Paediatric Foot Disorders

M G UGLOW  FRCS(Tr & Orth)
METATARSUS ADDUCTUS
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- 1:1000 incidence
- 50% bilateral
- Results from intrauterine position
- Forefoot adducted at TMT joint, sole is kidney shaped, heel is NOT equinus
METATARSUS ADDUCTUS

- 86% resolve spontaneously by age 6, 95% by age 16.
- 10-15% also have DDH
- Medial skin crease suggestive of resistant case
Metatarsus Adductus Grading System

- Grade I
  - Overcorrects

- Grade II
  - Corrects to neutral

- Grade III
  - Does not correct to neutral
Metatarsus Adductus Treatment

- **Correctable**
  - No treatment

- **Not correctable**
  - Serial casting
  - ?straight last shoes

- **Not correctable and symptomatic**
  - ? Surgery
Metatarsus Adductus

- Long term results of patients with mild-moderate residual deformity after treatment are good.

- **SURGERY** indicated in children >5yo with severe symptomatic residual metatarsus adductus.
Surgical treatment

Metatarsus Adductus

- Medial opening cuneiform and lateral closing cuboid osteotomies or
- Medial capsular release + Evans closing wedge calcaneal osteotomy and/or
- Multiple metatarsal osteotomies
Skewfoot

- Combination of forefoot deformity of metatarsus adductus and hindfoot deformity of flatfoot

- Tarsometatarsal adduction, talonavicular lateral subluxation, hindfoot valgus
Skewfoot

- Rare
- Aetiology unknown
  - ? iatrogenic
  - ? muscle imbalance
  - often syndromal
- Natural history unknown ?
  - Little evidence of disability
Skewfoot

- X-Rays:
  - Adduction & Plantarflexion at TMT
  - Navicular laterally placed and abducted and dorsiflexed
  - Increased AP talocalcaneal angle
Skewfoot

- Symptoms: Pain over talar head, 1st MT head, 5th MT base
- Treatment in young children: Serial casts as for metatarsus adductus with varus stress on heel
- Aim to convert foot to flatfoot
  - Danger of increasing hindfoot valgus
Skewfoot

- Treatment in older children:
  - Difficult to treat - recurrence common
  - Non-operative treatment not successful
  - Surgery demanding and may include:
    - calcaneal wedge or sliding osteotomy
    - cuboid opening and medial cuneiform closing wedge osteotomies
    - metatarsal osteotomies
    - lengthening tendo-achilles
PES CAVUS

- Elevated longitudinal arch due to plantar flexion of the forefoot &/or dorsiflexion of the calcaneus.
- Secondary contracture of plantar fascia.
- Claw toes - often the first deformity seen.
Cavus Foot - Aetiology

> 50% Neuromuscular

Hereditary Motor Sensory Neuropathy (CMT)
Poliomyelitis
Friedreich’s ataxia
Cerebral Palsy
Spina bifida
Spinal cord tumour
Syringomyelia
Cavus Foot - Aetiology

- Non neurological causes include:
  - Idiopathic
  - CTEV, Arthrogryposis
  - Traumatic
    - Compartment Syndrome
Types of Pes Cavus

- **Simple**
  - hindfoot neutral, forefoot balanced

- **Cavovarus**
  - hindfoot varus, forefoot plantar flexed

- **Calcaneus**
  - hindfoot calcaneus, forefoot fixed equinus

- **Equinocavus**
  - hindfoot equinus, forefoot equinus
Cavovarus

- Plantarflexion of first ray
- Pronation of forefoot
- Adduction of forefoot
- Hindfoot varus
- Toes clawed
With a fixed plantarflexed first metatarsal for the foot to be plantigrade when weight bearing the heel must go into varus
Coleman Lateral Block Test

- Assesses hindfoot flexibility of the cavovarus foot
- Foot considered a tripod
- Lift placed under lateral aspect of foot and look for hindfoot correction
Calcaneocavus

