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EXPERIENCE IN CONSERVATIVE TREATMENT OF CLUBFOOT IN EARLY CHILDHOOD

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Abstract: Clubfoot remains one of the most common congenital deformities of the musculoskeletal system in pediatric orthopedics. This review analyzes the historical evolution, principles, and current strategies of conservative treatment for congenital clubfoot in young children. The study highlights the transition from ancient manipulative methods to modern evidence-based techniques such as the Ponseti method, which currently serves as the gold standard for children under three years of age. The review discusses functional, fixation, and mixed approaches, emphasizing their effectiveness, limitations, and indications depending on the degree of deformity. Special attention is paid to the challenges of treating severe and atypical forms of clubfoot and the role of combined orthopedic and physiotherapeutic management. The authors conclude that early intervention and gradual correction remain the key principles for achieving stable functional outcomes and preventing disability.
Keywords: clubfoot, conservative treatment, Ponseti method, Zatsepin method, functional therapy, early intervention, pediatric orthopedics.

ОПЫТ КОНСЕРВАТИВНОГО ЛЕЧЕНИЯ КОСОЛАПОСТИ У ДЕТЕЙ РАННЕГО ВОЗРАСТА

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Аннотация: Косолапость является одной из наиболее распространённых врождённых деформаций опорно-двигательного аппарата у детей. В обзоре рассматриваются исторические этапы, основные принципы и современные подходы к консервативному лечению врождённой косолапости у детей раннего возраста. Отмечен путь развития от мануальных методов, описанных Гиппократом, до современных методик, основанных на биомеханике стопы, таких как метод И. В. Понсети, который признан «золотым стандартом» лечения детей до трёх лет. Представлены функциональные, фиксационные и комбинированные методы лечения, их эффективность и ограничения при различных формах и степенях деформации. Особое внимание уделено лечению тяжёлых и атипичных форм косолапости, а также комплексной ортопедо-физиотерапевтической коррекции. Подчёркивается значение раннего начала лечения и поэтапной коррекции для достижения стойких функциональных результатов и профилактики инвалидизации.
Ключевые слова: косолапость, консервативное лечение, метод Понсети, метод Зацепиной, функциональная терапия, ранняя коррекция, детская ортопедия.

ERTA YOSHDAGI BOLALARDA OYOQ KAFTI DEFORMATSIYASINING KONSERVATIV DAVOLASH TAJRIBASI

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Annotatsiya: Tug‘ma oyoq kafti deformatsiyasi pediatrik ortopediya sohasida eng ko‘p uchraydigan patologiyalardan biridir. Ushbu maqolada tug‘ma oyoq kafti deformatsiyasini konservativ davolashning tarixiy rivojlanishi, asosiy tamoyillari va zamonaviy usullari tahlil qilinadi. Qadimiy qo‘l bilan bajariladigan usullardan tortib, bugungi kunda 3 yoshgacha bo‘lgan bolalarda “oltin standart” sifatida qabul qilingan Ponseti usuligacha bo‘lgan evolyutsiya yoritiladi. Maqolada funksional, fiksatsion va aralash usullar samaradorligi, ularning afzalliklari va cheklovlari ko‘rib chiqiladi. Ayniqsa og‘ir va noodatiy shakllarda kompleks ortopedik va fizioterapevtik yondashuvning ahamiyati ta’kidlanadi. Erta boshlangan bosqichma-bosqich davolash barqaror natijalarga erishish va nogironlikning oldini olishda muhim omil hisoblanadi.
Kalit so‘zlar: oyoq kafti deformatsiyasi, konservativ davolash, Ponseti usuli, Zatsepin usuli, funksional terapiya, erta davolash, bolalar ortopediyasi.

