

# Treatment of congenital idiopathic clubfoot by the ponseti method. Experience children's hospital martagão gesteira. Preliminary assessment

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## Abstract

**Background:** Idiopathic Congenital Clubfoot (PTCI) is a congenital and complex three-dimensional deformity of the foot, which compromises both the bony structures and soft tissues. It is clinically characterized by equinus and varus hindfoot, midfoot cavus and adduction of the forefoot. The goal of treatment is to get a PTCI plantigrade foot, painless, flexible, with good muscle strength and allows the use of common footwear, featuring a march close to normal. Thus, it was presented in Iowa, United States of America, there are about fifty, the method described by Ignacio Ponseti technique conservative that has been widely disseminated and used. It is the method "gold standard" as choice for the treatment of PTCI in the world. This method involves manipulations with exchanges of serially fixed plastered inguinopodálicas weekly. The objective of the present study was to evaluate the efficacy of correction of clubfoot (PTCI) by Ponseti Method.

**Methods:** We treated 96 children with the deformity of the PTCI Children's Hospital Martagão Gesteira by conservative Ponseti technique. At the end of the adopted therapy patients were evaluated and classified into groups by Pirani classification to verify the effectiveness of treatment for deformity correction. Also studied were the variables of age, sex and handedness.

**Results:** The sample obtained efficacy of treatment in its entirety.

**Conclusion:** This study demonstrates that the Ponseti method showed safety and efficacy for the correction of clubfoot (PTCI).

**Level of evidence:** level IV.

## Introduction

The Idiopathic Congenital Clubfoot Foot (PTCI) is a congenital, three-dimensional and complex deformity of the foot, which compromises both the bone structures and the soft parts. It is characterized clinically by the equine and varus of the hind foot, midfoot cavus and forefoot adduction. The incidence is 1:1000 live births. Bilaterality is found in 50% of cases. It most often affects males at a ratio of 2:1. The PTCI has increased prevalence in the occurrence of familial cases, suggesting influence or genetic determination [1]. The purpose of PTCI treatment is to obtain a soft, painless, planitic foot with good muscular strength and that allows the use of common footwear, presenting a gait close to normality [2].

The first historical citation of PTCI treatment was described by Hipócrates (400 a.c.), who indicated repeated manipulations without the use of force, followed by bandage-type immobilizations. Guerin (1836) was the first to refer to the use of plaster in the treatment of PTCI. At the turn of the twentieth century, forced corrections appeared, using devices such as lever or splint of Thomas. Kite [3] made his first recommendations to avoid methods of forced correction and extensive surgical releases, for this he guided him using smooth and repeated manipulations, followed by plastered immobilizations, later being

known as Kite method for treatment of PTC [4,5]. Ponseti and Smoley described their method of conservative treatment through serial plaster manipulations and fixations. Bensahel developed a technique of non-surgical treatment involving manipulations made by the physiotherapist Diméglio, which described a variant of this treatment using continuous passive motion machines. In more recent studies, Delgado has associated applications of botulinum toxin in cases treated by the French method and incompletely corrected [1].

Some cases of resistant clubfoot (PTCR) to conservative treatment have, however, surgical indication, using techniques with release of mid-lateral and lateral parts. There is an agreement in the literature that all feet should be submitted to conservative treatment initially and that an assessment should also be performed after ninety days of life regarding the efficacy of this therapy and its possible surgical indications [1]. At the time of the surgical indication, the procedure is

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performed between the age of nine months and one year (phase where the foot is already well structured, both bone and soft parts). The most recommended incision is that of Cincinnati, advocated by Crawford. It allows extensive exposure of the structures and the resulting scar is indelible, according to evaluations by Garcia, *et al.* [6], the technique of tendon and articular release is the one advocated by McKay8-9-10 modified by Garcia, *et al.* [7]. In children over four years of age with rigid deformities, known as "old or aged crooked feet", we performed the posterolateral and medial releases, as advocated by Garcia, *et al.*, but with the Codevilla access [8]. When we are faced with a recurrence or PTCI that is very pronounced regarding the deformity and / or age of the patient, the thalactomy can be used as a secondary and / or primary procedure [2]. Severe deformities in older children over 10 years of age may be corrected with arthrodesis, which is considered a salvage procedure [2]. Currently, some indicate treatment with a special frame of the Ilizarov external fixator on inveterate or rigid recurrent feet [2].

In Iowa, United States of America, approximately fifty years ago, the method described by Ignacio Ponseti [1] has been widely disseminated and used. It is the "gold standard" method, as the choice for PTCI treatment worldwide. This method involves manipulations with serial changes of inguinopodal plaster castings weekly.

Thus, once demonstrated the efficacy of this method, the conservative principle, depends directly on the good application of the plaster apparatus, as well as on the frequent revisions of the patients. Therefore, the present research seeks to demonstrate the effectiveness of this method.

## Methods

Therapeutic studies investigating the results of the treatment of the Idiopathic Congenital Clubfoot (PTCI). Patients were treated in the same manner without comparison group of otherwise treated patients.

