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Club foot management in the Bafoussam Baptist Healthcare center (BBHC), Cameroon: Treatment outcomes and the associated factors of relapse with the Ponseti's technique

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Abstract

Background: Clubfoot is a birth defect found in about 1000 live births yearly in Cameroon and its treatment is often associated with relapses. The objective of this study was to evaluate treatment outcomes with the Ponseti's technique and factors associated with relapses.

Methods: We conducted a 5-year retrospective study on clubfoot children at the Bafoussam Baptist Healthcare Center (BBHC). Data on age, sex, birth setting, previous treatment, pirani scoring, number of casts and follow-ups, bracing and relapse were recorded in case report forms. Data were analyzed with SPSS: 25 software; bivariate analysis was performed to determine factors associated with relapse.

Results: This study enrolled 78 clubfoot children with median age, 12 months (IQR1,24), 44 (56.4%) had undergone previous treatment elsewhere. The mean Pirani score before treatment was 4.9 [\pm SD: 0.9] for the left foot (LF), and 4.9 [\pm SD: 1] for the right (RF). The average number of casts performed was 6.5 [\pm SD: 1.5]. Tenotomy of the Achilles tendon was performed in 54 (69.2%) children. The mean final Pirani score was 0.9 [\pm SD: 0.5] for the LF and 0.8 [\pm SD: 0.6] for the RF. Only 5 (6.4%) cases did not wear Iowa braces and loss of sight rate was 1.3% (1/78). The relapse rate was 9.1% (7 / 77). Treatment requiring >8 casts was associated with relapse (aOR: 10.35; CI [1.05-101.55]; P=0.04).

Conclusion: The Ponseti's technique is effective in the treatment of CTEV in the West region of Cameroon. Treatment requiring more than 8 cats is a risk factor for relapse.

Keywords: Club foot; Ponseti's technique; Relapse; Treatment outcome; Cameroon

1. Introduction

Also called congenital talipes equinovarus (CTEV), clubfoot is a birth defect where one or both feet are rotated inward and downward [1,2]. The affected leg may be smaller than the other but in 50% of cases both feet are affected and it is not usually associated with other problems [1,3]. Without treatment, the foot remains deformed, there are difficulties in walking and often accompanied with pain at the ankle joint [4]. The exact causes are not identified but genetic and environmental factors are believed to be involved [1,5].

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Clubfoot occurs in 1 to 4 of every 1000 live birth, making it one of the most common birth defects affecting the foot [3,4,5]. This accounts for approximately 150,000 to 200,000 newly affected children annually worldwide, 80% of whom are believed to be born in low and middle-income countries (LMICs) [3]. And it is most common in first born children and mostly affect males [1,3,4]. A study using the pooled data from birth defect surveillance program in the USA showed the overall prevalence of clubfoot was 1.29 per1000 live births; 1.38 among non-Hispanic whites, 1.30 among Hispanic and 1.14 among Hispanic blacks or African-Americans [6]. A recent meta-analysis of clubfoot in LMICs finds an incidence in African regions of 1.11 per 1000 and in the Americas of 1.74 per 1000, projecting 43 new babies born with clubfoot each year per million population in Africa and 30 per million in the Americas [7]. A recent review conducted by Smythe et al. in LMICs [3] revealed that the pooled estimated clubfoot birth prevalence in under-developed countries according to the WHO regions is 1.11 (0.96 to 1.26) per1000 live births within the Africa region. In Cameroon, there were 914 000 live births in the year 2020, meaning Cameroon registers approximately 1000 clubfoot cases yearly [8].

Without treatment such children may suffer from life-long deformity, disability, and profound social stigma hence impeding access to education and productivity [9,10,11]. Although, there are a number of conservative and non-conservative treatment used to correct clubfoot [12]. Historically conservative management was introduced by Hippocrates in around 400 BC [13,14]. Later in the 1963, Kite introduced his method, referred to as the Kite method, which included manipulation and casting technique, but the success rate of this method was poor [15, 16]. Subsequently in the 1960s the development of successful non-operative treatment program by Dr. Ponseti provided a grate impetus for universal treatment of clubfoot [9]. The Ponseti's technique consist of manipulation, casting, Achilles tenotomy and bracing, and it takes about four to five weeks to achieve the full correction of all the component of club foot deformity [17, 18]. This technique differs with the Knite's method above, as it involves tenotomy and bracing.

