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### RESEARCH ARTICLE

#### CLUBFOOT TREATMENT BY THE PONSETI METHOD IN YAOUNDE, ABOUT A COHORT OF 74 CASES.

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#### Abstract

Clubfoot is a common congenital invalidating pathology. The method of Ponseti, its reference treatment, remains little known in Cameroon: no local studies on the subject. This is why we conducted a prospective evaluation of clubfoot treatment at Promhandicam-Yaoundé, a center specialized on the Ponseti method, from August 1st 2013, to November 30th 2016. We followed and treated 47 children with 74 talipes equino varus feet, by the method of Ponseti. There were 27 (57.45%) bilateral clubfeet, and 20 (42.55%) unilateral including 14 (70%) unilateral rights feet out of the 20. The average age was 12 [1-36] months. The sex ratio was 1.9 boy for 1 girl. The mean initial Pirani score was 5 [4-6] over 6. The average number of plasters before tenotomy was 5 [4-7]. We did 58 (78.38%) percutaneous tenotomies of the Achilles tendon under local anesthesia. All children were prescribed IOWA abduction foot braces permanently (23H/24) for 3 months, and during sleep for up to 4-5 years. We had 63 (85.13%) very good results after an average follow-up of 20 [12-40] months, and recommend this method for those working in conditions similar to ours.

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#### Introduction:-

Congenital Talipes Equino Varus (CTEV) or clubfoot is a frequent pathology. Worldwide, its estimated incidence is one case per 1000 live births (Vito et al., 2012; Byron-Scott et al., 2005; Smythe et al., 2017). In Yaoundé, it represents 1.1 cases per 1000 live births and comes second after polydactyly (kamla et al., 2017). Prenatal diagnosis is possible, but CTEV is often discovered at birth (Suzan et al., 2014). It is a very disabling disease associating by definition four deformities: the cavus, the adductus, the varus and the equinus. In the absence of treatment, the patient will have difficulties to stand up, walk, put on shoes, work and get married. Several treatments are proposed to treat a clubfoot (Matthew et al., 2000; Jarde et al., 2002; Gary et al., 2015; Gray et al., 2014). Despite its high use elsewhere and its good results, the method of Ponseti (Jarde et al., 2002; Gary et al., 2015; Birhanu et al., 2014; Olayinka et al., 2017; Milind et al., 2011; Balasankar et al., 2017; Lior et al., 2014) is known worldwide but is still little known in Cameroon and not always used by caregivers. The aim of this work was therefore to evaluate the

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treatment of CTEV by the Ponseti method in a group of 74 patients followed in our context by a specialized team using the Ponseti method. We did not find any local studies on this topic.

### **Methodology:-**

We followed a prospective cohort of all children aged 0 to 3 years treated by the Ponseti method for idiopathic CTEV at the PROMHANDICAM Center in Mimboman, Yaoundé, during our 40-month study period, from August 1<sup>st</sup>, 2013 to November 30<sup>th</sup>, 2016. All patients were initially assessed by the Pirani score and classified as mild (Score 1 to 2), moderate (score 2 to 4) or severe (score 5 to 6). We have included all club feet, whether light, moderate or severe. We included untreated (never treated and aged less than 2 years old), neglected (never treated and older than 2 years), recurrent (after Ponseti treatment) and complex (initially treated with method other than that of Ponseti). All children were also assessed on a general basis for secondary clubfoot. We excluded secondary clubfeet due to ankle burns, osteomyelitis, neurological diseases such as spina bifida or cerebral palsy, amniotic bands, tibia agenesis and arthrogryposis. All patients then benefited from the Ponseti method in 3 steps: manipulations and casting (Figure 1), tenotomy when indicated (Figure 2) and IOWA abduction braces (Figure 3). Before the application of each plaster, there were manipulations to soften the posterior tibial, the triceps sural and the flexor tendons of the toes (common flexor tendon of the last 4 toes and the halluci longus); which allowed to gain amplitudes of movement ensuring the progressive correction. The plaster numbered 1 corrected the plantar cavus. Plaster numbered 2, 3 and 4 progressively corrected the abduction while plaster number 5 reduced the equinus. Plaster numbered 5 was always placed in a position of maximum abduction with an automatic reduction of the valgus of the hind foot and the equine (Figure 1). Some CTEV required a little more or a little less plasters for each step depending on their severity.

