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METHODICAL INSTRUCTION OF PRACTICAL EMPLOYMENT ON A THEME: «CONGENITAL TALIPES EQUINOVARUS (CTEV). CONGENITAL TORTICOLLIS (WRYNECK)»

Actually of theme: Congenital talipes equinovarus (CTEV) was described as early as the time of Hippocrates. 4 cases per 1000 live births among whites. A slight male predominance may exist, with a male-to-female ratio of 2-3:1, may be bilateral in up to 50%;

If untreated or incompletely treated, clubfoot causes an abnormal gait, and stress changes may occur on the lateral (fibular) side of the foot due to preferential weight bearing. a periosteal reaction, sclerosis, or fracture of the lateral metatarsals may occur as a result of abnormal weight bearing on this side of the foot in cases of inadequate correction of forefoot varus. Persistent hindfoot misalignment, pes cavus, overcorrection of forefoot varus, persistent forefoot varus, and stress fractures of the lateral metatarsals may occur in a previously treated clubfoot. Hindfoot misalignment is almost always corrected if the patient undergoes surgical repair. Stress fractures are an uncommon complication of inadequately treated feet with persistent forefoot varus, which is the most common indication for repeat surgery.

Congenital torticollis (wryneck). Congenital muscular torticollis has far-reaching effects on the craniofacial growth and development of the spine.

If uncorrected, as the child grows, the face on the side affected may stay "flattened", so that facial asymmetry is common. This is reversible if the torticollis is corrected before age 1. Beyond that, some facial asymmetry may remain permanent. There is a 20% incidence of hip dysplasia in children with muscular torticollis. So it is important that your doctor does an ultrasound exam of the hips in the first 4 to 6 weeks of life to rule that out.

General purpose: to be able to diagnose independently clinical diagnose congenital talipes equinovarus (CTEV), congenital torticollis (wryneck), to conduct differential diagnostics with similar diseases and syndromes. To appoint medical treatment depending on the age of patient and degree of deformities, to determine the prognosis.

The educational purposes

A=1 (The first level of mastering)

To familiarize with a clinical congenital talipes equinovarus, congenital torticollis. To know about principles of modern diagnostics, treatment and preventive abnormal development low extremity and the spine, skull.

A=2 (The second level of mastering)

To know clinical and radiological features congenital talipes equinovarus, congenital muscular torticollis. Know the normal growth of the foot, theories of etiology of congenital diseases. Pathophysiology, complications of these diseases. To master methods of conservative treatment in new-born (to 2 months), in toddler 2-6, 6-10 months, children, older than 1 year, know and be able correction manipulation of the deformities of foot (redressment) and bandaging Finku-Etingeru, plaster casting procedure, to define indications and ways of surgical treatment of these diseases.

A=3 (The third level of mastering)

To be able to carry out the differential diagnosis congenital talipes equinovarus, congenital muscular torticollis (CMT) with other conditions (other deformations of foot, acquired and osteal wryneck). To know clinical differential signs. To be able to interprete roentgenograms of children with congenital talipes equinovarus and osteal (bone) wryneck in various age groups, the measurement deformations used to evaluate the relationship of the bones foots. Capable of ultrasound evaluation sternocleidomastoid muscle at congenital muscular torticollis in new-born. To choose tactics treatment which depending on age and degree of non development tissues.

To be able to make redressment of the foot by means of maneuver and plaster casting procedure at the CTEV, stretching exercises to stretch the contracted sternomastoid muscle, massage at the CMT and used fixation. To define indications to surgical treatment of diseases in various age groups.

A=4 (The fourth level of mastering)

On the basis of a clinical material and use of sources of the basic and additional literature to know pathological change are observed in CTEV, CMT and the severity varies according to the stages of the diseases. To know substantiation clinical signs of deformities CTEV, CMT in infants, childhood and adolescents, the radiographic features abnormal growth of the foot. To know treatment regimen, performing monitoring treatment in various age groups. Causes of early and long-term complications of diseases and wrong treatment. To know the method of their prophylaxis and medical treatment.

Interdisciplinary integration:

Subject (discipline)	To know	To be able
1) Preliminary (normal anatomy, operative anatomy, topographical anatomy, histology, clinical biochemistry, patophysiology radiology, neurology).	1) Anatomical constitution of the ankle and foot regions in infants, childhood and adolescents, the secondary centre of ossification, anatomy of the neck. 2) Periods of normal development of the foot. What causes developmental CTEV, CMT? Position of the baby in the uterus, breech presentations. Embryologic, natal, and postnatal factors. 3) Structures of the ankle and foot joints, a place an attachment ligaments, their role in stabilization of a joints. What motions are possible in an ankle joint, talus-calcanus joint, the Shopara and Lisfranca joints? Which ligament strengthen the ankle joint and other joints of foot? 4) Muscles, their function and a role in deformities. Muscle forces acting across the ankle. 5) Anatomy-topographical features of neck region and around the ankle and foot joints. A substantiation rational operative procedures (access). 6) Features of blood, nerves supply of foot. 7) Reparative regeneration of bony soft tissues around the ankle and foot.	To defined radiographic features abnormal growth of the foot and dislocation in joints on the basis of radiological data. Roentgenologic anatomy of bones foot. Pathophysiology abnormal growth of the bones of foot. Diagnostic imaging technique of ultrasound. An examination of the gait (biomechanics of walking-phases), in normal walking - rhytmic cycles. Access to vessels and nerves of foot. Results of laboratory investigations
The following (which provided)	1) Terms immobilization in various age groups so that the foot can develop normally. 2) Preventive of possible complications of redressment and immobilization in the plaster cast and ways of their prevention	To defined symptoms of deformities of foot. Specific terms are used to better describe the deformities of foot. To know rules of application of POP casts and complications in childers.
Intrasubject integration (themes of the given discipline with which it is integrated).	1) Indication and methods of conservative medical treatment (medications, physical therapy, manipulations, immobilization. 2) Indication and choice of methods surgical treatment	1) To measure of active and passive motions in the ankle joint and neck. 2) To measure of the lengths of lower limbs, cause of changes. 3) To carry out medical immobilization of lower in the plaster in children. To know rules of application of bracing (device).

The plan and organizational structure of employment.

