CONGENITAL IDIOPATHIC TALIPES EQUINOVARUS: CURRENT CONCEPTS AND TREATMENT

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CONGENITAL IDIOPATHIC TALIPES EQUINOVARUS: CURRENT CONCEPTS AND TREATMENT (Abstract). Clubfoot is a congenital malformation that has a global distribution. Despite recent advances, its etiopathogenesis still remains unknown. Although surgical treatment was preferred in the past, the actual gold standard for treatment is conservative (the Ponseti method). Nevertheless, surgery can still be an option in a small percent of cases. As clubfeet are prone to relapses, their prevention with the use of the foot abduction orthosis (FAO) is important. Keywords: CONGENITAL TALIPES EQUINOVARUS, CLUBFOOT, PONSETI, FOOT DEFORMITIES.

Idiopathic congenital clubfoot or talipes equinovarus is a complex, three-dimensional rigid deformity of the foot and ankle, that affects 1 in 1,000 newborns in Romania, males being affected twice as frequently as females (1). About 50% of patients have a bilateral involvement. This deformity is characterized by the presence of four pathological deviations: varus, cavus, adductus and equinus. True idiopathic clubfeet should be differentiated from syndromic clubfeet, associated with genetic syndromes (e.g. Down syndrome and Larsen syndrome), neurological diseases (spina bifida), myopathies, amniotic band syndrome or teratological malformations. A common similar but benign deformity is the postural clubfoot, a condition determined by prolonged, in utero mispositioning of the feet, which is completely or almost completely correctable at the initial examination and requires no other surgical or conservative treatment except for passive mobilization and stretching.

Many classifications have been proposed in the past, but their reproducibility wasn’t satisfactory. The most frequently used classifications are the Dimeglio and the Pirani scores. Both are based on physical examination and they were found to have a good inter-observer reliability and reproducibility after an initial learning phase (2-4). The Dimeglio classification relies on grading the passive correction of the following parameters: equinus, varus,
derotation of the calcaneus-forefoot block and the adduction of the forefoot. Upon adding up the points attributed to each deformity, clubfoot can be classified in soft-soft feet (benign), soft-stiff feet (moderate), stiff-soft (severe) and stiff-stiff feet (very severe). The Pirani score, which relies on assessing six signs, evaluates and scores both the hindfoot contracture (posterior crease, empty heel, rigid equinus) and the midfoot contracture (medial crease, curvature of the lateral border, the position of the head of the talus). The final grading is obtained by adding the hindfoot and forefoot scores. As the Dimeglio score evaluates the reducibility of the foot and the Pirani score evaluates the foot aspect, they could be used at the same time when evaluating the results and monitoring the treatment (5). The International Clubfoot Study Group (ICFSG) score, which is more complex and measures the treatment results by scoring the morphological, functional and radiological evaluation of the feet, also proved to have a good inter-observer reliability (6, 7).

**ETIOPATHOGENY**

Although many theories (8-10) have been proposed so far, the etiology remains unknown. The mechanical theory, described in the past by Hippocrates, suggested that the deformity develops due to increased intrauterine pressure during development, but it is not accepted anymore as the appearance of clubfoot has been observed at 14 weeks in a uterine cavity with abundant amniotic fluid (11). The genetic component appears to be significant, as suggested by the incidence variations among different populations: 1-2: 1,000 in Caucasians and higher in Polynesians (12-14). Other theories were related to the abnormal development of connective tissue and bones (15, 16), neurological (17-19) or vascular anomalies (20). Maternal smoking (21, 22) and early amniocentesis leading to vascular disruptions (23) increase the risk for clubfoot. The pathological modifications of clubfeet have all been well described and it is beyond the purpose of this article to review them extensively. These include: the abnormal development and malposition of the foot bones; contracture and fibrosis of soft tissues (ligaments, tendons, muscles); vascular anomalies; abnormal innervations of the peroneal muscles. All of them can be present in various degrees in patients with clubfeet.

**DIAGNOSIS**

The ultrasonographical diagnosis of clubfoot can be established at a mean gestational age of 22 weeks (14 to 35.6) with a positive predictive value of 83%, but the accuracy rate varies in different studies and the need for karyotyping is still debated (24). At present, the diagnosis is still clinical, based on the presence of the four typical deformities: varus, equinus, adductus and cavus. The severity and rigidity of these pathological modifications vary from one patient to another. In very severe cases, the presence of a medial plantar and a posterior retrocalcaneal crease can be noted. The circumference of the calves and the length of the feet should also be noted because calf hypotrophy is always present on the affected side. Radiological evaluation was used as a preoperative and postoperative assessment method when the treatment of clubfeet was surgical. Nowadays, radiological examination is not routinely performed in newborns due to the absence of ossification of the foot bones at that age. In addition to that, Ippolito et al. (25) demon-
strated that the talocalcaneal angle, a common radiological parameter used to assess the hindfoot, was misleading in 75% of the patients which were investigated, and it didn’t reflect the true relationship between the two bones. Another issue is radiation exposure of infants. Taking into consideration the fact that radiographs are performed near radiosensitive organs and that the current treatment is mainly conservative, relying mostly on palpation of the bones in the foot, after measuring the radiation dose utilized in the assessment of clubfoot, Radler et al. (26) do not recommend taking radiographs while using the Ponseti method.

**TREATMENT**

The goal of treatment is to correct the four deformities and to obtain a plantigrade, functional, pain-free foot that allows standing and normal walking. Many treatment methods have been used so far and they can be divided into two groups, surgical and conservative.

