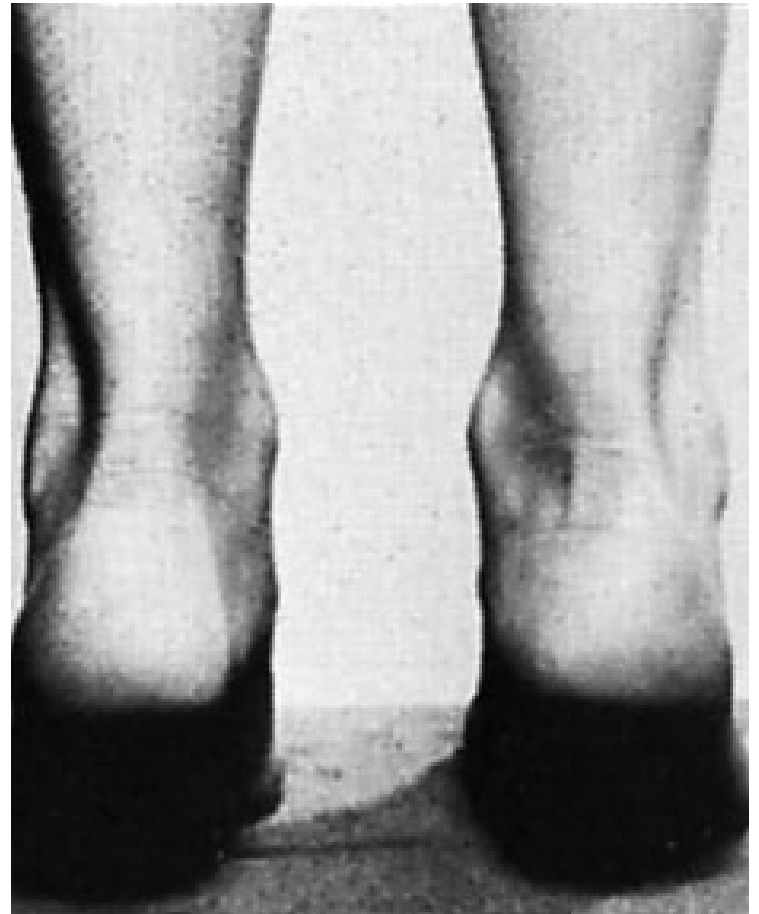


FLAT FOOT OR PES PLANUS

DR JOBIN ALEX MOHAN

- It is the flattening of longitudinal arch of foot
- The term 'flatfoot' applies when the apex of the arch has collapsed and the medial border of the foot is in contact (or nearly in contact) with the ground.
- Flat-foot is a common complaint among children.



Flexible flat-foot

Flexible pes valgus appears in toddlers as a normal stage in development, and it usually disappears after a few years, when medial arch development is complete.

- occasionally, though, it persists into adult life.
- The arch can often be restored by simply dorsiflexing the great toe
- Many of these children have ligamentous laxity and there may be a family history of both flat feet and joint hypermobility.

Stiff (or 'rigid') flat-foot

A deformity that cannot be corrected passively should alert the examiner to an underlying abnormality.

In older children, conditions to be considered are

(1) tarsal coalition.

(2) an inflammatory joint disorder

(3) a neurological disorder.

Compensatory flat-foot

This is a spurious deformity that occurs in order to accommodate some other postural defect

- The flat foot may be of anatomical and physiological type
- Anatomically
 - Ext rotation of tibia
 - Genu valgum
 - Equinus position of the foot
 - Varus position of forefoot

- Physiologically
 - Congenital variety of vertical talus
 - Infantile flat foot
 - Middle aged flat foot , obese individual
 - Postural defect like kyphosis
 - Temporary flat foot in long standing chronic illness, feet become flat c/o foot strain

