Neonatal Talipes

Recognition and Treatment

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Embryo & Foetal Development

Week 4 limb buds recognizable

Week 6 rays of digits become evident

Week 8 Fingers & toes separate

Week 11 foetal skeleton and long bones are formed

Weeks 13 to 20 Ossification commences and limbs become proportionate

Foot Deformities

- Three common deformities are often presented at birth
  - Talipes or clubfoot (Congenital Talipes Equinovarus)
  - Calcaneovalgus
  - Metatarsus Adductus and dynamic abduction of the great toe
  - Less commonly seen is Vertical Talus

Clubfoot

- Congenital
  - Syndromic
    - CP
    - Downs
    - Arthrogryposis
  - Idiopathic
    - Talipes Equinovarus
      - Positional
      - Structural
    - Calcaneovalgus
    - Metatarsus Adductus
- Acquired
  - CVA
  - GBS
  - Tumours
  - Polio

Ref: Cardy et al 2000

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Calcaneovalgus

Presentation

- Foot is dorsiflexed and everted
- Calcaneus is in a valgus position
- The dorsum of the foot can touch the shin
- Flexible deformity but may not fully plantar flex

Calcaneovalgus

- The incidence of severe calcaneovalgus is between 0.4 and 1 per 1000 live births; lesser degrees of the deformity occur in 5% of all newborns.
- Caused by intra-uterine pressure
- Can be associated with hip dysplasia (up to 6%)
- Can take up to 12 months to fully resolve
- Tightness of Tibialis Anterior, Extensor Hallucis Longus & over stretch of Achilles Tendon
- Occasional subluxation of peroneal muscles
- Generally, no long term functional implications

Hart et al 2005

Metatarsus Adductus

Dynamic abduction of the great toe

Metatarsus Adductus

- Often confused with positional talipes
- Hind foot is normal
- Forefoot is adducted at the tarso-metatarsal joint;
- Bilateral in 50% of patients may be associated with hip dysplasia (10-15%)
- Caused by intrauterine position, is flexible & resolves spontaneously in more than 90 % of children.

Hart et al 2005

Metatarsus Adductus

- If the deformity is not passively correctable
  - Stretches
  - Older child – serial casting/ anti-varus footwear

Vertical Talus

Vertical Talus

- Rare deformity
- “Rocker bottom” deformity (convexity of sole)
- Usually associated with other disorders i.e. arthrogryposis
- Stiff foot with contractures of both plantarflexors and dorsiflexors
- Radiology shows vertical orientation of the talus on the lateral view

Hart et al 2005; Staheli 2007

Management

- Plaster cast application to stretch soft tissues but very difficult technically
- Surgical correction

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Prognosis

- Awkward gait pattern
- Pain
- Some limitation of function

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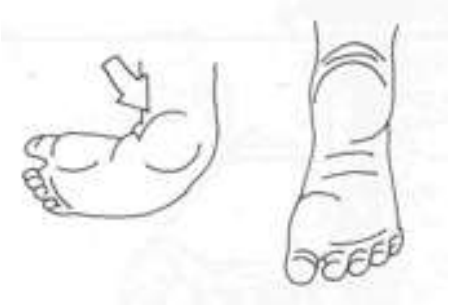
Positional Talipes

Positional Talipes

- Caused by intra-uterine pressure
- Estimated prevalence is 16 per 1000 live births
- No bony deformity
- Fully correctable passively
- If fully corrects actively or to stimulation, no intervention required

Treatment



Stretch the tissues on the back of the leg by gently pushing the foot upwards (10 seconds x 3)

Stretch the tissues on the inside of the foot by gently pushing the foot outwards (10 seconds x 3)

Stimulate the skin on the outside of the foot to help eversion

Congenital Talipes Equinovarus

Talipes Equino Varus

- Fixed equinus of the ankle
- Hindfoot varus
- Adduction of the forefoot and midfoot
- Cavus

