THE IMPORTANCE OF FOLLOWING THE ORIGINAL PONSETI METHOD IN TREATMENT OF CLUBFOOT: THE IOWA EXPERIENCE

СЛЕДЕЊЕ НА ОРИГИНАЛНИОТ ПОНСЕТИ МЕТОД ПРИ ТРЕТМАНОТ НА ВРОДЕНО КРИВО СТАПАЛО: ИСКУСТВО ОД АЈОВА

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АПСТРАКТ

Др. Игнацио Вивес Понсети е ортопедски хирург со шпанско потекло, роден на 03.06.1914 и починал на 18ти Октомври 2009 во Ајова, САД, каде што живеел и работел. Тој бил брилијантен педијатриски ортопедски хирург, прочуен по неговиот метод на конзервативен третман на вродената криво стапало, што и ден денес претставува златен стандард. Неговиот труд од 1963та година е еден од ретките во ортопедијата кој радикално го променил дотогашниот начин на третман. Методот по Понсети лесно се учи, но за жал и подлегнува на многу модификации, што негативно влијае на исходот од третманот. Тоа става дополнителен акцент на потребата од учење на точните чекори опишани од д-р Понсети. Првиот автор на овој труд беше на студиски престој во Детската болница на фамилијата Стед во Ајова, каде што го учеше методот на местото на неговиот изум, под водство на др. Хозе Моркуенде, наследникот на др. Понсети, кој на извонреден начин го продолжува наследството на д-р Понсети. Започнавме да го користиме оригиналниот метод во октомври 2019. Од тогаш, 16 пациенти, 7 со билатерална, 9 со унилатерална зафатеност (23 стапала вкупно) се третирани и евалуирани. Се трудевме во огромна мерка верно да го пратиме точниот протокол на Понсети, опишани во неговиот труд. Обично, за корекција на првите три компоненти од деформитетот потребни се четири до десет гипсени имобилизации, изведувани на неделно ниво. Еквинусот се коригира последен. Со цел да се избегне пролонгирано поставување на гипсови и последователна појава на “rocker bottom” деформитет, корекцијата на еквинусот се постигнува со едноставна перкутана ахилотенотомија во локална анестезија. Кај шеесет и пет проценти од пациентите имаше добри резултати, триесет и еден процент беа со просечен исход, додека кај еден пациент резултатот беше лош. Во споредба со оригиналниот труд на Понсети од 1963 година, не постојат сигнификантни разлики во резултатите, освен поголем процент на лош резултат кој вклучува само еден пациент во нашата серија.

ABSTRACT

Dr. Ignacio Vives Ponseti, an American orthopaedic surgeon with Spanish origin, was born on June the 3rd, 1914 and died at the age 95 in Iowa, USA, on October 18th 2009. He was a brilliant pediatric orhopaedic surgeon, best known for his method of nonoperative treatment of clubfoot, that has become a gold standard of clubfoot treatment. His iconic paper on clubfoot management (1963) is one of the few manuscripts in orthopaedic literature which has radically changed the practice as we know it now. The Ponseti method is easy to learn but, unfortunately easy to modify because modification negatively affects the treatment outcome. That emphasizes the need to learn and follow the exact steps explained by Dr. Ponseti. The first author of this article had the opportunity to learn this method in the place where it all started, guided by Dr. Jose Morcuende, the successor of Dr. Ponseti who continues his legacy in the brightest way possible. After return from the stay at Iowa Stead Family Children's Hospital 16 patients and 23 feet were treated with best possible adherence to the Ponseti Method.

We began using the original Ponseti method in October 2019. Since then, 16 patients, 7 bilateral, 9 unilateral (23 feet in total) have been treated and evaluated. We strove as much as possible to reproduce Ponseti's strict casting protocol faithfully, as explained in the paper. Usually, for correction of the first three components 4 to 10 casts are necessary, changed on a weekly basis. Equinus is the last deformity to be corrected. In order to avoid prolonged casting and concomitant appearance of rocker bottom deformity, the correction of equinus is facilitated by a simple operative procedure in local anesthesia. Sixty five percent of the patients had good results, 31% had acceptable results, in one patient there was poor result. Compared to the original Ponseti paper from 1963, there is not any significant difference in the results, except the bigger percent of poor results that involves only one patient in our series.