The Ponseti technique is the gold standard for clubfoot correction worldwide. The outcome is good in approximately 90% of cases [19, 20]. Many programs have emerged in the developing countries for the successful implementation of the Ponseti's technique [3, 10 ,14]. However, there are still a host of challenges related to delayed presentation to the Hospital, barriers to care, extended casting, non-compliance, and high relapse [4, 15, 17]. Furthermore, the uncorrected cases are still very high in LMICs due to a number of factors like local believes concerning clubfoot pathology, limited access to specialized clinics for the treatment of clubfoot, family burden [3]. Furthermore, even those treated lack follow-ups leading to relapse. This may lead to social and educational sigma and disability, which may ultimately lead to poverty [9,10,11]. To reduce the burden of CTEV in Cameroon, the Cameroon Clubfoot Care Project (CCCP) in partnership with local institutions as the Ministry of health and Cameroon Baptist Convention (CBC) Heath services have for the past years supervise and implement conservative treatment through the Ponseti's technique. However, recent studies on the subject do not present the factors associated with relapses after treatment with the Ponseti's technique in Cameroon [8]. Moreover, there are no studies on CTEV in the West region of Cameroon. Thus, with the ongoing expansion of clubfoot care, it is critical to understand the current state of treatment in this low resource setting to optimize care in Cameroon and other similar locations.

We conducted a 5-years retrospective study (2017-2022) to evaluate the outcome of CTEV treatment by the Ponseti's technique in a reference treatment center in the West region of Cameroon. More specifically, we evaluated the treatment performed at BBHC from 2017 to 2022, evaluated the follow-up of these patients and finally we determined the factors associated with relapse and the number of casts.

2. Material and methods

2.1. Study area, design, and period

We conducted a retrospective observational cohort study in a period of 5 years (1st April 2017 and 31st March 2022) at the BBHC and we analyzed patients' factors associated with relapse, and the high number of casts needed in correction (more than 8). The Cameroon Baptist convention (CBC) health service is a non-profit, faith based, healthcare, humanitarian and inclusive organization. The health care center opens 24/7 to patients coming all over the west region and other neighboring areas of the west region of Cameroon. The BBHC is the biggest referral center for the management of clubfoot in the western Cameroon region. In addition to being the largest clubfoot referral center in the region, it is also the most visited clubfoot referral center in the west region because they have community agents who canvass the surrounding villages and when they detect cases of clubfoot, they refer them to the center for treatment. The treatment is performed by a team of physiotherapists trained in the Ponseti technique.

2.2. Study population

We included in this study children affected by idiopathic CTEV aged 0 to 6 years old and with no other associated physical deformity who were received at the BBHC in the period from 1st April 2017 to 31st March 2022. Were excluded from this study: every child not having followed the treatment until the beginning of bracing and in case of refusal of the parent to participate in the study by the refusal to answering our telephone interview.

2.3. Data collection

We reviewed medical records of patients seen between 1th April 2017 and 31th March 2022. Clinic records were entered into a case report forms, including demographics (age of diagnostic, age of start of treatment, sex, setting of birth), prior treatment received elsewhere, type of prior treatment received elsewhere, laterality, Pirani score (Pirani et al devised a simple scoring system based on six clinical signs of contracture. Each was scored according to the following principle: 0, no abnormality; 0.5, moderate abnormality; 1, severe abnormality. The six signs are separated into three related to the hindfoot (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 hindfoot score between 0 and 3, a midfoot score between 0 and 3 and a total score between 0 and 6 [21]), treatment type (cast, tenotomy, brace), follow-up of patient after initiating braces, and number of appointments attended by the patient. We also collected data on the outcome after ponseti's technique and on the relapses. Relapse was defined as a return of the deformity any time after initiation of bracing, those with relapse were immediately returning to cast application. We utilized telephone interviews with parents of clubfoot children to enter missing data. Were considered lost to follow-up those who after beginning of the bracing did not honour any appointment and moreover were not reachable for a telephone interview.