Basic stages of employment and their functions	Educational purposes in levels of mastering (memorizing)	Quality monitoring and training	Materials of methodical support (maintenance)	Hour, minute
1. Preparatory stage				
1. Organization of employment 2. Definition of the educational purposes and motivation 3. The control of an initial level of knowledge, skills	The teaching and educational purposes of employment before group of students are established	Opening speech of the teacher The written control, express-questioning.	Methodical instruction Test tasks	2-3 3-5 10
2. Basic stage				
Forming of professional abilities and skills. To seize knowledge of diagnostic algorithm of congenital talipes equinovarus, congenital torticollis in various age groups. To receive skill of conducting of orthopaedic inspection of infants, childhood and adolescents with CTEV and CMT. Clinical: symptoms deformities of foot, neck in CTEV and CMT. To know indications and ways of conservative and operative treatment of these diseases, complication: a) To pay attention to the theories of etiology of congenital diseases. Pathophysiology of abnormal development of the foot sternomastoid muscle. To define change of tissues of lower extremity and sternomastoid muscle at survey and palpation. b) To be able to measure relative and anatomic length of a segment c) To be able to interpret roentgenograms of the foot in infants, childhood and adolescents. The relation between the bony points of foot, angles. d) Formations of the diagnosis. e) Treatment: substantiation of methods of treatment, the indication and ways of surgical treatment, principles of rehabilitation.		Inspection of patients (infants, childhood and adolescents), theoretical interviews. Studying of roentgenograms in an educational room. Discussion	Thematical patients, reference cards. Roentgenograms, tables, pictures, structural-logical charts, video materials. Educational rooms, structural departments, clinics.	30 20 30
3. Final stage				
5. For examination on an investigated theme it is recommended to solve situational tasks		Thematic situational tasks, independent work, discussion.	Educational room	20
6. Summarizing (theoretical, practical, organizational estimation) 7. Task home work		Individual analysis of control practical skills. Concluding remarks of the teacher	Educational room Results of inspection reports, protocols,reference card for independent work with literature Recommended literature	10

1) Materials of the control over maintenance of a preparatory stage of employment

Questions, task, tests etc.

A=1

1. The ankle and foot region.
2. Structure of the foot joints. Sternomastoid muscle.
3. Muscles around joints: function.

A=2

1. Place an attachment ligaments, muscles their anatomic and functional role. Muscle forces acting on the ankle and foot.
2. Normal development of the foot. Sternomastoid muscle.
3. Structures of the ankle and foot joints.

A=3

1. The foot in various age groups. Normal development of the foot in various natally periods. Muscles around of the ankle and foot joints, which depending on character deformities. Sternomastoid muscle of the neck.
2. Functional features structures around ankle and foot joints and their role in maintenance of function of the joints.
3. Structure. Anatomy-topographical features ankle and foot. Tibiocalcaneal, talocalcaneal angle.

A=4

1. Normal development of the foot in various natally periods.
2. To measure of active and passive motions in the anckle joint, of the lengths of lower limbs
3. Materials of maintenance of self-preparation of students.
4. Control questions. The written control (levels of mastering of a material).

A=1

Specific terms are used to better describe the conditions.
Etiology
Clinical inspection
Principle of treatment

A=2

Theories of etiology, pathophysiology.
Clinical features of the CTEV and CMT.
Radiographic features of congenital diseases.
Medical treatment of patients in various age groups. (conservative and operatively).

A=3

To carry out differential diagnostics CTEV and CMT with other deformations of foot, acquired and osteal wryneck. To proved tactics of treatment patients in various age groups.
To proved tactics of conservative treatment CTEV and CMT in depending on degree of non development tissues. Principle of redressment and terms immobilization extremity. Indications to operative treatment, their principles.

A=4

Techniques and methods of to reduce the deformations of foot and used fixation and preventive of possible complications.
Anatomical predisposition recurrent equinovarus deformity of inadequately treated, gypocorrection after serial closed reduction when the child is older than 6 months. Preventive of possible complications and ways of their prevention. Radiology and ultrasonographic monitoring treatment, CT scan.

2) Materials of the control over maintenance basic stage of employment.

Roentgenograms
Thematical patients
Measuring tape
Skin marking pencil
Goniometer

3) Materials of the control over maintenance final stage of employment.

Situational tests and tasks, roentgenograms.

Task 1.

1. To define the methods of complex medical treatment of congenital defects of development beginning with the period of neonatal taking into account age, degree of deformation, concomitant diseases.
2. To capture practical skills of correction of deformation and methods of fixation of the attained correction.
3. To know testimonies to surgical medical treatment and his principles.
4. To capture differential diagnostics of CTEV, CMT with similar diseases.
5. To familiarize with possible errors, complications in default of medical treatment or during its wrong conduction.

Task 2.

On the base of study of literature from the theme of employment give in written form the answers for such questions:

1. What is the congenital torticollis disease?
2. What signs of congenital torticollis is seen at inspection and palpation of new-born?
3. The conditioned origin of this abnormal development?
4. What signs of congenital torticollis is seen at inspection, palpation, functional inspection of the children from 2-3 years?
5. What excellent clinical signs:
   a) cervical ribs
   b) syndrome Shprengelya
   c) syndrome Clippel-Feylya?

6. Which age the correcting gymnastics is appointed in at torticollis and who conducts it?
7. What methods of fixing of head are applied in congenital torticollis after correction taking into account the age-old features?
8. What position the head is fixed in congenital torticollis:
   a) right side;
   b) left-side;
   c) both side
9. What age conservative medical treatment for torticollis are conducted?
10. What the essence of surgical medical treatment of congenital torticollis?
11. What methods of fixing and medical treatment are used after surgical intervention?
12. What complications arises at inefficient medical treatment or its absence?
13. What basic elements of deformation of foot at a typical CTEV? Describe essence of every element.
14. What changes take place in the ankle joint and each of elements of deformation?
15. What excellent clinical signs:
   a) the adducted foot;
   b) artrogriposis deformations;
   c) paralytic deformation of foot?
16. What age the correcting gymnastics in CTEV begins from? What sequence of correcting manipulations? Who conducts it with what periodicity?
17. What method of fixing of foot at correction of CTEV from 1 month (sketch a chart)?
18 Who conducts correction of CTEV at children (older than 1 month, what method of fixing is used with what periodicity?
19. Which existing testimony and in what age are proposed to surgical medical treatment, if to take into account that only a 25% CTEV is fully cured by conservative methods?
20. What principle of surgical intervention at a CTEV? What anatomic structures the manipulations are executed on? Their essence and purpose.
21. What features of shoe must be after conservative or surgical medical treatment of CTEV?
22. What complications, except for septic, can arise up after surgical medical treatment of CTEV?
23. What anatomico-biomehanical changes of lower extremities arises at patients with a CTEV, that did not treat oneself?