Although preferred in the past decades, the surgical treatment was almost completely replaced by the conservative one. However, in certain cases such as resistant forms, very stiff types of clubfeet or residual deformities, it remains the only available option. It was usually preceded by passive mobilization or stretching sessions followed or not by immobilization, to increase foot flexibility and correct as much as possible the deviations. If results were not satisfactory and there was little progress, surgical treatment was indicated. The proper age for surgery used to vary from surgeon to surgeon, depending on the age and the foot dimension. The surgical interventions used for the treatment of clubfeet can be divided into three main types: soft tissue releases, tendon transfers and bone procedures, the last ones being reserved for older children. The most frequently used were the posteromedial approach (Turco), the posterolateral approach (Metaizeau) and the circumferential approach (Cincinnati), the latter allowing an excellent visualization. The soft tissue surgery included: lengthening of the Achilles tendon, posterior capsulotomy of the ankle and release of the subtalar joint, lengthening of the flexor hallucis longus, flexor digitorum longus, tibialis posterior tendon, capsulotomy of the talonavicular joint, partial or total release of the interosseous ligament, release of the calcaneocuboid joint and calcaneofibular ligament. The extent of release used to vary among surgeons. The corrected position of the foot was thereafter temporarily maintained by some form of internal fixation, usually a Kirschner wire passed through the talonavicular joint, followed by immobilization in a cast for 6 to 12 weeks.

Since Ponseti (11) described his method, it has become the most utilized method of treatment throughout the world. It consists of two phases: the initial correction phase and the maintenance phase. The correction phase is mainly conservative and consists of weekly sessions of manipulation and immobilization of the foot to gradually correct each of the four deformities (cavus, varus, adductus and equinus). It has a mean duration of 5 to 7 weeks depending on the stiffness of the clubfoot and the doctor’s experience. The cavus is the first deformity corrected by supinating the foot and applying pressure on the first metatarsal head to realign the forefoot with the hindfoot. The adductus and the varus deformity are corrected together by performing a progressive abduction, while applying counterpressure on the head of the talus. The equinus is the
last deformity to be corrected: a percutaneous Achilles tenotomy under local anesthesia is performed after the foot can be abducted more than 60º and if dorsiflexion is less than 15º-20º. The procedure is followed by immobilization in a long leg plaster cast for 3 weeks. The removal of the last plaster marks the beginning of the maintenance phase, which consists of wearing a foot abduction orthosis for the next 4 years (fulltime during the first 3 months and 14 to 16 hours a day until the age of 4-5 years). The FAO maintains the affected feet in 60º-70º of abduction and 10º-15º of dorsiflexion. Non-compliance with wearing the FAO was found to be associated with recurrence (27). Factors associated with non-compliance or poor-compliance are: discomfort while using the brace, low educational level of parents and low family income (28).

**DISCUSSION**

Satisfactory results were obtained on the short term after surgical release of clubfeet (29-31), but long term follow up studies report stiff and not fully functional feet, which needed additional surgeries (32). In a 17-years follow-up study, after evaluating foot function and patients’ satisfaction, Symeonidis et al. (33) concluded that even after achieving an initial successful surgical correction, residual symptoms after surgical treatment may alter walking ability and the quality of life. Ponseti’s method of treatment achieves the highest correction rate in approximately 90% of the cases as reported by different Pediatric Orthopedics Centers where the method was adopted (34-37). Complications are possible with both methods of treatment. In surgically treated patients, leaving aside the surgery-related risks, the most frequent complications are: increased stiffness of the ankle, subtalar and midfoot joints, under correction or residual deformities (forefoot adduction, persisting cavus, equinus or hindfoot deformity), talar flattening and avascular necrosis of the talus, overcorrection, in-toeing gait, weakness of the plantar flexors, pain and development of arthritis (38, 39). However, after the Ponseti treatment, recurrence of one of the four deformities (usually the forefoot adductus with dynamic supination) is the most frequent complication to arise and it is correlated with the inadequate use of the foot abduction orthosis (28). Conservative treatment consisting of manipulations and immobilization in long leg plaster casts followed by bracing after the deformity is corrected can usually be effective, but with growth children don’t tolerate the foot abduction braces as well. Transfer of the tibialis anterior tendon to the lateral part of the foot is preferred in these cases because it maintains the corrected position and eliminates the need for bracing (40).

The thing about clubfoot is its natural tendency to recur despite successful surgical or non-surgical correction. This is can be explained by the fact that the pathological modifications and contractures are still present in the posterior and medial aspect of the calf, ankle and foot. These relapses occur until the age of four or five, and are rare afterwards, even in only partially corrected clubfeet (41). This is the main reason for the indication of wearing the FAO for the following four years of age. In a prospective study that compared surgical treatment to the Ponseti method of treatment, Halanski et al. (42) found that despite the high recurrence rate in both groups, patients treated with the Ponseti method required less interventions for the correction of the deformity and less revi-
sion surgery. Even though this method has a high initial correction rate (90%), extensive surgery will still be required in the rest of the feet which don’t respond to treatment (43, 44).

**CONCLUSIONS**

In our opinion, even though it has been described as a congenital malformation, clubfoot should be considered a developmental disorder due to the nature of its pathological modifications and its strong tendency to relapse. After reviewing the literature and based on our experience, we recommend the Ponseti method as the first choice of treatment. If clinicians strictly respect its principles, a high correction rate can be achieved. We consider useful weekly evaluating the foot with the Pirani and Dimeglio scores during the correction phase. The importance of the FAO cannot be overemphasized and sometimes the maintenance phase proves to be more challenging than the correction phase. As non-compliance with the bracing protocol is an important factor linked to relapses, efforts should be made to improve compliance and the brace design. Despite the high initial correction rate of the Ponseti treatment, surgery will still be necessary in those feet that don’t respond to treatment and in some forms of relapsed feet.

**REFERENCES**


