

CLUB FOOT/ CTEV

DR JAGANNATHA SAHOO, MBBS, DNB(PMR), DNB(ORTHO)

Congenital talipes equinovarus describes a deformity noted at the birth and includes idiopathic as well as non-idiopathic talipes equinovarus. In non idiopathic group it is a manifestation of a systemic skeletal syndrome; the associated skeletal anomalies are due to the same etiological factor that caused failure of the normal development as in:

- 1) From muscle imbalance e.g. neuromuscular disorders.
- 2) From fibrosis of soft tissue as in Arthrogyphosis
- 3) From bone and joint anomalies.

Theories to explain

Idiopathic CTEV

1. Mechanical pressure in utero e.g.: Oligohydraminos
2. Neuromuscular defect
 - Spina bifida
 - Weak peroneal muscles
3. Germ cell defect
4. Intrauterine arrest of the growth.
5. Hereditary.
6. Multifactorial.

Non-idiopathic causes:

- Arthrogyphosis
- Nail patella syndrome
- Streeter syndrome
- Muscular dystrophy
- Myelomeningocele, Spina bifida, Spinal cord defects

EPIDEMIOLOGY

- 1 in 1000 birth

- M: F: 2.5:1
- 50% Bilateral
- 20 - 30 times common if one child affected
- 1 - 4% if one parent affected
- 15 - 20% if both parents affected
- 32% in case of monozygotic twins
- 3% in case of dizygotic twins.

Pathological Anatomy:

The clubfoot deformity is due to the abnormal relationship of the tarsal bones: the navicular and calcaneus are displaced around the tarsus. Correction of this abnormal tarsal relationship is resisted by pathological contracture of the associated softer parts. The severity of the deformity depends on the degree of displacement, whereas the resistance to the treatment is determined by the rigidity of the soft tissue structures. Two laws used for understanding are:

Wolf's law: every change in the use of the static function of the bone causes a change in the internal form as well as the architecture and also the external form and function according to mathematical law.

Davis law: When ligaments and soft tissue in lax state they will shorten.

Components of the deformity.

1. **Equinus** - At the ankle joint plantar flexion of the forefoot.
2. **Varus** - primary at sub talar joint but entire tarsus rotated except talus.
3. **Adduction** - talonavicular and tarso metatarsal joint
4. **Cavus**- forefoot plantar flexion.

Anatomical region wise involvement:

Posterior contracture: Tend Achilles, Tibiotalar capsule, talo calcaneal capsule, posterior talo fibular ligament, calcaneo fibulas ligament. These structures resist equinus correction.

Medial: Most important and most resistant structures Tibialis posterior, deltoid, talonavicular capsule and spring ligament.

Subtalar: Talo calcaneal interosseous ligament, bifurcated Y ligament.

Plantar contractures: Abductor Hallucis, intrinsic flexors, quadratus plantae, plantar aponeurosis.

Clinical Examination

- Smaller stubby feet with shortened first metatarsal ray.
- Equinus deformity with inversion of the heel, adduction and varus of the fore foot.
- Medial border of the foot is concave and elevated, its plantar surface face up ward.
- Lateral border of the foot is convex and depressed down.
- The posterior tuberosity of the heel is upwards, difficult to palpate and less visible.
- Callosity on the dorsal aspect of the fifth metatarsal.
- Bony prominence visible and palpable over the dorsolateral aspect of the foot represents the head and neck of the talus which are partially uncovered by the navicular



X-rays:

1 Simulated weight bearing A-P view

- Tibio calcaneal angle normal range 20-40 degrees, abnormal if less than 20 degrees.
- Talo 1st metatarsal angle.

2. Lateral film in maximum dorsiflexion:

- Talocalcaneal angle normal range 25-50 degrees, abnormal if less than 25 degrees.

- Tibio calcaneal angle normal range 5-15 degrees, abnormal if less than 5 degrees or negative.

Kites view: AP view with foot flexed 30 degrees and tube angled 30 degree anteriorly in sagittal plane. Importance of x-ray on follow-up - Clinically the heel varus may appear to be corrected because manipulation may have displaced the heel pad laterally, but x-ray will demonstrate an abnormal tarsal relationship between talus and calcaneus confirming whether one is dealing with spurious correction.

MANAGEMENT OF CTEV:

Aims:

- To correct the deformity early
- To correct the deformity fully
- Hold the correction until growth stops.

Non-operative treatment:

- Manipulation and serial casting
- Stretching and adhesive strapping
- Dennis - Browne splinting.

Manipulation and serial casting:

- Should begin in nursery ideally
- Manipulation before the cast application is most important part of nonoperative treatment. The objective is to stretch the soft tissue contracture, the plaster of paris cast serves to maintain the correction obtained by manipulation.

Method of Casting:

a. **Kites** - Each component of deformity corrected in the sequence. Kite believed that heel varus would correct simply by everting the heel.

b. **Ponsetti** - All component of the deformity must be corrected simultaneously, not in the sequence except for equinus, which should be corrected last. The cavus, which arises from the pronation of the forefoot in relation to the hind foot is corrected by supinating the fore

foot in proper alignment with the hind foot. With the arch well molded, the entire foot can be gently and gradually abducted under the talus, which is secured against rotation, in the ankle mortise by applying counter pressure with thumb against the lateral part of the talus. Heel varus will get corrected when the entire foot is entirely abducted. Finally equinus is corrected by dorsiflexing the foot, which can be facilitated by simple percutaneous tenotomy of the tend Achilles. Well molded plaster cast applied after manipulation is complete.

