

Long-Term Results of Treatment of Children with Congenital Vertical Talus in Russia

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Abstract

Introduction: According to various authors the frequency of the vertical position of the talus is 1 per 10 000 newborns.

Objective: To study the long-term results of treatment of feet with congenital vertical talus, treated by means of the classical techniques of treatment and the minimally invasive approach of M. Dobbs.

Materials and Methods: 30 clinical impressions (54 feet) with serious congenital flat-valgus deformities of the feet were analyzed for 11 years. The age of patients at the beginning of treatment varied from 1 month to 13 years. Primarily, 54 operations were performed to them. Three-articular arthrodesis - 2, open reduction of the talus bone by S.J. Kumar, K.R. Cowell, D.L. Ramsey - 5, open reduction of the talus by Coleman with bonding - 6, serial casting and percutaneous fixation of the Talo-navicular joint with K-wire with Achilles tentotomy - 41. In these conditions, the reduction of the talus bone of 23 feet was carried out under control of the eye with capsuloplasty, in other cases it was closed under the C-arm.

Results: According to the analysis the most beneficial results were those results of treatment of 21 children (41 feet) who at an early age had an approach M. Dobbs, including a serial casting in combination with minimally invasive surgical procedures and the further wearing of braces. Despite the initial decentish correction in the course of growth (on average 6.1 years) there were relapses of the vertical talus (3 children - 4 feet) to the level of transverse talus and the case of a complete loss of correction results, which required follow-up surgery. However, the need for open reduction of the talus bone in this patient's population in our clinic has significantly decreased after introduction of the M. Dobbs method. In addition, there are more and more cases of successful primary treatment by Dobbs method in the national literature and long-term results in our country are not yet presented.

Conclusion: Method of Dobbs demonstrates its effectiveness. Surgical intervention according to the methods of Kumar and Coleman are rescue therapy for children whose feet deformity was revealed late or recurred due to the lack of efficacy of the Dobbs methods. Triple arthrodesis as a definitive surgery can be used in case of late detection of pathology or poor results.

Keywords: Vertical Talus; Flatfoot; Dobbs' Method; Foot Deformity

Introduction

The vertical position of the talus is a congenital anomaly of development and is characterized by severe flatfoot [1]. The frequency of this anomaly, according to various authors, is 1 case per 10 thousand newborns [8,14]. In 50% of cases, this anomaly is associated with

spinal, neuromuscular developmental abnormalities, malformations, and chromosomal syndromes, such as arthrogryposis, neurofibromatosis, myelodysplasia, etc. [5,13,16] and is inherited in an autosomal dominant manner with no complete penetrance [4]. Dobbs M in 2006 identified genes responsible for the formation of a vertical talus bone - HOXD10 M319K [9]. The early start of treatment with a conservative method (step-by-step casting) is recommended in connection with the greatest opportunities for gentle correction of deformities. The experience of I. Ponseti in the treatment of children with clubfoot naturally led to the idea of adapting this approach for children with congenital flatfeet. The orthopedic surgeon and at the same time medical geneticist Matthew Dobbs (Philadelphia-USA) developed the author's technique. With timely access to an orthopedist who owns the M. Dobbs method, the child has a chance to use the elasticity of the soft tissue structures of the foot. In children up to three years of age, fibrous changes in the soft tissues of the hind and middle parts of the foot do not prevent the restoration of anatomical ratios in the joints, which avoids major surgical interventions [6,14-17]. However, according to the literature, successful treatment results for children with congenital flatfeet are achieved much less frequently than those in patients with clubfoot [2,3,5-12]. And observation of this group of patients shows that in children with a non-idiopathic vertical talus against the background of growth, a correction loss occurs, sometimes requiring subsequent surgical interventions.

Materials and Methods

In 2006 M. Dobbs visited our clinic in Yaroslavl, where at the conference he reported the immediate results of the treatment of children with a vertical talus according to the method he proposed. Before his arrival, we adhered to traditional approaches in the treatment of this contingent of patients. By analogy with plastering according to V. Ya. Vilensky and T.S. Zatselin, we used the method of step-by-step casting in order to reduce deformities and prepare for surgery. All patients with a vertical talus at that time were operated using the tactics of open reduction of the talus. Operations on deformed feet were performed in children over 1.5 years of age, mainly due to the release of soft tissue structures, supplementing the tibia of the sinus tarsi with bone grafting after 5 years, and triple arthrodesis was performed after 12 years.