INTRODUCTION

Dr. Ignacio Vives Ponseti, an American orthopaedic surgeon with Spanish origin, was born on June the 3rd, 1914 and died at the age 95 in Iowa, USA, on October 18th 2009.[1] He was a brilliant pediatric orhopaedic surgeon, best known for his method of nonoperative treatment of clubfoot, that has become a gold standard of clubfoot treatment. His iconic paper on clubfoot management (1963) is one of the few manuscripts in orthopaedic literature which has radically changed the practice as we know it now.[2]

But, until the 1990s there wasn't any interest about his technique for treating clubfoot. Given that the results of surgical treatment can beso discouraging, parents looked for alternative treatments. That's what caused Dr. Ponseti to come out of retirement which launched a new era in the clubfoot treatment. The importance and execution of this method was sealed in 1996 when he published his book "Congenital Clubfoot: Fundamentals of Treatment".[3] This and the emerge of internet brought a new sight of this forgotten method.[4]

It has always been clear to most surgeons that the initial treatment of idiopathic congenital clubfoot should be serial gentle manipulations to stretch the contractures, with serial casting and splinting to maintain the correction obtained by stretching.[5, 6, 7] But, with the previous conservative methods, that were deficient with understanding of the nature of the deformity and the normal functional anatomy of the foot, the success rate was 10-50%, as 50-90% of the patients were referred to extensive surgery.[8, 9, 10,11] In those patients, the main concern is functional outcome that often abruptly deteriorates in their adult life.[12]

The Ponseti method is easy to learn but, unfortunately easy to modify because modification negatively affects the treatment outcome. That emphasizes the need to learn and follow the exact steps explained by Dr. Ponseti.Because many parents were now seeking out physicians trained in the Ponseti Method, orthopaedic surgeons began traveling to Iowa City from around the world to train with Dr. Ponseti and become proficient in his method. Now, more than two decades later, the Ponseti Method is the standard of treatment worldwide. The first author of this article had the opportunity to learn this method in the place where it all started, guided by Dr. Jose Morcuende, the successor of Dr. Ponseti who continues his legacy in the brightest way possible.

After return from the stay at Iowa Stead Family Children's Hospital 16 patients and 23 feet were treated with best possible adherence to the Ponseti Method. Besides demographic data we evaluated the number of

casts used, that indicated the severity of the clubfeet, the need of tenotomy, as well as appearance of recurrence of the deformity.

Material and methods

We began using the original Ponseti method in October 2019. Since then, 16 patients, 7 bilateral, 9 unilateral (23 feet in total) have been treated and evaluated. We strove as much as possible to reproduce Ponseti's strict casting protocol faithfully, as explained below.

The guidelines for the treatment developed by Ponseti and followed at our institution are as follows:[2, 3]The casting is performed by a treating surgeon and a nurse/casting technician. The molding should be done exclusively by the surgeon. Simultaneous correction of all the components of the deformity (cavus, adductus, varus), except for the equinus that is corrected last (figure 1).

Figure 1. Not treated clubfoot in 10 days old newborn. It has all the components of the deformity-cavus, adductus, varus and equinus

The cavus should be corrected with the first cast using supination of the forefoot regarding the hindfoot by applying counter pressure on the superiolateral aspect on the head of the talus. The padding is thin and in one layer only followed by the application of plaster cast in two sections, the first below the knee, in order to obtain enough time to mold the cast before it becomes stiff, by contouring the lateral malleolus and emphasizing the posterior crease of the calcaneus (figures 2 and 3).