Practically, we have: initially assessed the children according to the Pirani score, checked the exclusion criteria, before admitting the child and starting the treatment sessions. The children were treated once a week. At each session, we had to:

#### **To properly install the child**

The installation for plasters requires the child to be calm. It is useful to have a trained assistant, because two trained personnels are needed for casting. It is also sometimes necessary to have the help of parents. The assistant holds the foot while the operator carries out the weekly re-evaluation and the correction of the day, after having located the lateral head of the talus.

#### **Locating the head of the talus precisely**

This step was essential. First, the lateral malleolus should be palpated with the thumb / index finger of one hand while the metatarsals and toes were held by the other hand. Then we slid our thumb / index finger forward to feel the head of the talus.

#### **Make a stretching**

It was done for 3 to 5 minutes to gradually correct the CTEV. The manipulation consists of a correction of the cavus with a small aggravation of the supination, then a progressive abduction around a pivot constituted by the head of the talus previously localized and stabilized. This progressive abduction leads through kinematic coupling, to an automatic correction of the varus of the hind foot and a small reduction of the equine. All components of clubfoot deformity, except for the equinus ankle, are progressively corrected.

#### **Put the plaster**

The foot being maintained in the corrected position by the assistant, the operator first applied the Soffband®, then a plantar splint, before putting the cast with the plaster of Paris or Biplatrix®. The Soffband® role is to protect the child's skin so that it is not compressed between two hard planes that are the bone on the one hand and plaster on the other hand. The padding (Soffband®) overflowed a little at the ends, preventing skin wounds.

#### **Mold the plaster**

It was not necessary to try to force the correction with the plaster, nor to apply a constant pressure on the lateral head of the talus with the thumb, but to apply successive pressures and releases in order to avoid having painful cutaneous areas. For the right club foot, for example, the left thumb of the operator is on the lateral head of the talus while the right hand molds the forefoot by holding it in abduction (two hands holding technique). The plantar face was carefully molded to prevent deformation in flat foot or convex foot. The heel was well molded by applying the

plaster well above the large calcaneal tuberosity. The malleoli were also carefully molded. The calcaneus was not touched during the entire manipulation and molding phase in order to allow its automatic rotation to progressively arise. The molding was dynamic, with frequent changes of finger position to avoid excessive pressure on any site. We also continued to mold the plaster until it hardened.

#### **Extend the cast to the thigh**

Initially below the knee, the cast was then extended to the root of the thigh, with a splint on the anterior aspect of the knee, the knee being flexed at 90°.

#### **Make the final cuts of the plaster**

We left in place the plantar part of the plaster that supports the toes (to maintain the gain obtained by stretching the plantar flexors of the toes, the dorsal surface of the toes being released up to the metatarsophalangeal joints to count all the toes and monitor them: edema, coloration, recoloration time, mobility).

#### **Make a tenotomy before the last plaster.**

It was preceded by informed consent and verification of the four tenotomy criteria / indications : head of the talus completely covered, abduction of 50 to 70°, heel in valgus and equinus at least 0°, but less than 15°. We also checked the contraindications ( general pathology, respiratory tract infection, skin infection in progress) and asked for allergies, past medical illness, preoperative laboratory assessment. An anesthetist was always informed and the monitoring and resuscitation equipment available, verified and functional. After removal of the previous plaster, it was necessary to take the measurements of the foot and order the corresponding foot abduction braces of the corresponding size, to prepare the post tenotomy step.