In total, over the past 11 years, 30 clinical observations of children (54 feet) with an innate vertical position of the talus were analyzed. The age of patients at the beginning of treatment ranged from 1 month to 13 years. Initially, he performed 54 operations - one for each foot. All patients were divided into 2 groups.

The first group (9 patients - 13 feet), treated using traditional techniques of open reduction of the talus. Although preoperative casting was used in this group, it did not lead to any significant result. The average age of patients in this group was 6.1 years. Operative reduction of the talus was carried out by him depending on age at the time of treatment. Up to 4 years, surgery Kumar, Cowell, Ramsey (5 feet) was performed, up to 12 years open reduction of the talus by Coleman with fixation with screws (6 feet), and three-joint arthrodesis after 12 years (2 feet). Screw fixation of the foot with triple arthrodesis of the foot was traumatic, but it allowed patients to move with full support on the operated limb as early as 4 weeks after surgery.

The second group (21 children, 41 feet) of patients consisted of children with vertical talus who underwent treatment in our clinic after mastering the M. Dobbs method. The average age of the patients was 1 year 3 months. Stage cast and percutaneous fixation of the talar-scaphoid joint with Kirschner spoke with tenotomy of the Achilles tendon - 41 feet. Reduction in the talar-navicular joint occurred during successive manipulations with the front of the foot with counter support in the plantar-medial hemisphere of the head of the talus against the background of a persisting equinus. Correction, which is carried out by achillotomy with simultaneous fixation of the adjusted talar-navicular joint with Kirschner's spoke. At the same time, in 23 feet manual closed correction under the image intensifier tube was not enough and the talus bone reduction was performed through a medial incision with the talus head elevation under the control of the eye, followed by capsuloplasty. After the operations, the children were given a plaster cast for a period of 8 weeks. After removing the knitting needles, the children were in plaster boots with a longitudinal arch laid out without fixing the knee joint and the possibility of full support on the legs for 1 month. Then they wore braces with a neutral foot position for 3 months 23 hours a day and later on for all types

of sleep up to 4 years of age to prevent relapse of foot deformities. All children were assigned orthopedic shoes with a longitudinal arch. Despite the initial satisfactory correction according to the Dobbs method, recurrence of the vertical talus (3 children - 4 feet) to the level of the oblique and vertical battering talus occurred, which became an indication for reoperation.

All children of groups 1 and 2 were assigned a consultation of medical genetics. Despite this, not all patients received it for various reasons, and children after examination and examination did not always have a result. Total in 24 children (80%) of 30 in our opinion proceeded against the background of neuromuscular diseases or genetic syndromes. Genetically verified syndromes: Freeman Sheldon-2, Patau-1, Arthrogryposis-4, Marfana-1, cerebral palsy-2. And the group of children with genetically unverified syndromes made up the majority: 14 children with many (more than 5) small developmental abnormalities, combined with severe mass deficiency, hypermobility in the joints of the limbs and the presence of one or two feet with the vertical position of the talus.

In addition to genetic testing, all children underwent radiography. This is an objective, simple and cheap method for assessing the severity and results of treatment of foot pathology. X-ray examination was carried out before the start of treatment (with suspicion of a vertical talus), at the end of this course, before surgical treatment, intraoperatively, at the end of treatment. Periodic X-ray monitoring is also necessary if necessary as the child grows with dubious clinical data. The following images were analyzed: anteroposterior in neutral position (AP) and lateral (L) in maximum dorsal and plantar flexion. At the same time, at the initial examination, in the case of repositioning of the talus with maximum plantar flexion, which is manifested in the radiograph of the alignment of the length of the nucleus of the ossification of the talus with the first metatarsal bone, the patients were excluded from the study group. Because the study of oblique talus patients is beyond the scope of this study.

The most informative indicators were measured: the angles between the axes of the talus and calcaneus (AP1), the first metatarsal and talus (AR2), the talus and calcaneus (L1), the axis of the calcaneus and the perpendicular to the axis of the tibia (L2), the angle between the talus and the axis of the first metatarsal bone (L3). The angle AP1 shows the divergence of the bones of the posterior section; the angle AP2 during treatment decreases and reflects the magnitude of the abduction of the forefoot; L1 progressively decreases with increasing deformation, sometimes reaching 0°, but increases with correction of the posterior section; L2 - shows the severity of the equine position of the calcaneus; L3 - tend to zero as a result of treatment. The data obtained are presented in table 1.