All individuals from ten to fifteen days to twelve months of age, of both sexes, with PTCI, treated at the Martagão Gesteira Children's Hospital were studied. As inclusion criteria, patients diagnosed with PTCI, aged from ten to fifteen days to twelve months, with unilateral or bilateral foot deformities. Exclusion criteria were children with no PTCI diagnosis, patients with associated basic pathologies (myelodysplastic, neurological, arthrogyrous), in the case of the large number of patients that we have in our outpatient clinic from the interior of the state and by the social difficulty these patients patients have to meet the return every eight days, according to the protocol of the Ponseti method, it is as exclusion criterion patients who can not meet the weekly return or who have initially met continuously but have not fulfilled all the reviews, in this way it is not possible to evaluate the appropriate technique and those that have been treated previously for this same pathology with other therapeutic techniques, those patients who have incomplete data in the medical record will also be excluded. The variables to be studied are sex, age and treatment efficacy.

This is a descriptive study, formulated from the database of the pediatric orthopedic outpatient service of the Hospital Infantil Martagão Gesteira, in the city of Salvador. Data were collected from the medical records review. Patients were evaluated weekly when the devices were plastered and with thirty days, six months and one year postoperative, where they were classified, according to Pirani's classification.

All activities were carried out in the facilities of the Martagão Gesteira Children's Hospital, where all procedures, evaluations and therapeutic indications were made in the pediatric orthopedic department of the Hospital, from 2006 to January 2013.

The study was approved by the Research Ethics Committee of the Faculdade de Tecnologia e Ciências - FTC, by the protocol No. 3932, to approve the therapeutic study to investigate the results of the treatment of idiopathic congenital idiopathic foot with the Ponseti method, obeying the postulates of the Declaration of Helsinki amended in Hong Kong and resolution 196/96 on research involving human beings of the National Health Council, and was initiated only after its adoption.

The Ponseti technique involves manipulations and plaster exchanges with weekly inguinopodal immobilization. In the best case, a total of six plaster devices are planned, but up to ten in more resistant cases. Placement of the first gypsum aims to correct the cavus by stretching the plantar structures and maintaining them in supination of the forefoot in relation to the hindfoot. The foot should not be pronated and the knee flexed at 90°.

The next five plasters aim at the correction of varus and adduction. With the foot in supination and the thumb positioned on the lateral aspect of the head of the talus, the abduction of the foot is carried out. The hindfoot varus is corrected with abduction and no calcaneus support is necessary. After manipulation, the foot should be immobilized with inguinopodal plaster with the knee at 90° of flexion, in external rotation, in order to keep the foot rotated externally below the talus. This rotation should reach about 50° in the fifth cast and 70° in the sixth and last plaster. Only after correction of the adduction and varus should the equine correction be initiated. By manipulating two or three well molded heels on the heel after manipulation to elongate the soft parts of the posterior portion of the ankle through pressure applied to the midfoot.

When dorsiflexion is not achieved with manipulations of cast changes, percutaneous tenotomy of the calcaneus tendon is indicated. This is performed in the operating room under general anesthesia.

After tenotomy, the foot is immobilized with inguinopodal gypsum with the ankle at 15° of dorsiflexion and sharp external rotation of 70° to 90°. The maintenance of the correction is performed by the Denis-Brown apparatus in rotation of about 70° in continuous use for three months, followed by nocturnal use in a period of one year.

## Results

The study sample consisted of ninety-six patients, consisting of forty-nine male and forty seven female (Table 1).

Of the 96 patients studied, twenty-four (25%) had congenital right foot only in the right lower limb, twenty-seven (28.12%) had congenital crooked foot only in the left lower limb and forty-five (46.87) bilateral congenital foot. Among PTCI patients in the right lower limb, fifteen (62.5%) were males and nine (37.5) were females. Among the patients with PTCI in the lower left limb, seventeen (62.9%) were female and ten (37.1%) were male. When bilateral, twenty-five (55.5%) are male and twenty (44.5%) are female (Table 2).

Of the patients who achieved correction after treatment by the Ponseti method, seventy-two patients (75%) were aged between 10-15 days and 6 months, and twenty-four patients (25%) were aged between 6 months and 1 year (Table 3).

Of the ninety-six patients studied, 84 (87,5%) obtained, according to the classification of Pirani, a score equivalent to normality of the feet which means the effectiveness of the treatment (Table 4).

**Table 1.** Number of individuals in the study sample divided by sex.

GENDER	PONSETI (96)
Male	49 (51,04%)
Female	47 (48,95%)

**Table 2.** Characteristics of laterality.

LATERALITY OF CORRECTION BY PONSETI		
LEFT	RIGHT	BILATERAL
27(28,12%)	24(25%)	45(46,87%)

**Table 3.** Age Group of Patients.

AGE GROUP	PONSETI
10-15 days to 6 months	72 (75%)
6 months to 1 year	24 (25%)

**Table 4.** Therapeutic Efficacy.

EFFICACY	PONSETI
EFFECTIVE	84 (87,5%)
INEFFECTIVE	12 (12,5%)

## Discussion

The importance of the PTCI is given not only by the number of individuals who present it, but also by the difficulties that its treatment entails, as well as the subsequent maintenance of the correction obtained. [9,10]

PTCI is one of the most prevalent pathologies in children treated at pediatric orthopedic outpatient clinics. When they are treated or treated incorrectly, this pathology leads to permanent, disastrous sequelae both from a functional and psychosocial point of view, significantly altering gait. In this way, the choice of an effective treatment interferes directly in the prognosis of this pathology. The international literature shows that the Ponseti method [11] brings important benefits, since it is a conservative and minimally invasive technique. When we do not achieve the expected satisfactory result, surgical treatment recommended by the method should be considered.