Figure 2 and 3. After the first manipulation, correction of the cavus with supination of the first metatarsal bone regarding the hindfoot is achieved.

Then the other section of the cast is added that covers the thigh with the knee in 90 degrees of flexion. The long cast is essential to avoid cast slippage and to correct tibial torsion. Distally, the toes are opened from the dorsal side, leaving enough cast on the plantar side, to avoid crowding and flexing of the toes. Once the longitudinal arch of the foot is corrected with supination, the entire foot is abducted under the talus. When the foot is abducted fully under the talus, the calcaneal varus will correct without touching the heel (figures 4, 5, 6 and 7).

Figure 4

Figure 5

Figure 6

Figure 7

Figures 4, 5, 6 and 7. Serial casting with weekly change of the casts until abduction of 70 degrees is achieved.

Equinus is the last deformity to be corrected. In order to avoid prolonged casting and concomitant appearance of rocker bottom deformity, the correction of equinus is facilitated by a simple operative procedure in local anesthesia which is administrated half an hour before the operation. The intervention is performed in the operating room, older babies (more than six months) get an additional sedation. The patient is placed supine on the operating room, while an assistant holds the baby's foot and knee in flexion, parallel to the operating table. We use knife number 15, which is placed from medial to lateral, parallel to the tendon, with the blade facing proximally. When the tendon is probed by gentle anterior placement of the knife, the blade is rotated for 45 degrees posteriorly and the tendon is severed completely, followed by a increase of the dorsiflexion of about 15 degrees. The surgeon thumb from the opposite hand is placed over the skin in order not to damage it. No sutures are necessary. Afterwards, pressure is applied for several minutes to stop the bleeding and sterile thin gauze is placed over the heel. The last cast is applied in the same manner as all the previous casts with extreme correction of equinus (dorsiflexion of 15 degrees) and adductus (abduction of 70 degrees). These extremes are necessary to avoid relapse (figure 8).

Figure 8. Achieved correction after serial casting and tenotomy in the same patient as in figure 1. Photography taken after five cast changes and tenotomy, at three and half months of age. On this visit boots and bar were placed

The last cast is worn for three weeks and afterwards an abduction brace is applied to the baby's feet. Abduction of the feet is set to 60-70° on the affected side and 40° on the normal side. In bilateral cases abduction is set to 60-70° in both feet.The length of the bar should be identical to the shoulder width of the baby. This brace is worn constantly in the first three months, for 23 hours daily and afterwards it's worn for 14 hours a day, in the next three to five years (figure 9).

Figure 9: Abduction boots and bar brace that needs to be worn 23 hours daily for the first three months after the tenotomy and 14 hours daily for the next 4-5 years.

Usually, for correction of the first three components 4 to 10 casts are necessary, changed on a weekly basis.

If any of the components of the clubfeet reoccurs (cavus, varus, adductus and/or equinus), it complies to appearance of a recurrence. Depending on the severity of the recurrence, it can be addressed by increase of the time of the wearing of the brace, additional manipulation with or without tenotomy (complete tenotomy, not lengthening) of the Achilles tendon.Criteria for a complete tenotomy were: feeling of a sudden pop as the tendon is severed, correction of equinus deformity by achieving bigger dorsiflexion and a palpable gap in the substance of the tendon.The tendon fully regenerates following percutaneous tenotomy.[13]

Of out sixteen patients, eight were female and eight were male. Two of them were twins, with unilateral clubfeet. The other twin didn't have any anomalies. From the unilaterally affected patients, six feet were right and three were left. Our patients underwent 3-9 cast changes (5 casts in average). The patients presented from ten days to six months in age, average 7 weeks. Seven patients, twelve feet were previously treated elsewhere. Percutaneous Achilles tenotomy was performed in eleven patients, sixteen feet.

