



CLINICAL PEDIATRIC RESEARCH

The Assessment of Five Years Results for Congenital Talipes Equinovarus Treatment at Saint Francis Rural Referral Hospital in Kilombero, Morogoro Tanzania

Theresia Andrea Karuhanga^{1,2,3*}, Br Joseph Swai^{2,3}, Fassill Tekie^{1,2,3}, Wilfred Gingo^{1,2,3}, Prosper Sitta^{1,2,3}, Rahabu Morro⁴, Ashura Ramadhani³, Bartazari Sakuran⁵ and Casian Magori⁴



¹Department of Surgery and Trauma, Faculty of Medicine, Saint Francis University College of Health and Allied Sciences, Tanzania

²Department of Physiotherapy, Saint Francis Referral Hospital, Ifakara, Tanzania

³Department of Surgery, Saint Francis Referral Hospital, Ifakara, Tanzania

⁴Department of Anatomy and Pathology, Faculty of Medicine, Saint Francis University College of Health and Allied Sciences, Ifakara, Tanzania

⁵Department of Biochemistry and Physiology, Faculty of Medicine, Saint Francis University College of Health and Allied Sciences, Ifakara, Tanzania

***Corresponding author:** Theresia Andrea Karuhanga, Senior Lecturer, Department of Surgery and Trauma, Faculty of Medicine, Saint Francis University College of Health and Allied Sciences; Department of Physiotherapy, Saint Francis Referral Hospital; Department of Surgery, Saint Francis Referral Hospital, PO Box 175, Ifakara- Tanzania, Tel: +255628970350

Abstract

Background: Congenital talipes equinovarus (CTEV) may be defined as a fixation of the foot in adduction. It is one of the common developmental malformations of the musculoskeletal system. To date, there is no global appropriate medical care. On addition to poverty, ignorance and inadequate health system are the major risk factors to the CTEV burden to developing countries. The Pirani scoring system is an instrumental tool for assessing both the severity of the deformity, and the progress of treatment.

Objectives: To assess the CTEV treatment outcome within five years based on Ponsent method in rural referral private hospital in Kilombero, Morogoro Tanzania.

Methodology: The prospective study, hospital based was carried out in a tertiary hospital. Ethical clearance was obtained from the hospital Ethics Committee. Patients who met the inclusion criteria were purposively recruited. The Pirani score of all feet were determine attending the child at the first time before initial manipulation was commenced, and was also done at each follow up visit until correction was achieved.

Results: A total of 167 children were recruited of which 5 were excluded hence, 162 were included. The male to female ration was M: F 1.8:1. The Pirani score at presentation was ranging between 6 to 0.5. All candidates with clubfoot were treated primarily with padded cast as treatment phase. The stabilization phase involving tenotomy followed by foot abduction boot (FAB). The clubfoot correction achievement rate was 90.76%.The recurrent rate was 5.6%, failure rate was 3.7% noncompliance to clinic follow up and presence of other congenital malformations were two variables related to statistical management poor outcome (P-value 0.000 and 0.001 respectively).

Conclusion: The Ponseti method remains the gold standard in club foot treatment, it simple, accessible and inexpensive. Since the approach requires a long-term follow-up of the child's foot, therefore, there is a need of improving local clinic such that people in most remote area can be reached towards SDG #3 achievements.

Keywords

Equinovarus, Tenotomy, Complex Syndrome, Disability, Quality of life

Introduction

Congenital talipes equinovarus (CTEV) may be defined as a fixation of the foot in adduction, supination and varus with concomitants of tissue abnormalities [1,2]. It is one of the most common congenital musculoskeletal deformities worldwide. It affects approximately 1 in 1000 live [1,3]. It is termed as the main congenital malformation of the lower limb causing physical disability and mobility impairment if left untreated [2,4,5]. Untreated clubfoot results in pain, physical impairment and can ultimately cause disability [6].