2.4. The Ponseti's technique

The Ponseti technique is being widely publicized, both in developed countries and in those under development [21-24], because of the good correction rates achieved, which are close to 90% [19, 20]. With widespread acceptance, it was extended for use on older children [25-30]. At BBHC, the treatment according to Ponseti, started as soon as possible, after diagnostic was made. It started with gentle manipulations, performed at intervals of five to seven days, followed by the application of a cruro-pedic cast, with the knee flexed ~90°. Cavus was the first deformity to be corrected with forefoot supination and plantar support on the head of the first metatarsal. Thereby placing the forefoot in proper alignment with the hind foot. Once the cavus was corrected then the manipulation to correct the adduction started. The planter flexed foot slowly adducted while a counter pressure was used on the lateral head of the talus. Ligaments on the medial side of the foot were stretched. The distal end of the calcaneum disengages from its position under the head of the talus and allowed the calcaneum to abduct. Varus was automatically corrected once cavus and adduction were corrected. Equinus correction only started after the correction of cavus, adduction and varus, with modelled plaster casts in the posterior part of the foot, with dorsiflexion. Any residual equinus was treated with a percutaneous Achilles tenotomy performed by a surgeon or a medical doctor. After tenotomy, the last cast was mounted and lasted for three weeks. When all those deformities were corrected, foot correction was maintained with Iowa foot abduction braces (provided by CCCP). For the first three months, children were to wear the braces 23hours daily every day, after which braces were maintained only when the child is sleeping for 4-5 years. For children in walking age they were not given the Iowa foot abduction braces, Instead, they were prescribed ankle boots to be worn continuously for at least 3 months under the supervision of the physiotherapist.

2.5. Data elements

We dichotomized some continuous variables and created categorical variables based on clinical relevance and frequency distribution: regarding the follow-up of patients after braces, we considered as having had a good follow-up, those who made at least the first 6 visits (1 week after braces, 2nd 02 weeks after, 3rd 03 weeks after, 4th 01 month after, 5th 02 months after, 6th 03 months after). The setting of birth was dichotomized in normal for uncomplicated vaginal delivery and abnormal for delivery requiring a surgical intervention. The Pirani score was classified as mild (Score 1 to 2), moderate (score 2 to 4) or severe (score 5 to 6).

2.6. Statistical analysis

The data from the registers once collected were entered into an Excel spreadsheet and then analyzed using SPSS software version 25. We calculated descriptive statistics as percentages for categorical variables or as means (\pm standard deviation [SD]) or medians (25th and 75th percentiles) for continuous variables based on distribution. to highlight the association between the variables, we made a bivariate analysis (odd ratio). The statistical significance level was set at P-value <0,05 and the confidence interval [CI] was set at 95%.

2.7. Ethical consideration

The study was approved by the Western Regional Delegation of Public Health and was conducted with the consent and approval of BBHC management. Patient records were anonymized and entered into a database. For data completions that required calling the patient's relative, they were routinely asked for informed consent to participate in the study. To do this, we presented the study, the purpose of the study and the main risks and benefits. Then we asked them if they would be willing to give us the missing information in their child's file.

3. Results

3.1. Demographic features of study population

This study enrolled 78 children aged 1 day to 6 years, all delivered normally without complication, the median age was 12 months (IQR:1-24). The males were more represented, 49 (62.8%) than females 29 (37.2%). Clubfoot was bilateral in 39 (50%) of cases. In the unilateral cases, the right foot was more affected 24 (30.8%) of cases. Of the 78 cases, 44 (56.4%) had undergone previous treatment elsewhere without expected result before starting Ponseti treatment at West regional reference center for clubfoot care. For those who received previous treatment, the most common treatment was a below-knee cast (18 of 44 children or 41.9%) (Table 1). Concerning the severity of the club foot, 46 (59%) children had severe clubfoot compared with 32 (41%) who had moderate clubfoot. The mean Pirani score at initial assessment was 4.9 [\pm SD: 0.9] for the left foot, and 4.9 [\pm SD: 1] for the right foot.