In cases where the dorsiflexion remained below 15°, a tenotomy was then indicated. After surgical washing of the hands, sterile gloving, we used to disinfect with iodinated polyvidone (the red Betadine®, drying and then the yellow Betadine®), do sterile field and then infiltrate 0.5ml (per foot) of lidocaine (Xylocaine®) 1% (without exceed 0.3ml / kg / patient, maximum dose) 1.5 cm from the calcaneal insertion of the Achilles tendon. The tenotomy was performed by a trauma orthopedic surgeon, after a 0.5 cm vertical postero-medial cutaneous incision, with the surgical blade number 15 (Figure 2). The incision was made 3 minutes after infiltration of the local anesthetic, tendon stretched by a maximum dorsiflexion ensured by the operative aid, blade parallel to the anterior face of the Achilles tendon previously carefully palpated. The blade was then inserted into a safety triangle that separates the Achilles tendon from the more anterior elements that are from medial to posterior: the tendon of the posterior tibial muscle, the flexor digitorum longus tendon common to the last 4 toes, the posterior tibialis artery, the posterior tibial vein, the tibial nerve, and the flexor hallucis longus tendon. Rotating the blade towards the back permitted the tenotomy (cross section of the Achilles tendon from front to back) to be performed. This was usually audible or perceptible and followed by dorsiflexion gain of more than 15 °, and palpation of the tendon discontinuity. A Kelly hemostasis forceps was used to check the completeness of the tenotomy and it was then completed with fine scissors (tenotomy scissors), if necessary. After the tenotomy, a digital compression of 5 to 10 minutes using a gauze was applied to control the bleeding and a dry dressing was then placed. This last cast was kept for 3 weeks. In case of insufficient gain of dorsiflexion, a stretching to increase it more was done (without all causing an osteoclast of the anterior of the tibia cortex), after 10 days and a new plaster put in place for 21 days.

#### **Order and apply the abduction IOWA braces (Figure 3)**

The measurements of the splints were taken just before the tenotomy, at the time of the last plaster, to allow the orthoprosthesis to manufacture them so that they are available directly at the time of removal of the last plaster (21 days after the tenotomy). The wearing of IOWA foot abduction braces continued over 4 -5 years. Initially they are worn 23h / 24 for 3 months then only during nap and sleep. The children who were walking already at the beginning of the treatment had only the night splints. Splint monitoring was done after one week, six weeks, three months and then every six months. An evaluation at the end of treatment was also made using the Pirani score. Continuous monitoring of complications: between two appointments, the accompanying parent was given specific instructions for monitoring the child, plaster, toes, bleeding (after tenotomy), abduction foot braces and had a phone number he could call back 24 hours a day, 7 days a week, in case of a problem.

**Results:-**

We had a total of 54 children with CTEV. We excluded 7 children (12.96%) with secondary clubfoot: 3 Cerebral palsies, 1 agenesis of the tibia, 1 myelo-meningocele, 1 arthrogryposis and 1 false CTEV. There were 47 children left (87.03%). We followed and analyzed 47 children with 74 idiopathic CTEV, of which 27 (57.45%) were bilateral, and 20 (42.55%) unilateral: 14 unilateral concerned the right side over 20 (70%) and 6 were on the left foot over 20(30%). We had a total of 41 right feet out of 74(55.41%) and 33 left feet out of 74 (44.59%) as shown in Table 1. The average age was 1 year with extremes ranging from one month to 3 years. Of these 47 children, 31 were male and 16 were female, making a sex ratio of 1.9 boys to one girl. The average initial Pirani score was 5 [4-6] over 6. All children had manipulations and cruro-pedal successive casts. The average number of plasters before tenotomy was 5 [4-7]. The casts lasted 7 [6-10] days on average. We did 58 (78.38%) percutaneous Achilles' tendon tenotomies and 16 CTEV (21.62%) did not need it. Of the 16 girls 8 (50%) were treated without tenotomy Achilles tendon. On the contrary, only 5 (12.13%) out of 31 boys were treated without tenotomy. All children were prescribed IOWA abduction foot splints for 3 months permanently (23H/24) and then for overnight and nap for up to five years. We had: 63 (85.13%) very good results (Figure 4), mostly in children aged 2 and under, with a Pirani score maintained at 0; 5 (6.76%) relapse; 6 (8.10%) cutaneous irritations and 6 (8.10%) lost to follow up after a 20 [12-40] months followup period.

**Discussion:-**

We carried out an interventional prospective study on a cohort of 74 clubfoot. Our intervention was a correction by the Ponseti's method. We did an evaluation before and after. Of the 74 foot idiopathic bots, we had 85.13% very good results. However, our sample size was not very large. We had 6 (8.10%) lost to follow up. The 5 recurrences we had were related to the misuse of the abduction foot braces; These cases recovered after additional castings, without tenotomy. 50% of girls were treated without Achilles tendon tenotomy against 12.13% of boys and the sex ratio is in favor of boys (1.9: 1), as other authors have noted (Milind et al., 2011; Angela et al., 2016; James et al., 2018): natural flexibility in girls? Our main results are compared in Table 2 with those of other authors. Despite our small sample size, our results are good but can be improved to be similar to those of other authors: We must reduce the number of lost to follow up, improve the compliance to the foot abduction braces, initiate treatment early enough, and continue monitoring long enough to expect the same percentages of good results as other authors.