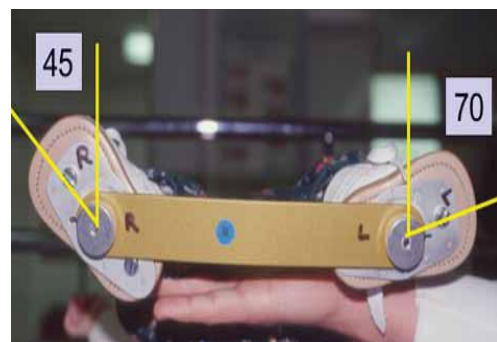
Frequency of cast change – ideally weekly but practically done fortnightly.

On reassessment

A. If completely corrected: Maintain in maximally corrected position for total of 6-8 months, after 6- 8 months Dennis Browne bar with attached tarso pronator shoe for 24 hrs checked at routine intervals for recurrence, mother also taught to look for heel cord shortening. Once walking age attained only tarso pronator shoe with the Dennis Browne splint at night. Night time splinting continued till 7 years of age. CTEV shoes used in day time.

B. Partially corrected or no correction – observed for further 3 months with manipulation and casting. If no correction, static deformity may require surgery at 10 months.

Denis Browne Splint - A dynamic splint in which the kicking movement of each leg exerts a corrective force on the counter part.



Relapsed foot - The deformity recurred after Fair correction.

Resistant foot- foot is considered resistant when the deformity shows no evidences of further improvement with manipulation the radiograph and the X rays confirming the persistence of equinovarus deformity.

OPERATIVE MANAGEMENT

Indications:

- When a plateau has been reached in non operative treatment.
- The child is old enough for the anatomy of foot to be recognized usually by ten months.

Complete Subtalar release:

A. Incision:

- L shaped or hockey stick.
- Transverse circumferential (Mc Kay's, Cincinnati).
- Two incision technique of Carroll: Curvilinear medial incision and a posterolateral incision.
- Hemicincinnati incision

B: Identify and isolate the **neurovascular bundle** and the sural nerve. Take care to preserve the medial calcaneal branch of the posterior tibial nerve.

C. **Identify and expose** Tibialis Posterior, FDL, FHL, tendoachilles.

D. **Transect the master knot of Henry**- which is hypertrophied thickening of the tendon sheaths of long toe flexors functioning as suspensory ligament that holds FDL & FHL close to the plantar surface of the navicular. Excision is necessary to completely mobilize the navicular and permit transection of the spring ligament.

E. **Posterior release:** Done first as it facilitates the exposure of medial plantar and subtalar contractures.

i. Tendo - Achilles lengthening:

- Z lengthening in the sagittal plane

- Detaching medial half of the insertion on calcaneum thereby eliminating the inversion force of the T.A.
- Lengthen enough to permit immobilization at 90 degrees.

- ii. Capsulotomy of the tibio-talar joint.
- iii. Capsulotomy of the tibio-calcaneal joint.
- iv. Transection of the posterior talofibular ligament.
- v. Transection of the calcaneofibular ligament.
- vi. Posterior portion of the deltoid ligament

F. Medial Plantar Release:

- i. Lengthening of Tibialis posterior.
- ii. Division of FHL, FDL.
- iii. Transection of superficial Deltoid & spring ligament.
- iv. Cutting the talonavicular capsule
- v. Mobilization of navicular.
- vi. Capsulotomy of subtalar joint.

G. Subtalar Release

- Division of talocalcaneointerosseous ligament: limited to the amount necessary to unlock calcaneum
- Y ligament bifurcated

After 3 weeks POP cast & stitches removed. Foot is remanipulated & POP cast will be applied for another one month.

Potential Complications:

- Infection and wound breakdown
- AVN of talus
- Overcorrection

Residual deformity: Must ensure that there is no neurologic cause. The residual deformity may be:

- a. Dynamic - If unable to actively evert the foot. Consider SPLATT (Split ant. Tibialis transfer).
- b. Fixed - Look for the uncorrected component and treat accordingly.

1 Metatarsus adductus – after 5 year MT osteotomy

2 Hind foot varus:

< 2-3 year

- Repeat soft tissue procedure preferably complete subtalar release (McKay's)

3-10 year

- Dwyer's procedure - later closed wedge or medial open edge osteotomy of calcaneum.
- For long lateral column Cuboid decancellation
- Litchblau's procedure: lateral close wedge osteotomy of calcaneum or cuboid enucleation.

3 Equinus:

- TA lengthening with posterior Capsulectomy of ankle, Subtalar joint.
- Lambrunidi's triple arthrodesis.

4. All three deformities severe, resistant: Triple arthrodesis

Use of Joshi's External Stabilizing System/ UMEX / ILLIZAROVE in CTEV

Principle - Controlled differential distraction

Main indications:

- Dropout of conservative treatment
- Recurrence after earlier surgical release.
- Known resistant cases like AMC, streeter's syndrome
- Late presentation for treatment
- Adjunct to soft tissue, surgical procedure for realignment of skeleton to minimize bone resection and shortening of the foot.

Cure of CTEV: The CTEV deformity is considered cured when there is no deformity, passive movement to full calcaneovalgus. The child is able to evert and dorsiflex the foot voluntarily to about the right angle.

Follow up and success of treatment by a particular method is audited by using **Pirani's classification** whose scoring is based on:

- The curvature of lateral border
- Severity of the medial crease
- Severity of the posterior crease
- Palpation of the lateral part of the head of the talus
- Emptiness of the heel.
- Rigidity of Equinus.