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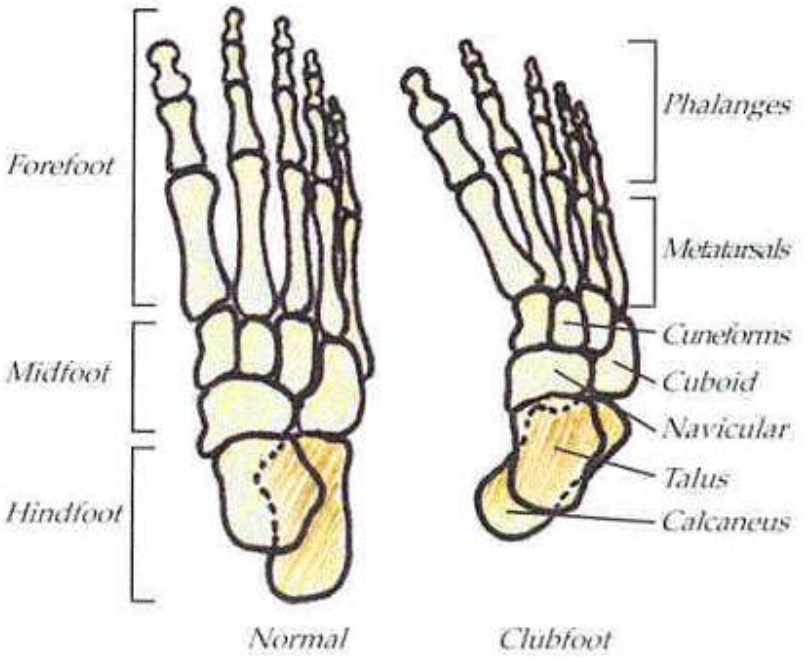
Presentation

- The tarsal bones are flexed, adducted and inverted.
- The talus is severely plantarflexed and the neck is deflected medially and plantarflexed.
- The navicular is displaced medially and is wedge shaped
- The calcaneus is adducted and inverted under the talus



Staheli 2009; Ponseti 2008

- Tibialis posterior tendon is very thick
- The distal end of the gastrocsoleus is rich with collagen which spreads into the TA
- The posterior and medial ligaments of the ankle and tarsal joints are thickened
- Gastrocsoleus size usually correlates with the severity of the foot deformity

Facts and Figures

- Prevalence of CTEV approx 1.29 per 1,000 livebirths
- 50% of cases have bilateral talipes
- Ratio is 2 males: 1 female
- A sibling of a patient has a 2% to 4% chance of having CTEV. If a child and another family member, or both parents, have clubfoot, the risk in another child increases by 10% to 20%.

Siapkara and Duncan 2007;

Cause theories

- Arrest of foetal development in the fibular stage
- Defective cartilaginous anlage of the talus
- Neurogenic factors: This is postulated to be due to innervation changes in intrauterine life secondary to a neurologic event
- Increased fibrous tissue in muscles and ligaments
- Anomalous tendon insertions
- ? Genetic factor but no obvious pattern of inheritance
- Little evidence to support maternal fault i.e. smoking/drinking
- Increase in number of type I slow fibres