Angular index	Normal	Treatment of children with a vertical talus					
		Before		After operation		After 6 years	
		1 gr.	2 gr.	1 gr.	2 gr.	1 gr.	2 gr.
AP1	+30°+50°	53.2	56.4	31.1	37.2*	30.8	49.5*
AP2	0°+20°	46.9	45.1	15.6*	18.5	13,4*	10.3*
L1	+25°+55°	2.2	2.5	45.1	39.2	33,4	19.2
L2	+10°+40°	-3.1	-7.7	19.9*	18.4	15,6	10.7
L3	0° -45°	55.4	76.2	-20.1	-11.5	-15.9	-9.5*

Table 1: Changes in the angular characteristics of the hind and middle sections of the feet in groups before treatment.

*P < 0,05; *: In relation to the initial indicator.*

The first group of patients (1 group) was treated using traditional techniques of open reduction of the talus. The second group of patients was divided into 2 subgroups (2A and 2B) because There were significant differences in radiological results. 2A - included patients

without genetic syndromes with clinical problems, only the presence of vertical talus (6 children-feet). 2B - children with vertical talus with proven genetic abnormalities or children with genetically not verified syndrome (Figure 1). A total radiographic evaluation of 164 radiographs of the feet was carried out before, during and after treatment, an average of 6.8 years after the initial surgical treatment.



A



B



C



D

Figure 1: The patient from group 2B, age 2 years, 1 month. The talus was reduced using the Dobbs method, open to the right, closed to the left. A- Radiography before treatment in direct and lateral projection with plantar flexion. Obviously the rigid vertical position of the talus. B- The same patient at 5 years old. X-ray in a direct standing and in a lateral projection with the maximum back and bottom flexion. The nucleus of ossification of the scaphoid bone appears in the anteroposterior hemisphere of the head of the talus with dorsiflexion. With plantar flexion, the complete centration of the scaphoid on the right and incomplete on the left. C- In addition, clinically, in addition to reducing the longitudinal arch and weakening of the triceps of the lower leg (walking poorly on the toes and poorly bouncing in place) against the background of generalized dysplasia of the connective tissue in the child and parents. D- One of the tests showing increased extensibility of connective tissue in the father and child.

Results

Long-term treatment results were evaluated in 23 children (76.7%). Duration of observation ranged from 1 year to 14 years on average 6.8 years.

To evaluate the results of treatment of patients and their comparison, we used the international scales of the American Society of Foot and Ankle Surgeons (AO FAS) for the hind and middle parts of the foot (Table 2).

Rating system	Patient groups		
	Arthrodesis	Soft-tissue release	Dobbs method
Midfoot Scale AO	51.3	56.2	82.9
	P < 0,05		
Hindfoot Scale AO	50.8	55.4	85.5
	P < 0,05		

Table 2: Long-term results of surgical treatment were studied in 23 children in the period from 1 to 14 years (average 6.8 years).

The angles AP1 and AP2 in both groups of children before the operation testified to pronounced abduction of the anterior part of the feet. And the angles L1, L2 and L3 before treatment characterized the severity of the pathology and the presence of “true” malformations of the talus with its vertical position. Against the background of observation after treatment, the angular indices of the lateral radiographs were better, but there was a violation of ossification with the development of osteoarthritis in the joints of the back and foot. Moreover, the angular characteristics of the lateral radiographs in the second group of observations were slightly worse, but without the manifestation of disturbances in the blood supply to the bones. The studied x-ray indices made it possible to evaluate the dynamics of foot changes during treatment of the vertical position of the talus in both observation groups.

Retrospectively, evaluating intraoperative radiographs, the main reason for the failure (2 feet recurred within a year against the background of verticalization), we consider the incomplete reduction of the talus with fixation with a knitting needle (Figure 2). Now, with doubts about the complete reduction in the scaphoid-navicular joint, we are making a medial incision and “from the eye” we are achieving complete correction.