Introduction. Clubfoot is a common pathology in pediatric orthopedics. According to various authors, one to three children per thousand live births are born with congenital clubfoot [6]. Severe forms of clubfoot (typical forms as an isolated defect and atypical forms in combination with other defects) in the absence of treatment or an irrational choice of treatment lead to patient disability, severely impairing physical activity and work capacity. There are many methods of conservative and surgical treatment of clubfoot. The first descriptions of clubfoot were given by Hippocrates (400 BC), who already then emphasized two key points: early treatment and gradual correction of the foot to a position opposite to the deformity. He was the first to identify the need for hypercorrection and maintenance of the foot in this position to prevent recurrence. The next mention of repeated manipulations to "stretch" the foot refers to Arcaeus, who in 1658 wrote a treatise on the treatment of clubfoot [30]. In 1806, Timothy Sheldrake published his work "Curvature of the Legs and Feet in Children". Sheldrake used bandaging, like Hippocrates, and argued that early treatment is necessary and that it is imperative to fix the foot in the corrected position until the child began to walk [30]. In the mid-18th century, Cheselden treated clubfoot by staged redresses with maintenance of the achieved correction under plaster casts [30]. To this day, conservative treatment methods include: 1. Functional methods: a) corrective massage. The peculiarities of massage for congenital clubfoot include relaxation of the internal and posterior muscle groups of the lower leg, in which strong tension is observed. Stroking and shaking of the muscles are widely used. To strengthen the stretched and weakened anterior and lateral groups of the lower leg muscles, more vigorous techniques are used: rubbing and kneading, possibly light tapping with the fingers; b) therapeutic exercises. The purpose of therapeutic exercises is to gradually and gently correct the malposition of the foot by moving the foot in the direction opposite to the deformity. All exercises should be combined with massage, performed gently, so that the child does not feel pain [11]; c) functional splints. The functional splint of G.F. Feoktistov allows for the foot to be constantly held in the extension and pronation position and preserves the ability to move the ankle joint. However, the method is not effective in severe forms of clubfoot [7, 8, 18]; d) dynamic corrector with shape memory [9, 19]. A dynamic corrector with shape memory is a method for treating congenital clubfoot based on elastic materials and their resilience and damping function. The properties of a shape-memory alloy (titanium nickelide), its elasticity, and hysteresis behavior, which corresponds to living tissue, are utilized. This method is ineffective in severe cases and leads to impaired soft tissue nutrition [9, 19]. 2. Fixation methods:a) Kite's method (1930). The method involves gradually removing the edge of the plaster cast to correct the components of the deformity. Kite corrected each component of the deformity separately, rather than simultaneously. Although

