association between functional outcomes and younger age group < 23 12 (50%), for the patients aged (24 - 34) years 8 (33.3%), and least significant for the patients aged more than 35 years was 4 (16.7%) (p value = 0.021).

As shown in Table 3 there was a significant statistical association between post-operative functional outcome and males gender 16 (66.7%) compared to 6 females. There was a significant statistical association between satisfaction and excellent outcome of surgery. Patients who scored excellent in postoperative functional outcomes were fully satisfied 24 (100%) (p value = 0.001).

4. Discussion

The complexity of the multi-planar foot deformity requires early intervention, good surgical planning, and the choice of the appropriate soft tissue and or bone procedures. The surgical management aimed to achieve plant-grade, stable, and pain-free feet and restore the alignment of bones and the movement of joints. In our series, all patients were adults coming with relapsed or neglected deformities because of the local beliefs in traditional bone setters. This makes the surgical treatment more challenging because of the soft tissue contractures and the changes in the bones and joints as a result of the long-standing deformity. Several soft tissues and bone procedures were documented for the treatment of severe club foot deformity with a variety of clinical, functional, and radiological outcomes. The described bony procedures are numerous in the literature. Evan's procedure, medial column lengthening, double mid-foot osteotomies [8], and many other types of osteotomies were tried with some degrees of success. Gradual correction by Ilizarov frame is a suitable option for severe deformities with

Table 3. The correlation between the post-operative AOFAS scale and the age, gender, and satisfaction.

		Postoperative AOFAS score								p value
		<60 Poor		60 - 69 Fair		70 - 79 Good		80 - 92 Excellent		
		N	%	N	%	N	%	N	%	
Age	12 - 23 years	0	00	3	50	2	28.6	12	50.0	0.021
	24 - 34 years	2	66.7	2	33.3	1	14.3	8	33.3	
	35 - 45 years	1	33.3	1	16.7	4	57.1	4	16.7	
Gender	Male	1	33.3	3	50	5	71.4	16	66.7	0.015
	Female	2	66.7	3	50	2	28.6	8	33.3	
Patient's satisfaction	Fully satisfied	0	00	5	83.3	7	100	24	100	0.001
	Partially satisfied	2	66.7	0	00.0	0	00.0	0	0	
	Not satisfied	1	33.3	1	16.7	0	00.0	0	0	

The p value < 0.05 is considered significant.

poor soft tissue status but needs an experienced surgeon and compliant patient. Acute surgical correction was the choice in this study as its one session intervention and more convenient to our patient's budget rather than gradual correction with circular frames. For all patients, we performed Achilles tendon lengthening, the release of the posterior capsule, and multi-planar closing wedge osteotomy in the midfoot. Those who have pressure ulcers or poor soft tissue conditions were not chosen for this procedure. According to these study's findings, excellent functional results, as determined by AOFAS, were reported one year after surgery in 24 patients who had excelled in all functional activities regards to Prasad S, *et al.* [5] evaluated the effects of triple arthrodesis and posterior Tendoachilis lengthening for stiff neglected clubfoot in adult patients and its effect on clinical and radiological outcomes had excellent outcome in Alignment of foot and support mainly. Similarly, Chandak and Khatri evaluated the outcome of a single-stage procedure for neglected congenital Talipes Equinovarus. They studied a total of 13 patients, all of whom had a unilateral deformity [9]. In a rural tertiary care setting, Jacob *et al.* determined the functional outcome and patient satisfaction after a triple arthrodesis procedure on patients with neglected Talipes Equinovarus. According to AOFAS AHS, 94% of the 22 cases reported satisfactory functioning. The AHS score improved statistically significantly with TRA, indicating a better functional outcome, and 95% of patients were satisfied with the outcome. [10]. J. Correll and A. Forth performed gradual correction for 43 cases of neglected or relapsed foot [11]. They defined good outcomes as the ability of the patient to walk normal distances and the absence of gross defer satisfactory factory outcome is defined as mild residual deformity without skin breakdown. The bad outcome is labelled as a recurrence of the deformity after the removal of the frame. Good results were achieved in 20 patients and satisfactory results in 11 patients. Recurrence of the deformity was encountered in 3 cases. The residual deformity is found in 11 candidates. Khan and Chinoy [12] found that these feet are often rigid and severely deformed and surgical correction is the predominant treatment option taken to attain a plant-grade foot, and the extent of correction required predisposes to wound-healing problems. The outcome and satisfaction rates in the above series are comparable to our study with more relapses and less satisfaction seen in the gradual correction study.

5. Conclusion

Acute correction of neglected Talipes Equinovarus in adult patients by corrective midfoot osteotomy and elongation of the Achilles tendon has a good functional outcome. High satisfaction levels and lower complication rates were reported with the above procedure. Therefore we recommend it as the procedure of choice in neglected TEV in adults as it is an easy, relatively safe, and intervention procedure. The functional outcome of this operation is comparable to other procedures like triple Arthrodesis, double osteotomies, and gradual corrections by external fixators.

Acknowledgements

- First and last our thanks to Allah for lightning our way made us able to finish this work.
- We are greatly indebted to our colleagues who are the contributor to bringing this work to light.
- We are thankful to our families who have been devoting themselves the moment to provide all kinds of support.

Thank you.

Ethics Approval and Consent to Participate

We declare that we have:

- Written ethical clearance and approval for conducting this research obtained from Sudan Medical Specialization Board Ethical Committee and by (EDC).
- Written permission was obtained from the administrative authority of Bashaer Hospital, Future hospital.
- Confidentiality was considered intentional, data was used anonymously by using code Numbers instead of names to participants' identities and keep secure, and information Was used for research purposes only.

Conflicts of Interest

The authors declare that they have no competing interests.

Authors' Contributions

S.N: Orthopaedic surgeon, conceptualization, methodology, resources, project administration, writing original draft.

H.H: Orthopedic resident, conceptualization, data collection, methodology, assist in writing original draft.

A.K: Orthopedic resident, conceptualization, assist in data collection, writing original draft.

D.S: Medical student, data curation, formal analysis, software, and assisting in writing original draft.

H.A: Orthopedic surgeon, data curation, resources, validation, review and editing.

M.F: Orthopedic surgeon, resources, visualization, validation, and assisting in analysis & editing.

The manuscript has been read and approved by all the authors.

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