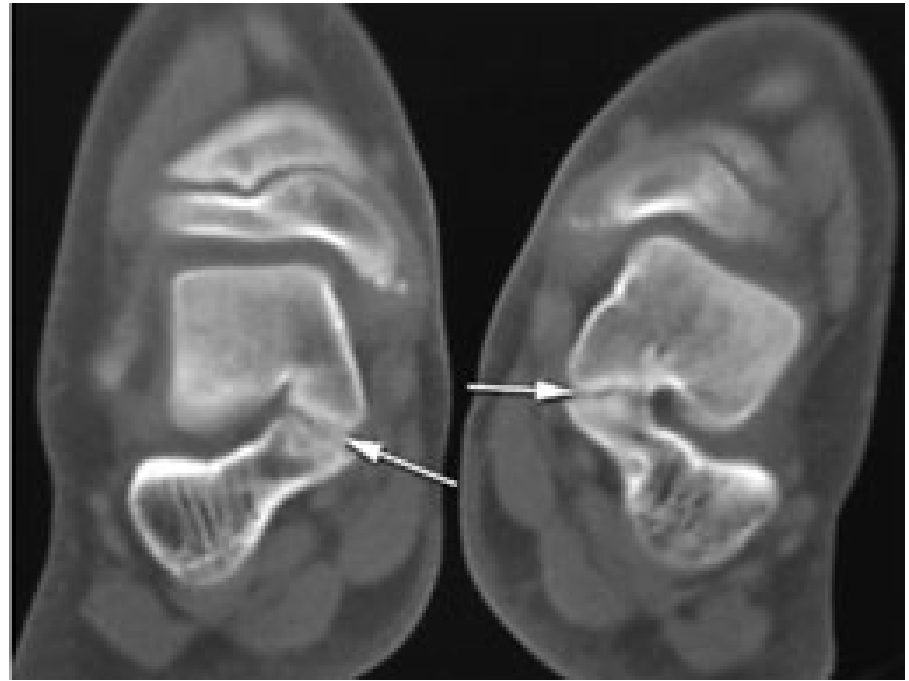
Clinical assessment

- Watch the child stand and note the position of the heels from behind.
- Are they in neutral or valgus, and do they invert when the child stands on tiptoe?
- The tiptoe test will confirm a mobile subtalar joint and functioning tibialis posterior tendon.
- Let the child walk - for normal gait
- The heels set flat during the stance phase, or does the child have tight achilles tendons

- Examine the foot and note its shape.
- Palpate for tenderness.
- A tight Achilles tendon may be 'constitutional' or part of a neuromuscular problem.
- Try to correct the flat-foot by gentle passive manipulation.
- The spine, hips and knees also should be examined.
- The clinical assessment is completed by a swift general examination for joint hypermobility and signs of neuromuscular abnormalities.

PERONEAL SPASTIC FLAT-FOOT (TARSAL COALITION)

- Older children and teenagers sometimes present with a painful, rigid flat-foot in which the peroneal and extensor tendons are in spasm.



Tarsal coalition (a) X-ray appearance of a calcaneonavicular bar.
(b) CT image showing incompletely ossified talocalcaneal bars bilaterally (arrows).

DIAGNOSIS

- Is made by looking at the medial side of foot
- Instead of concavity, there is flattening or even convexity with prominence of the tarsal navicular.
- Examine the shoes that the pt is wearing
- The sole and heel are worn away more than inner side and inner side bulges medially and downwards. And there will two physical signs
 - Limitations of movements of tarsal joints
 - Localized tenderness in spring ligament

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IMAGING

- X-rays are unnecessary for asymptomatic, flexible flat feet.
- For pathological flat feet (which are usually painful or stiff) standing anteroposterior, lateral and oblique views may help to identify underlying disorders.
- On the lateral view, 'beaking' of the head of the talus suggests the presence of a tarsal coalition.
- Narrowing of the talocalcaneal joint, which is sometimes seen in talocalcaneal coalition, is easily mistaken for 'arthritis'.
- Calcaneonavicular bars, if ossified, can be seen in oblique views of the foot.
- CT scanning is the most reliable way of demonstrating tarsal coalitions.
- Radioscintigraphy is occasionally used if a covert infection or osteoid osteoma is suspected. It may also help to identify a 'hot' accessory navicular before advocating its removal.

Treatment

- *Physiological flat-foot* Young children with *flexible flat* feet require no treatment.
- Parents need to be reassured and told that the 'deformity' will probably correct itself in time.
- even if it does not fully correct, function is unlikely to be impaired.
- *Tight tendo Achillis* Flat-foot associated with a *tight* tendo Achillis and restricted dorsiflexion at the ankle may benefit from tendon-stretching exercises.

Rigid flat-foot (tarsal coalition)

- The anomaly is sometimes discovered as an incidental finding in asymptomatic feet.
- The initial treatment should always be conservative.
- A walking plaster is applied with the foot plantigrade and is retained for 6 weeks. splintage with an outside iron and inside T-strap may have to be continued for another 3–6 months.
- If an inflammatory joint disorder is discovered, this will have to be treated.
- If symptoms do not settle, operative treatment is needed.
- A calcaneonavicular bar can be resected without much difficulty through a lateral approach, and the operation may be performed before puberty. A portion of the bar is removed and the gap filled with fat or a piece of muscle to prevent recurrence.
- Talocalcaneal coalitions are more difficult to deal with and it may be wiser to wait until after the patient reaches puberty and then perform a triple arthrodesis.