Program of independent work of students. for practical work.

1. To capture practical skills of inspection of children with CTEV.
2. To conduct differential diagnostics.
3. Taking into account age, anatomical and physiological features of patient, to the degree of deformations to draw up a plan of medical treatment.
4. To capture practical skills of orthopaedic correction of Congenital Torticollis and CTEV and facilities of their fixing.

Execution sequence:

1. During collection of anamnesis to pay attention to heredity, course of pregnancy and labour, preceding diagnostic and medical measures.
2. Review: features of step, new-born position on bed. Symmetry of facial and cerebral skull, positions of head relatively shoulders, contours of neck, identical of length and heights of location shoulder; form of thorax, feature of its structure, axial deformations of lower extremities, form of leg and feet, expressed of physiology curvatures of spine and level of location of scapula. Study of shoe: features of design and wear.
3. Palpation: to define tone of muscles of neck on either side - at rest, at movement of head, to expose limitation of motions, presence of unusual bone educations, compression of soft tissues. palpation of scapula, to define their level of location, distance from the line of processus spinosus of vertebrae. During deformation of foot to define the degree of deformation, features of the loaded surface. Dorsiflexion, plumbline, scratch test
4. Interpretation of roengenograms, MRI , sonograms.
5. Differential diagnostics and guess (tentative), provisional, final diagnosis.
6. Planning of medical treatment.

Show the clinical and rentgenological data, diagnosis, method of medical treatment to the teacher and participation in the discussion of theme of practical work in a group.

Task 4.

For verification of the capturing your program of practical employment decide such tasks:

The contents of employment.

CONGENITAL TALIPES EQUINOVARUS (CTEV)

FOOT

One may pride in having flat foot, agile foot, nimble foot, but look at the tale of woes a club-foot presents to the unfortunate victim affected with this malady!

Interesting features of CTEV

Talipes It is a Latin word derived from Talus = ankle, pes = foot

Original meaning :A deformity that causes the patient to walk on the ankle.

Club-foot It is so called because severe untreated talipes equinovarus has a club-like appearance.

This is the most common congenital foot disorder. Incidence is 1.2/1000 live births.

Sex: Males are more commonly affected than females.

CTEV	ATEV
1 Present since birth 2 May be associated with spina bifida 3 Bilateral 4 Skin, subcutaneous tissue, muscles are normal 5 Transverse crease is seen across the sole on the medial side 6 Bones are normal in thickness	1 Not present from birth 2 May be due to polio, cerebral palsy, etc. 3 Usually unilateral 4 Trophic changes in the skin, muscles are flaccid (LMN lesion) or spastic (UMN lesion) 5 No transverse crease 6. Bones are thinner than normal

Types of CTEV (Aetiology)

1	**Osseous type**	Club-foot is associated with absence of tibia and fibula.
2	**Muscular type**	Arthrogryposis multiplex congenita or multiple congenital contractures.
3	**Neuropathic type**	Due to spina bifida, etc.
4	**Idiopathic type**	No apparent cause, commonest variety.

Idiopathic CTEV This is the most common type of CTEV one encounters in clinical practice. There is no apparent cause and various theories are proposed (Table).

Pathology

The pathology in CTEV affects all the bones and joints of the foot with corresponding soft tissue contractures especially of the posteromedial structures. The primary pathology may be in the surrounding soft tissues which brings about secondary changes in the bones. Articular malalignments are fixed by contracted joint capsules, ligaments, and contracted foot and ankle tendons. But sometimes the primary problem usually lies in the bones with secondary soft tissue contractures.

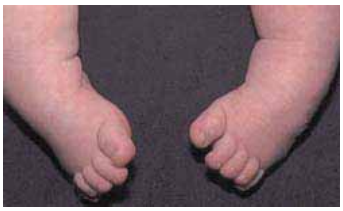
Table 20.8 shows the bony changes and also the structures involved in the posteromedial aspect of the ankle and foot in a case of CTEV. All these contracted soft tissue should be released during surgery to bring back the bones to normal alignment.

Table. Theories of CTEV (see Fig .)

Theories	What do they say?
1. Turco's	Medial displacement of navicular and calcaneus around the talus
2. Brockman't	Congenital atresia of the talonavicular joint
3. McKay's	Three-dimensional bony deformity of the subtalar complex
4. Intrauterine	Due to compression by malposition of foetus *in utero*
5. Genetic	General population 1:800 • In siblings 1:35 • In identical twins 1:3
6. Germ plasm theory	Primary germ plasm defect in talus with subsequent soft tissue changes.
7. Soft tissue theory	Primary soft tissue defect with secondary bony changes
8. Prenatal muscle imbalance theory	Weak pronators and overacting extensors and inverters

Clinical Features

The diagnosis is fairly simple and straightforward. *Five classical primary deformities are seen and in response to this, secondary deformities develop. This primary and secondary deformities together form the clubfoot complex.* A detailed examination of the foot is necessary to detect the full spectrum of deformities in CTEV.



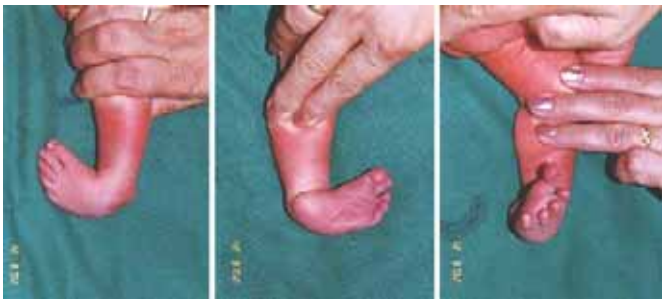


Fig. Spectrum of deformities CTEV

With advancing age, the cosmetically unsightly clubfoot (Fig.) starts posing functional problems like altered gait (stumbling gait) (Fig.), callosities, degeneration and arthritic changes in the ankle and foot joints. Correction is a must to restore normalcy.