Incorrect theory

- Intrauterine pressure

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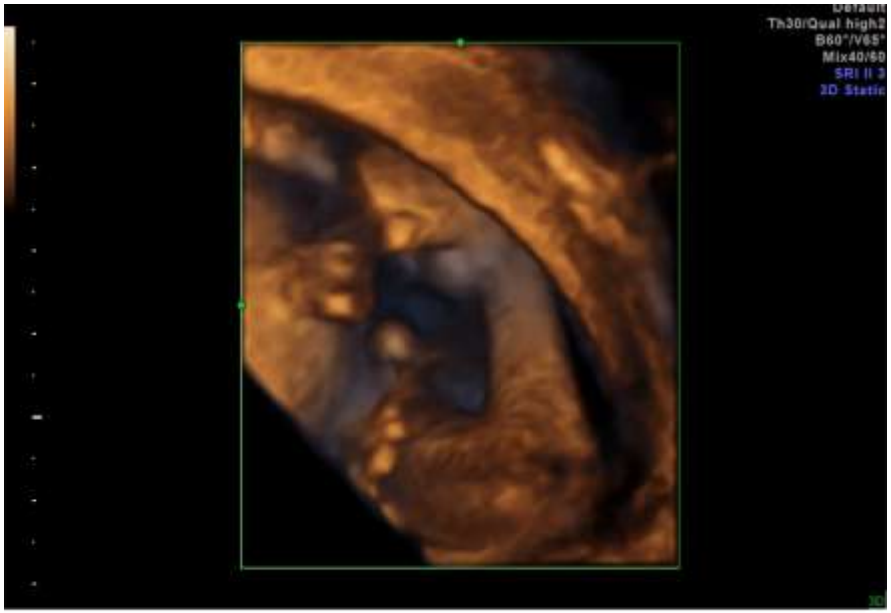
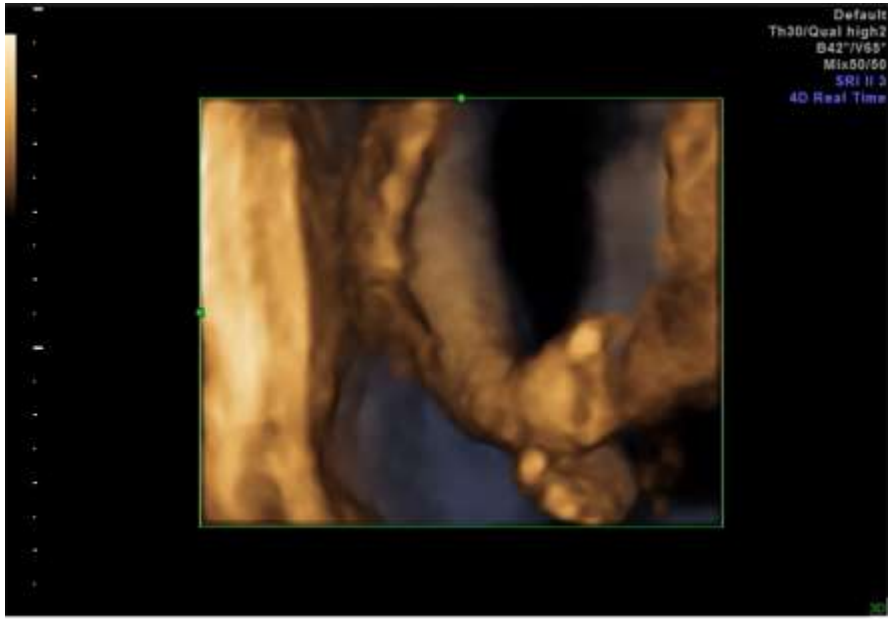
Ante-natal diagnosis

- Picked up on 20 weeks scan
- Positive predictive value of 85%
- Detected on approx 80% of scans (higher rate of detection in bilateral CTEV)
  - Foetal position
  - Maternal body habitus
  - Ultrasonographer skill
  - Quality of equipment

Offerdal et al 2007; Oetgen et al 2015

4D Scan





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Structural Talipes

- Varies in severity

- *Usual* presentation
  - Deep heel crease
  - Tight heel cord – heel pad feels empty
  - Deep crease on the medial aspect of the foot
  - Bony prominence on the top of the foot

  - Calf muscle will be thinner on the affected side
  - Foot may be smaller on affected side