3.2. Results on the treatment and follow-up

Treatment was done by a succession of casts; the average number of casts performed in this population was 6.5 [\pm SD: 1.5], 64 (83.1%) cases required 8 or less casts while 13 (16.9%) cases required more than 8 casts. Percutaneous tenotomy of the Achilles tendon was performed in 54 (69.2%) children. At the removal of the last cast, the mean final Pirani score was 0.9 [\pm SD: 0.5] for the left foot and 0.8 [\pm SD: 0.6] for the right. After removing the last cast, bracing was immediately initiated. Of the 78 cases, 5 (6.4%) did not wear the Iowa braces. Participants were followed up by appointments with the therapist to ensure that the braces were worn correctly. Of the 78 cases 46 (58.9%) children had good post-correction follow-up (at least 6 appointments) compared to 32 (41%) children who had less than 6 appointments. (table 1)

Table 1 Demographic and clinical features, treatment and follow-up of cases

Affected foot	Effective	Percentage (%)
Left	15	19.2
Right	24	30.8
Both	39	50
Total	78	100
Type of prior treatment received elsewhere	Effective	Percentage (%)
Massage	11	25.6
Under the knee casts	18	41.9
Braces	6	14
Over the knee casts	8	18.6
Total	44	100
Sex	Effective	Percentage (%)
Female	29	37.2
Male	49	62.8
Total	78	100
Pirani initial score classification	Effective	Percentage (%)

Moderate	32	41
Severe	46	59
Total	78	100
Setting of birth	Effective	Percentage (%)
Normal	78	100
Number of casts needed	Effective	Percentage (%)
8 or less	64	83.1
More than 8	13	16.9
Total	78	100
Tenotomy performed	Effective	Percentage (%)
Yes	54	69.2
No	24	30.8
Total	78	100
Braces	Effective	Percentage (%)
Yes	73	93.6
No	5	6.4
Total	78	100
Good follow-up after initiating bracing	Effective	Percentage (%)
Yes	46	59
No	32	41
Total	78	100
Lost to follow-up	Effective	Percentage (%)
Yes	1	1.3
No	77	98.7
Total	78	100
Relapse	Effective	Percentage (%)
Yes	7	9.1
No	70	90.9
Total	77	100

3.3. Lost to follow-up and relapse

Of the 78 children treated, 77 were actually followed up by appointments, and 1 was lost to follow-up, for a loss to follow-up rate of 1.3%. Of the 77 children followed up, 7 had a relapse, for a relapse rate of 9.1%. The mean age of relapse was 4.1 years [\pm SD: 2.1], the mean age of initiation of treatment in these children with relapse was 2.4 years [\pm SD: 1.5] (table 1).

3.4. Factors associated with and increased number of casts

In this cohort, the increased number of casts was significantly associated with bracing (OR: 0.11; 95%CI [0.017-0.79]; P=0.01) and relapse (OR: 8.13; 95% CI [1.57-49.90]; P=0.004).

After logistic regression, the increased number of casts was associated with relapse (aOR: 6.03; 95% CI [1.06 -34.25]; P= 0.04) (table 2)

Table 2 Factors associated with a high number of casts among cases

Variables	Total N=78(%)	Number of casts (>8) n=14(17.95%)	Number of casts (≤8) n=64 (82.05%)	OR (95% CI)	p-value	aOR (95% CI)	p- value
Age of start of treatment							
≥5 years	13 (16.67)	3 (21.43)	10 (15.63)	1,47 [0.34-6.24]	0.59		
<5 years	65 (83.33)	11 (78.57)	54 (84.38)				
Sex							
Male	49 (62.82)	11 (78.57)	38 (59.38)	2.50 [0.63-9.87]	0.17		
Female	29 (37.18)	3 (21.43)	26 (40.63)				
Prior treatment elsewhere							
Yes	44 (56.41)	8 (57.14)	36 (56.25)	1.03 [0.32-3.33]	0.95		
No	34 (43.59)	6 (42.86)	28 (43.75)				
Bracing							
Yes	73 (93.59)	11 (78.57)	62 (96.88)	0.11 [0.017-0.79]	0.01*	0.18 [0.023-1.41]	0.10
No	5 (6.41)	3 (21.43)	2 (3.13)				
Gravity of affection							
Severe	46 (58.97)	11 (78.57)	35 (54.69)	3.03 [0.77-11.93]	0.09		
Moderate	32 (41.03)	3 (21.43)	29 (45.31)				
Good follow up							
Yes	76 (97.44)	13 (92.86)	63 (98.44)	0.26 [0.01-3.51]	0.23		
No	2 (2.56)	1 (7.14)	1 (1.56)				
Tenotomy							
Yes	54 (69.23)	12 (85.71)	42 (65.63)	3.14 [0.64-15.30]	0.14		
No	24 (30.77)	2 (14.29)	22 (34.38)				
Relapse							
Yes	7 (8.97)	4 (28.57)	3 (4.69)	8.13 [1.57-41.90]	0.004**	6.03 [1.06-34.25]	0.04
No	71 (91.03)	10 (71.43)	61 (95.31)				