Club-foot Complex

Primary deformities
1. Equinus
2. Varus
3. Cavus
4. Forefoot adduction
5. Internal tibial torsion

Late changes
1. Degeneration of joints
2. Fusion of joints

Secondary deformities
1. Foot size is decreased to 50%
2. Medial border is concave, lateral border is convex
3. Forefoot is plantarflexed upon hindfoot
4. Skin is stretched over the dorsum of the foot
5. Callosities are present over the dorsum of the foot
6. Stumbling gait
7. Hypertrophic anterior tibial artery
8. Atrophy of muscles in anterior or . posterior compartments of the leg

Repetition. **The three classic signs of clubfoot are:**
1. Fixed plantar flexion (equinus) of the ankle, characterized by the drawn up position of the heel and inability to bring to foot to a plantigrade (flat) standing position. This is caused by a tight achilles tendon.
2. Supination (inversion or turning) in of the hindfoot and forefoot
3. Adduction (turning under) of the forefoot

Fig. Signs of clubfoot. Equinus of the ankle (of hindfoot): heel is inverted (varus), talus lies in a position of equinus, medial rotation (in the ankle mortise); Supination (varus, inversion) or turning in of midfoot; Adduction (turning under) of the forefoot: forefoot and midfoot are inverted and adducted - forefoot cavus, fixed forefoot supination relative to the hindfoot (forefoot varus).

Fig. Signs of clubfoot. Midfoot: no midtarsal mobility; medial or transverse midfoot crease (indicates more severe deformity) curved lateral foot border or turning in of midfoot

Table : Bony changes in CTEV

Bones and joints (bony)

- **Calcaneus** is in varus position
- **Talus** dispiaced medial and plantarwards
- **Navicular** medially displaced and rotated
- **Cuboid** displaced medially and articulates with the non-articular surface of the calcaneus **(known as cuboid sign or locked cuboid)**
- **Metatarsals** deviates medially at tarsometatarsal joints
- **Tatocalcaneal articulation** is a ball and socket joint. The anterior and middle articulation of the calcaneum forms the socket and the head of the talus forms the bad which is dislocation in CTEV
- **Tibia** usually shows medial torsion, rarely lateral torsion. *In short all the above bones ate displaced down and media. In a case of CTEV*

– ***Muscle shortening is present, tendons and ligament contractures:***
Muscles, capsules, ligaments (soft tissues) **(See Figs A to C)**

Structures contracted on the medial side (3)

Rule of 3

3 Muscles	**3 Ligament**	**3 Capsules of subtalar**
▪ AHL ▪ TP ▪ FHL	▪ Deltoid ▪ Spring *(calcaneonavicular)* ▪ Plantar	▪ Tarsal ▪ Tarsometatarsal joints
Plantar aponeurosis-causing a cavus deformity of foot;		

Structures contracted on the posterior side (2)

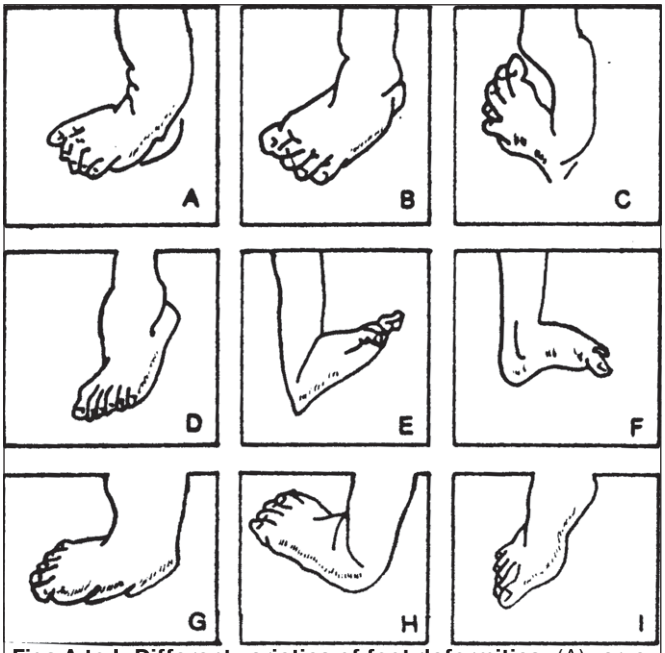
Rule of 2

2 Muscles	**2 Ligament**	**2 Capsules**
▪ Tibialis posterior ▪ Tendoachilles	▪ Talofibular ▪ Calcaneofibular	▪ Ankle joint ▪ Subtalar joint

Structures involved on the anterior side (1)

Rule of 1

1 Muscle	**1 Ligament**	**3 Capsules**
▪ Tibialis anterior ▪ Inserted	▪ Superior peroneal Retinacula	▪ Calcaneocuboid joint
Note. **AHL** → Abductor halluds longus, **TP** → Tibialis posterior, **FHL** → Flexor hallucis longus		



Figs A to I: Different varieties of foot deformities: (A) varus, (B) equinovarus, (C) calcaneovarus, (D) equinus, (E) calcaneus, (F) cavus, (G) valgus, (H) calcaneovalgus, and (I) equinovalgus

In other varieties of CTEV, clinical features peculiar to the aetiological factors can be elicited.

Fig. : Club-foot

Three clinical tests are of extreme importance in CTEV and are described below:

Dorsiflexion test In a newborn child it is possible to dorsiflex the foot till its dorsal surface comes in contact with the anterior surface of the tibia. This is not possible in CTEV and this can be used as a screening test (Fig.).

Fig. Dorsiflexion test in a newborn

Plumbline test This test helps to detect the tibial torsion. The child is made to sit on a table with both the lower limbs hanging from the edge. A line drawn from the centre of the patella to the the tibial tubercle when extended down, should cut the foot at the first or second intermetatarsal space normally. This is called the plumbline. In CTEV with medial rotation of the tibia it cuts the fourth or fifth intermetatarsal space and vice versa in lateral rotation of the tibia (Fig.).

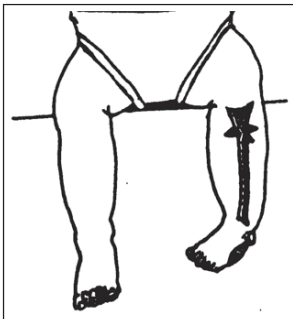


Fig. : Plumbline test

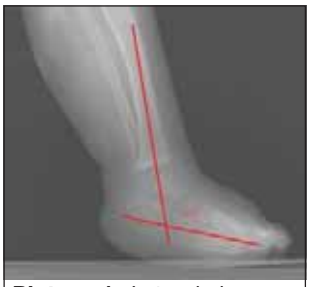
Scratch teat This test is perfomed to detect muscle imbalance in an infant who cannot obey commands.

- ***Medial scratch test*** In a normal child when the medial sole is scratched, the foot everts. This tests the peroneals.
- ***Lateral scratch test*** Here when the lateral sole is scratched the child inverts the foot. This tests the invertors.