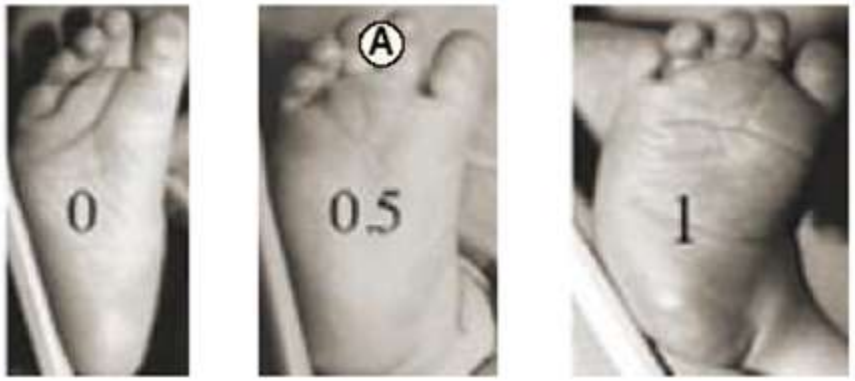
Classification / Scoring

- Several different methods of scoring the severity of the talipes
  - PIRANI
  - DIMEGLIO

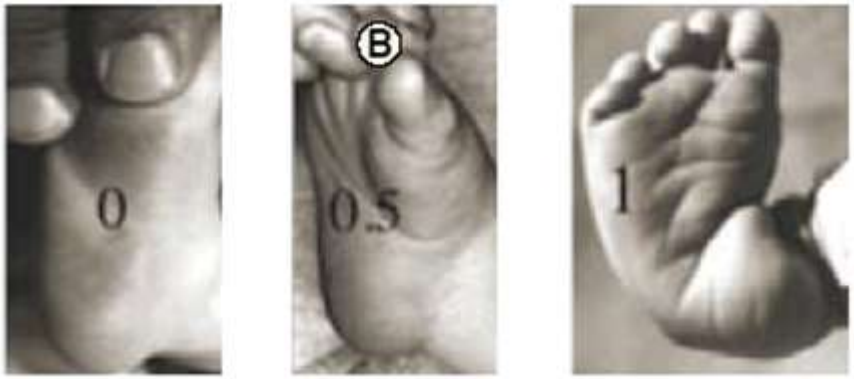
Pirani method of scoring

- Use six clinical signs to quantify severity of each component of the deformity.
- Each component is scored as:
  - 0 (normal),
  - 0.5 (mildly abnormal) or
  - 1 (severely abnormal)
- Foot is held in position of maximum correction and then scored
  - Score of 6 – severe talipes
  - Score of 0 – normal foot

