

Clubfoot (congenital talipes equinovarus)

Congenital talipes equinovarus (*clubfoot*, *CTEV*) is the most common non-positional congenital defect of the leg (1:1000) and the second most common developmental defect in orthopedics (after DDH).

It can be a postural (fully conservatively correctable) or structural defect.

Famous personalities with this defect included, for example, the Roman Emperor Claudius, the poet George Gordon Byron or the Nazi propaganda minister Joseph Goebbels.

- boys are more often affected (2:1), in ½ cases the defect is bilateral
- in 10% associated with other birth defects (DDH, hernia, meningomyelocele)
- the main factor in the creation and maintenance of this deformity is the pull of the *tibialis posterior* muscle, longer medial subluxation in the Chopart joint and shortening of the Achilles tendon.

Characteristic

- equinus position in the ankle joint (falk of the tip of the foot plantarly)
- heel varus (the heel is turned inwards when viewed from the back - heel bone supination)
- excavation (arching of the middle part of the foot)
- inversion of the forefoot (caused by a combination of adduction and supination of the forefoot) - i.e. the front part of the foot deviates from the longitudinal axis of the foot in the direction of the thumb and is placed on the outer edge
- medial subluxation in the talonavicular joint
- internal torsion of the tibia (can only be a consequence)



clinical picture of congenital talipes equinovarus

Etiology

It is multifactorial, the etiology is not exactly known, there are several theories:

1. **theory of neuromuscular defect** - striated muscle defect / intrauterine lesion of the peroneus nerve
2. **mechanical theory** - arrest of talus development during arrest of leg rotation during intrauterine development
3. **theory of primary bone dysplasia** - congenitally defective shape of the talus

Structural *clubfoot* also occurs in connection with Edwards syndrome, oligohydramnios, congenital constriction band syndrome or spina bifida cystica

Pathogenesis

- due to the predominance of the muscles on the medial side of the foot (main pull of the *tibialis posterior* muscle), the leg twists into a cone-shaped deformation, the foot steps on the outer edge, calluses or ulcerations form in places of non-physiological stress, as well as early arthrosis of the leg joints
- susceptibility to relapse

Pathological - anatomical findings

- **talus** - head with neck curled plantarly and medially, sinus tarsi laterally,
- **os naviculare** - medially dislocated,
- **calcaneus** - front part curled medially,
- **fibula** - dorsally dislocated,
- **Achilles tendon** - shortened.

Clinical picture

- foot in plantar flexion
- heel smaller, varus and pulled up towards the outer ankle, the outer ankle is further back and protrudes on the medial side in the area of the heel a deep skin groove
- on the medial side in the area of the heel a deep skin groove
- forefoot in adduction and supination, varus and equinus
- Achilles tendon shortened and strained
- calf hypotrophy, shorter flat leg
- in most cases there is no difference in limb lengths

Classification (Lehman and Tachdjian)

1. **position type CTEV**
2. **right - rigid CTEV type**
3. **resistant rigid type**, associated with other congenital defects or arthrogryposis
 - positional CTEV is quickly corrected after exercise, but untreated it can turn into a rigid form
 - rigid CTEV is always indicated for operative solution

X-ray examination

In the lateral and dorsoplantar projection, we evaluate 3 angles:

- **Kite's angle** (dorsoplantar TC angle) – the angle between the longitudinal axis of the calcaneus and talus, norm: $> 20^\circ$, CTEVP: calcaneus and talus axes almost parallel
- **angle between the axis of the talus and the longitudinal axis of the 1st metatarsal** – norm: $< 20^\circ$, CTEV: $> 20^\circ$
- **talocalcaneal angle** (lateral TC angle) – evaluated in lateral projection, norm: $> 35^\circ$, increases in dorsiflexion (with eversion of the calcaneus), decreases in plantiflexion (with inversion of the calcaneus), CTEV: 15° , decreases in dorsiflexion, in the plantar increases
- **talocalcaneal index** – sum of TC angles in both projections, values less than 40° – incomplete healing

Therapy

- with the aim of creating a shapely and functionally normal leg
- inform parents that the leg will almost always remain shorter and the calf weaker, that healing lasts from birth to adolescence
- treatment must be carried out carefully to avoid bone damage (risk of osteonecrosis)

Conservative therapy

It goes hand in hand with surgical treatment, simple conservative treatment is sufficient for positional CTEV therapy. The essence is the release of muscle and ligament contractures and the achievement of dislocation reposition in the talonaviculocuneiform joint (however, this is impossible with the right CTEV).

