

Common Pediatric Lower Limb Disorders

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Acknowledgement:

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Topics to Cover

1. In-toeing
2. Genu (varus & valgus), & proximal tibia vara
3. Club foot
4. L.L deformities in C.P patients
5. Limping & leg length inequality
6. Leg aches

1) Intoeing



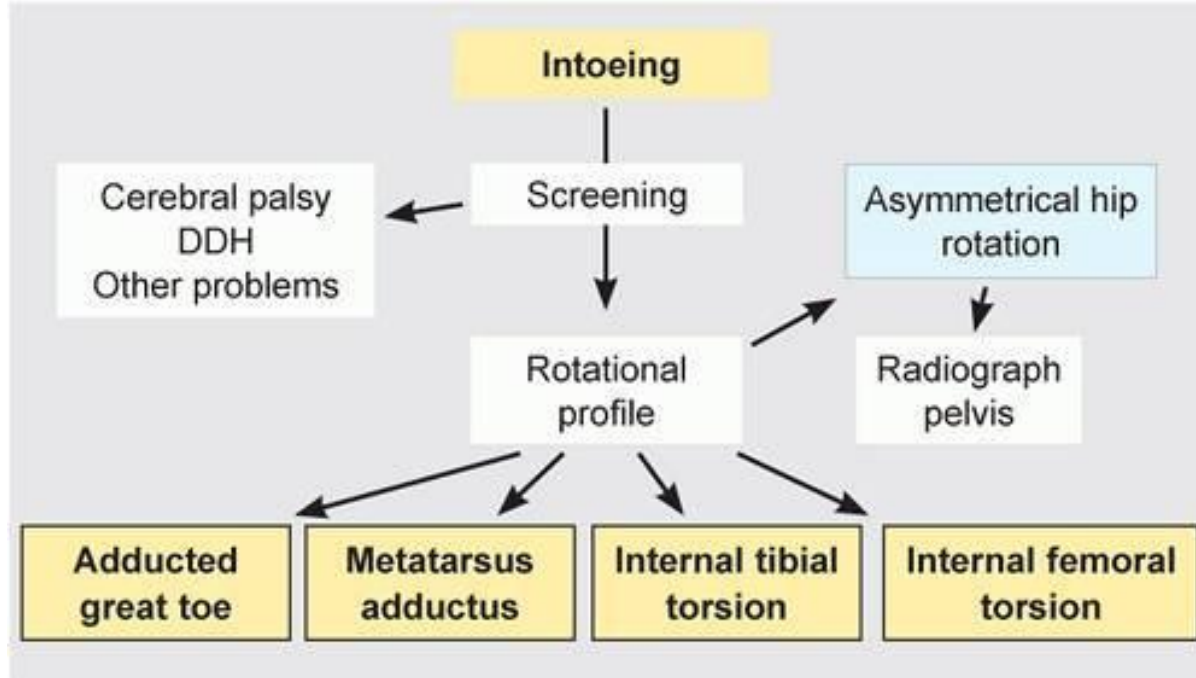
Intoeing- Evaluation

- Detailed history
 - Onset, who noticed it, progression
 - Fall a lot, specially when runs
 - How runs “Egg-Beater” legs
 - How sits on the ground
 - Family history
 - Is it bilateral or unilateral
- Screening examination (head to toe)
- Pathology at the level of:
 - Femoral anteversion
 - Tibial torsion
 - Forefoot adduction
 - Wandering big toe



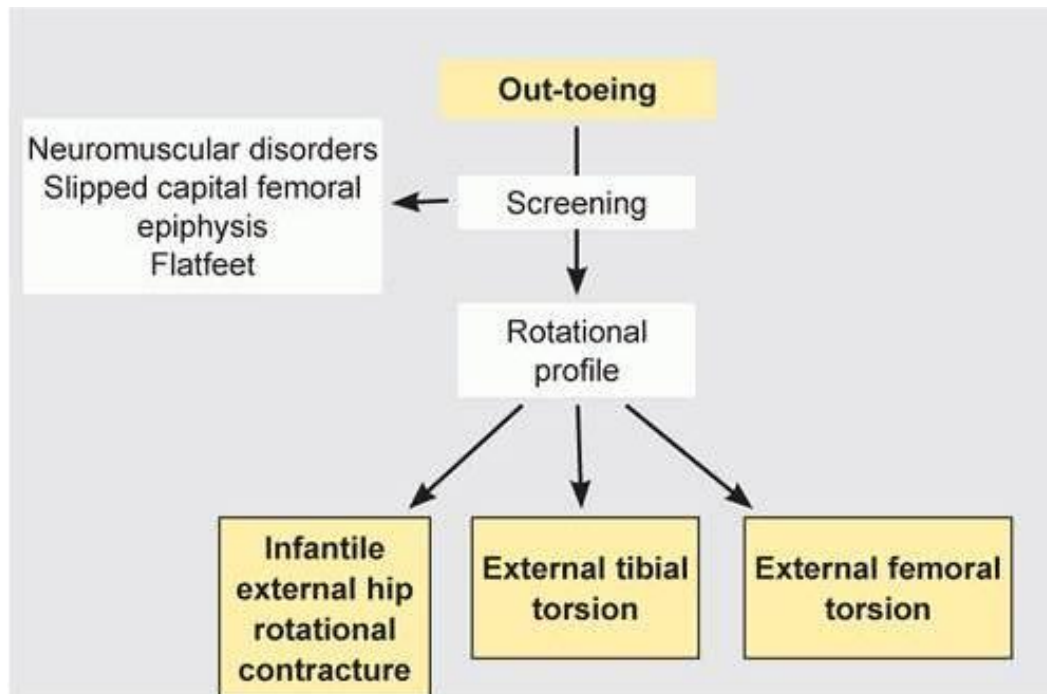
In-toeing

- Evaluation
 - History
 - Screening examination
 - Rotational profile



Out-toeing

- Evaluation
 - History
 - Screening examination
 - Rotational profile

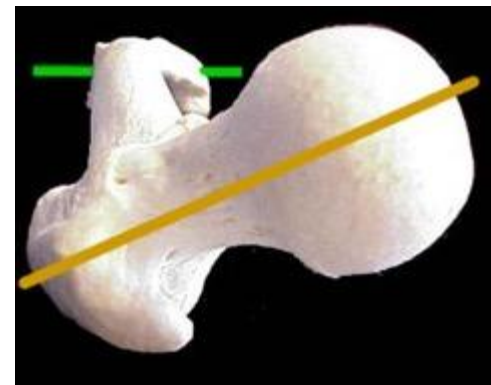
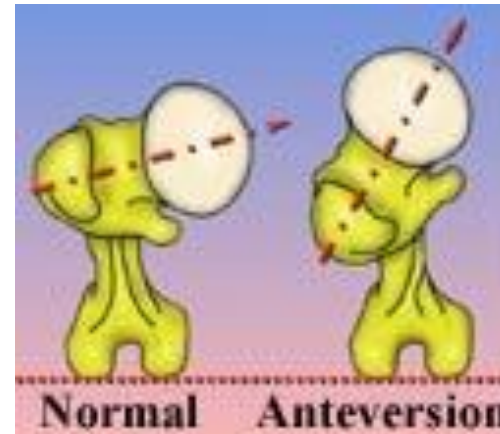


Intoeing- Asses rotational profile

Pathology Level

- Femoral anteversion

Meaning

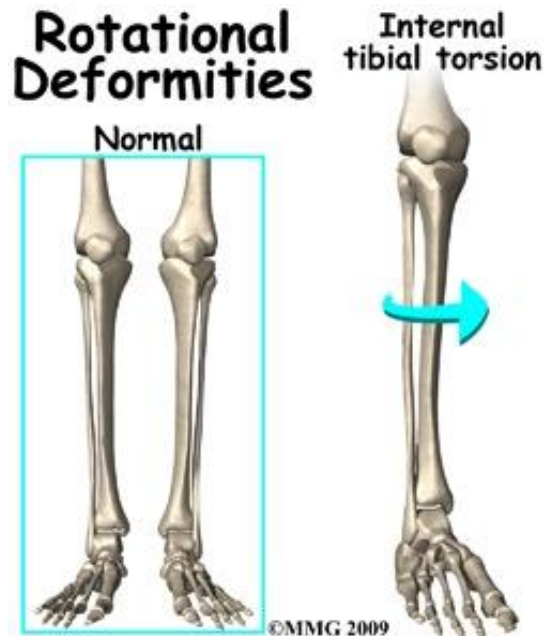


Intoeing- Asses rotational profile

Pathology Level

- Femoral anteversion
- Tibial torsion

Meaning

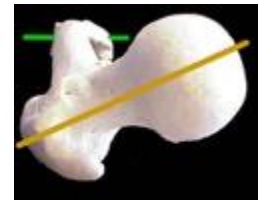
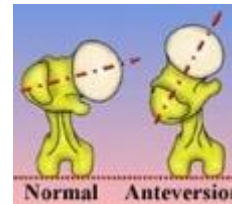


Intoeing- Asses rotational profile

Pathology Level

- Femoral anteversion
- Tibial torsion
- Forefoot adduction

Meaning

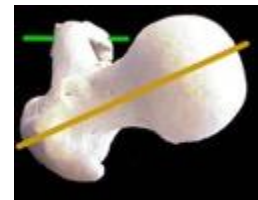
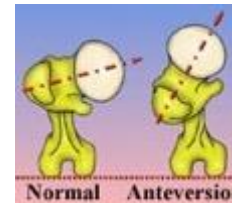