- Dorsiflexion of calcaneus
- Plantarflexion of forefoot
- Neurological cause: Polio, CP, spina bifida, spinocerebellar degeneration etc
- Iatrogenic: overlengthening of Achilles tendon
Calcaneocavus
Simple Cavus

- Rare
- If flexible - midfoot release
- If rigid - metatarsal or midfoot osteotomy at apex of cavus
Cavus foot symptoms

- Clawtoes
- Metatarsalgia
- High arch
- Anterior ankle pain
- Recurrent ankle sprains
Cavus Foot X-Rays

- **Cavovarus:**
  - First metatarsal plantarflexed relative to axis of talus on standing lateral X-Ray

- **Calcaneocavus:**
  - Dorsiflexed calcaneus
Cavus Treatment

- Full neurologic work-up especially if unilateral
  - Spinal X-Rays
  - MRI
  - NCS

- Referral to neurologist
Cavovarus foot - treatment

- Non-operative → well moulded orthosis
- Surgery: Plantar release, dorsal cuneiform ostetomy
  - Tendon transfers
  - Calcaneal osteotomy
  - Ilizarov for multiply operated case
Calcaneocavus foot - treatment

- **<5 years**
  - tenodesis of tendoachilles to fibula

- **5-12 years**
  - Extraarticular subtalar arthrodesis
  - Plantar release +/- calcaneal osteotomy
    - +/- tendon transfers (into calcaneus)

- **>12 years**
  - Triple arthrodesis
  - Ilizarov
Congenital Vertical Talus

- Irreducible dorsal dislocation of navicular on talus with a fixed talocalcaneal complex. Dislocation can be limited to talonavicular joint or can also involve calcaneocuboid joint.
- Common cause of rigid flatfoot
- 50% bilateral
Congenital Vertical Talus

- Teratologic - most CVT
  - Chromosomal abnormalities
  - Arthrogryposis
  - Myelomeningocele
- Neurogenic
- Iatrogenic - overcorrection CTEV
- Idiopathic - rare
CONGENITAL VERTICAL TALUS

PATHOLOGY:

- Navicular dorsally dislocated, wedge shaped with hypoplastic plantar component
- Talar head flattened dorsally, only posterior 1/3 of talar dome articulates with tibia
- Calcaneus plantar flexed and everted
- Hypoplastic sustentaculum tali
- Peronei and tib post sublux anteriorly becoming dorsiflexors
CVT
Differential diagnosis
- Oblique talus
- Tarsal coalition
- Calcaneovalgus foot
- Posteromedial bowing of tibia
- Idiopathic pes planus
- Paralytic pes valgus
CONGENITAL VERTICAL TALUS
CVT - RADIOLOGY

- AP X-Rays show increased talocalcaneal angle & forefoot abduction
- Plantarflexed lateral X-Ray:
  Fixed forefoot dorsal dislocation
- Dorsiflexed lateral X-Ray:
  Fixed equinus of hindfoot
Foot Disorders

NORMAL
OBLIQUE TALUS
VERTICAL TALUS
CVT TREATMENT

- Non-operative initially - stretching
- serial casting

plantarflexion/inversion

stretch soft tissues in preparation for surgery
CVT - SURGERY

- Surgery is aimed at correcting hindfoot equinus and forefoot dorsiflexion and abduction.

- Correction of hindfoot is the primary step in correction of the foot.
CVT : Surgery

- **Lengthen**
  - Achilles
  - Peroneal
  - Tibialis Anterior
  - Toe Extensors

- **Release**
  - Posterior ankle
  - Posterior subtalar
  - Calcaneocuboid
  - Talonavicular

- **Plicate**
  - Tibialis Posterior
  - Talonavicular capsule

- **Reduce & pin joints**
  - Subtalar
  - Talonavicular
  - +/- Calcaneocuboid
CVT TREATMENT

- Recurrent deformity corrected through revision STR between 2-6yo.