There are various information regarding various modalities of treatment ranging from bandages to surgical treatment however, still there is no single modality to date which can have achieved the ultimate goal of particularly achieving a functional, pain-free, plantigrade foot [7-9]. Nonsurgical management generally led to inadequate correction whereas those children with idiopathic clubfoot who underwent surgery often developed extensive scarring of the soft tissues and residual pain [7,10]. But these statements have been infrequently reported by those people who use Ponseti method of serial manipulation and casting [7,11,12]. Ponseti claims to avoid open surgery in 89% of cases by using his technique of manipulation, casting, and limited surgery [3-5]. Successfulness of Ponseti technique is ranging from 78% to 90.6% [12-14]. It consists of two distinct phases, the correction phase and the maintenance phase involving a series of weekly castings [13,15]. Tendo-Achilles tenotomy in most cases, and a subsequent period of bracing using a foot abduction brace (FAB) [2,5,14]. Children treated appropriately are expected to have normal foot function, with no resulting disability [3,4]. Ponseti method management of clubfoot has proven to be effective, and in the last decade has come to be accepted as the treatment of choice in the majority of centers worldwide [4,13]. The aim of this study was to determine the management outcome and factors associated with treatment failure in children with talipes Equinovarus who were managed by using biphasic Ponseti method.

Methods

Study area

The studies will be conducted at St. Francis Referral Hospital located in Ifakara, a semi-urban area in Kilombero district, Morogoro Region in the South-western part of Tanzania. SFRH has 400 bed capacities and serves as a referral center for tertiary specialized care for a catchment population of approximately 1.5 million people from neighboring districts of Ulunga, Kilosa, and Kilombero. Among the outpatient services include physiotherapy (rehabilitation care) whereby in physiotherapy, there is clubfoot clinic and pediatric other supportive therapy to children with walking disability and walking impairments.

Study design, period and settings

Prospective study design was conducted from January 2018 to December 2023. Purposive sampling method was applied involving the children with congenital talipes Equinovarus feet. Ethical clearance was obtained from the SFUCHAS internal reviewer board (IRB). The informed consent was signed by the mother. Other inclusions were unilateral or bilateral clubfoot with their **Pirani score** and willingness to participate in the study. Exclusion Criteria were; age more than five years, previous foot operated for clubfoot and unwillingness to participate in the study. Multiple certified Ponseti-trained health workers participated in the technique. This involved two surgeons, one physiotherapist and two nurses.

Data collection

Patients were evaluated through detailed history and physical examination. Every clubfoot taken up for the study was graded according to the Pirani Severity score for hind foot, mid foot and total score. Weekly appointment was subjected to each who was diagnosed to have CTEV. At each weekly visit the three-dimensional deformity of the foot was evaluated to determine correction progression. Simple scoring system was used following principles according to the Pirani score whereby: 0, no abnormality; 0.5, moderate abnormality; 1, severe abnormality was recorded depending on the defect severity. In this scoring method; six signs are separated into three related to the hind- foot (severity of the posterior crease, emptiness of the heel and rigidity of the equinus), and three related to the midfoot (curvature of the lateral border of the foot, severity of the medial crease and position of the lateral part of the head of the talus). Thus, each foot can receive a hind foot score between 0 and 3, a mid- foot score between 0 and 3 and a total score between 0 and 6 [4,7]. After recording the degree of deformity and Pirani score the first phase of Ponseti method started immediately by manipulation and casting on the affected foot/feet. During the first phase (also known as treatment phase) was performed by using padded plaster cast while the foot is kept on supination position (aiming to align the forefoot with the mid foot and hind foot). All children under five years with CTEV underwent on a period of serial casting according to the Ponseti protocol. The cast was changed after every one week until the Pirani score was at minimum to allow tenotomy to be performed. The target Pirani score was between 1.5-0.5 when percutaneous tenotomy was performed to start the second phase of treatment. Therefore, the second phase included tenotomy, padded cast (one week), and application of club foot brace to prevent recurrence. The mother was instructed to have regular clinic follow up of which the interval of one clinic to the next depended on progression of foot towards to normality. In case of recurrence procedure was revised depending on the

severity of based on the restoring of Pilan scales. The child was discharged from the club foot clinic at the age of 60 months. However, the discharge depended on the successfulness of foot correction (0 Pilan score). In some extent there was extension of the clinic for delayed recovery children.