OR: odd ratio, aOR: adjustable odd ratio

3.5. Factors associated with relapse

This study found statistically significant associations with: bracing (OR:0.07; 95% CI: [0.008- 0.63]; P=0.003); bilateral involvement (OR:0.14; 95% CI [0.01–1.22]; P=0.04) and treatment requiring more than 8 casts (OR: 10.15; 95% CI [1.15-89.09]; P=0.01). But after logistic regression, some of these associations were no longer significant although very relevant. Bracing was associated to clubfoot relapse (aOR: 0.11; 95%CI [0.01-1.37]; P=0.08); bilateral involvement was associated with relapse (aOR: 7.90; 95%CI [0.77-80.34]; P=0.08) and treatment requiring more than 8 casts was highly associated with relapse (aOR: 10.35; 95%CI [1.05-101.55]; P=0.04) (Table 3).

Table 3 Factors associated with relapse among cases

Variables	Total N=77(%)	Relapse (+) n=7 (9.09%)	Relapse (-) n=70 (90.91%)	OR (95% CI)	p-value	aOR (95% CI)	p-value
Age of start of treatment							
≥5 years	12 (1.58)	1 (14.29)	11 (15.71)	0.89 [0.09-8.17]	0.92		
<5 years	65(84.42)	6 (85.71)	59 (84.29)				
Sex							
Male	48(62.34)	5 (71.43)	43 (61.43)	1.56 [0.28-8.67]	0.60		
Female	29(37.66)	2 (28.57)	27 (38.57)				
Prior treatment							
Yes	43(55.84)	5 (71.43)	38 (54.29)	2.10 [0.38-11.59]	0.38		
No	34(44.16)	2 (28.57)	32 (45.71)				
Bracing							
Yes	73(94.81)	5 (71.43)	68 (97.14)	0.07 [0.008-0.63]	0.003**	0,11 [0,01-1,37]	0,08
No	4 (4.19)	2 (28.57)	2 (2.86)				
Gravity							
Severe	44(57.14)	5 (71.43)	39 (55.71)	1.98 [0.36-10.94]	0.42		
Moderate	33(42.86)	2 (28.57)	31 (44.29)				
Tenotomy							
Yes	53(68.83)	6 (85.71)	47 (67.14)	2,93 [0.33-25.84]	0.31		
No	24(31.17)	1 (14.29)	23 (32.86)				
Affection							
Bilateral	39(50.65)	1 (14.29)	38 (54.29)	0.14 [0.01-1.22]	0.04*	7,90 [0,77-80,34]	0,08
Unilateral	38(49.35)	6 (85.71)	32 (45.71)				
Number of casts							
≥8	32(41.56)	6 (85.71)	26 (37.14)	10.15 [1.15-89.09]	0.01*	10,35 [1,05-101,55]	0,04*
<8	45(58.44)	1 (14.29)	44 (62.86)				

OR: odd ratio, aOR: adjustable odd ratio

4. Discussion

To assess the status of clubfoot management in the West region of Cameroon and also, to evaluate the effectiveness of this technique in our population as well as factors influencing relapses, we conducted a 5-year retrospective study at the BBHC from April 1st, 2017 to March 31st, 2022.