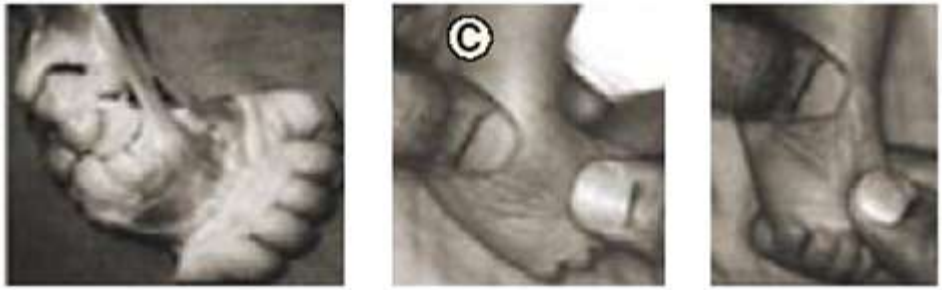
Curvature of the lateral border



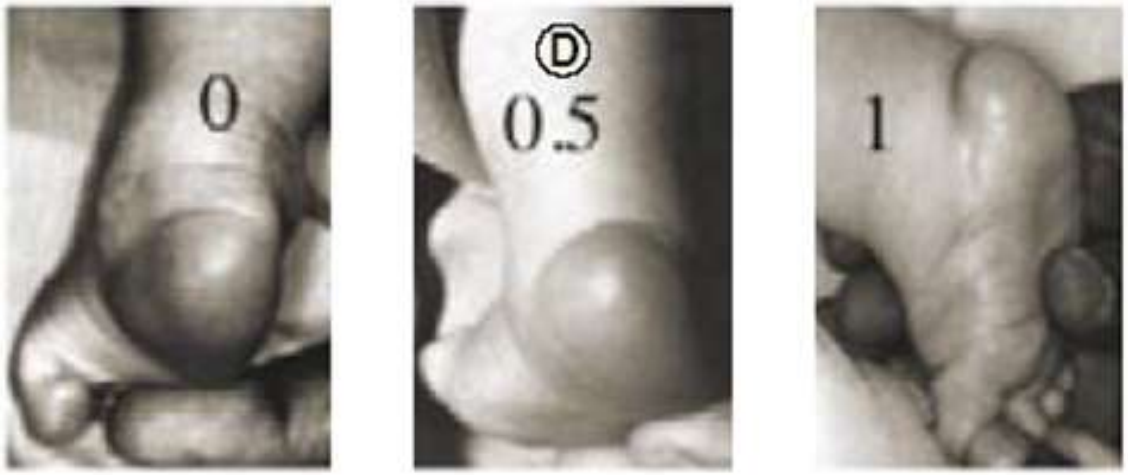
Medial crease of the foot



Lateral head of talus

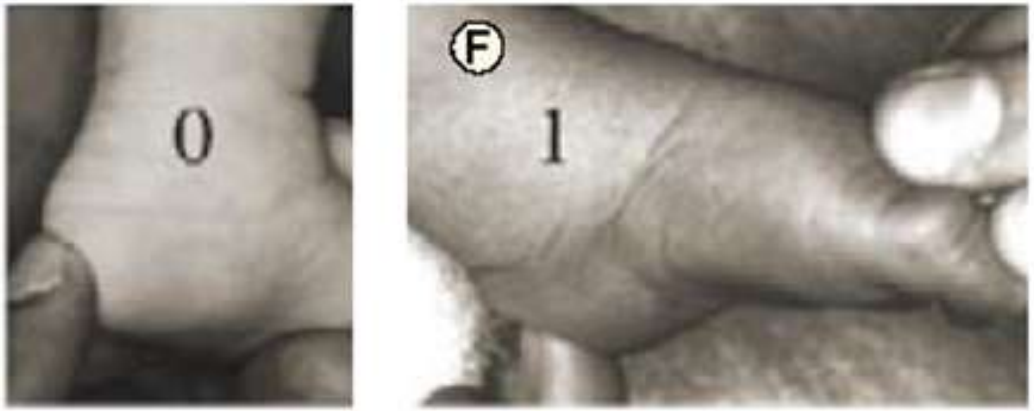


Posterior crease of ankle



Rigidity of equinus

Emptiness of heel



- It is not possible to determine the outcome of treatment from the initial Pirani score
- However, a score over 4 generally results in requirement of a percutaneous tenotomy

Treatment

- Ante-natal counselling
- Babies should be referred for treatment as soon as possible after birth
- Preferably refer to a centre with experience of treating CTEV
- Preferred method of treating clubfoot is the Ponseti method

Ponseti Method

- Internationally accepted gold standard treatment
- The method requires a series of precise manipulations, gently rotating the bones and stretching the soft tissue.
- Whenever possible, treatment should be started in the first week of life

- Above knee plaster of Paris casts will be applied to hold the foot in an increasingly corrected position

Progressive casting

Weeks 1 to 5

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Weeks 1 to 5 casts

- Initial elevation of the 1st ray to reduce the cavus deformity, using the lateral head of the talus as a fulcrum
- Foot may look “worse” in first cast

- Next : Abduction with the talus as fulcrum is **in the plane of the sole of the foot** and follows the normal motion of the subtalar joint.
- Abduction simultaneously corrects the midfoot adductus, hindfoot varus, AND the subtalar portion of the equinus

Casts 1,3,5: note decreasing supination and equinus of the entire foot from abduction alone.