Data analysis

Data analysis was done by using SPSS 26 version. Descriptive statistics was used to determine the variable frequency distribution. Binary logistic regression was applied to assess the association of dependent variable with independent variables and to determine statistical predictors of using odds ratios with 95% confidence intervals (CIs). Independent factors with P-value less < 0.25 in the bivariate binary logistic regression were subjected to multivariate binary logistic regression test overcome probability of confounding. Lastly, the variable with P-values less than 0.05 at a 95% CI in the multivariable logistic model was taken as statistically significant.

Results

The total of 167 babies was recorded to have CTEV within the study period, out of the recruited children 5 were excluded due to different reasons. Three (3) were referred to Munimbili national Hospital due to other malformations, two (2) babies died due to other medical disease. So, the 162 babies were included in this study. Male to female distribution was 105 and 57 respectively making M: F 1.8:1. Majority were within one month making 58.64% of all participants. Majority had bilateral CTEV making 61.72% while left limb was the least making 13.58%. Majority of the participant were coming outside of Ifakara town council, while many of them had walking distance between 50 to 150 Km. Most of the mother education was primary level 53.08% as there appear in [table 1](#). Majority of children received tenotomy 97.54% and the study most of the children had full recovery 90.74%. The three figures signifies the lutein clinic activities from the first clinic visit to fully recovery ([Figure 1A](#), [Figure 1B](#) and [Figure 2](#)) respectively.

In this study, adherence to clinic follow and presence of other congenital anomalies were statistically significant with AOR = 3.434 (0.144-0.536; P-value 0.001 for anomalies and AOR 5.091 (0.209-0.474; P value 0.000 for adherence respectively.

The [figure 1A](#) and [figure 1B](#) is one child who had regular CTEV clinic visit with fully recovery at 23-month-old. However, he was supposed to complete the clinical up to five years to prevent probability of recurrence.

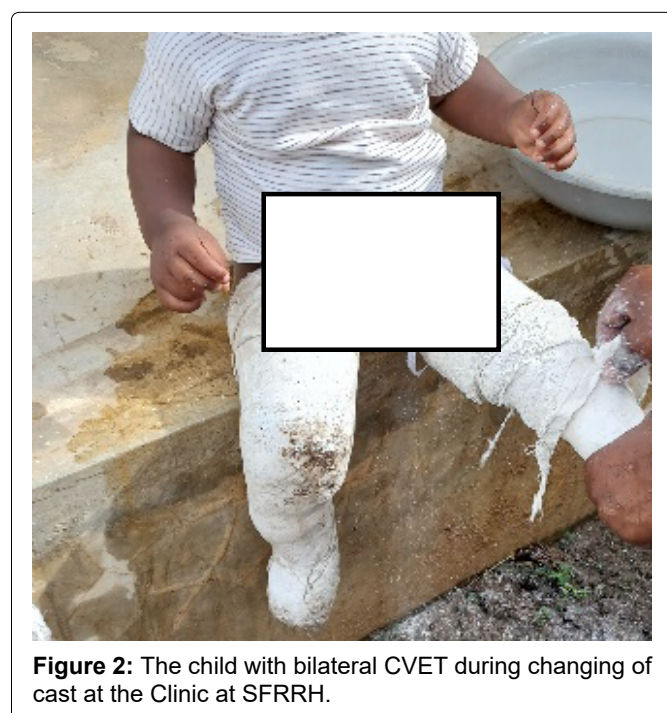
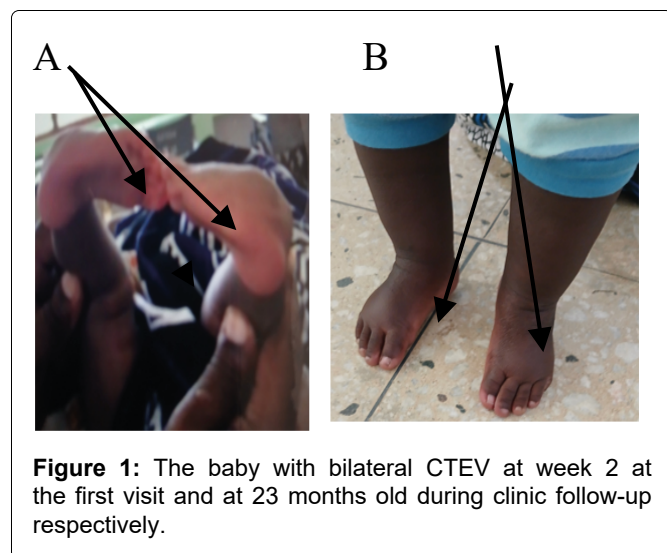
The [figure 1A](#) represent majority of the babies who were received with significant sever clubfeet at first

Table 1: Baseline social-demographic and clinical characteristics and the patient management outcome.