- Late treatment:
  
  STR + navicular excision
  Subtalar arthrodesis 2\(\frac{1}{2}\)-6yr
  Triple arthrodesis >6yr
OBLIQUE TALUS

- Talonavicular subluxation that reduces with plantar flexion of the foot.

- Treatment - observation
  - UCBL insert
  - pinning reduced
talonavicular joint & tendoachilles lengthening
TARSAL COALITION

- Disorder of mesenchymal segmentation leading to fusion of 2 or more tarsal bones
- Autosomal dominant with variable penetrance
- 3% of population
- 50% bilateral
- 90% calcaneonavicular or talocalcaneal
TARSAL COALITION

- May be bony, cartilaginous or fibrous
- Multiple coalitions may exist in same foot
- Leading cause of peroneal spastic flatfoot
TARSAL COALITION

- Become symptomatic when coalition ossifies:
  - TALONAVICULAR 3-5yo
  - CALCANEONAVICULAR 8-12yo
  - TALONAVICULAR 12-16yo

- Hindfoot pain aggravated by activity.
- Ankle sprains
- Stiff subtalar joint
- Medial or lateral tenderness
- Peroneal spastic flatfoot
TARSAL COALITION

- X-Rays: Oblique - calcaneonavicular
  Lateral - “Anteater” sign
    (elongated ant process calc)
    - Talar beaking
    - Narrowed posterior subtalar jt
  Harris axial view - irreg middle facet

- CT Scan - talocalcaneal coalition
CALCANEO-NAVICULAR BAR

ANTEATER’S NOSE
TARSAL COALITION

- Asymptomatic - observation
- Symptomatic:
  - NON-OPERATIVE - activity modification
    - orthotics
    - short leg walking cast
  - OPERATIVE
    - Calcaneonavicular - excision & EDB interposition
    - Talocalcaneal - adolescent with <50% of facet involved
      - subtalar OA resection
CALCANEVALGUS FOOT

- 1:1000 live births
- Intrauterine Positioning
- Associated with lateral tibial torsion
- Common in first born
- Dorsiflexion/eversion/abduction
- Passively correctable
- Resolves spontaneously - passive stretches & splints may be used
CALCANEOVALGUS FOOT DDx

- Neurologic dysfunction eg myelomeningocele
- Congenital Vertical Talus
  - stiff & equinus
  - lat stress X-Rays
- Posteromedial bowing of tibia
JUVENILE BUNION

- Bilateral, familial, more common in females
- Aetiology: Imbalance of forces
- Predisposing factors:
  - Metatarsus primus varus
  - Oblique 1st MT-medial cuneiform
  - Long 1st MT
  - Ligamentous laxity
  - Hypermobile first ray
  - Forefoot pronation
  - Heel cord contracture
  - Neurologic disorders
  - Shoewear with narrow toe-box
JUVENILE BUNION

- X-Rays (AP & Lat Standing):
  - Intermetatarsal angle (N <= 90°)
  - Maximal hallux valgus angle (N <= 160°)
  - Distal metatarsal articular angle (N <= 150°)
  - Proximal phalangeal articular angle (N <= 50°)
  - First TMT jt alignment
  - Length of 1st MT
JUVENILE BUNION

- Most asymptomatic & require no treatment

- Non-operative treatment: wide shoes and arch support

- Surgical treatment - progression of deformity or failed non-op tx

  SOFT TISSUE CORRECTION
  OSTEOTOMY - metatarsal
    - phalangeal
    - cuneiform

ARTHRODESIS
JUVENILE BUNION

Complications

* OVERCORRECTION/HALLUX VARUS
* RECURRENCE 20% (soft tissue only >50%)
  - inversely related to age
  
  REOPERATE AFTER SKELETAL MAT

* PHYSEAL INJURY - rare
* AVN - rare
* STIFFNESS
* DEFUNCTIONING 1ST RAY
BUNIONETTE

- Lateral prominence of 5th MT head
- Usually unilateral
- Irritated by shoewear
- Treatment:
  - Non-operative - shoewear modification
  - Operative - exostectomy
Flexible Flatfoot

- Flattening of the medial longitudinal arch on standing
- Heel valgus, forefoot pronation and abduction.
- Prominent talar head medially.