Kite was a leading advocate of conservative treatment of clubfoot for many years and deserves praise for his attempts at non-surgical treatment of clubfoot, his method was lengthy and unsuccessful. Kite pointed out the need to correct the cavus and eliminate pronation of the foot and its harmful effects; correction of varus of the heel took him a very long time. He did not realize that the calcaneus can be abducted and rotated outward [25]. b) Flannel fixation (Fink-Oettingen bandaging). The bandaging method is based on the principle of gradual correction of all elements of clubfoot. Initially, adduction of the forefoot and the supination component are eliminated, and correction of the equinus component is left for subsequent stages of treatment. This method clearly depends on the severity of the deformation. The method works only for mild and moderate degrees of deformation, while for severe degrees the method becomes completely ineffective [17]; c) adhesive plaster fixation ("French" method for treating congenital clubfoot) [22]. The essence lies in daily manipulations and physiotherapy followed by soft fixation with special splints; in case of ineffectiveness, a posteromedial arthrolysis operation was performed at the age of 3-4 months, without opening the talocalcaneal joint. After the operation, conservative treatment was continued again; d) staged plaster fixation: the method of T.S. Zatsepin (1947), the method of IV Ponseti (2000), the method of I.Yu. Klychkova (2011). Having analyzed the functional anatomy of the foot, IV Ponseti proposed a new plastering technique that takes into account the biomechanics of the foot (feet). The method consists of three main stages: achieving correction, maintaining the achieved correction, and combating relapses. The earlier treatment is started, the more mobile the foot deformity is, and the faster its complete correction will occur. This method is the "gold standard" in the treatment of newborns and children up to three years of age, and in older groups as a stage in preparation for subsequent surgical treatment or as a final stage. According to the author himself, the effectiveness of the method is up to 94-96% [27, 28, 29]. Obviously, despite the relatively high percentage of positive results obtained by various researchers in the treatment of clubfoot using the Ponseti method, severe rigid and recurrent deformity in this disease poses a difficult task for the physician. The IV Ponseti method in its original version is impossible in the presence of valgus deformity of the knee joints (provocation of progression of deformity of the shins during the bracing stage) and bony coalition of the tarsal joints. Extension contracture of the knee joints and congenital "cone-shaped foot" greatly complicate treatment with the IV Ponseti method [28, 29]. T.S. Zatsepina's method:The staged plastering was carried out with the gradual elimination of adduction, varus and equinus components of the foot with the knee joint flexed to 150°. The degree of deformity correction in one stage did not exceed 10° for each component. The main feature of Zatsepin's method is the mechanical approach in the stages of plaster corrections, based on stretching the tissues in the direction opposite to the main deformity [10]. The method of I.Yu. Klychkova: the peculiarity of the method is that staged plaster corrections gradually normalize the relationships in the Lisfranc joint by bringing the first cuneiform bone to the level of the navicular. In the Chopart joint, the navicular bone rolls onto the head of the talus [34]. 3. Mixed In 1973, V.Ya. Vilensky proposed a method for the early treatment of congenital clubfoot. The essence of the technique lies in the combination of staged plastering and gymnastics elements. The method allows for targeted action on certain muscle groups of the lower leg, with passive movements of the foot in a closed plaster cast with free space (towards the correction of the deformity) created by removing the wedge-shaped pad. However, a fairly long-term (up to 2-3 years) treatment was required [4]. Physiotherapy: the standard treatment protocol is carried out 4 times a year: a) electrical stimulation of the short and long flexors of the toes of both feet, 10 sessions for each leg; b) electrical stimulation of the anterior and posterior tibial muscles, 10 sessions for each leg; c) hydrotherapy: hot wet wraps of the affected limb, irradiation with a Sollux lamp or a Minin lamp, ultrasound (phonophoresis) on the muscles of the lower leg of the affected leg; d) UHF electric field, amplipulse therapy, diadynamic therapy, microwave therapy, ultrasound, medicinal electrophoresis, electrical stimulation, mineral baths. Orthotics are used to maintain the achieved correction and are currently the only successful method of preventing relapse. Subsequently, the patient requires orthopedic footwear for a long time. Sanatorium and spa treatment. A type of therapeutic and preventive care for the population, which is based on the predominant use of natural healing factors (climate, mineral waters, therapeutic mud, sea bathing, etc.). The main resorts, serving mainly children, are