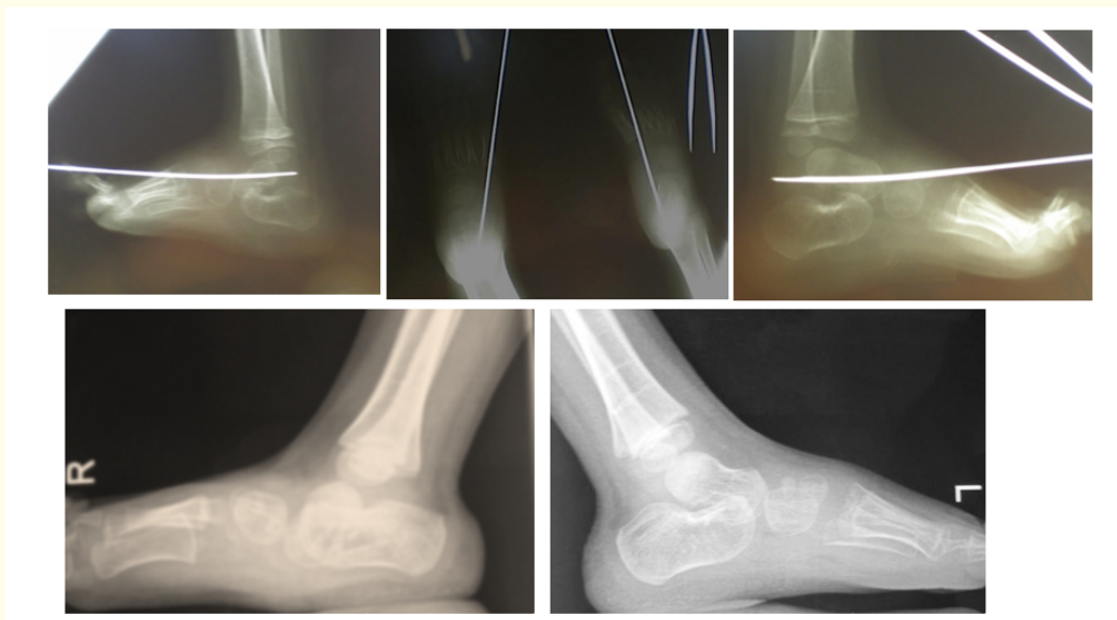


Figure 2: Patient 2 was treated with vertical talus in 2 years according to the Dobbs method. Intraoperative images with needles show that there is an incomplete correction of the right foot. A year later, there was a relapse of the vertical talus on the right.

When mastering the technique of M. Dobbs, the absence of a core of ossification of the scaphoid bone up to 4 - 5 years old prevented the reduction. But the orientation along the axis 1 of the metatarsal bone and the length of the nucleus of the ossification of the talus in the future made it possible to more correctly perform the technique of repositioning and fixing with the spoke. Full reduction of the idiopathic vertical talus in the form of a key into the lock and held by braces for up to 3 years allows it not to recur. In the presence of genetic syndromes and neuromuscular diseases with pathological tendon cravings against the background of growth, a loss of primary correction occurs. But flat feet with oblique taluses after treatment according to the Dobbs method are painless and mobile. The stops after an open

reduction, as a rule, with the worst rates for FAS JSC by an average of 28 points. In children with a partially relapsed position of the talus with the presence of syndromes, reaching the age of 5-6 years, the operation of arthroeresis gave good stable results, because it is convenient to operate on a larger anatomy and the degree of bone maturity allows you to act more reliably (Figure 3).



Figure 3: A- The vertical position of the talus. B. The position of the talus after surgery according to Kumar-Cowell-Ramsey at 3 years. C and D. Relapse to the level of oblique talus against the background of growth and genetically not verified syndrome at 6 years. X-ray signs of impaired blood supply to the bones of the hind and middle parts of the foot after performing perital releases. (Revealed the uplift of the hindfoot, a reduced block of the talus, a feature of the nucleus of the ossification of the head of the talus). E. The position of the talus after Grice's surgery 8 weeks before the needles are removed.

Discussion

In group 1 of children with open reposition of the talus by means of aggressive intervention on the soft tissues and bones of the foot, we see a more stable variant of correction, which is confirmed by the data of x-ray dynamics (Table 2). At the same time, we know about the peculiarities of blood supply to the talus, which do not allow the surgeon to work “freely and with impunity” in this area (Figure 4).