Intoeing- Asses rotational profile

Pathology Level

- Femoral anteversion
- Tibial torsion
- Forefoot adduction
- Wandering big toe

Meaning



Intoeing- Asses rotational profile

Pathology Level

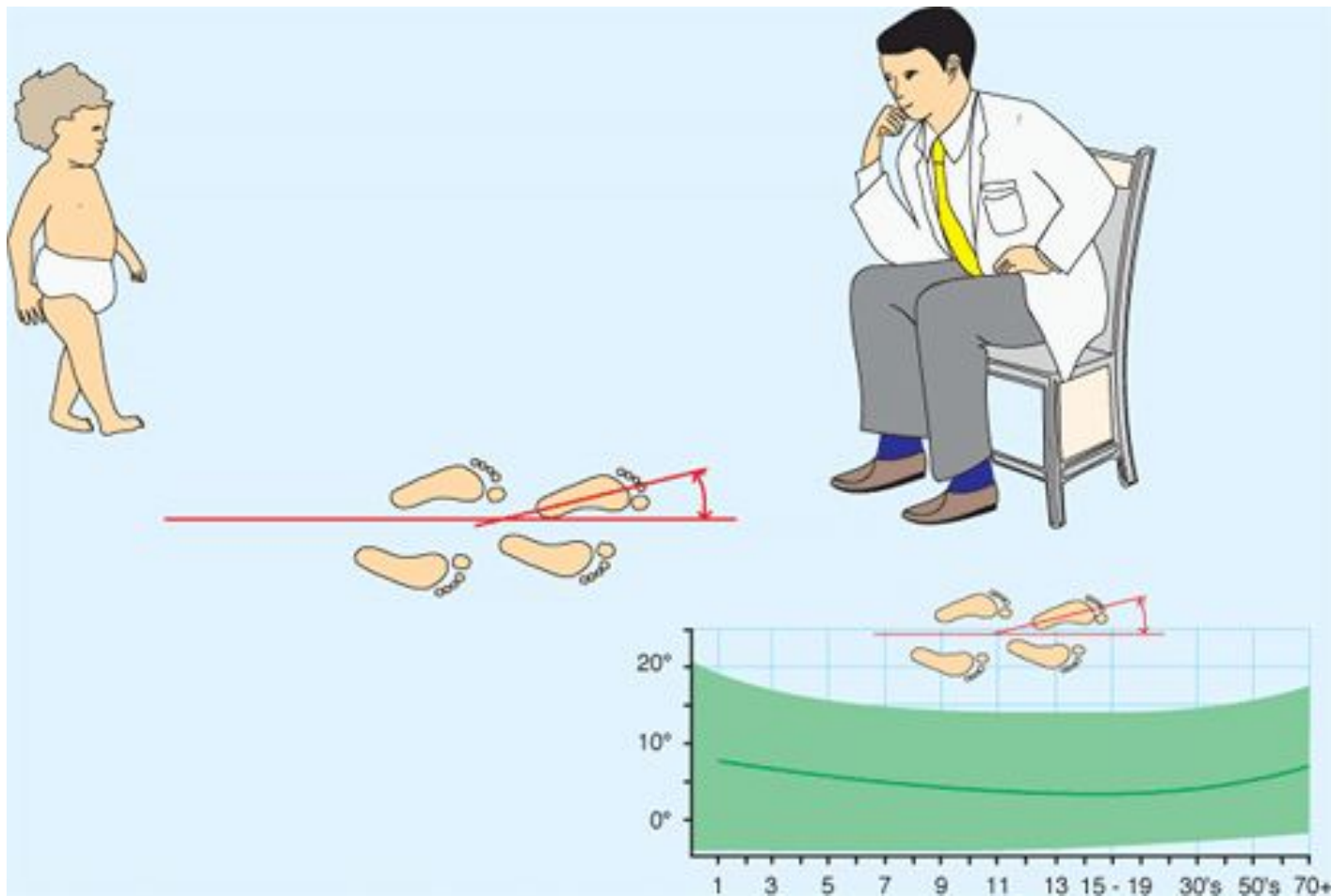
- Femoral anteversion
- Tibial torsion
- Forefoot adduction
- Wandering big toe

Special Test

- Hips rotational profile:
 - Supine
 - Prone
- Inter-malleolus axis:
 - Supine
 - Prone
- Foot thigh axis
- Heel bisector line

Intoeing- Special Test

Foot Propagation Angle □ normal is (-10°) to (+15°)