The vector of manipulation force must parallel the plane of the sole of the foot

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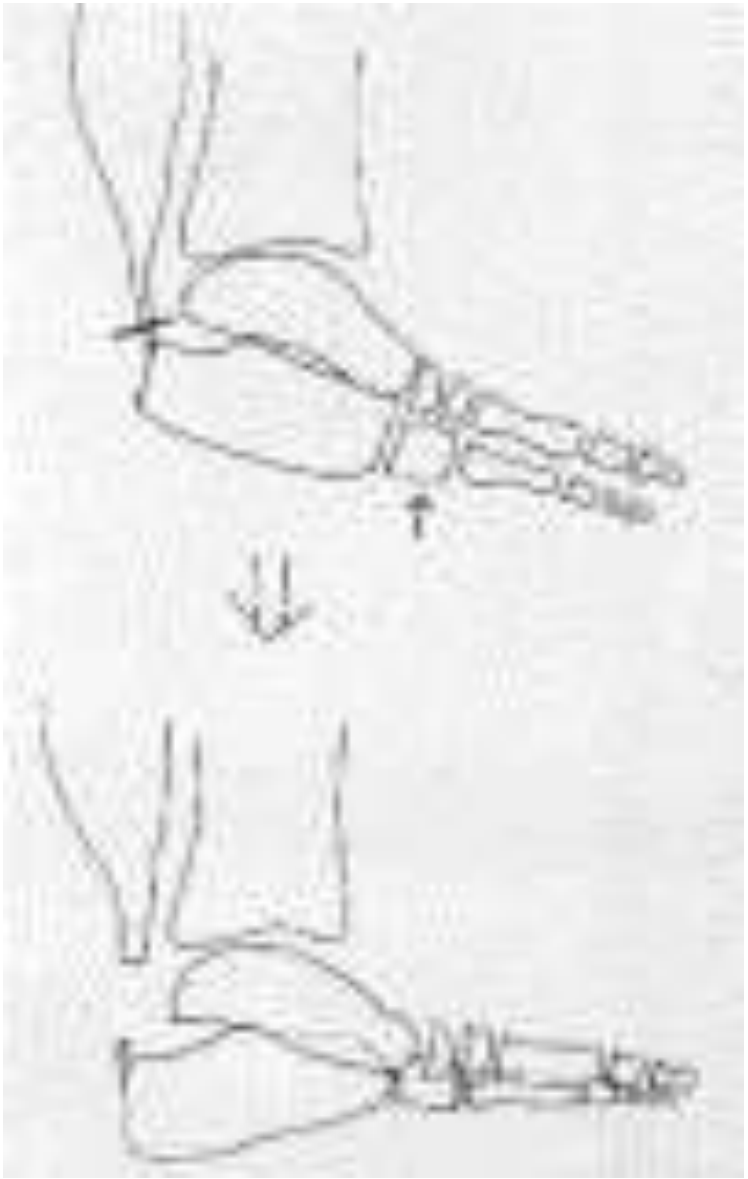
Video

Treatment progression

- At the stage of the 4th or 5th cast, when full abduction has been achieved (60-70°) we determine whether the foot will require a achilles tenotomy
- We will not achieve dorsiflexion unless the foot is fully abducted
- In the region of 90% of babies require this small procedure
- Typically the percutaneous tenotomy is performed under a local anaesthetic in the clinic area



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Tenotomy

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Ponseti continued

- Following the tenotomy, baby goes back into cast for 3 weeks in a maximally corrected position (full abduction (60-70°) and (20-30° dorsiflexion))

- Ultrasonographic findings confirm the Achilles is intact and demonstrates continuity by 6 weeks following tenotomy
- Subsequent rupture of the tendon has not been reported in the literature