This study found a clear decrease in the pirani scores before and after application of the Ponseti's technique; at initial evaluation, the pirani score of the left foot was: 4.9 [\pm SD: 0.9], right foot: 4.9 [\pm SD: 1]. The pirani score at the final evaluation was left: 0.9 [\pm SD: 0.6], right: 0.8 [\pm SD: 0.6]. The average number of casts applied was 6.5 [\pm SD: 1.5]. These results are similar to those reported by other authors [7, 19]. Compared to a study done in India in 2011 by Milind et al. [31], in which tenotomy was performed in 95.91% of cases, we obtained a tenotomy rate of 69.2%. The disparities in tenotomy rates between the two studies may be explained based on the context and experience of the disease in the West region and Cameroon as a whole. The populations see surgery, however small it may be, as a serious medical act as it is believed it is only done when the condition is critical. This cause many parents to refuse this aspect of correction and return to the traditional masseurs for further treatment thus justifying the low tenotomy rates recorded in our study. Therefore, practitioners are doing everything possible to avoid resorting to tenotomy as much as possible. Future studies should address the experiences of relatives of children with clubfoot in the West region of Cameroon to highlight the psychological barriers to treatment and subsequently conduct targeted educational programs to improve clubfoot care. Also, training of health professionals in the Ponseti technique should include additional counseling techniques to give them the ability to maintain parents' confidence and allow them to continue the treatment according to standards. Unlike other studies in Haiti and India [7,31] where 100% of the children wore the braces, in our study 6.4% of children did not wear braces. Bracing is a key element in the maintenance of clubfoot by the Ponseti's technique to maintain correction and prevent relapses [32]. The age of onset of treatment could account for the failure of some children to wear braces as some of the children were already of walking age and it becomes very constraining for the parents to follow-up treatment till the end. Also, the Iowa braces produced by CCCP are not designed for children of a certain height.

Previous studies reported relapse rates of up to 40% [33]. However, a common question that is usually raised is, "What factors are associated with relapse?" [34]. In our study we found a relapse rate of 9.1%. The relatively low relapse rate observed in this study could suggest that the Ponseti technique was well performed, as the treatment at BBHC was done by physiotherapists previously trained in the Ponseti technique. The follow-up of patients after correction is also a major element in the prevention of relapse [9,13,15], as the patients were followed by the health care team (who were recurrently calling the parents to remind them their rendezvous, and where available in any case of problems concerning the children's foot care), which could also have had a positive influence on the relapse rate. Furthermore, in this cohort, we had only 1.3% of patients lost to follow-up. From another point of view, the fact that the participants were not recruited at the same time means that the follow-up time after correction is not the same for all participants. Therefore, future studies could check relapses according the different age groups.

The only factor significantly associated with relapse observed in our study was treatment requiring more than 8 casts (aOR: 10.35; 95%CI [1.05-101.55]; P=0.04). centrality to the results obtained in this study, Qudsi et al. [19] in Haiti 2019 found that female sex, high initial pirani score were factors associated with relapse. Similarly, the study by Hu et al. [32] in 2022 reported that the age at the first casting, high Pirani scores and noncompliance with foot abduction bracing are the main risk factors for the relapse of congenital clubfoot after treatment with the Ponseti technique. These differences observed could be explained by the fact that they considered all types of clubfoot contrarily to our study where only CETV were included. Furthermore, the fewer cases registered in our study for the past 5-years may have reduced the statistical power. Also, differences in socio-demographic and cultural features as well as study designs could explain these differences. Further studies therefore need to be done to identify factors associated to relapses taking into consideration the socio-cultural and socio-economic factors in order for the adoption of targeted preventive strategies.

Limitations

This is a retrospective study, so the veracity of the information collected relies solely on the rigor of the practitioners who reposted these data in the patients' files. The data was obtained from a single clubfoot treatment center in the West region of Cameroon, so it does not necessarily reflect the situation in western Cameroon. However, provided the BBHC is the referral clubfoot correction center for the West region, our results are relevant as this center receive most of the clubfoot cases in the West region of Cameroon.