Intoeing- Special Test

Foot Propagation Angle \square normal is (-10°) to $(+15^\circ)$



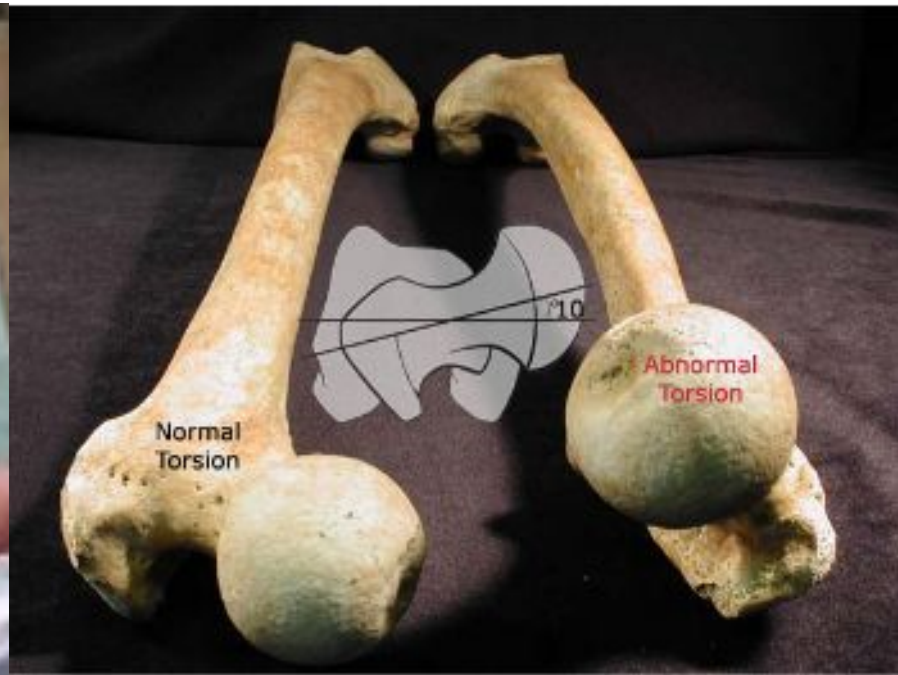
Intoeing- Femoral Anteversion

Hips rotational profile, **supine** □ IR/ER normal = 40-45/45-50°



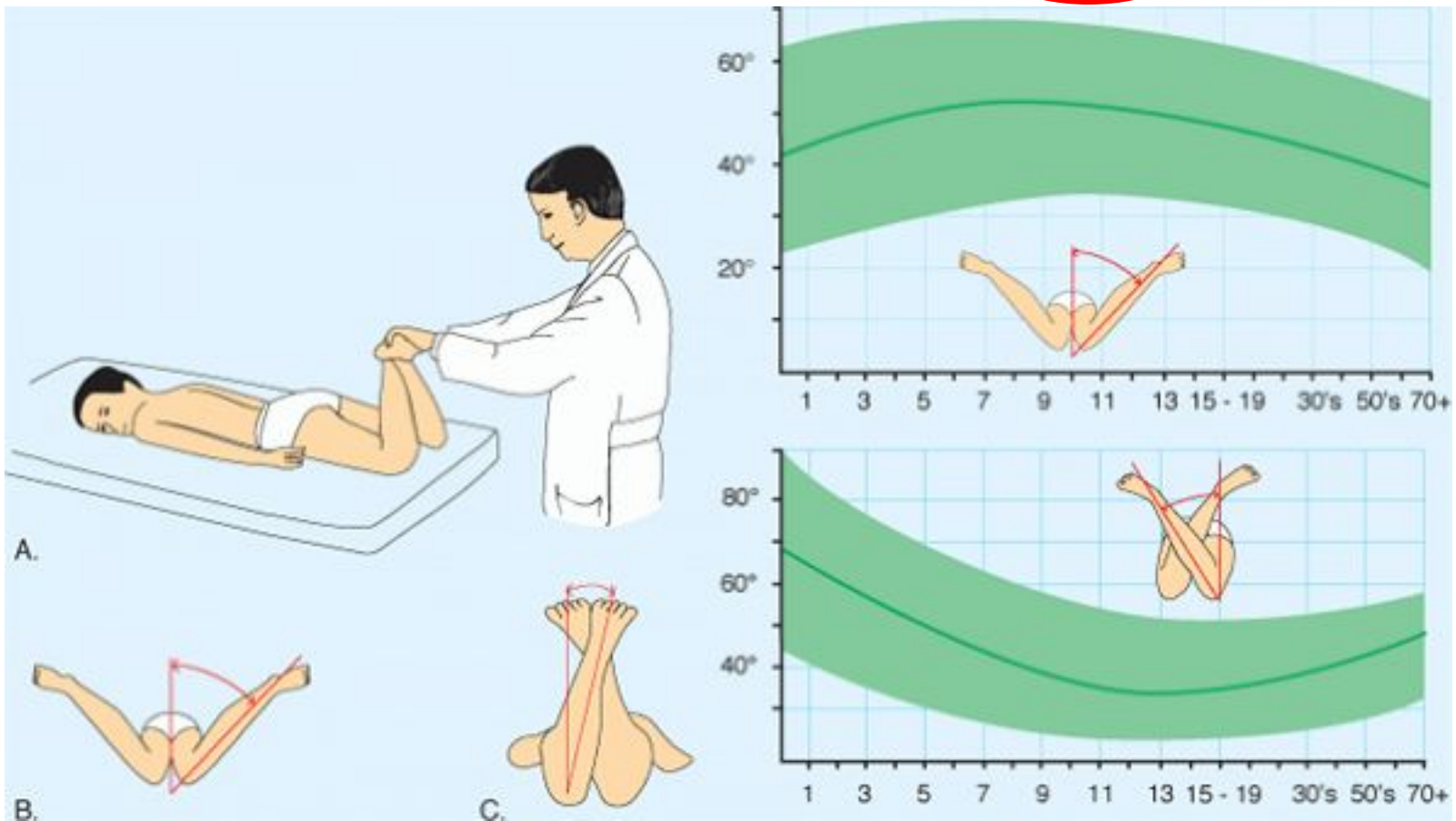
Intoeing- Femoral Anteversion

Hips rotational profile, supine IR/ER normal = 40-45/45-50°



Intoeing- Femoral Anteversion

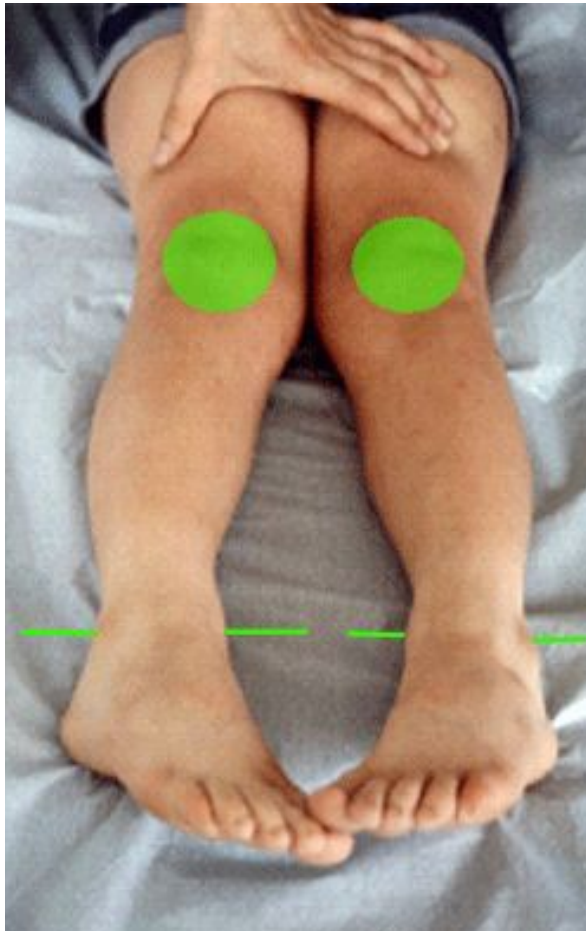
Hips rotational profile prone



Intoeing- Tibial Torsion

Inter-malleolus axis

Supine position

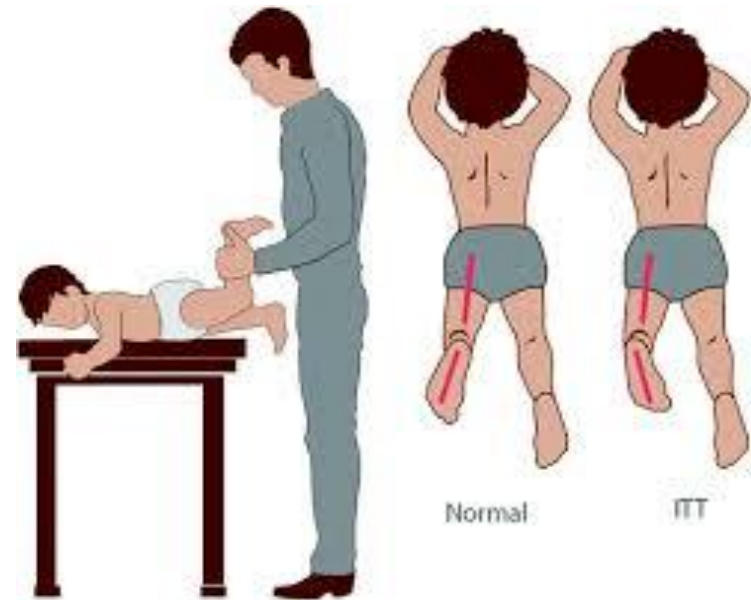


Sitting position



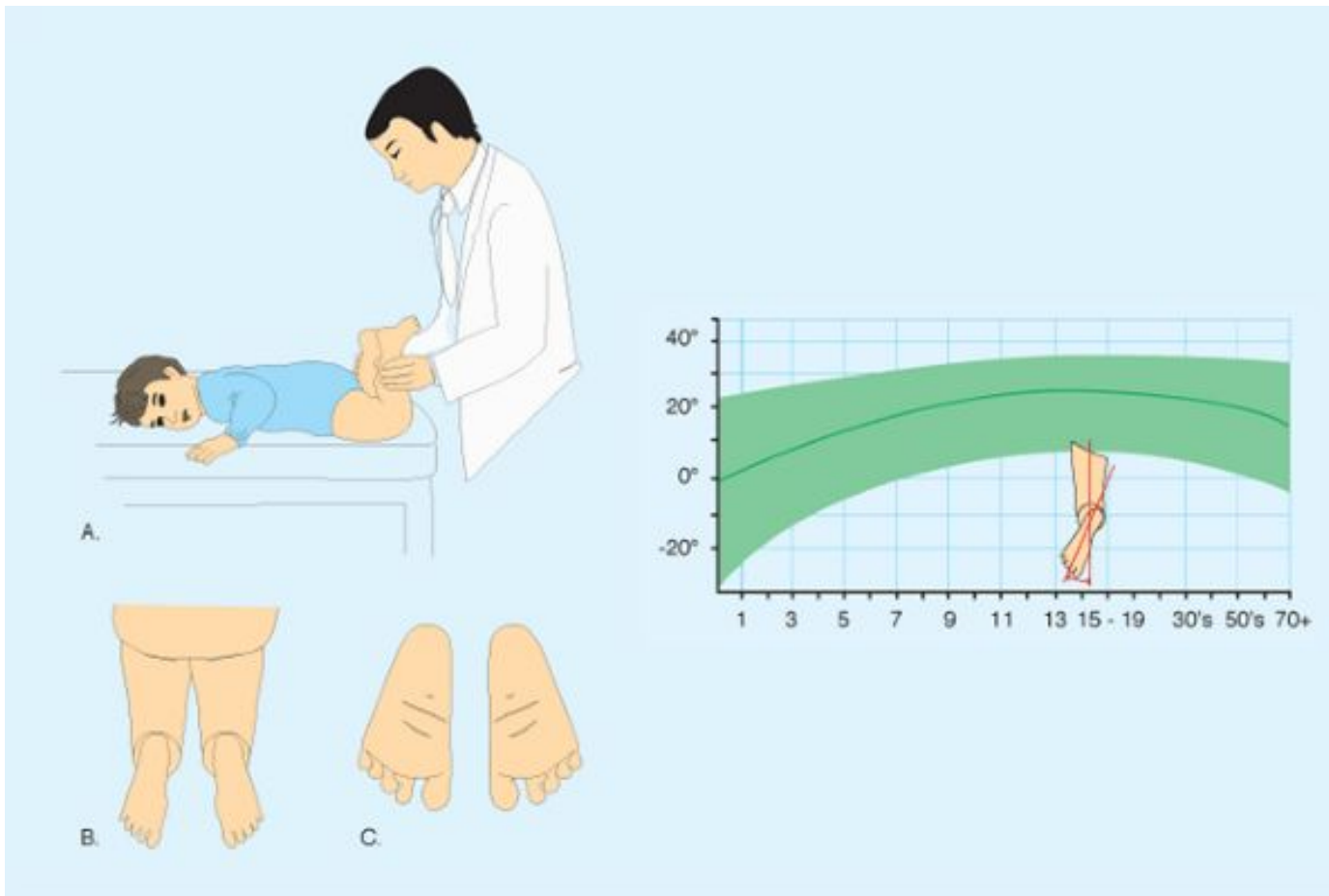
Intoeing- Tibial Torsion

Foot Thigh Axis □ normal (0°) to (-10°)



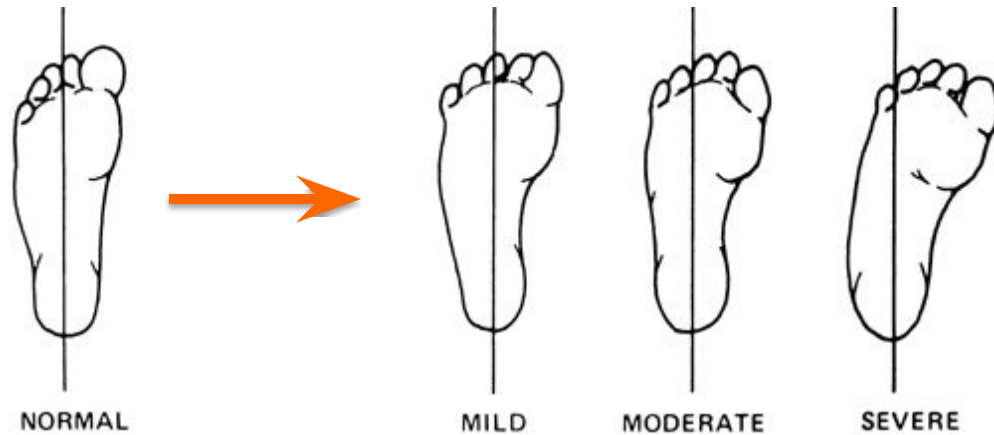
Intoeing- Tibial Torsion

Foot Thigh Axis □ normal (0°) to (-10°)