**Conclusion:-**

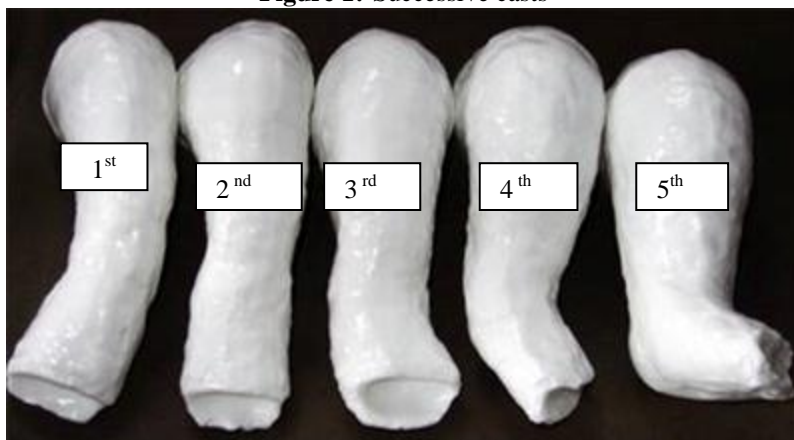
The management of idiopathic clubfoot by the Ponseti method involves three simple steps: successive manipulations and casting, Achilles tendon tenotomy and wearing foot abduction braces. It has very good results in our context. This is why we recommend it to all those working in conditions similar to ours. Start treatment early. Most cases need a tenotomy and wearing of foot abduction braces up to 4 - 5 years must be rigorously respected to avoid recurrence.

**Ethical considerations**

Data confidentiality was provided at each step and we asked for informed consent before any treatment, and before tenotomy.

**Conflict of interest**

None

**Figure 1:-**Successive casts**Figure 2:-** Achilles tendon percutaneous tenotomy under local anaesthesia

A. Tenotomy session



B. Final dorsiflexion (right foot)



B. Final dorsiflexion (left foot)

**Figure 3:-**Iowa Food Abduction Braces (Fab)

A. Before assembling



B. Braces ready for use



C. Plantar view



D. Bilateral clubfoot and braces

**Figure 4:-**A two years old Patient's photos before and after Ponseti

Before



After

**Table 1:-**Repartition of feet per child and side

	Number of children	Number of clubfeet		
		Right side	Left side	Total number of feet
Bilateral clubfoof	27	27	27	54
Unilateral clubfoot	20	14	6	20
Total	47 children	41 right feet	33 left feet	74 feet

**Table 2:-**Discussion of our main results

	Our study	Milind et al., 2011	Angela et al., 2016	Turner and al., 2018
Year of study	2018	2011	2016	2018
Country	Cameroon	India	Bangladesh	Malawi
Sample size	47 children	49 children	99 children	596 in 29 centres
Number of clubfeet	74	67	147	936
Mean age	1year [1month-3years]	0-3 years	1.1 [0.2-4] years	97days (0-8 years)
Sex ratio	1,9 male for 1 female	3,9 :1	2,6 :1	1,67 :1
Bilateral cases	27 / 47 (57,45%)	18 / 49 (37,73%)	55/99 (55,55%)	340/596 (57,04%)
Unilateral cases	20	31	44	256
Right side alone	14 (70%)	17 (54,84%)	27 (61,36%)	143 (55,86%)
Left side alone	6	14	17	113
Initial Pirani score	5 [4-6] over 6	5.56	4,67	4.55
Number of casts	6 [5-7]		janv-17	5
Tenotomies	58 feet (78,38%)	47children (95.91%)	80% of feet	-
Foot abduction braces	100%	100%	100%	100%
Follow up period	20 [12 – 40] months	36-60 months	48 months	-



Final Pirani score	0 for 63 (85,13%)	0		1.39
Very good results	63 feet (85,13%)	86.56%	99%	100%

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