Barker and Lavy 2006

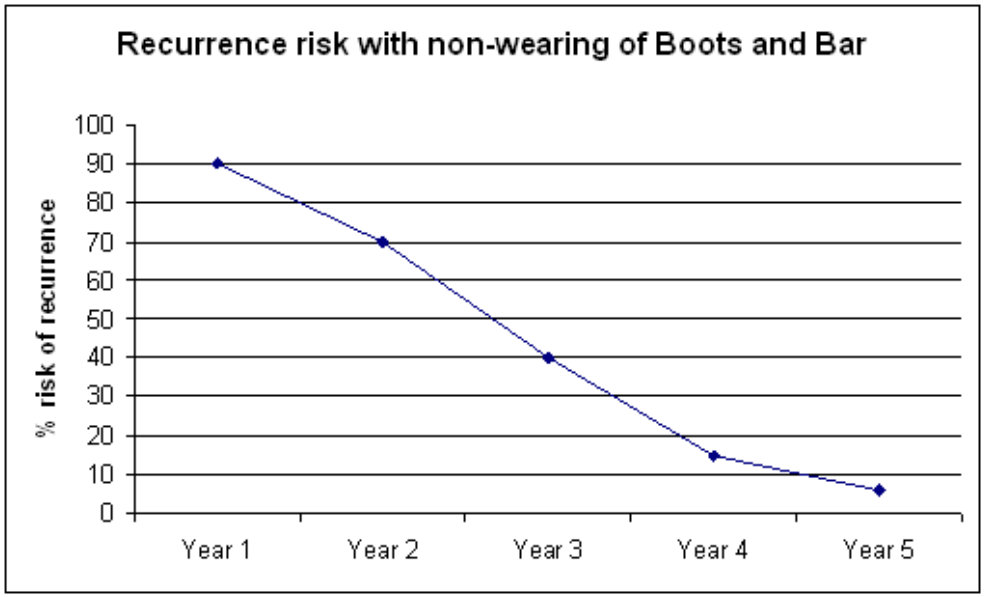
Mitchell Boots and Bar

Boots and Bar

- Compliance at this stage is essential to prevent recurrence of the deformity
- Boots must be worn for 23 hours per day for a period of twelve weeks
- Boots and bar are then worn for naps and night times until the age of 5 years (Ponseti recommendation)

Compliance

- Compliance with boots and bar stage is the biggest issue
- Biggest cause of relapse is discontinuing brace wear
  - 1st year 90%
  - 2nd year 70-80%
  - 3rd year 30-40%
  - 4th Year 10-15%
  - Subsequent 6%



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Long term outcome

- With the Ponseti method almost normal foot
- Able to run, jump, play football
- Foot may be slightly smaller and calf thinner
- Normal lifestyle

Relapse

- Occasional relapse can occur despite full compliance

- We do our best to minimise this
- Occasionally, more than one tenotomy is required

- If the relapse occurs when the child is older – more surgical intervention is required

Further intervention

- Weakness of the evertors can lead to overactivity of the supinators and a gait pattern whereby the child may walk on the lateral border of the foot
- Requires a Tendon transfer procedure approx 3 years old.

Atypical clubfoot

Deep transverse crease and short first ray

Presentation

- Deep posterior crease
- Marked plantaris
- Hyperextended great toe – appears short
- Short fat foot
- Possible transverse crease on the sole of the foot

What is an atypical clubfoot?

- Normal CTEV has medial tightness
- Atypical foot has increased tightness posteriorly and also on the plantar aspect
- Correcting the equinus and plantaris is difficult
- Often ends up with casts slipping (usually after cast number 3)

Treatment of atypical clubfoot

- Ponseti protocol – but resistant to treatment
- Often requires early tenotomy (after third cast) - followed by attempt to gain full abduction
- May require a repeat tenotomy to gain full dorsiflexion
- May require 8 to 9 casts

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Resources

- Red Book

http://www.ponseti.info/site/publisher/files/RedBook_Ponseti%5B1%5D.pdf

- Green Book

http://www.ponseti.info/site/publisher/files/PonsetiTextreduced_English.pdf

- Steps Charity website

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Q&A