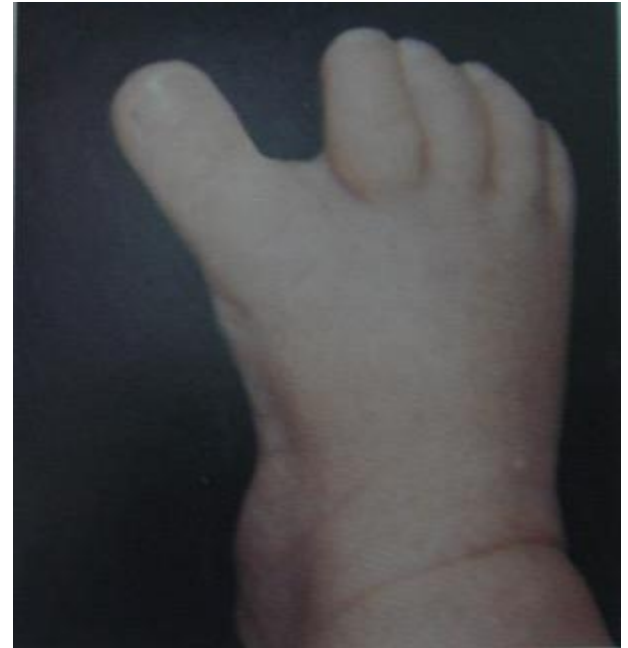


Intoeing- Forefoot Adduction

Heel bisector line normal along 2nd toe



Intoeing- Adducted Big Toe





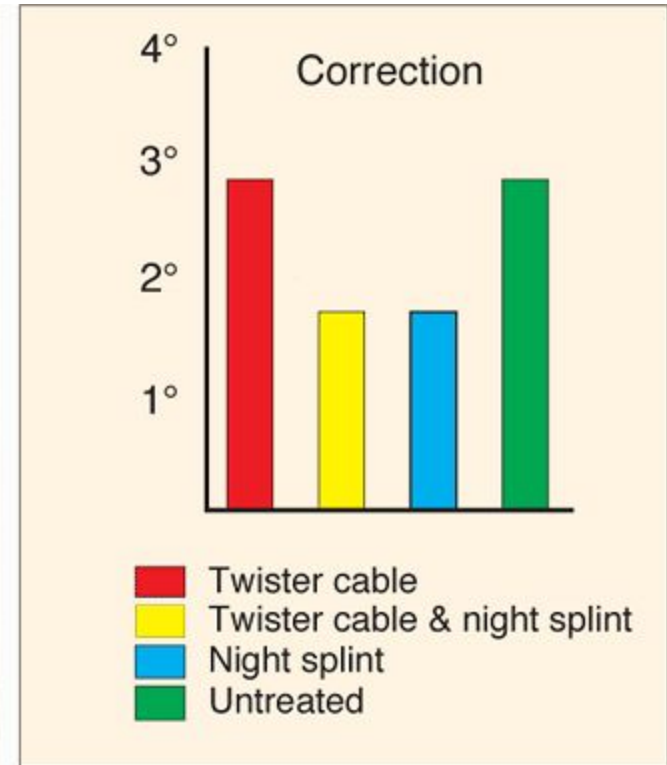
Intoeing- Treatment



- Establish correct diagnosis
- Parents education
- Observation (annual F/U) asses degree of improvement
- Femoral anti-version sit cross legged
- Tibial torsion spontaneous improvement
- Forefoot adduction anti-version shoes, or proper shoes reversal, if older child PT strengthen peronii
- Adducted big toe spontaneous improvement

In-toeing and Out-toeing

- Management principles
 - Establishing correct diagnosis
 - Allow spontaneous correction (observational management)
 - Control child's walking, sitting or sleeping is extremely difficult and frustrating
 - Shoe wedges or inserts are ineffective
 - Bracing with twister cables limits child's activities
 - Night splints have no long term benefit



Intoeing- Treatment

- Operative correction indicated for children:
 - (> 8) years of age
 - With significant cosmetic and functional deformity <1%



2) Genu Varus & Valgus

Genu Varum and Genu Valgum

- Definition:

Bow legs

Knock knees

Genu Varum and Genu Valgum

- Definition:

Bow legs



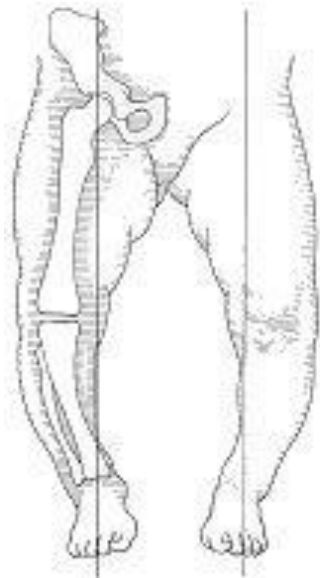
Knock knees

Normal Genu Varum and Genu Valgum

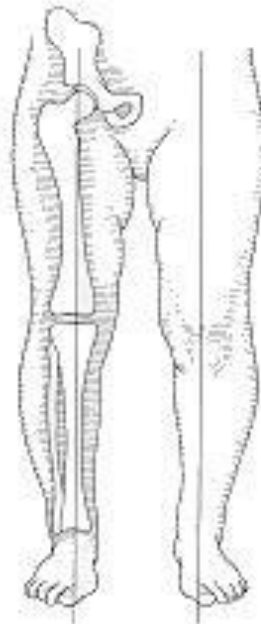


Normal Genu Varum and Genu Valgum

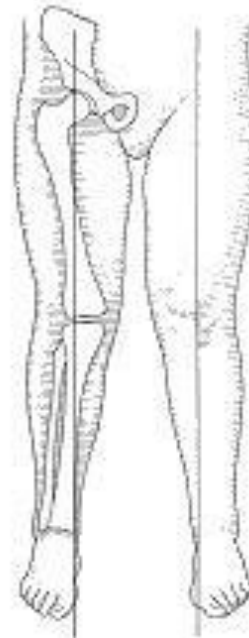
FIGURE 1 - Physiologic evolution of leg alignment at various ages.



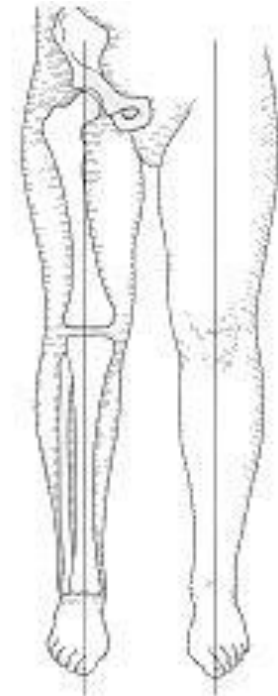
Newborn
Moderate genu varum



1 1/2 to 2 years
Legs straight



2 years, 6 months
Physiologic genu varum



4 to 6 years
Legs straight

Genu Varum and Genu Valgum

- Types:
 - Physiological is usually bilateral
 - Pathological can be unilateral



Genu Varum and Genu Valgum

- Types:
 - Physiologic
 - Pathologic

Feature	Physiologic	Pathologic
Frequency		
Family history		
Diet		
Health		
Onset		
Effect of growth		
Height		
Symmetry		
Severity		

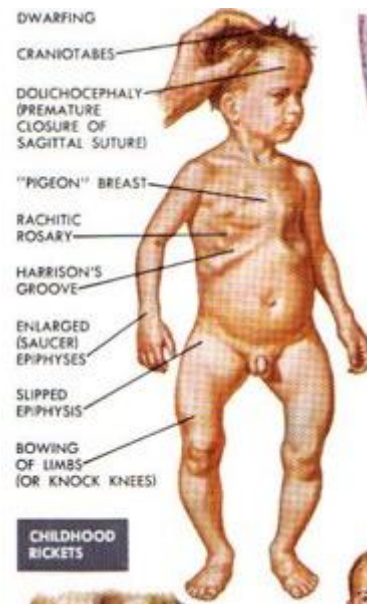
Genu Varum and Genu Valgum

- Types:
 - Physiologic
 - Pathologic

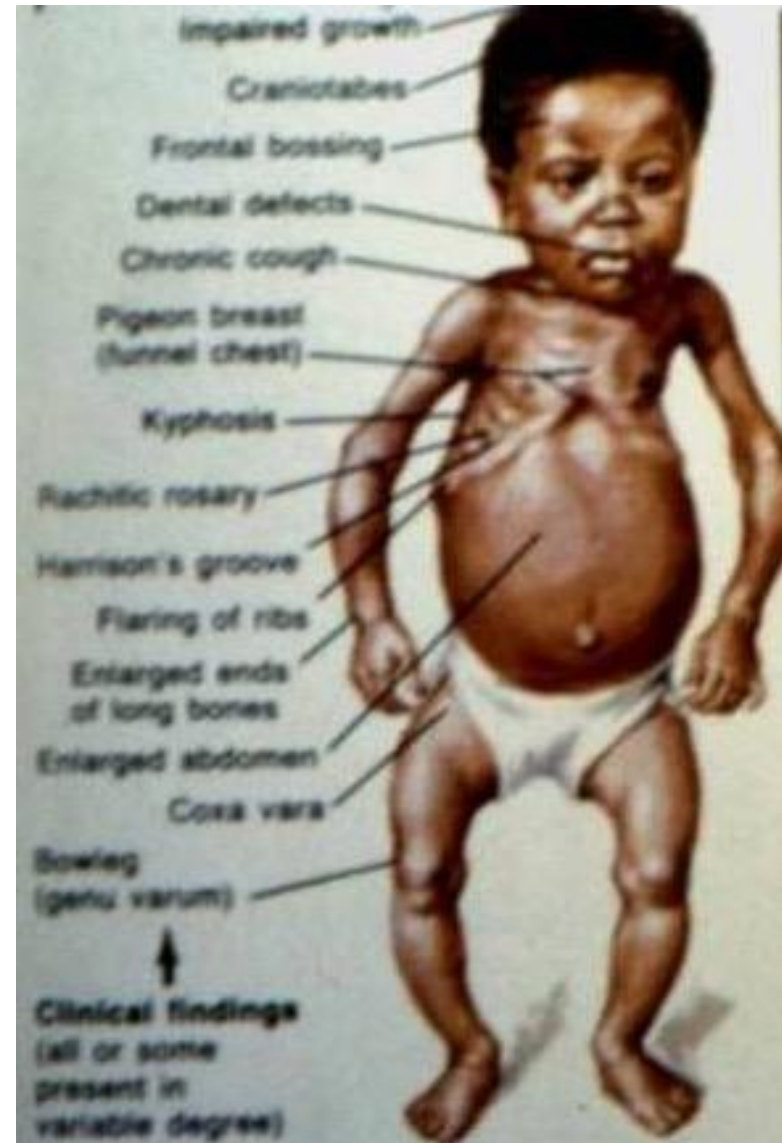
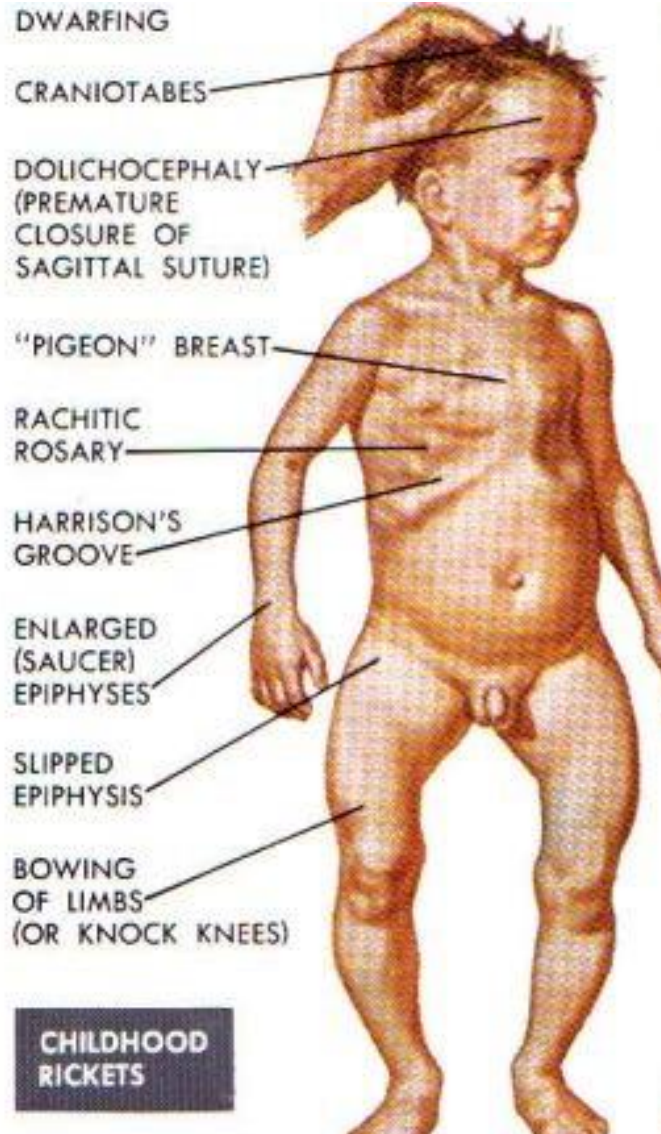
Feature	Physiologic	Pathologic
Frequency	Common	Rare
Family history	Usually negative	May occur in family
Diet	Normal	May be abnormal
Health	Good	Other MS abnormalities
Onset	Second year for bowing Third year knock-knees	Out of normal sequence Often progressive
Effect of growth	Follows normal pattern	Variable
Height	Normal	Less than 5th percentile
Symmetry	Symmetrical	Symmetrical or asym
Severity	Mild to moderate	Often beyond ± 2 SD