RESULTS

In most of our patients, the deformity was corrected with five casts in average. In eleven patients more than six casts were used which indicates bigger severity of the deformity. Dimeglio and Pirani clinical scoring systems before and after the treatment are insufficient to predict the course and results of treatment by the Ponseti method.14 We also have found that significant correlation in predictive factors (i. e. complexity, number of casts, need for tenotomy, probability of recurrence) is exposed by clinical evaluation before the initiation of Ponseti treatment and after the removal of the second cast the accuracy is higher. We clinically evaluated the persistence of any of the components of the clubfeet in all our patients after the initial treatment following the Ponseti method. The clinical components analyzed were ankle dorsiflexion, heel varus, adduction of the forefoot as well as tibial torsion(table 1).

Ankle dorsiflexion (degrees)	**Heel varus (degrees)**	**Heel varus (degrees)**	**Tibial torsion (degrees)**	**Results**
>10	0	0-10	0	Good (n:15, 65%)
0-10	0-10	10-20	Moderate	Acceptable (n:7, 31%)
0	Over 10	Over 20	Severe	Poor (n: 1, 4%)

Table 1. Results

The cavus deformity, once corrected properly by the first and maybe the second cast rarely recurs. In one patient there was recurrence of this deformity, but it was corrected by recasting and up lifting the first metatarsal.

In four patients hindfoot varus and forefoot adductus reappeared. In all of them noncompliance to the brace wearing was reported by the parents. If the deformity persist after two and a half years, anterior tibial tendon transfer to the cuboid bone will be suggested.

Tibial torsion was completely corrected in all patients, except in one calf in a patient with bilateral deformity.

Dorsiflexion of the ankle lacked in four patients. In two of them the tendon was sectioned at the initial treatment. In one of them repeated percutaneous Achillotenotomy was performed.

The results are collected in table 1. Sixty five percent of the patients had good results, 31% had acceptable results, in one patient there was poor result.

DISCUSSION

In our case series, as well as in many works before, it has been proven, that following the original Ponseti method gives fruitful results.[2, 15, 16, 17]

We compared our results to those of the original Ponseti paper from 1961.[2] It involves evaluation of sixty seven patients with total of ninety-four clubfeet. The results in 71 per cent of the feet were good; in 28 per cent a slight residual deformity persisted; and in one foot a poor result was obtained, as compared to ours, 65 per cent had good result, some residual deformity present in 31% and poor result in four percent of our patients. Our study involves significantly lesser number of cases, and lesser time of follow up (two years) but there is not any significant difference in the results, except the bigger percent of poor results that involves only one patient in our series.

Of great importance is to mention the common errors in treatment of congenital clubfoot.[18] It is only illusive that the severe supination of the foot is corrected by pronation, in fact, the forefoot is pronated related to the rearfoot and it should be supinated to achieve a correction of the cavus. The foot must not be externally rotated if the calcaneus is in varus because it leads to posterior displacement of the lateral malleolus which is a sign of poorly treated clubfoot. Another common mistake, commonly taught by previous methods of conservative treatment of clubfeet is pressing the calcaneocuboid joint as a fulcrum to rotate the foot. It is necessary to use the talar head as fulcrum under which the foot underlines properly.[19] All manipulations must be followed by plaster cast immobilzation, in order to keep soft tissues stretched between manipulations. It is necessary the plaster cast to be long, from toes to the groin, otherwise, the ankle and talus will rotate. Also, the surgeon must be aware that perfect anatomical correction is not possible in most cases, but it doesn't cause any functional impairment in the future.

And last but not the least, the casting and molding of the plaster cast must not be left to the casting technician, because all of these afore mentioned errors are responsibility of the treating physician.

It is interesting to mention how the internet affected the treatment of congenital idiopathic clubfoot. It is well observed in Morcuende's work from 2003.20 Since the information for clubfoot treatment in Iowa became virtual on the internet, there'd been a dramatic increase in the number of patients in their clinic, representing profound effect in clinical practice patterns, and in the patient physician relationship. In that way the parents became aware of the Ponseti method in order to avoid extensive surgical treatment.

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