- immediately after detecting the defect: **corrective** exercises, untying, corrective plaster bandages (for small children and rigid forms we change them every week, for older children we leave them for 14 days / we make sensing splints made of plastic, they reach from the toes to the groin in $70-90^\circ$ flexion of the knee joint, we correct all 3 components of the deformity)
- after the correction part of the treatment, the retention treatment begins (retention plaster bandages, laminate splints, **Denisov-Brown splints** - shoes without a toe with a connecting pole)
- **Kite's conservative therapy** – he corrected each component separately and sequentially (forefoot adduction \rightarrow heel varus \rightarrow foot equinus)
- **Ponseti's conservative therapy** (1996) – correction of all components of the deformity at the same time (correction of forefoot adduction, lateral subtalar derotation and inversion correction), achieving correction with less than 10 changes of straightening plaster casts, to overcome equinosity adds subcutaneous Achilles tendon tenotomy, after putting aside *Denisov plaster cast - Brown splint* up to 6 years of age

Operative therapy

- it usually starts around 6 - 8 months of the child's age
- the so-called path of small steps / one-time complete correction
- only the first operation has any hope of success

Surgery on soft parts (tendons, joint capsules, ligaments)

- we lengthen **the tendons** in different ways (Achilles tendon (Z-cut), tibialis post. muscle tendon, flexor hallucis lg., flexor digitorum lg.) or transpose (e.g. tibialis anterior muscle tendon from attachment to 1st metatarsus on the outside of the dorsum of the foot)
- we cross **joint capsules** (medial and dorsal capsulotomy, e.g. talonavicular joint, naviculocuneiform joint, talocrural joint) plantar aponeurosis or ligaments connecting the individual bones of the tarsus

Skeleton surgery

We operate on the skeleton later (at least after the 3rd year, but more likely after the 6th year of age).

- **calcaneal osteotomy** (to correct varus)
- **forefoot osteotomy** (to correct forefoot adduction)
- **arthrodesis** (e.g. triple subtalar arthrodesis as a definitive solution to residual CTEV deformities after treatment) - at least after 12, preferably after 15 years of age

Complete performances

- **Turco procedure** – posteromedial release of all mentioned joints, lengthening of the Achilles tendon, tendons of the flexors of the fingers and big toe, release / lengthening of the tendon of the tibialis posterior muscle, at the same time we release all interskeletal ligaments, place the leg in the correct position and secure it by transfixing the K-wire from the foot through the calcaneus, and with the other we fix the shuttle bone with the talus and metatarsals, fix the whole thing with a plaster bandage for at least 12 weeks, after 6 weeks we replaster, remove sutures and transfixion, in the 4th month we allow full weight bearing in modeled shoes
- **McKay operation** – more radical and complex, suitable for up to 3 years of age, it is a plantar (complete subtalar) release - from a wide circular surgical approach, after dissection of the suralis nerve and nerve-vascular bundle behind the inner ankle, we completely release the talus and calcaneus so that they could rotate the talus against the calcaneus and secure it in the correct position with K-wire, the next procedure is the same (plastering and corrective shoes)

Links

Related articles

- Congenital limb defects
- Developmental hip dysplasia
- Arthrogryposis multiplex congenita
- Diastrophic dwarfism
- Developmental hip dysplasia
- Congenital developmental defects

References

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- Wikipedia. *Club foot* [online]. ©2004. The last revision 2009, [cit. 2009-10-15]. <https://en.wikipedia.org/wiki/Club_foot>.

External links

- Achilleus, z.s (<http://achilleus.cz/>). patientská organizace, sdružuje rodiče a dospělé s vrozenou vadou
- Ponseti metoda (<http://ponseti.cz/>). odborné stránky věnující se podrobně VVV pes equinovarus, provozuje Achilleus z.s.
- MedlinePlus Medical Encyclopedia (<https://medlineplus.gov/ency/article/001228.htm>)
- eMedicine, Orthopedic Surgery (<https://emedicine.medscape.com/article/1237077-overview>)
- Clubfoot.co.uk (<http://clubfoot.co.uk/>)