Genu Varum and Genu Valgum

- Evaluation
 - History (detailed)
 - Examination (signs of Rickets)
 - Laboratory



Genu Varum and Genu Valgum

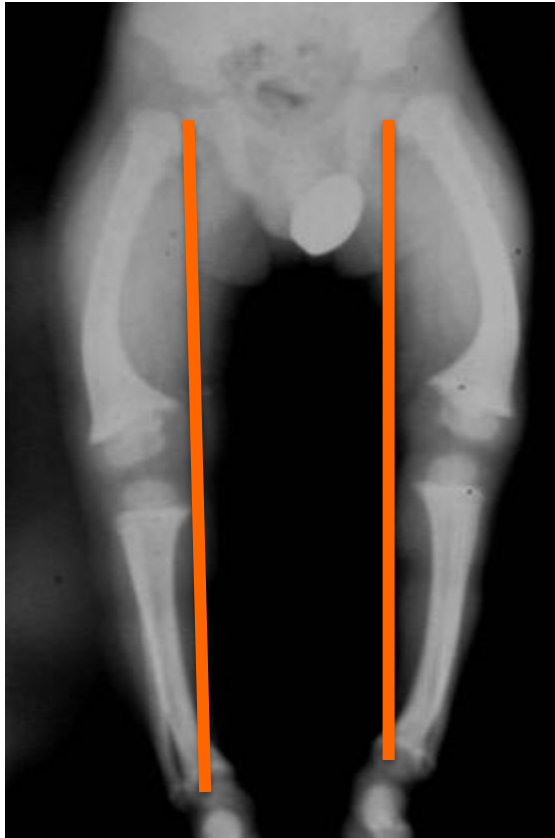


Genu Varum and Genu Valgum



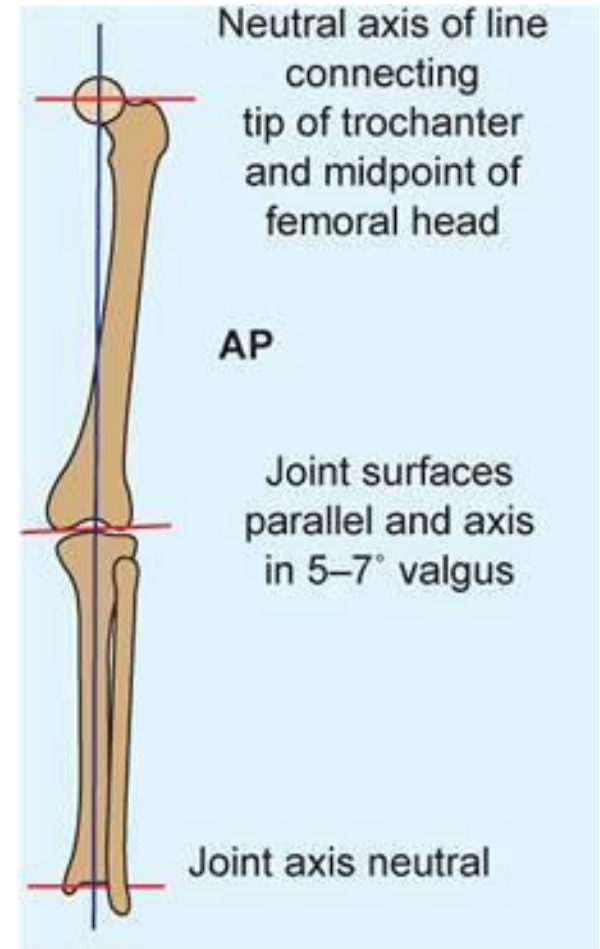
Genu Varum and Genu Valgum

- Evaluation:
 - Imaging



Genu Varum and Genu Valgum

- Evaluation
 - Imaging



Genu Varum and Genu Valgum

- Management principles:
 - Non-operative:
 - Physiological usually
 - Pathological must treat underlying cause, as rickets
 - Epiphysiodesis (temporary vs. permanent)
 - Corrective osteotomies



“Proximal Tibia Vara”

Proximal Tibia Vara

- “Blount disease”: damage of proximal medial tibial growth plate of unknown cause

- Usually:

- Overweight
- Dark skinned

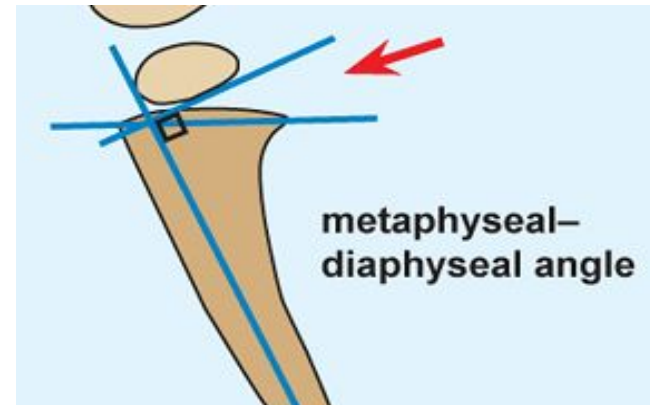
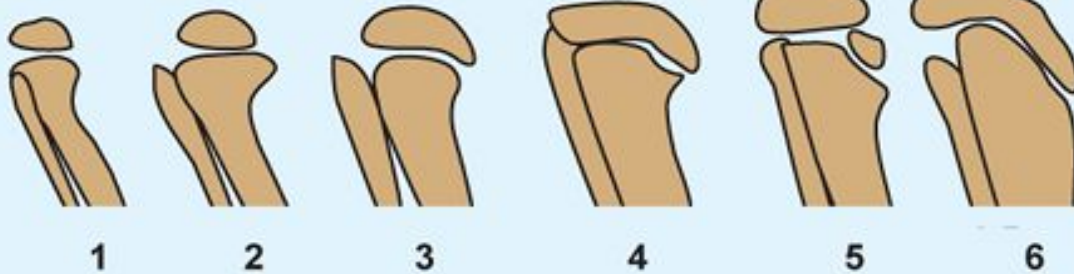
- Types:

- Infantile $\square < 3y$ of age, usually Bil & early walkers
- Juvenile $\square 3 -10 y$, combination
- Adolescent $\square > 10y$, usually unilateral



Blount Disease- Staging

Langenskiöld Stages



Blount Disease- Investigation

- MRI is mandatory:

- When:

- Sever cases
- Recurrence

- Why?