- 7%-22% prevalence
- Bilateral and familial
- Associated with ligamentous laxity and limb alignment problems
Flexible Flatfoot

- **X-Rays:**
  - AP/lat/oblique standing + plantar flexed lateral:
  - Increased talar plantarflexion
  - (talar-1st MT angle >0°)
Flexible Flatfoot

- Increased talocalcaneal angle (20-40° norm)
- Abduction of forefoot with navicular subluxation
Flexible Flatfoot

- Symptoms: midfoot ache, pretibial pain, excessive shoe wear. Pain and callosity over talar head.
- Longitudinal arch develops spontaneously during first decade and most flatfooted adults are asymptomatic.
Flexible Flatfoot

- No treatment if asymptomatic

- If symptomatic
  - Arch orthosis/UCBL inserts
  - Achilles tendon stretches if tight

- If refractory
  - wedge or sliding calcaneal osteotomy
  - +/- Achilles tendon lengthening
KOHLER’S DISEASE

- AVN of navicular due to repetitive compressive forces
- Males (5:1)
- 4 - 5 yo
- Bilateral in 1/3
- Self limiting

X-Ray - flattening, sclerosis, irregularity of navicular
KOHLER’S DISEASE

- May be asymptomatic

- Present with pain over navicular, antalgic gait, weight bearing on lateral aspect of foot

- Treat with decreased activity, soft arch support, inner heel wedge, Thomas heel +/- immobilisation

- Prognosis excellent
FREIBERG’S INFRACTION

- AVN usually of 2nd MT head (other MTs may be affected) due to vascular insufficiency 2\(^0\) to chronic stress

- Adolescents; female 75%

- Occasionally bilateral

- X-Ray: MT head flattening and irregularity
FREIBERG’S INFRACTION

- Metatarsalgia, mild swelling and stiffness

- Treatment: non-operative - walking cast
  - metatarsal pad

  operative - curettage & bone graft
SEVER’S DISEASE

- Traction apophysitis at insertion of Achilles tendon

- Heel pain & tenderness, aggravated by activity & relieved by rest

- Decreased ankle dorsiflexion

- Normal X-Rays - sclerosis and fragmentation of calcaneal apophysis normal variant

- Treatment: Activity modification, rest
ACCESSORY NAVICULAR

- Normal variant seen in 4-21%
- Often incidental discovery
- Associated with flatfeet
- Medial arch pain with overuse centred over navicular.
- External oblique X-Ray view demonstrates
ACCESSORY NAVICULAR


- **TYPE II** - synchondrosis. (70% of acc navic) Triangular up to 12mm diameter, tib post inserts into it. May be symptomatic.
ACCESSORY NAVICULAR

- Treated with restriction of activities +/- immobilisation in short leg cast, then shoe modification/padding

- Excision relieves pain but does not correct flatfoot
CURLY TOE

- “Underlapping toe”. Flexion deformity of PIP jt with external rotation and varus of the toe.
- Usually occurs in lateral 3 toes
- Familial, bilateral, symmetrical, rarely symptomatic
- Congenitally short FDB & FDL without joint contracture initially
CURLY TOE

- 25% resolve spontaneously. Remainder don’t worsen with growth but may develop symptoms and become stiff.