Investigation

Radiography is by far the most important investigation. It helps to know the exact angles of each deformity seen clinically in CTEV. *X-ray views* are to be taken with feet in the stabilisation frames. *AP view* is to be taken with tibia absolutely vertical. *Lateral view* is the stress dorsiflexion view. In children of older age group; anterioposterior and lateral standing radiographics are preferred.

Apart from giving the accurate estimate of the angle of the deformities, radiology helps in confirmation of the correction of the deformities by various treatment modalities.

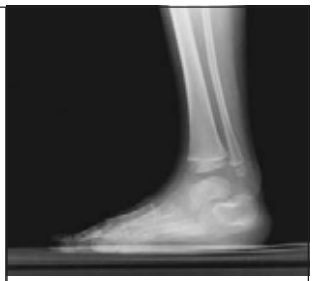


Picture 1. Lateral view an abnormally elevated tibiocalcaneal angle. A normal angle is 60-90°.

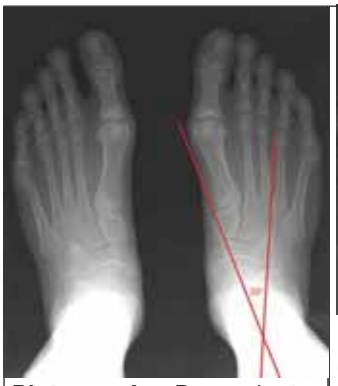
Hindfoot equinus is plantar flexion of the anterior calcaneus (similar to a horse's hoof) such that the angle between the long axis of the tibia and the long axis of the calcaneus (tibio-calcaneal angle) is greater than 90° (see Image 1).

In hindfoot varus, the talus is assumed to be fixed relative to the tibia. The calcaneus is considered to rotate around the talus into a varus (toward midline) position. On the lateral view, the angle between the long axis of the talus and the long axis of the calcaneus (talocalcaneal angle) is less than 25°, and the 2 bones are more nearly parallel than in the normal condition (see Images 2-3). On the DP view, the talocalcaneal angle is less than 15°, and the 2 bones appear to overlap more than normal. Also, the longitudinal axis through the middle of the talus (midtalar line) passes lateral to the base of the first metatarsal, because the forefoot is medially deviated (see Images 4-5).

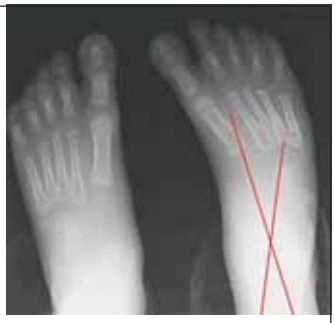
Picture 2. Normal lateral view shows the measurement of the talocalcaneal angle. The calcaneal long axis is drawn along the plantar surface. The normal range is 25-45°. Note the normal overlap of the metatarsals on the lateral view.



Picture 3. Lateral view of clubfoot shows the nearly parallel talus and calcaneus, with a talocalcaneal angle of less than 25°.



Picture 4. Dorsoplantar projection of a healthy foot shows that the line through the long axis of the talus passes just medial to the base of the first metatarsal. The talocalcaneal angle measurement is shown. The normal range is 15-40°.



Picture 5. Dorsoplantar views obtained in a patient with unilateral clubfoot show that the talus and calcaneus are more overlapped than in the normal condition. The talocalcaneal angle is 15° or less. Note that the line through the long axis of the talus passes lateral to the first metatarsal due to the varus position of the forefoot.

Forefoot varus and supination increase the convergence of the bases of the metatarsals on the DP view, compared with the normal slight convergence (see Image 6). On the lateral view, instead of having the normal overlapped appearance, the metatarsals are arranged in a ladder like configuration, with the first being most dorsal (see Image 7). The following table contains a summary of the normal and clubfoot measurements:

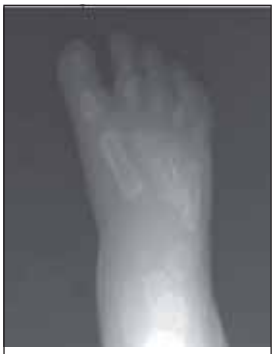


Image 6

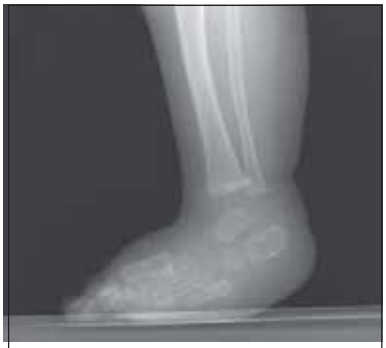


Image 7

Measurement	Normal Foot	Clubfoot
Tibiocalcaneal angle	60-90° on lateral view	>90° (hindfoot equinus) on lateral view
Talocalcaneal angle	25-45° on lateral view, 15-40° on DP view	<25° (hindfoot varus) on lateral view, <15° (hindfoot varus) on DP view
Metatarsal convergence	Slight on lateral view, slight on DP view	None (forefoot supination) on lateral view, increased (forefoot supination) on DP view

Ultrasonographic findings in normal feet or clubfeet. The main disadvantage of ultrasonography is the inability of the beam to penetrate all of the bones, particularly if a postoperative scar is present. Advantages of ultrasonography include the lack of ionizing radiation, no need for sedation, its ability to depict nonossified portions of bones, and its capacity for dynamic imaging.

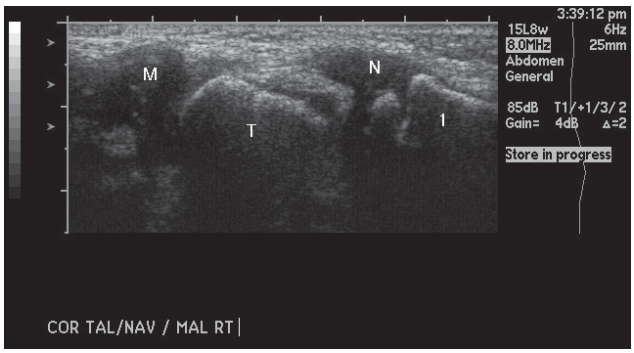


Fig. Clubfoot. Sonogram of the medial aspect of a normal foot illustrates the relationships between the cartilaginous medial malleolus (M), ossified talus (T), and nonossified navicular (N). The first metatarsal (1) is also ossified.