Blount Disease- Treatment

Bilateral

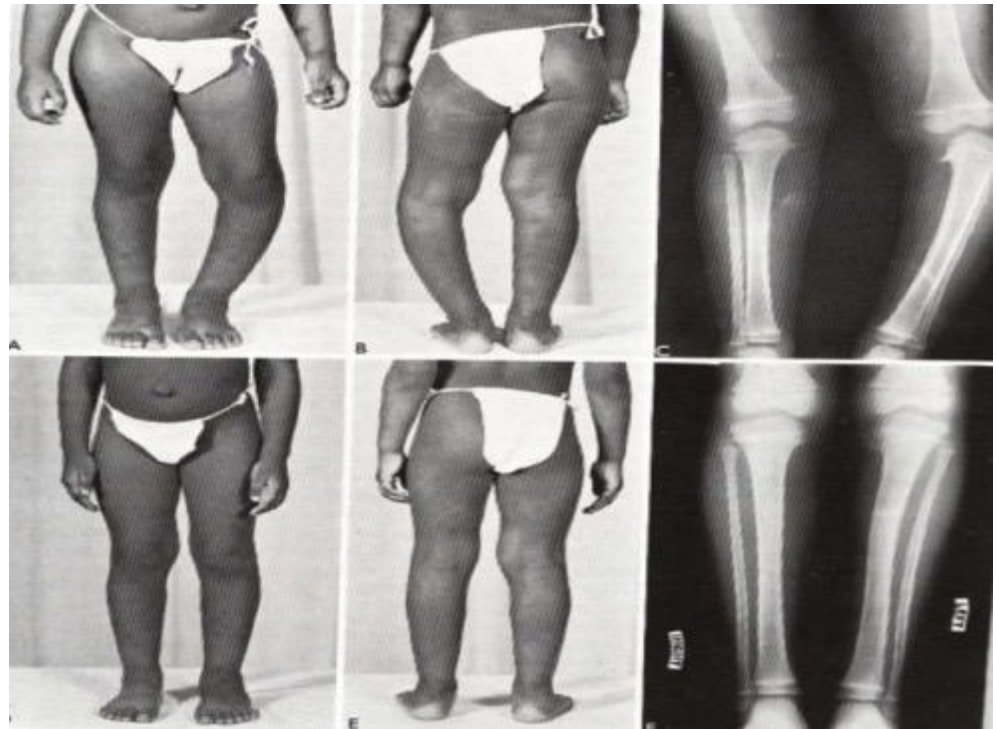


Unilateral



- Types:
 - Infantile
 - Adolescent

Blount Disease



3) Club Foot



Clubfoot

- Etiology

- Postural f
- Idiopathic (CTEV) f
- Secondary (e.g. MMC) I



Clubfoot

- Etiology

- Postural fully correctable, needs only intensive P.T
- Idiopathic (CTEV) partially correctable
- Secondary (e.g. MMC) rigid deformity, pt needs workup (e.g. X-ray or MRI), and exclude D.D



Clubfoot

- Diagnosis by exclusion

Exclude

- Neurological lesion that can cause the deformity “Spina Bifida” (excluded by spine x-rays)
- Other abnormalities that can explain the deformity “Arthrogryposis, Myelodysplasia”
- Presence of concomitant congenital anomalies “Proximal femoral focal deficiency”
- Syndromatic clubfoot “Larsen’s syndrome, Amniotic band Syndrome”

Clubfoot

- Clinical examination
Characteristic Deformity :
 - **Hind foot:**
 - Equinus (Ankle joint, tight A.T)
 - Varus (Subtalar joint)
 - **Mid & fore foot:**
 - Forefoot Adduction
 - Cavus (pronation)



Clubfoot

- Clinical examination:
 - Deformities don't prevent walking
 - Calf muscles wasting
 - Foot is smaller in unilateral affection
 - Small heel
 - Callosities at abnormal pressure areas
 - Abnormal cavus crease in middle of the foot



Clubfoot



Clubfoot

- Clinical examination:
 - Deformities don't prevent walking
 - Calf muscles wasting
 - Internal torsion of the leg
 - Foot is smaller in unilateral affection
 - Callosities at abnormal pressure areas
 - Short Achilles tendon
 - Heel is high and small
 - No creases behind Heel
 - Abnormal crease in middle of the foot



Clubfoot

- Management:

The goal of treatment for is to obtain a foot that is plantigrade, functional, painless, and stable over time

A cosmetically pleasing appearance is also an important goal sought by surgeon and family

Clubfoot

- Manipulation and serial casts:
 - Technique “Ponseti” serial casting □ weekly (usually 6-8w)



- Validity up to 12-months □ soft tissue becomes more tight

Clubfoot

- Manipulation and serial casts:
 - Maintaining correction “Dennis Brown Splint” □ 3-4y old



Clubfoot

- Manipulation and serial casts:
 - Follow up □ watch and avoid recurrence, till 9y old
 - Avoid false correction □ by going in sequence
 - When to stop ? □ not improving, pressure ulcers

Clubfoot

- Indications of surgical treatment:
 - Late presentation (>12m old)
 - Complementary to conservative treatment, as residual forefoot adduction (also > 12m)
 - Failure of conservative treatment (>9m old)
 - Recurrence after conservative treatment (>9m old)

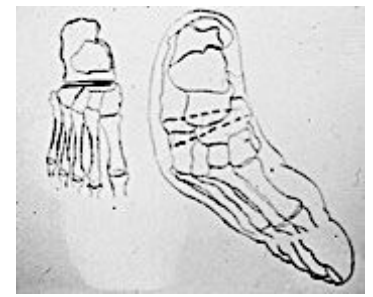
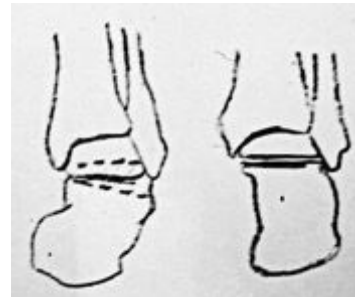
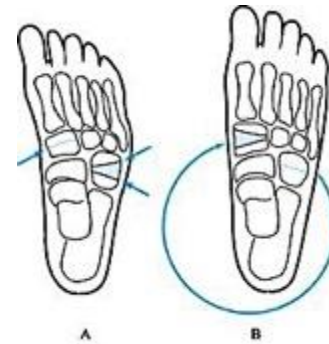
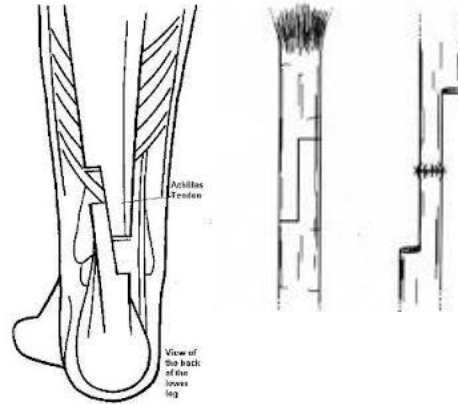
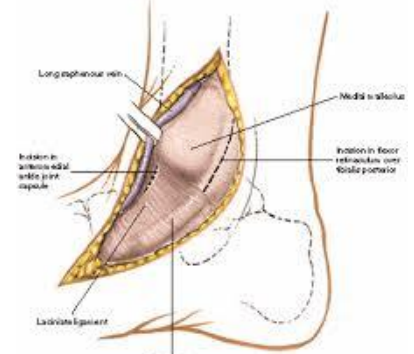
Clubfoot

- Types of surgery:

- Soft tissue □ > 9-12 m

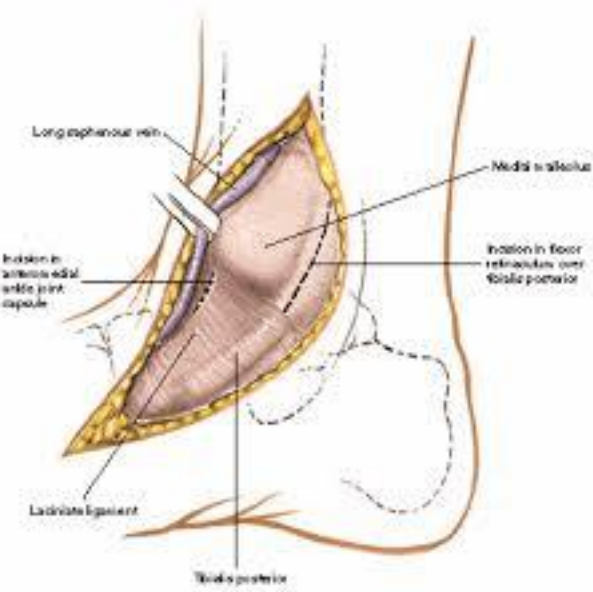
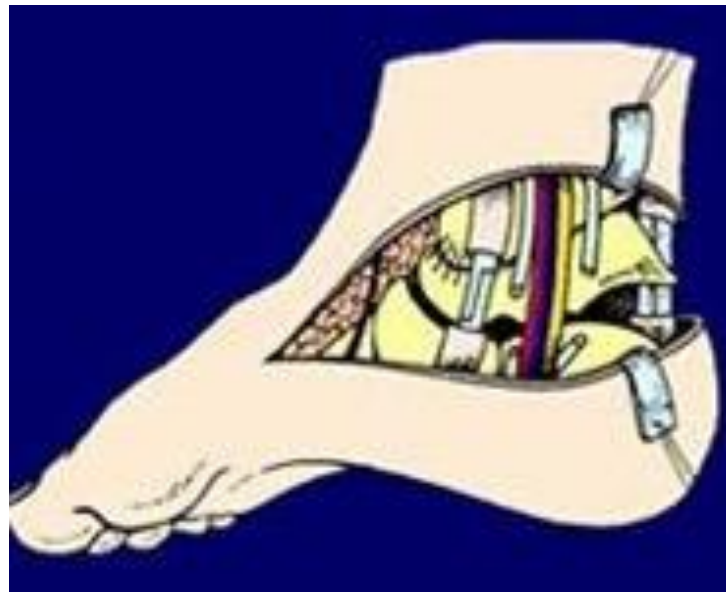
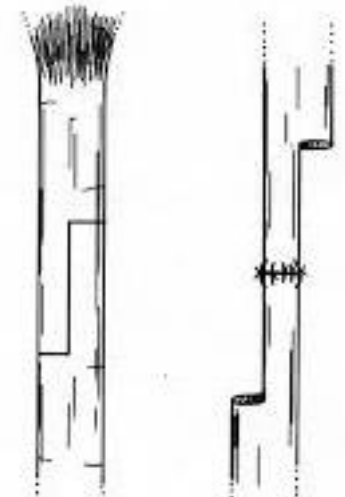
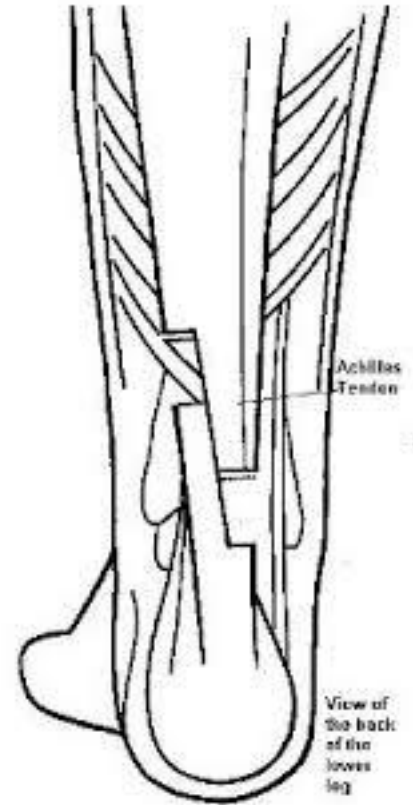
- Bony □ > 3-4 y old