CONGENITAL VERTICAL TALUS

- Congenital vertical talus, rocker-bottom flatfoot, or congenital rigid flatfoot or **CONGENITAL CONVEX PES VALGUS**
- CVT is a common cause of **rigid flat foot**
- must be distinguished from **flexible pes planus** commonly seen in infants and children.
- **may be associated** with numerous neuromuscular disorders, such as
 - trisomy 18,
 - arthrogryposis and
 - myelomeningocele,
 - Neural tube defects

pathoanatomy:

- complex deformity that affects the **hindfoot and the forefoot** – the hindfoot is in equinus and valgus, whereas the forefoot is abducted and dorsiflexed (pulled dorsally by unopposed extensor and peroneal muscles).
- this deformity includes irreducible dorsal **dislocation of the navicular on talus** as well as calcaneocuboid joint dislocation, contractures of anterolateral muscles, and a tight heel cord and posterior capsule;
- The **talonavicular joint** is dislocated with the navicular sitting on the dorsum of the neck of the talus.
- The **talus** is markedly plantarflexed and the head of the talus that is unsupported by the spring ligament is palpable in the sole of the foot.
- The calcaneus also is in an equinus position, but to a lesser degree

- The **Achilles tendon**, the ankle and toes dorsiflexors and the peronei are all contracted to varying degrees.
- The **medial longitudinal arch** is completely reversed giving rise to the characteristic 'rocker bottom' appearance of the foot

diff dx:

- **oblique talus:** -
 - milder form of CVT and may respond to non operative treatment; -
 - diagnosis is confirmed on forced plantar flexion lateral in which the talus will align w/ 1st metatarsal (unlike CVT);

Clinical Presentation

- clinically talar head is prominent medially, sole is convex, forefoot is abducted and dorsiflexed, and the hindfoot is in equinovalgus; -
- **head of talus** is prominent at medial sole of foot; - flat foot deformity is rigid; -
- sole of foot has a **rocker-bottom (convex)** deformity; -

- there **are deep creases** on the dorsolateral aspect of the foot anterior and inferior to the lateral malleolus
- pts demonstrate **peg-leg gait** (akward gait w/ limited forefoot pushoff);
- . **Callosities** develop beneath the anterior end of the calcaneus and along the medial border of the foot superficial to the head of the talus



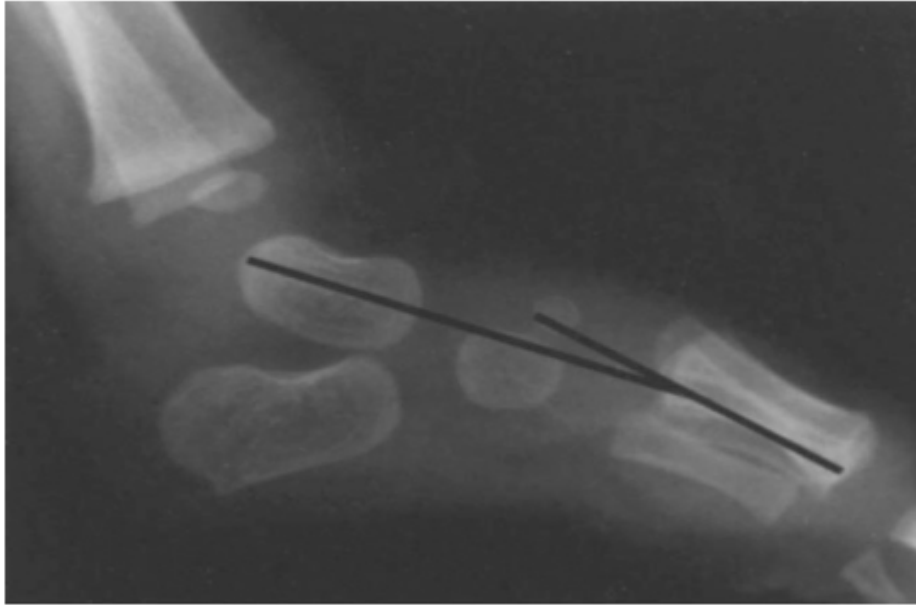
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Radiographs:

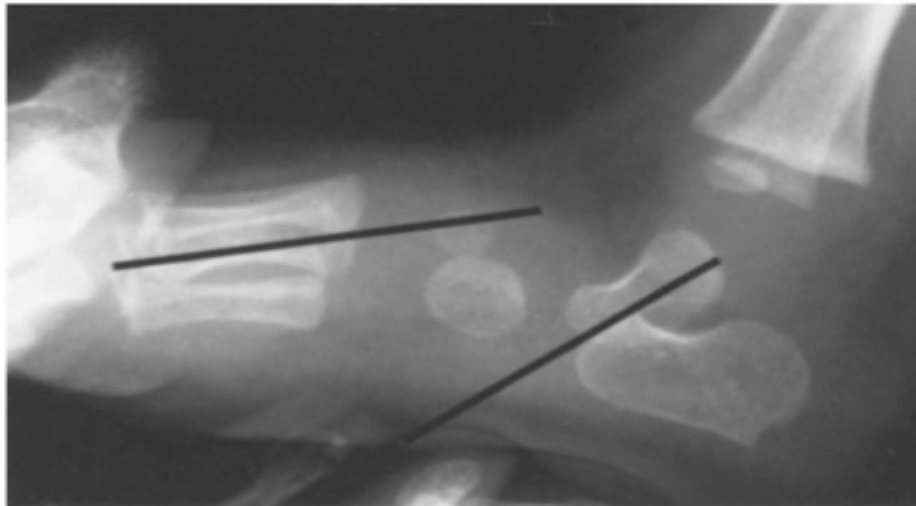
- **normal foot:**
- - w/ normal feet, a line projected thru longitudinal axis of talus falls to dorsal side of navicular on maximum plantar flexion lateral view;
- - since navicular does not ossify until age 3 yrs, it may be better to say that the line should fall to dorsal side of cuboid

- **CVT foot:** -
- key feature of fixed dorsal dislocation of navicular on neck of talus, equinus position of talus and calcaneus, dorsiflexion of forefoot, and abduction contracture of the foot; -
- in CVT line through talus is plantar to navicular (cuboid) in both resting lateral and plantar flexed views;

- **Plantar flexion view**
- lateral x-ray in maximum plantarflexion, which demonstrates the **irreducible talonavicular joint**,
- and in maximum dorsiflexion, which demonstrates **fixed equinus**;
 - - navicular cannot be reduced on the talus;
 - - plantar flexion fails to realign talus & first metatarsal, confirming diagnosis of a fixed talonavicular dislocation ("vertical talus");
 - - line drawn thru axis of talus passes plantar to metatarsal axis;



A



B

. A, In normal foot, long axis of first metatarsal passes plantarward to long axis of talus. B, In congenital vertical talus, long axis of first metatarsal remains dorsal to long axis of talus

Treatment

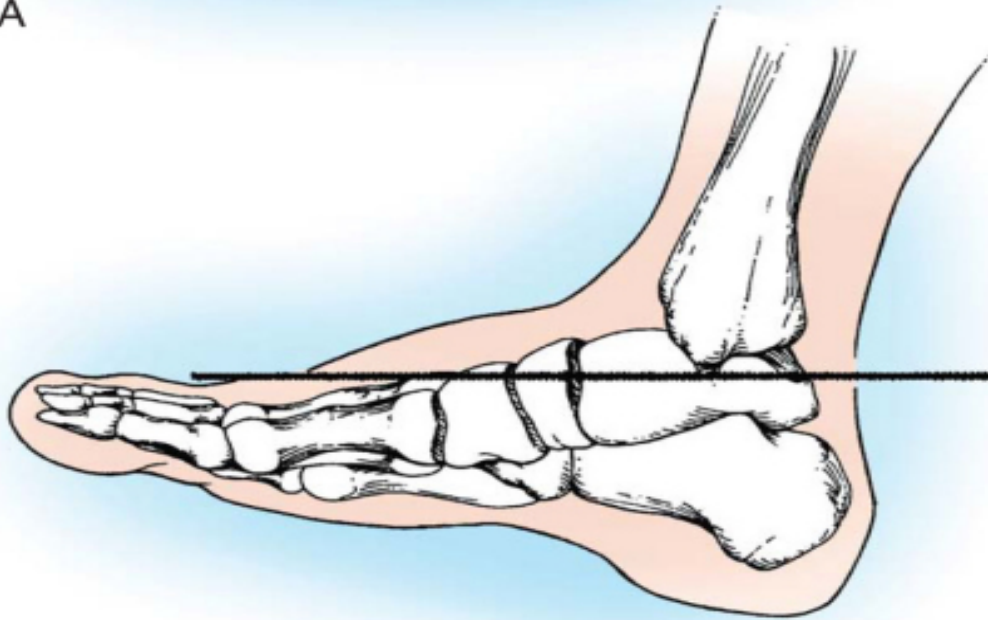
Non-Operative:

- conservative treatment has **no role** in true congenital vertical talus.
- Reduction of the talonavicular joint rarely is possible by conservative means alone; consequently, open reduction usually is necessary
- treatment may be instituted to stretch the skin, soft tissues, and tendons over the dorsum of the foot and **to facilitate the operation** that is almost inevitably needed;
- casting **facilitates wound closure**;
- recommended initial treatment is **long leg cast** with the foot in maximum plantar flexion and inversion

- The exact surgery indicated is determined by the **age of the child and the severity of the deformity**
- surgery is usually delayed until child is about 12 to 18 mo old
- **Children 1 to 4 years old** generally are best treated by **open reduction and realignment of the talonavicular and subtalar joints.**
- single-stage procedure in which a threaded Kirschner wire is used as a **“joystick”** to manipulate the talus into correct position. The corrected position is held with threaded Kirschner wires across the talonavicular and subtalar joints



A



Single-stage correction of congenital vertical talus. A, Threaded Kirschner wire is placed axially in vertical talus from posterior and is used as “joystick” to manipulate talus into reduced position. B, Wire is advanced across talonavicular joint.

Open Reduction and Realignment of Talonavicular and Subtalar Joints

Kumar, Cowell, and Ramsey



A, Anteroposterior view shows correction of talocalcaneal and talus–first metatarsal angles. B, Lateral view shows corrected position of talus and reduction of navicular and forefoot after fixation with single Steinmann pin.

- Recently, sequential serial manipulations followed by limited softtissue surgery have been shown to be effective.
- The foot is manipulated into inversion and adduction and, after the forefoot deformity is corrected, limited tendon releases and percutaneous K-wire fixation of the talonavicular joint is performed.
- After obtaining correction, bracing through infancy and a thermoplastic ankle–foot orthosis for 2 years after the child has started walking is recommended

- **in children 3 years old or older** who have a **severe deformity**, **navicular excision** is required at the time of open reduction.
- **Children 4 to 8 years old** can be treated by **open reduction and soft-tissue procedures** combined with **extraarticular subtalar arthrodesis**.

Soft tissue procedures

- tendo achilles lengthening –
- lengthening of all foot extensors; -
- shortening of the tibialis posterior; -
- extensive posteromedial & posterolateral releases to relocate talonavicular and subtalar joints; -
- peroneus longus or brevis, or both, may be transferred to the insertion of the tibialis posterior or near the navicular or talus, & tibialis anterior may be transferred to the neck of the talus; -
- posterior ankle/subtalar capsulotomy; -
- peroneal tendon lengthening; -
- calcaneocuboid capsulotomy; - reconstruction of spring ligament;

Grice Arthrodesis

- simple method of obtaining **fusion of subtalar** joint performed through a lateral approach using a corticocancellous bone graft
- **extra-articular arthrodesis** which is useful in blocking subtalar motion in those patients who have no gross skeletal deformities but have instability of the hindfoot; -
- this arthrodesis is particularly applicable in **children**, since there is little interference with future growth of the foot
- should triple arthrodesis be necessary later in life, it is felt that early correction w/ Grice procedure makes the operation easier because it **restores the anatomy more nearly to normal;**

- **Prepare the graft beds** by removing a thin layer of cortical bone from the inferior surface of the talus and superior surface of the calcaneus
- From proximal **tibial metaphysis**, incise the periosteum, and take a block of bone large enough for two grafts
- With the foot held in a slightly overcorrected position, place the grafts in the sinus tarsi. Evert the foot to lock the grafts in place.



Grice-Green subtalar fusion. A, Preparation of graft bed and placement of graft in lateral aspect of subtalar joint

Dennison and Fulford

- modification
- a screw can be inserted anteriorly from the talar neck into the calcaneus, as described by Dennyson and Fulford, for rigid fixation



A



B

Corrected position of talus fixed with screw through neck of talus into calcaneus, as described by Dennyson and Fulford. Bone graft in middle and posterior aspects of subtalar joint.

- **Children 12 years old or older** are best treated by **triple arthrodesis** for permanent correction of the deformity
- The results are likely to be poorer in children with **arthrogryposis and spina bifida**.
- In children with spina bifida, muscle imbalance may need to be corrected by appropriate **tendon transfers** to avoid the risk of recurrence of the deformity