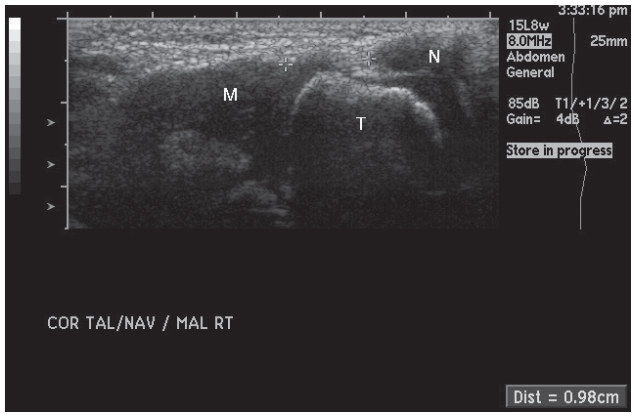


Fig. The distance between the medial malleolus (M) and navicular (N) can be reproducibly measured in a dynamic range of motion. Here, it is shown in the neutral position in the normal foot.

Management

Broadly speaking CTEV can be managed by three methods.

1. Conservative management
2. Surgical management
3. Treatment as early as possible (shortly after birth).

Conservative management It is the treatment of choice in infants less than 6 months of age. When the child is ***3 days -6 weeks***

Serial correction manipulation of the deformities (redressment) and bandaging Finku-Etingeru (each time before *breastfeeding* – 6 time per day) is continued until the deformity is either corrected. Manipulation by mother is usually sufficient. Maintained through exercise.Then the orthopaedic shoes until the child has started school.

Remember

Clinical tests in CTEV

- **Scratch test**
- **Dorsiflexion test**
- **Plumbline test**

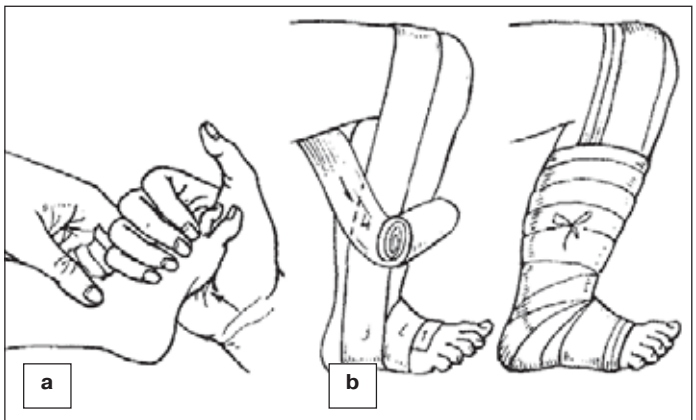


Fig. Correction manipulation and bandaging Finku-Etingeru

6 weeks – 6 months *of life* Weekly serial manipulation of the deformities (redressment) and above knee casting for the first 6 weeks of life. Later, it is done every fortnightly till correction is achieved. Course of treatment-5-10 plaster casting (see order and stage of correction of deformity (redressment).

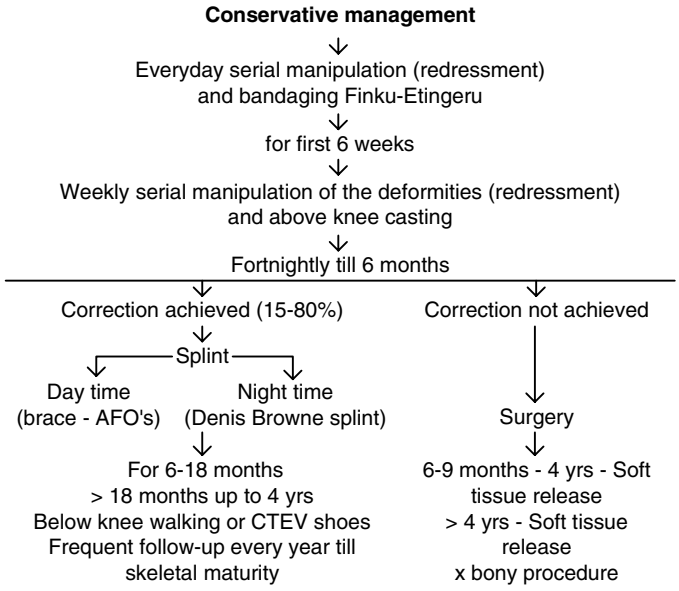
Success rate of serial manipulation (redressment) and plaster casting ranges from 15 to 80%. Sometimes – the Achilles' tendon will be lengthened after the tenotomy, thereby reducing or elminating the equinus of the ankle. Percutaneous (through the skin) heel cord lengthening tenotomy is used to augment the casting – the foot is placed in a long leg cast for three weeks. This procedure is often done in the office with a very quick (3-4 second) cut of the heelcord (achilles tendon).

If correction is achieved in first 6 months of age. Brace (Ankle-foot orthoses (AFO's), is used during day time and Dennis Browne splint (special orthopaedic device) during the night time from 6 to 18 months to prevent recurrence.

After 18 months, below knee walking calipers are given up to 4 years of age. From 4 years to skeletal maturity regular follow-up is advised.

Fig. Dennis Browne splint

Fig. Ankle-foot orthoses



Remember order of correction of deformity (redressment)

The mnemonic ADVERB helps to remember the order of correction.

AD **Forefoot adduction is corrected first**
V **Correction of heel varus next**
E **Lastly correction of hindfoot equinus**
RB **This order is followed to prevent "Rocker Bottom Foot" which develops if foot is dorsiflexed through hindfoot rather than midfoot.**

Surgical management

Surgery is usually performed when the child is about 6-9 months old. NOT ossified all bone foot. Until secondary bony changes developing over years.

Indications (5 R's)

- **R**esponse not obtained to conservative treatment after 6 months.
- **R**igid club-foot (means *forefoot deformities are corrected but hind-foot deformities remain uncorrected after conservative treatment)*.
- **R**elapsed club-foot (means deformities are corrected initially, but relapse later, either partial or total).
- **R**ecurrent club-foot (it is type of relapse, the cause being muscle imbalance which was overlooked initially).
- **R**esistant club-foot (totally resistent to correction).

Surgical Methods

Soft tissue procedures are advocated for children less than 4 years. Soft tissue releases that release the tight tendons/ ligament around the joints and result in lengthening of the tendons. For mild CTEV with no severe internal rotation deformity of calcaneus, a one-stage posteromedial release of TURCO is preferred.