5. Conclusion

In conclusion, the Ponseti technique provides favorable outcomes in the treatment of CTEV in the West region of Cameroon. However, treatment requiring more than 8 casts and bilateral involvement are factors associated with relapses. Follow-up of patients after treatment, although not associated with relapse, would be a very important element in the treatment of CTEV not only to ensure the effectiveness of the treatment but also psychologically to help the families of clubfoot children not to feel alone in the situation. The efforts of the CCCP are to be encouraged to get closer to the populations and facilitate the compliance of parents to the treatment in order to eradicate this deformity in Cameroon through early and adequate correction. The results obtained from this study will inform strategies to limit relapses and improve parents-treatment compliance.

What is already known on this subject?

The Ponseti technique is the most widely used technique in the world for the treatment of clubfoot. It offers very good outcomes in the treatment of CTEV; the relapse rate with this technique is quite low compared to other techniques.

What this study adds

The study report for the first-time factors associated with relapse after Ponseti in Cameroon. As another strength, this study report for the first-time state of situation concerning club foot treatment in the Cameroon's West region.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflicts of interest exist for any of the authors.

Statement of ethical approval

The study was conducted under the approval of the Western regional Delegation of Public health.

Statement of informed consent

For data completions that required calling the patient's relative, they were routinely asked for informed consent to participate in the study.

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Author's contribution

Hyacinte Trésor Ghassi: study design, writing, Nicaise Derole Motba Ndjomou: data collection, Franklin Chu Buh: study design, editing, Jean roger Moulion Tapouh: editing, Ange Faustine Talla KENMOGNE: data analysis, Faustin Atemkeng Tsadedem: editing.

References

- [1] Ganesan B, Luximon A, Al-Jumaily A, Balasankar SK, Naik GR. Ponseti method in the management of clubfoot under 2 years of age: A systematic review. *PLoS ONE*, 2017;12(6): e0178299
- [2] Smythe T, Kuper H, Meaceleod D, Foster A, Lavy C. Birth prevalence of congenital talipes equinovarus in low- and middle-income countries: a systematic review and meta-analysis. *Tropical medicine and international health*. 2017;22(3):269-285
- [3] O'Shea RM, Sabatini CS. Current review in musculoskeletal medicine. *Europe PubMedCentral*. 2016;9(4):470-477