the Crimean coast (Evpatoria, resorts of the southern coast of Crimea), the Black Sea coast of the Caucasus (Anapa, Gelendzhik, Sochi, Gagra, New Athos, Batumi). Resorts such as Anapa and Yevpatoriya offer comprehensive treatments, including, in addition to natural healing factors, physiotherapy, dietary therapy, exercise therapy, and medication. Surgical treatment is also available. Failure of all conservative treatment methods is a direct indication for surgical treatment. Rigid deformity caused by various factors (previous treatments, foot stress in a malposition, systemic diseases, arthrogryposis) prevents overcorrection with conservative treatment.Surgical interventions for congenital clubfoot can be divided into several groups depending on the child's age, the form and severity of the foot deformity: interventions on soft tissues and on the bony structures of the foot, operations using external fixation devices. In 1823, Delpech performed subcutaneous transection of the Achilles tendon in two patients with acquired equinovarus foot deformity, but unfortunately, he experienced two serious complications and subsequently stopped using this type of surgical intervention. Many surgeons of the time retained a negative attitude towards achillotomy. However, Stromeyer continued to perform these operations. In 1831, he performed subcutaneous achillotomy in several patients without signs of inflammation [30]. W.J. Little, a young British surgeon, had acquired equinovarus foot deformity as a result of poliomyelitis. He visited Stromeyer in Hanover, who successfully operated on him. In addition, Stromeyer taught Little how to perform this operation and allowed him to operate on several patients who came to his clinic. Little then actively began practicing achillotomy [30]. Rodgers in 1834 and Dixon in 1835 were the first to use subcutaneous achillotomy in the United States [30]. In 1866, Adams was the first to draw attention to the erroneousness of achillotomy as the first step in the treatment of foot deformities. To understand the structure of the foot in clubfoot, Adams performed autopsies on several stillborn children with clubfoot and published the results. His work was the first to describe the microscopic structure of the muscles in clubfoot. It was shown that in clubfoot there were no pathological changes, either macroscopically or microscopically. He also studied the skeletal system and found that the only bone in which visible changes were observed was the talus, which was curved medially. This occurs due to the incorrect position of the calcaneus and navicular bones. His further study of the structure of the articular surfaces only confirmed this assumption [30]. The main type of surgical intervention on the soft tissues of the foot is the Codivilla method (1905) [16], which includes dissection of the plantar anoneurosis, the abductor hallucis muscle, lengthening the tendons of the anterior and posterior tibialis muscles, the long flexor of the fingers, the long flexor of the hallucis longus, opening the first metatarsocuneiform, cuneonavicular, Chopart, talocalcaneal and tibiotalar joints, as well as subcutaneous tenotomy of the Achilles tendon [16]. In 1939, T.S. Zatsepin proposed an operation that became a turning point in the radical surgical treatment of congenital clubfoot. This type of surgical intervention has found the widest use and is performed through two approaches [10]. In 1951, V.A. Shturm published his method for treating severe forms of congenital clubfoot in children and called it tenoligamentocapsulotomy [21]. Complementing the operation of T.S.With the opening of the talonavicular and cuneonavicular joints, the surgical approach to the treatment of congenital clubfoot continued to improve in the second half of the 20th century [21]. In 1960, Loeffler described a surgical technique that was significantly different from all previously proposed operations. Through a small incision along the medial contour, he lengthened the tendon of the posterior tibial muscle and transcutaneously dissected the plantar aponeurosis. Through a longitudinal approach along the posterior surface, he lengthened the Achilles tendon and performed a trial translation of the foot into the corrected position. If the correction was insufficient, he dissected the capsule of the ankle joint and subtalar joint. In the absence of repositioning of the head of the talus, a complete release of the talus was performed through an additional dorsal approach [16]. P.F. Moroz (1966) proposed an operation, calling it ligamentocapsulotomy. In this operation, the incision is made along the medial surface to the lower third of the leg behind the medial malleolus, bends around it from below and reaches along the dorsal surface of the foot to the talonavicular joint. The posterior tibial muscle and the long flexor of the fingers are lengthened in a Z-shape, the ligamentous-capsular apparatus of the ankle joint is dissected along the entire medial surface. The capsular-ligamentous apparatus of the talonavicular joint is also dissected and the talus is aligned with the navicular bone [17]. A new type of operation