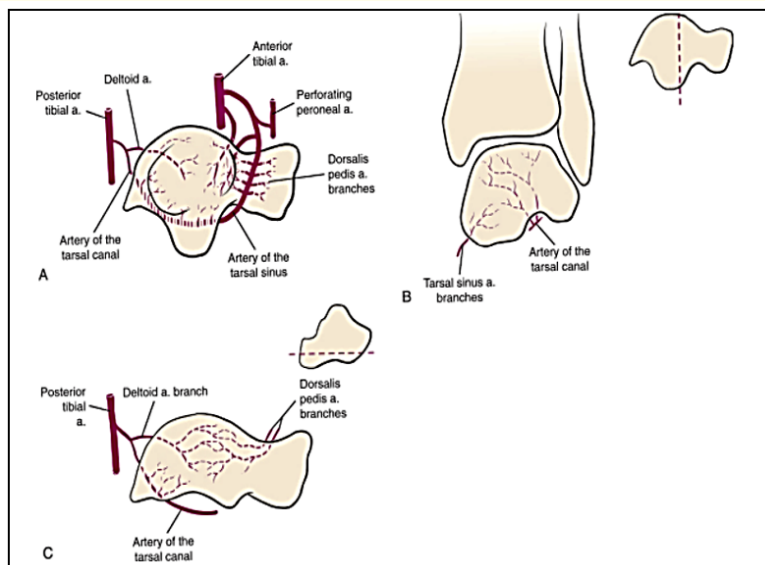


Figure 4: Features of blood supply to the talus. (Tachdjian's Pediatric Orthopedics: From the Texas Scottish Rite Hospital for Children: 5th Edition).

After open reduction of the talus in a long period, the radiographs reveal the consequences of a violation of blood supply, manifested by a decrease in the height of the talus block, subchondral osteosclerosis and marginal exophytes of the bones of the hind and midfoot after surgery. The available evaluation of the results of open operations according to the international scales of the American Society of Surgeons of the Foot and Ankle Joint (AO FAS) for the hind and middle parts of the foot indicates lower rates in comparison with patients treated according to the M. Dobbs method. It is also obvious that in the future with an increase in mass amid growth, indicators will only worsen. At the same time, the X-ray angular characteristics are close to normal and show more stable results against the background of growth compared with the results of treatment according to Dobbs. The introduction of the M. Dobbs method in the treatment of children with congenital vertical talus bone under the age of 3 years made it possible to initially avoid open reduction in 38 cases out of 41 (92.7%). Subsequently, against the background of growth, the detected correction loss in group 2B led to the need for repeated operations (Figure 3) in 3 children (4 feet) to the level of an oblique and vertical talus, which became an indication for repeated operation. We in domestic and foreign literature did not meet the data on the finished results of the treatment of vertical talus in children, apparently, in connection with the relative “youth” of the M. Dobbs method.

Moreover, there is a variety of techniques depending on the clinic and the availability of foreign literature on the primary correction of vertical talus in children. Many options for surgical techniques in the treatment of patients with vertical talus bone only emphasizes

the lack of a unified treatment system. In 50% of cases, this anomaly is associated with spinal, neuromuscular developmental abnormalities, defects and chromosomal syndromes, such as arthrogyposis, neurofibromatosis, myelodysplasia, etc. Moreover, the possibility and availability of typing syndromes in our country is very low. An orthopedist often treats a child with vertical talus without knowing the underlying diagnosis. Therefore, the child is a mystery. The orthopedist cannot answer the question about the persistence and prospects of the position of the feet of the child against the background of growth, which emphasizes the need for long-term observation and preventive long-term fixation of the feet in the correction position against the background of growth. Also, the rare occurrence of 1: 10000 defect leads to the fact that the diagnosis is not always, and therefore the treatment begins on time. In medium-sized cities of the Russian Federation, such children are born with a frequency of 1-4 per year; and not every orthopedic surgeon meets them on their labor path during their lifetime, which certainly leads to difficulties in diagnosis and treatment. At the same time, in group 2A we see a long-lasting persistent correction. These children have no restrictions in physical development, and with a bilateral defeat of "noticeable traces" of vice, an outside observer does not notice. They use regular shoes and attend physical education classes at school.

The works we met in domestic and foreign literature demonstrate immediate results, within a year, when the degree of bone ossification is not yet complete, and we cannot judge by the results of x-ray the presence of aseptic iatrogenic osteonecrosis. Which also emphasizes the need for a study of this group of patients in the long term.

Conclusion

Peculiarities of the blood supply to the talus lead to the fact that soft tissue releases around the latter and peritalar arthrotomies often lead to poor blood supply, which subsequently leads to deforming osteoarthritis. And he, in turn, with an increase in the mass of patients against the background of growth, is likely to lead to a decrease in the estimated indicators of quality of life. But this is not immediately revealed. the nuclei of ossification of the bones of the hind and middle parts of the foot have their own appearance dates. That is why the method of M. Dobbs, by analogy with the method of I. Ponseti with clubfoot, is of clinical interest. But the initially good results obtained require observation especially in children with genetic and neuromuscular diseases since loss of correction may lead to the need for additional operations. After treatment, children's feet after treatment continue to be monitored in this study, but it is now clear that the number of primary open adjustments of the talus has been sharply reduced, and the estimated performance of AO FAS has increased.

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