- [4] Dobbs MB, Gurnett CA. Update on clubfoot: etiology and treatment. *Clinical Orthopaedics and Related Research*. 2009;467(5):1146-53
- [5] Parker SE, Mai CT, Strickland MJ, Olney RS, Rickard R, Marengo L, et al. Multistate study of the epidemiology of clubfoot. *Birth Defects Res A Clin Mol Teratol*. 2009;85(11):897–904
- [6] Lewin S, Lavis JN, Oxman AD, Bastías G, Chopra M, Ciapponi A, et al. Supporting the delivery of cost-effective interventions in primary health-care systems in low-income and middle-income countries: an overview of systematic reviews. *Lancet London England*. 2008;372(9642):928–39
- [7] Qudsi RA, Selzer F, Hill SC, Lerner A, Hippolyte JW, Jacques E, et al. Clinical outcomes and risk-factor analysis of the Ponseti Method in a low-resource setting: Clubfoot care in Haiti. *PLoS ONE*. 2019;14(3):e0213382
- [8] Atemkeng TF., Wondje F. Therese, Nguene Nyemb AG, Needem Stephanie, Nguifo ML. Clubfoot treatment by the ponseti method in yaounde, about a cohort study. *International Journal of Advanced Research*. 2018;6(11):953-959
- [9] Penny JN. *The Neglected Clubfoot. Techniques in Orthopaedics*. 2005;20(2):153–66
- [10] Penny AM. *School access: children with disabilities in rural Uganda*. 1999. <https://dspace.library.uvic.ca/handle/1828/6191>. Accessed 10 September 2022
- [11] Moyi P. Access to education for children with disabilities in Uganda: Implications for Education for All. *Journal of International Education and Leadership*. 2003;2(2):1-13
- [12] Strach EH. Club foot through the centuries. *Progress in Pediatrics Surgery*. 1986;20:215-37
- [13] Turco VJ. *Club foot (current problems in orthopedics)*. 1982. New-york. Churchill Livingstone
- [14] Gibbons PJ, Gray K. Update on clubfoot. *Journal of pediatrics and child health*. 2013;49 (9):434-437
- [15] Kite JH. Non-operative treatment of congenital clubfoot. *Clinical Orthopaedics and Related Research*. 1972;84:29-38
- [16] Dalmau-Pastor M, Guelfi M, Malagelada F, Mirapeix R, Vega J. *Anatomy of the Ankle Joint and Hindfoot*. 2020: 3–9
- [17] Martin Oliva X, Rios J, Guelfi M. Arthroscopy of Subtalar Joint. In: *Arthroscopy: Basic to Advanced*. 2016: 1079–1087
- [18] Hadley G. *Essential Clinical Anatomy*. *Journal of Anatomy*. 2007;211(3):413
- [19] Morcuende JA, Dolan LA, Dietz FR, Ponseti IV. Radical reduction in the rate of extensive corrective surgery for clubfoot using the Ponseti method. *Pediatrics*. 2004;113(2):376-80
- [20] Cooper DM, Dietz FR. Treatment of idiopathic clubfoot. A thirty-year follow-up note. *Journal of Bone and Joint Surgery American volume*. 1995;77(10):1477-89
- [21] Dyer PJ, Davis N. The role of the Pirani scoring system in the management of club foot by the Ponseti method. *Journal of Bone and Joint Surgery British volume*. 2006;88-B(8):1082–4
- [22] Pirani S, Naddumba E, Mathias R, Konde-Lule J, Penny JN, Beyeza T, et al. Towards effective Ponseti clubfoot care: the Uganda sustainable clubfoot care project. *Clinical Orthopaedics and Related Research*. 2009;467(5):1154-63
- [23] Siapkara A, Duncan R. Congenital talipes equinovarus: a review of current management. *Journal of Bone and Joint Surgery British volume*. 2007;89(8):995-1000
- [24] Pirani S, Staheli L, Naddumba E. *Ponseti Clubfoot Management: Teaching Manual for Healthcare Providers in Uganda*. 2008. https://globalhelp.org/products/ponseti_clubfoot_management_teachin_manual_for_health-care_providers_in_uganda/. Accessed 9 September 2022
- [25] Gupta A, Singh S, Patel P, Patel J, Varshney MK. Evaluation of the utility of the Ponseti method of correction of clubfoot deformity in a developing nation. *International Orthopaedics*. 2008;32(1):75-9
- [26] Zwick EB, Kraus T, Maizen C, Steinwender G, Linhart WE. Comparison of Ponseti versus surgical treatment for idiopathic clubfoot: a short-term preliminary report. *Clinical Orthopaedics and Related Research*. 2009;467(10):2668-76

- [27] Spiegel DA, Shrestha OP, Sitoula P, Rajbhandary T, Bijukachhe B, Banskota AK. Ponseti method for untreated idiopathic clubfeet in Nepalese patients from 1 to 6 years of age. *Clinical Orthopaedics and Related Research*. 2009;467(5):1164-70
- [28] Ponseti IV. Common errors in the treatment of congenital clubfoot. *International Orthopaedics*. 1997;21(2):137-41
- [29] Ponseti IV. Clubfoot management. *Journal of Pediatric Orthopaedics*. 2000;20(6):699-700
- [30] Ponseti IV. The Ponseti technique for correction of congenital clubfoot. *Journal of Bone and Joint Surgery American volume*. 2002;84(10):1889-91
- [31] Milind, M., P., Dipak, S. P. and Hiral, R. C. Mid-term results of Ponseti method for the treatment of congenital idiopathic clubfoot - A study of 67 clubfeet with mean five-year follow-up. *Journal of Orthopaedic Surgery Research*. 2011;6(3):1-7
- [32] Jowett CR, Morcuende JA, Ramachandran M. Management of congenital talipes equinovarus using the Ponseti method: a systematic review. *Journal of Bone and Joint Surgery British volume*. 2011; 93:1160–4
- [33] Masrouha K, Chu A, Lehman W. Narrative review of the management of a relapsed clubfoot. *Annals of Translational Medicine*. 2021;9(13):1102
- [34] Hu W, Ke B, Niansu X, Li S, Li C, Lai X, et al. Factors associated with the relapse in Ponseti treated congenital clubfoot. *BioMedCentral Musculoskeletal Disorders*. 2022;23:88