was proposed by J. Slavik (1967). The surgical technique is based on the principle of decompression of the talus, which occurs due to pressure from the Achilles tendon and plantar aponeurosis. The essence of the operation consists of cutting off the attachment site of the Achilles tendon and plantar aponeurosis and shifting it more towards the lateral contour. If this was unsuccessful, a Z-shaped lengthening of the plantar aponeurosis was performed. In addition, the tendon of the posterior tibial muscle and the flexor hallucis longus were lengthened, and a complete release of the talus was performed [32]. V. Turco (1979) proposed another type of surgical treatment, which involved a complete release of the ankle and subtalar joints through a medial approach, lengthening of the posterior tibial tendon, and an open Z-shaped lengthening of the Achilles tendon. Next, the talus and navicular bones were repositioned and fixed with a Kirschner wire [31]. All these types of surgical treatment have recognized significant disadvantages, such as the risk of avascular necrosis of the talus, stiffness of the foot joints, a lack of skin to close the wound surface, or the development of planovalgus deformity [12, 13, 23, 24, 26]. Since the late 1960s, transosseous osteosynthesis techniques have been used in the treatment of patients with congenital clubfoot [1, 2, 3, 5, 20]. The choice of treatment tactics is determined by the severity of the deformity, the disruption of joint relationships, and the patient's age. Despite the pathogenetic validity of the transosseous osteosynthesis method,Negative aspects are also noted in the form of various complications (inflammation of soft tissues, cutting through the skin around the pins, cutting through the calcaneus by the pins, subluxation in the Lisfranc joint, contracture of the toes, hypercorrection of the foot) [1, 5, 20]. As for bone plastic interventions, the most widely used operations were those proposed by M.I. Kuslik (1931), which were used both independently and as a supplement after the operation according to T.S. Zatsepin [14]. Many authors supplemented the operation according to T.S. Zatsepin with osteotomy of the navicular bone with the introduction of a bone graft into the resulting defect [14]. By now, many different modifications of bone operations have accumulated, up to and including astragalectomy in severe cases of clubfoot [13]. Operations on bone structures are in some cases an option of choice, especially in severe forms of clubfoot and in older children [7, 13]. There is a general worldwide trend toward achieving maximum results through minimally invasive methods. All modifications of releases should be of interest only from a historical perspective. Conservative treatment of clubfoot is the generally accepted standard for young children. When choosing a conservative treatment method, priority should be given to the most effective methods that take into account the biomechanics of the feet. Currently, this is the Ponseti method, which has demonstrated high efficacy in children under 3 years of age, and in older patients, as a preparatory stage for subsequent surgical treatment or as a final step. In older patients, the rigidity of the deformity, caused by various factors (previous treatment, foot loading in a vicious position), does not allow for hypercorrection using the original method. Therefore, we have developed, implemented, and approved a medical technology called "Treatment of typical and atypical forms of clubfoot in children during the first years of life" (registration certificate FS 2011-233). In cases of severe rigid varus, forefoot adduction, and significant equinus deformity in children over three years of age, correction with an external fixator is performed. In our opinion, hardware treatment is certainly and completely effective in relieving the stiff deformity, but it is safer to manually gradually adjust the foot to a hypercorrected position to prevent damage to the hyaline cartilage and the development of deforming arthrosis of the foot joints. In cases of rigid forefoot adduction and moderate (within 10 degrees) varus of the calcaneus without equinus, a corrective wedge osteotomy of the tarsal bones is performed. In cases of bony coalition of the subtalar joint in a vicious varus position, a longitudinal osteotomy of the calcaneus is performed, restoring the vertical axis of the talocalcaneal trochlea.In cases of isolated residual forefoot adduction, we perform peroneus brevis tendon transposition. This review demonstrates the need for a differentiated approach and treatment algorithm for clubfoot depending on age, type, and severity.

Conclusion. The management of congenital clubfoot in early childhood requires an individualized, stage-based approach that balances conservative and surgical techniques according to the severity, rigidity, and age of the patient. Historical evolution—from Hippocrates' manipulations to the Ponseti method—has demonstrated that early, gradual, and biomechanically sound correction yields the most stable results and minimizes disability. Conservative treatment

remains the global standard for infants and young children, with the Ponseti method achieving up to 96% effectiveness when applied correctly and early. Nevertheless, rigid, recurrent, or atypical deformities often necessitate a combination of conservative and surgical measures. The use of external fixation devices, wedge osteotomies, or tendon transpositions allows correction of severe residual deformities while preserving foot function. Modern trends favor minimally invasive techniques, hypercorrection prevention, and long-term maintenance through orthotics and rehabilitation programs. Ultimately, success in treating clubfoot depends on early diagnosis, adherence to biomechanical principles, staged correction, and continuous follow-up to prevent relapse. A differentiated therapeutic strategy—guided by age, deformity pattern, and anatomical features—provides optimal outcomes and ensures full functional recovery of the child's locomotor system.

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