- If severe & rigid □ arthrodesis (types), >10y old



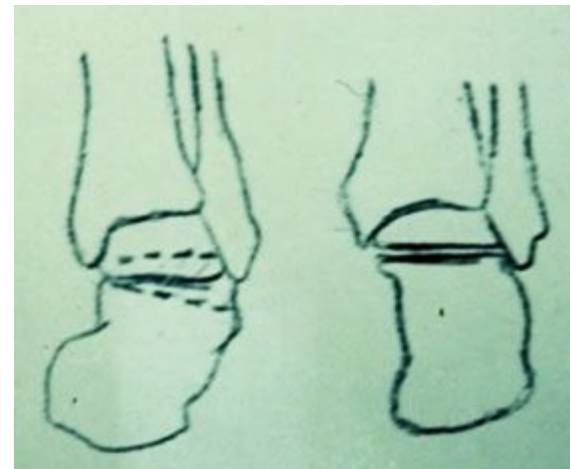
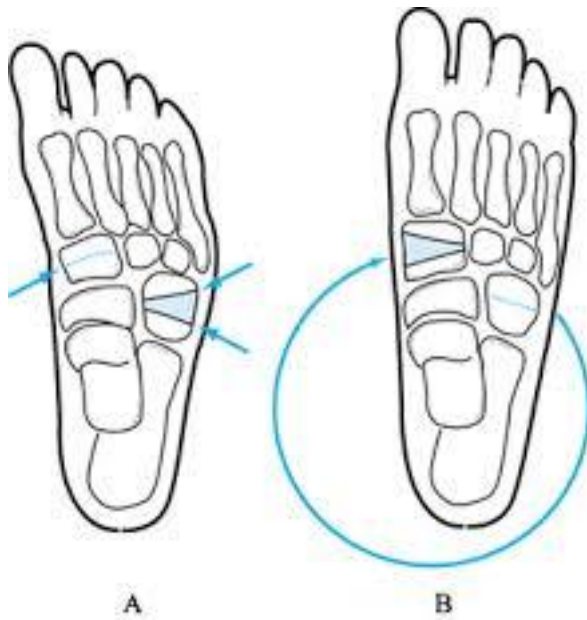
Clubfoot

- Types of surgery:
 - Soft tissue



Clubfoot

- Types of surgery:
 - Bony



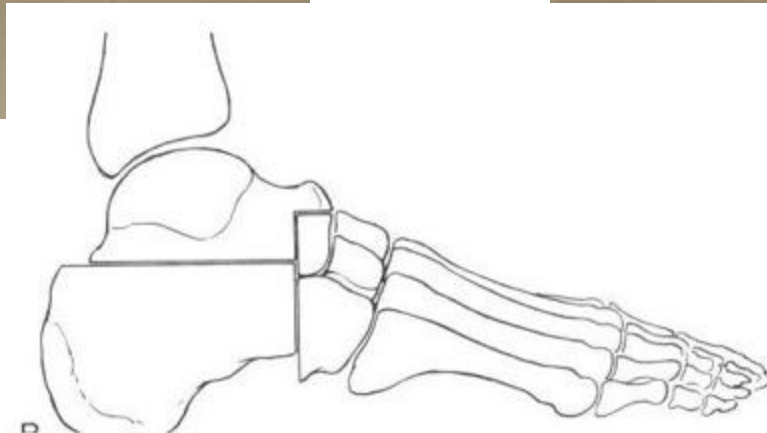
Clubfoot

- Types of surgery:
 - If sever, rigid, and in an older child



Clubfoot

- Types of surgery:
 - If sever, rigid, and in an older child (salvage)



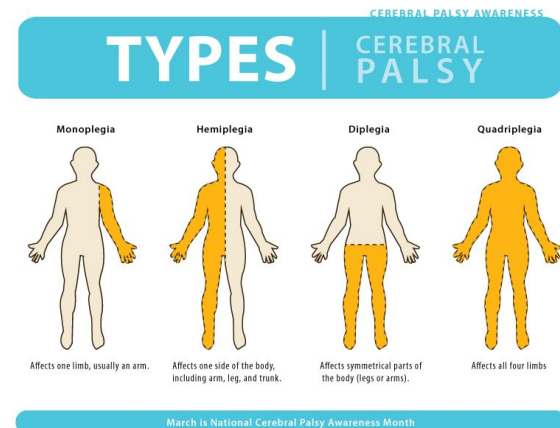
4) L.L Deformities in C.P Patients

Lower Limb Deformities in CP Child

- C.P is □ a non-progressive brain insult that occurred during the peri-natal period
- Causes □ skeletal muscles imbalance that affects joint's movements
- Can be associated with:
 - Mental retardation (various degrees)
 - Hydrocephalus and V.P shunt
 - Convulsions
- Its not-un-common

Cerebral Palsy- Types

- Physiological classification:
 - Spastic
 - Athetosis
 - Ataxia
 - Rigidity
 - Mixed
- Topographic classification:
 - Monoplegia
 - Diplegia
 - Paraplegia
 - Hemiplegia
 - Triplegia
 - Quadriplegia or tetraplegia



Cerebral Palsy- Clinical Picture

- Hip
 - Flexion
 - Adduction
 - Internal rotation
- Knee
 - Flexion
- Ankle
 - Equinus
 - Varus or valgus
- Gait
 - In-toeing
 - Scissoring
 - Crouch



Cerebral Palsy- Clinical Picture

- Right hemiplegia classic appearance:
 - Flexed elbow
 - Flexed wrist
 - Foot equines



Cerebral Palsy- Examination

- Assessment:
 - Hips □ Thomas test



Cerebral Palsy- Examination

- Assessment:
 - Knees popliteal angle



Cerebral Palsy- Examination

- Assessment:
 - Ankles □ Achilles tendon shorting



Cerebral Palsy- Treatment

- Is multidisciplinary
- Parents education
- Pediatric neurology □ diagnosis, F/U, treat fits
- ***P.T (home & center)*** □ joints R.O.M, gait training
- Orthotics □ maintain correction, aid in gait
- Social / Government aid
- Others:
 - Neurosurgery (V.P shunt),
 - Ophthalmology (eyes sequent),
 - ...etc.

Cerebral Palsy- Treatment



Cerebral Palsy- Treatment



P.T should be as fun & games



Being a quadriplegic dose not mean they can not walk or can not get a colleague degree

Cerebral Palsy- Treatment

Give them a chance, support them, let them enjoy their lives



Cerebral Palsy- Treatment

- Indications of Orthopedic surgery:
 - Sever contractures preventing P.T
 - P.T plateaued due to contractures
 - Perennial hygiene (sever hips adduction)
 - In a non-walker to sit comfortable in wheelchair
 - Prevent:
 - Neuropathic skin ulceration (as feet)
 - Joint dislocation (as hip)

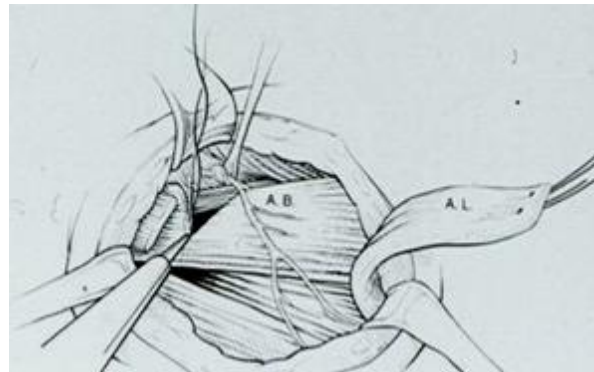
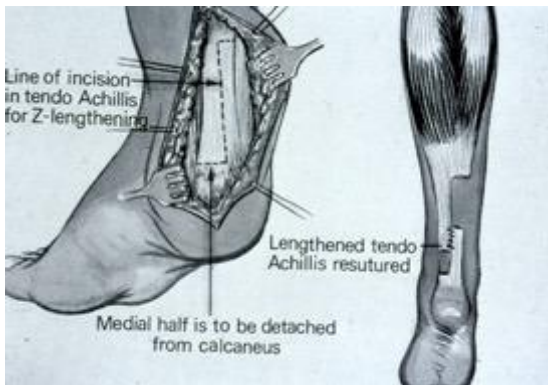
Cerebral Palsy- Treatment

To prevent skin ulceration (as feet)



Cerebral Palsy- Treatment

- Options of Surgery:
 - Tendon elongation
 - Tendon Transfer
 - Tenotomy
 - Neurectomy
 - Bony surgery osteotomy / fusion



5) Limping

Limping Definition

- Limping an abnormal gait
- Due to:
 - Deformity (bone or joint)
 - Weakness (general or nerve or muscle)
 - Pain (where)
- In one or both limbs