STRUCTURES RELEASED INTURCO'S PROCEDURE (POSTEROMEDIAL RELEASE)

1. On the posterior side
   a. Z-plasty of tendoachilles to lenghten it (Fig.).
   b. Posterior capsulotomy of the ankle and subtalar joints.
   c. Release of posterior talofibular and calcaneo-fibular ligaments.
2. One the medial side
   a. Lengthening of the tibialis posterior, flexor hallucis longus and flexor digitorum longus muscle.
   b. Release of talonavicular ligament spring ligament and the superficial part of deltoid ligament.
   c. Release of interosseous talocalcaneal ligament, capsules of naciculocuneiform and first meta-tarso-cuneiform joints.
3. On the plantar side
   a. Plantar fascia.
   b. Release of abductor hallucis and flexor digitorum brevis.

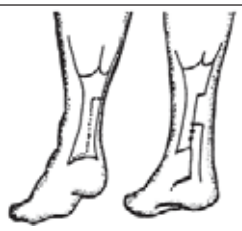


Fig. : Tendo-Achilles lengthening by Z-plasty for club-foot

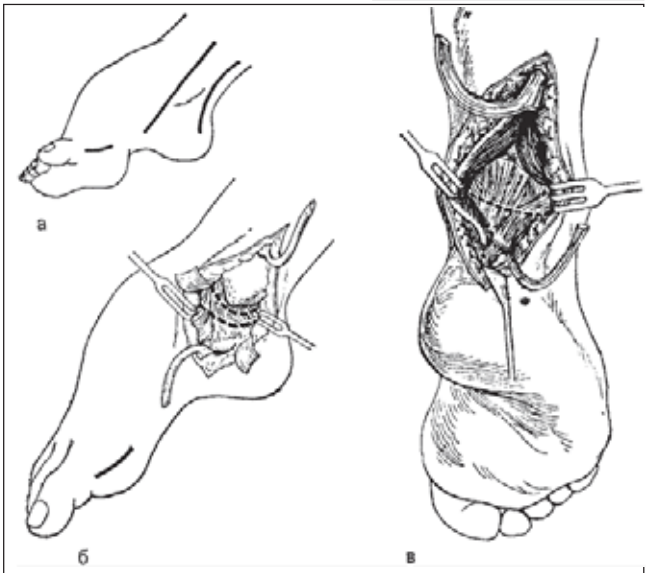


Fig. : Soft tissue releases procedure.

For severe deformities with severe internal rotation of calcaneum—a one-stage modified Mc-Kay procedure of both posteromedial and posterolateral release is preferred.

Postoperative regimen

The corrections articular positions is are typically held in place by inserting small pins, which are removed in the office approximately 4-6 weeks after surgery. The corrections articular positions is are typically held in place by inserting small pins, which are removed in the office approximately 4-6 weeks after surgery. The casting may be followed by full-time or nighttime use of brace for varying periods of time.

Bony procedures These are added to the soft tissue procedures after 4 years of age. Dwyer's lateral closed wedge osteotomy (Fig.) helps correct the varus deformity, Evan's and Davis operations also helps to correct varus in slightly older child. Triple arthodesis is recommended after skeletal maturity.

Surgeries for uncorrected club-foot In older children and adolescents

Triple arthrodesis (Fig.) Indicated for children more than 10 years. It is functionally and cosmetically, superior. Lateral closed wedge osteotomy through subtalar and midtarsal joints is done to fuse all the three joints of the foot namely the subtalar, talonavicular and calcaneuloid joints.

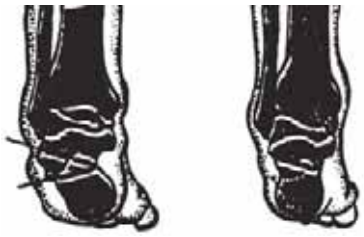


Fig. : Dwyer's lateral closed wedge osteotomy

Surgery for recurrent club-foot (recurrence is due to muscle imbalance, here peroneals are weak and invertors are strong).

Garceaus method Transfer of tibialis anterior to middle cuneiform bone.

Modified Garceaus method Transfer of tibialis anterior to base of fifth metatarsal bone.

Surgery for correction of tibial torsion in club-foot (Sell's criteria) more than 15° torsion should be corrected by denotation osteotomy. Otherwise all deformities will recur due to the pressure of the caliper on the lateral border of the foot.

Caliper is used after the correction to maintain the correction of deformities obtained either by conservative or surgical measures.

Remember

Three I's for relapse

- **I**mproper and inadequate conservative treatment and also surgical release of contracted structures
- **I**mbalance of foot muscles if left uncorrected
- **I**nternal torsion of tibia if overlooked

QUICK FACTS

Do you know how does a CTEV shoe differ from a ordinary shoe?

1. **It has a straight inner border which helps prevent forefoot adduction**
2. **It has an outer shoe raise and this helps prevent foot-inversior**
3. **There is no heel and this helps prevent equinus.**

Treatment plan of CTEV

3 days – 6 weeks	Redressment and bandaging Finku-Etingeru (each time before *breastfeeding* – 6 time per day)
6 weeks – 6 months	Weekly redressment and above knee casting Later, it is done every fortnightly till correction is achieved. 5-10 plaster recasting
6 to 12 months (Turco's)	Cincinnati's incision is used Structures released are: **Medial** ▪ TP/AHL/FHL/FDL muscles ▪ Capsules of ST/Tarsal/TM joints Ligaments—deltoid/plantar/spring ligs **Posterior** Tendo-Achilles lengthening by Z-plasty (Fig.) Posteapsulotomy of the ankle and subtalar joints Calcaneoflbular ligs **Subtalar ligaments** talocalcaneal lig. interosseous lig. bifurcated Y-lig. **Postoperative regimen** ▪ Change cast at 2 weeks ▪ Remove K-wire at 6 weeks ▪ Long leg cast till 3 months ▪ Brace or ankle foot orthoses for 6 to 9 months
12 to 36 months (Mckay's)	Cincinnati's incision All the structures on the posteromedial side are released as in Turco. In addition lateral structures released are ▪ Superior peroneal retinaculum ▪ Inferior external retinaculum ▪ Dorsal calcaneocuboid lig. ▪ Origin of extensor digitorum brevis muscle
1–5 years (Grey area)	Treatment guidelines unclear
Older child (untreated or treated with partial or total relapse)	1. **Metatarsus adductus** > 5 years metatarsal osteotomy. 2. **Hind-foot varus** > 2-3 yrs modified Mckay's procedure. **3-10 yrs** **Dwyer's** lateral closed wedge osteotomy of calcaneus is done. **Dillwyn Evan's** procedure-resection and arthrodesis of calcaneocuboid joint. **Davis procedure** wedge resection from the midtarsal area. **10-12 yrs of age** Triple arthrodesis. 3. **Equinus** Mild-Tendo-Achilles lengthening and posteapsulotomy of ankle and subtalar joints is done. Sever-Lambrunidi's triple arthrodesis is done. 4. **All three deformities are present** over ten years triple arthrodesis is done.