Variables		Frequency (162)	Percent %
Age (months)	0-1	95	58.64
	1.1-5	47	29.0
	5.1-12	9	5.6
	12.1-24	6	3.7
	24.1-48	3	1.85
	48.1-60	2	1.23
Site	Bilateral	100	61.72
	right	40	24.7
	left	22	13.58
Sex	male	105	64.81
	Female	57	35.18
Walking distance (km)	1-50	19	11.72
	> 50-100	76	47.0
	> 100-150	62	38.27
	> 150	5	3.09
Education (mother)	formal	45	27.8
	primary	86	53.09
	secondary	23	14.2
	Above	8	4.94
1 st Pirani score	≤ 2	4	2.46
	≤ 3	7	4.32
	≤ 4	62	38.27
	≤ 5	64	39.51
	≤ 6	25	15.43
Treatment	Conservative	4	2.47
	Tenotomy	158	97.53
Anomalies	All anomalies	15	9.26
	Spinal bifida	4	2.47
	ARM	3	1.85
Adherence	Normal visit	103	63.58
	Irregular visit	52	32.1
	Drop out	7	4.32
Address	ITC	19	11.72
	Out of ITC	143	88.27
Outcome	Fully recovery	147	90.74
	Recurrent	9	5.6
	Failure	6	3.7

Table 2: Binary regression analysis of risk factors for poor outcome.

Variables	Yes/no	AOR (CI 95% CI)	P-value
Age	yes	3.48 (0.25-0.17)	0.729
	no	1	
Sex	yes	1.717 (0.24-1.72)	0.088
	no	1	
PRS1	yes	0.26 (0.67-0.69)	0.979
	no	1	
Address	yes	4.91 (0.142-0.236)	0.624
	no	1	
Anomalies	yes	3.434 (0.144-0.536)	0.001
	no	1	
Adherence	yes	5.091 (0.209-0.474)	0.000
	no	1	



clinic visit at Saint Francis Referral Hospital while [figure 1B](#) represent full recovery with no visible defect at walking age.

Discussion

Talipes Equinovarus comes from the combination of the following words as follows: *Tali* means Ankle, *Pes* means Foot, *Equinus* means foot pointing down (like a horse's foot) and *Varus* means deviated towards midline [16-18]. Untreated or partially treated usually leads to severe deformity causing affecting quality of life [1,5]. As the child grows and increase in weight on their lower extremities, the feet bear weight sideways causing the limb to bend outward. This cause also the formation of the callus on the skin which leads to pain, skin injury and sometimes skin infection [3,7,19]. The clubfoot management by using Ponseti method approach remains a revolutionary treatment. Since CTEV is among the common congenital limb deformity