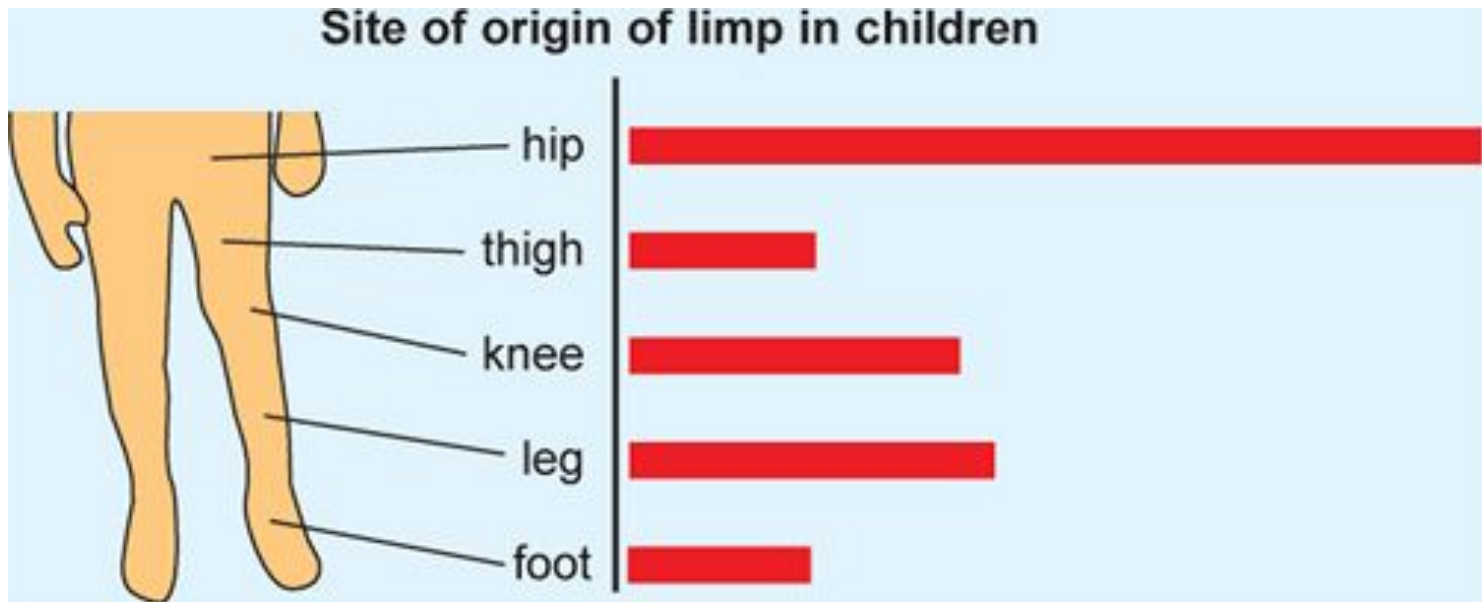
Limping

- Diagnosis by:
 - History (detailed, specially age of onset)
 - Examination:
 - Gait good analysis
 - Is it:
 - Above pelvis Back (scoliosis)
 - Below pelvis Hips, knees, ankles, & feet
 - Neuro.Vascular



Limping

- Management:
 - Generalization can't be made.
 - Treatment of the cause:



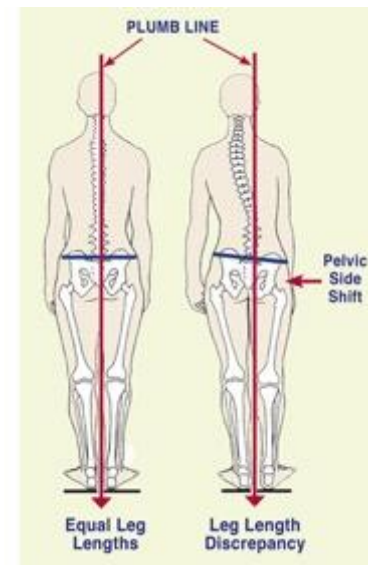
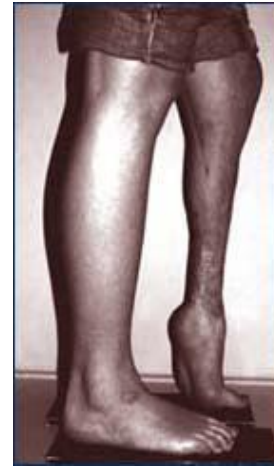
**If The Cause Was MSK
That Led To
Limb Length Inequality**

Limb Length Inequality

- True vs. apparent
- Etiology:
 - Congenital □ as DDH
 - Developmental □ as Blount's
 - Traumatic □ as oblique # (short), or multifragmented (long)
 - Infection □ stunted growth or dissolved part of bone
 - Metabolic □ as rickets (unilateral)
 - Tumor □ affecting physis

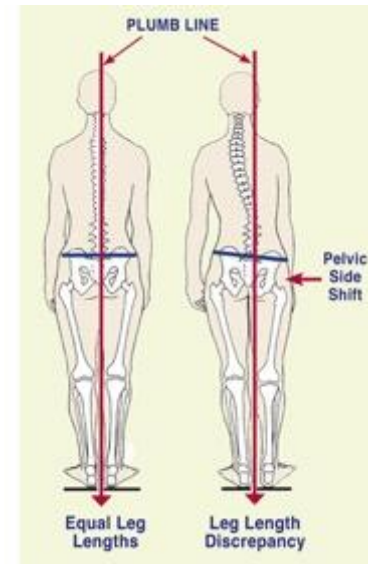
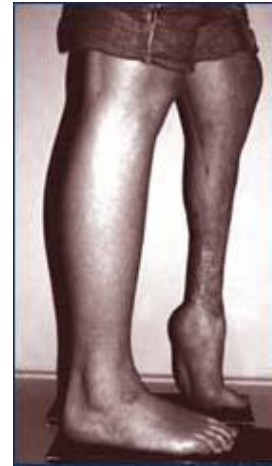
Limb Length Inequality

- Adverse effects & clinical picture:
 - Gait disturbance
 - Equinus deformity
 - Pain: back, leg
 - Scoliosis (secondary)
- Evaluation:
 - Screening examination
 - Clinical measures of discrepancy
 - Imaging methods (Centigram)



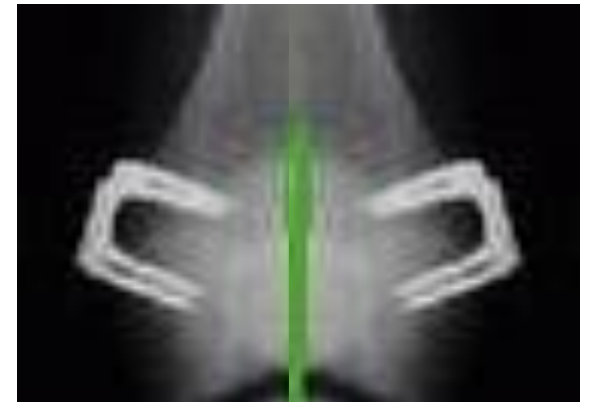
Limb Length Inequality

- Adverse effects & clinical picture:
 - Gait disturbance
 - Equinus deformity
 - Pain: back, leg
 - Scoliosis (secondary)
- Evaluation:
 - Screening examination
 - Clinical measures of discrepancy
 - Imaging methods (Centigram)



Limb Length Inequality

- Management depends on the severity ($>2\text{cm}$):
 - For shorter limb:
 - Shoe raise
 - Bone lengthening
 - For longer limb:
 - Epiphysiodesis (temporary or permanent)
 - Bone shortening



6) Leg Aches

Leg Aches

- What is leg aches?
 - “Growing pain”
 - Benign
 - In 15 – 30 % of normal children
 - F > M
 - Unknown cause
 - No functional disability, or limping
 - Resolves spontaneously, over several years

Leg Aches

- Clinical features (
- H/O:
 - At long bones of L.L (Bil)
 - Dull aching, poorly localized
 - Can be without activity
 - At night
 - Of long duration (months)
 - Responds to analgesia
- O/E:
 - Long bone tenderness nonspecific, large area, or none
 - Normal joints motion

Leg Aches

- Clinical features diagnosis by exclusion
- H/O:
 - At long bones of L.L (Bil)
 - Dull aching, poorly localized
 - Can be without activity
 - At night
 - Of long duration (months)
 - Responds to analgesia
- O/E:
 - Long bone tenderness nonspecific, large area, or none
 - Normal joints motion

Leg Aches

- D.D from serious problems, mainly tumor:
 - Osteoid osteoma
 - Osteosarcoma
 - Ewing sarcoma
- Also could be:
 - Leukemia
 - SCA
 - Subacute O.M

Leg Aches

- Management
 - Reassurance
 - Symptomatic:
 - Analgesia (oral, local)
 - Rest
 - Massage

Any Question ?

Remember

Take Home Message

1. **Intoeing** is one of 4 causes, treatment depends on the level, mainly observe, operate >8y old
2. **Genu varus & valgus** phys vs. patho, rickets, when operate
3. **Blount** early walkers, treatment mainly surgery
4. **CTEV** 3 types, treat as young as possible, Ponseti better to avoid surgery
5. **L.L in C.P** mainly treat spastic, PT importance, surgery indications
6. **Limping** due (pain- week- deformed), above or below pelvis
7. **L.L.I** proper assess (cause & level), treated >2cm, options of treat
8. **Leg aches** symptomatic treatment

Lecture Objectives

1. **Intoeing** □ level of causes, special tests for each level, know normal angles of rotational profile, treatments, parents education
2. **Genu varus & valgus** □ physiological vs. pathological, rickets clinical & radiological evaluation, when operate
3. **Blount** □ pathology level, types, how to read XR, MRI when needed, surgery
4. **CTEV** □ 3 types, clinical picture, Ponseti treat, surgery options
5. **L.L in C.P** □ types, clinical assessment, treatments
6. **Limping** □ due (pain- week- deformed), uni or bi, proper assessment
7. **L.L.I** □ true vs. apparent, proper assessment to know cause & level, effects if not treated, >2cm, options of treat
8. **Leg aches** □ clinical picture, D.D, treatment