Note: TP → Tibialis posterior; AHL → abductor hallucis longus; FHL → flexor hallucis longus; FDL → flexor digitorum longus

RETENTION OF CTEV CORRECTION

Whatever may be the methods of correction of CTEV whether conservative, surgical or by external fixators, retentions of the corrected deformities should be done by one of the following methods to prevent relapse:

a. Denis Browne splint—used usually during the day time.
b. Brace—used mainly in the night
c. Below knee walking calipers.
d. CTEV shoes—these are mainly used when the child starts walking and upto 5 years of age.

CONGENITAL TORTICOLLIS (WRYNECK)

Torticollis is derived from the Latin, tortus – meaning twisted and Collum – meaning neck.

Fig. : Wryneck

Congenital torticollis is a condition where the sternocleidomastoid muscle of the neck undergoes contractures pulling it to the same side and turning the face to the opposite side (Fig.).

Exact cause of this condition is unknown but hypothetically it may be due to fibromatosis within the stemomastoid muscle.

Features

- Tumour palpable at birth or during the first two weeks of life.
- Common on the right side.
- May include the muscle diffusely but more often it is localised near the clavicular attachment of the muscle.
- It attains maximum size within 1 to 2 months, usually it diappears within a year.
- If it fails to disappear, then the muscle becomes permanently fibrotic and contracted and causes torticollis.

Aetiology

- Middle part of the stemomastoid is supplied by an end artery, which is a branch of the superior thyroid artery that gets blocked due to trauma, etc. Intrauterine vascular disturbance in the sternomastoid muscle – position of the head causing fibrosis or shortening of the muscle. The fibrosis in the muscle may be due to venous occlusion and pressure on the neck in the birth canal because of cervical and skull position.
- Birth trauma—Breech delivery, improper application of forceps, etc. may cause injury to the stemomastoid muscle. That causes bleeding in the sternomastoid muscle – the hematoma (blood clot) within the muscle scars down over time, causing the muscle to shorten

The above two reasons can result in sternocleidomastoid muscle ischaemia, necrosis and fibrosis later

Clinical Features

Deformity is the only complaint initially. Later facial changes and macular problems in the retina may develop. The child's head is tilted to affected side and his face and chin rotation to healthy (opposite) side. If uncorrected, as the child grows, the face on the side affected may stay "flattened", so that facial asymmetry is common.

Ultrasonography – evaluating a congenital muscular torticollis-shown of fibrous tissue

Deformities in Congenital Torticollis

Primary

- Tilt of the head to the same side
- Taut stemomastoid

Secondary

- Facial appearance distorted
- Macular changes in the retina

There are other causes of torticollis.

- vertebral abnomalities
- atlanto-axial subluxation
- hemivertebra
- spinal cord abnormalities

In these cases, X-rays or even MRI exams may be required.

Acquired torticollis:

- atlanto-axial rotary subluxation
- inflammatory torticollis: inflammatory processes such as myositis, lymphadenitis, otitis media, cervical adenitis, pharyngitis, retropharyngeal abscess, and mastoiditis or tuberculosis can cause muscular damage infections of the surrounding soft tissue.

Treatment

Principles

- During infancy, conservative treatment consists of stretching of the stemomastoid by manipulation and physiotherapy. Positioning child in bed for stretching of stemomastoid, massage. Excision is unjustified in infancy.

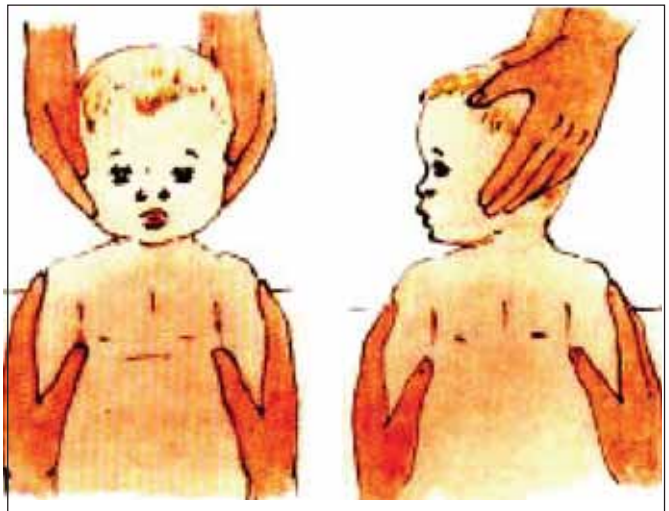


Fig. Stretching exercises

For example: right torticollis-You will want to tilt his head to the left (left ear towards left shoulder), and rotate his face to the right (chin to right shoulder) – 4 to 6 times /a day.

- Exercise programme is successful
  — when restriction of motion is less than 30°.
  — when there is no facial asymmetry.
- Nonoperative treatment after 1 year is rarely successful.
- Surgery is delayed till fibroma is well formed. The muscle may be released at one or both ends or the muscle may be excised as a whole.
- If the muscle is still contracted at the age of 1 year it should be released.
- If wryneck is persistent for 1 year it will not resolve spontaneously and needs to be interfered operatively.
- Any permanent torticollis becomes worse during growth. Head is inclined towards the affected side, face is turned towards the opposite side, ipsilateral shoulder is elevated and the fronto-occipital diameter is increased.

Surgical Methods

The most commonly employed surgical method is subcutaneous tenotomy of the clavicular attachment of the stemomastoid muscle. This procedure is inaccurate and dangerous as there could be an injury to the external jugular vein and phrenic nerve. Hence release from its attachment on the mastoid process is also tried. Open tenotomy if done before the child is 1 year old, tethering of the scar takes place.

Fig. Surgical release of the sternomastoid muscle

Postoperative period – holds the head in the overcorrected position (plaster casts or braces) first 6-12 weeks

If the surgery is done between 1 and 4 years of age, tilt of the head and facial asymmetry are corrected less satisfactorily. If done after 5 years of age, the secondary deformities are less corrected.

For older children or after failed operation, bipolar release of the muscle from both sides, Ferkel's modified bipolar release or Z-plasty of the muscle are tried.

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