in developing countries, and remain the cause of limb dysfunction as most of the children are untreated due to parents' ignorance, inadequate screening at birth, sometimes CTEV is diagnosed at the walking age. In the present study, 162 children with 221 CTEV were recruited. The most common age range was 0-1 month with 58.64% while the least was 48-60 months 1.23%. The findings correlates with which was reported by Christopher, C 2019 who reported high prevalence in early days of life [12]. However, the study differ from what has been reported in the literatures whereby the predominant age within 1-12 months (43.33%) and above months (30%) [14]. The early diagnosis at the first month of life may be attributed by adequate maternal and child health services where by most of the birth are hospital deliveries and hence the nurses and physician are likely to identify the limb defect at birth. In this study male were predominant in comparison to female with male to female ratio 1.8:1. This male to female epidemiological variation signifies the probability genetic related disorder [16,20-22]. The involvement of several etiological factors are not excluded in this study such that clubfoot one of a complex malformation syndrome which may be to extrinsic factors involving abnormal positioning of intrauterine fetal foot/feet which may also be caused by several factors such as amniotic band sequence, preach presentation and Müllerian anomalies [4,19]. The fetal growth theory arrest theory was proposed by Volkmann in 1963 states that, "intrinsic errors or environmental insults during gestation prevents the correction of equinovarus to pronated foot" [4,15,23]. But also, can be Intrinsic factors including *Chromosomal abnormalities, genetic syndrome and neurological anomalies* such as spinal muscular atrophy, neural tube defects, and hydranencephaly [19,24]. It has been reported that, genetic mutation of muscle development genes are risk factors for clubfoot, specifically those encoding the muscle contractile complex (MYH3, TNNT3, MYH8, TPM2 and TNN12) the condition which may lead to congenital contractures, including clubfoot [24-26]. The study, correlate with other reported previously whereby there was statistical correlation between outcome and presence of other malformations of which in logistic regression the p-value; 0.001 indicating statistical significance. The study leaves the room of more study to be done on genetic screening in general population. In this study most the walking distant from home to the area of clinic was significantly high ranging between 50-100 (47.0%) and above 100-150 km (38.27%) while above 150 km was significantly low (3.09%). But also, there was correlation between treatment outcome and walking distance (**P-value 0.000**) as it appears in [table 2](#). This high walking distance may signify the reason for nom adherence to the clinic and hence reason for recurrence, treatment failure and clinic drop out. It leaves the challenge on how to reach these patients

in order to improve quality of life. Another point to note in this study is that, the mother education was either primary (53.09%) or formal education (27.8%). Low education level of the parents contributes to the ignorance of the baby health quality. But also, it is the group of people having financial challenge such that it is difficult to afford cost transport for regular clinic follow up for five years when the child is regarded to graduate of clinic follows up.

The study also showed high prevalence of moderate and severe deformity being high rated by the degree of Pilan score > 4 to 6 (93.21% which led to high tenotomy rate (97.53%). The study comes similar to what has been reported by other published studies [12,18,26]. The tenotomy is major factor for good treatment outcome. Percutaneous tenotomy is remains major component of the Ponseti method for the management of equine varus clubfoot [4,10,12,18,19]. Other author suggestion that, tenotomy should be performed routinely for all types of clubfoot after the series of casts to avoid early recurrence and additional surgery [3,10]. However, treatment of clubfoot remains controversial [1,4,27]. In area where Orthopedic surgeons, are significantly limited to reach to every population area, Ponsent method is effective and can be performed by any trained health personally such that the technique does not require high specialization [3,13]. Management outcome was significantly successful (90.74%) with very low recurrence (5.6%) and treatment failure (3.7%) respectively. Lack of compliance of parents to clinic follow up and or club foot brace application at home is the major risk factor for treatment failure and recurrence. While walking distance, ignorance, irritate, and low financial remain the overall factors for hindering parents' compliances of two mentioned above.

Conclusion

The Ponseti method remains the gold standard in the management of congenital clubfoot. It is easily accessible and inexpensive. Since the approach requires a long-term follow-up of the child's foot, therefore, there is a need of improving of local clinic in order to reach the so "called" hard to reach population. Treatment failures and recurrence leaves the room for improvement aiming to participate in SDG # 3 "good health for all by 2030.

Recommendation

In order to improve CTEV correction in limited resources like Tanzania, the Ponsent method should be advocated in order to reach the majority especially in remote areas.

Conflicts of Interest

There was no conflict of interest in this study.

Source of Fund

No fund was obtained in order to conduct the study.

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Author Contributions

Theresia Karuhanga, Brother Josephy Swai, Wilfred Gingo and Ashura Ramadhan collected data, Theresia Karuhanga and Project Sita analyzed the data. Theresia Karuhanga wrote the paper. Fasil Tekie and Rahab Morro checked the data. Professor Baltazary Sakurani gave much detail about the genetic knowledge. Finally, Professor Casian Magori supervised and controlled the quality of the research. All authors reviewed and approved the paper.

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