A well-shaped cast keeps the foot in the correct position. The bones and joints remodel each plaster application due to the properties of the young connective tissue, the cartilage, and the bone, which respond to changes in the direction of mechanical stimuli. The first element of the treatment is the correction of cavity deformity, positioning the forefoot in proper alignment with the backfoot. The cavus, which is the enlargement of the medial arch occurs due to pronation of the forefoot in relation to the hindfoot. The cavus is always flexible in newborns and requires only supination of the forefoot to obtain a normal medial longitudinal arch of the foot. The manipulation consists of abduction of the foot below the head of the stabilized talus. All components of the crooked foot deformity are corrected simultaneously. Stabilization of the talus is the pivot of the correction around which the foot rotates when it is abducted. This further stabilizes the ankle joint while the foot is abducted and counteracts the tendency of the posterior calcaneofibular ligament to push the fibula posteriorly during manipulation. Then abducting the foot in supination with the foot stabilized by the thumb over the head of the talus, abduct the foot. The lateralization of the navicular and the anterior portion of the calcaneus increases as the deformity is corrected. The complete correction is usually obtained in the fourth or fifth plaster. On stiffer feet, more plaster may be needed. In the next plaster, the adduct and the varus are completely corrected. The deformity in equine gradually improves with adduct and varus correction. This is part of the correction because the calcaneus frees

dorsally as it is abducted under the talus. Correction of the equine should not be attempted prior to correction of the calcaneus varus. Prior to the application of the last cast, the Achilles tendon may need to be sectioned to obtain the complete correction of the equine. The Achilles tendon, unlike the tarsal ligaments, which can be elongated, is composed of thick, non-distended, collagen fibers with few cells.

The last plaster is left for 3 weeks while the sectioned Achilles tendon regenerates at proper stretching with minimal healing. After this period, the tarsal joints are already remodeled in the corrected position. This stage is reached when the anterior part of the calcaneus is abducted and leaves under the talus. Abduction allows the foot to be flexed dorsally without flattening between the calcaneus and the tibia.

In the sample of 96 patients who underwent the treatment of idiopathic congenital clubfoot performed by the Ponseti technique [7] in the pediatric orthopedic department of the Martagão Gesteira Children's Hospital, there was a similar distribution regarding to gender (male 51.1% and female 48, 9%) with a certain prevalence of males. Already in the studies of MERLOTTI MHR, *et al.* [14]; SANTIN RAL and HUNGRIA FILHO JS [15] report a very unequal distribution in relation to sex, with males 67.3% and females 32.7%. Some studies, such as MERLOTTI MHR, *et al.* [12] and Rijal R, *et al.* [13], report that the male sex is twice as affected as the female for this pathology. The results of these works are in disagreement with what was found in our service. The classification of the patients according to laterality showed that twenty-four (25%) were affected by the congenital deformity of the right lower limb, twenty-seven (28.12%) were affected in the left lower limb and 45 (46.87%) had PTCI on both feet. According to the studies done by RIJAL R, *et al.* [14] and MERLOTTI MHR, *et al.* [15], the highest prevalence of PTCI is bilateral, which is according to our study. When researching the studies of MERLOTTI MHR, *et al.* [16] and RIJAL R, *et al.* [17], regarding the unilateral deformities, the right foot is more affected than the left foot, which is contrary to the results of our study. research in which the left foot was more prevalent in unilateral deformities.

As the diagnosis and treatment by the Ponseti method is predominantly clinical [7], we used revised data in medical records, as necessary information the evaluations of all cast and postoperative changes of thirty days, six months and one year, all of them classifying feet treated by the Pirani method. In our results, all the feet evaluated after complete treatment (one year postoperative) in which the Denis-Brown device was used by the patients for only one year, since they do not fit longer because they have already started the running phase. The gait for these patients was evaluated as unchanged. In addition to the advantages of conservative treatment and because it is minimally invasive Ponseti qualifies as a "gold standard" all over the world has been widely disseminated and used. After our research, we brought together the full efficacy of the treatment in question, with no flaws, that is, in our study, the applied Ponseti method was successful in PTCI treatment.

## Conflict of interest

The authors declare that there were no conflicts of interest during the confection of this work.

## Authorship and Contribution

### Fernando Cal Garcia Filho

The author made substantial contributions to the conception work, revised it critically for important intellectual content, made the and final

approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

#### Walter Guimarães Cova Neto

The author made substantial contributions to the the acquisition, analysis, and interpretation of data for the work, revised it critically for important intellectual content, made the and final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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