- Treatment if symptomatic or if severe - *flexor tenotomy* (FDL +/- FDB) at 3yo
  - immediate improvement in alignment
  - further correction with growth
  - flexor function invariably returns

- Late treatment - resection or arthrodesis of PIP joint may be necessary for correction
OVERLAPPING FIFTH TOE

- Familial, bilateral & asymptomatic
- Fifth toe adducted, extended & externally rotated at MTP jt & overlaps fourth toe
- May cause footwear problems
- Contracture of dorsal medial MTP capsule & extensor tendon
- Non-operative tx: stretching & buddy taping
- Operative - tenotomy, dorsal capsulotomy & V-Y advancement
CONGENITAL HALLUX VARUS

- “Atavistic Great Toe”
- Great toe adduction deformity often associated with supernumerary toes
- Deformity at MTP joint with thick short first MT and firm band (abductor hallucis)
- Surgical release
OLIGODACTYLY

- Congenital absence of toe(s)
- Requires no treatment
- Associated with fibular hemimelia and tarsal coalition
TOE POLYDACTYLIES

- Extra digits - preaxial, central or postaxial
- Incidence 2:1000
- Usually involves lateral ray (80%)
- May be inherited (30%) (AD)
- 25% bilateral
- Associated with finger polydactyly & metatarsal anomalies
- Preaxial deformities assoc with longitudinally divided epiphysis of 1st metatarsal bone
TOE POLYDACTYLY

- Rudimentary digits treated by ligation in nursery and allowing “autoamputation”

- Surgical excision of digit at 9-12 months:
  - save digit with best axial alignment
  - repair capsule & balance soft tissues
  - shave MT prominences
  - central physolysis for longitudinal bracket
TOE SYNDACCTYLY

- Fusion of adjacent toes (2nd-3rd)
- Familial & asymptomatic
- Simple or Complex
- Complete or partial
- Simple does not require treatment
- Complex treated as for fingers at 18mths - 5yrs.
POLYSYNDACTYLY

- Duplication of fifth toe with syndactyly between the duplicated toes. These may in turn be syndactylised to 4th toe.

- Treated usually by excision of lateral 5th toe

- Excision of medial 5th toe if there is syndactyly to fourth, or better contour is
MACRODACTYLY

- Increase in the size of the constituent elements of a digit - bone, tendons, nerves, vessels, fat, skin enlarged.

- Aetiology usually unknown but may be assoc with neurofibromatosis, haemangioma, lymphangioma

- Treatment - resection of soft tissues
HAMMER TOE

- Flexion deformity at PIP jt with hyperextension at DIP jt +/- secondary hyperextension at MTP jt.
- Flexor tightness
- Bilateral, symmetrical, commonly 2nd toe.
- Asymptomatic early - later painful corn, stiffness
- Treatment flexor tenotomy in early childhood
- Fixed deformity - release of MTP + extensor tenotomy +/- Girdlestone & resection
CLAW TOE

- Flexion deformity at PIP and DIP joints with hyperextension at MTP joint
- Usually all 4 lesser toes involved
- Usually associated with pes cavus but can be idiopathic
- Result of imbalance between intrinsics and extrinsics
- Often asymptomatic.
- Symptoms - metatarsalgia, painful corns over PIP joints
CLAW TOE

Treatment:

Non-operative - shoe wear modification (deep toe box, soft shoes), metatarsal bar

Operative - MTP dorsal capsulotomy + extensor tenotomy + Girdlestone flexor to extensor transfer
If deformity fixed - excision arthroplasty or arthrodesis PIP jt
In CMT - transfer EDL to MT necks +
MALLET TOE

- Flexion deformity at DIP jt
- Aetiology: FDL shortening
- Commonly 2nd toe
- Assoc with long 2nd MT
- Symptoms from dorsal corn or toenail irritation
- Treatment: young child - FDL tenotomy
  fixed deformity - excision
SUBUNGUAL EXOSTOSIS

- Benign bone tumour occurring on distal phalanx of a digit beneath or adjacent to the nail.
- Commonest in great toe. Usually on medial side of dorsum of phalanx.
- Histologically similar to osteochondroma but not adjacent to physis.
- May be painful & cause nail deformity.
- Unknown aetiology? trauma.
- Treatment excision & nail bed repair.
- 10% recurrence.