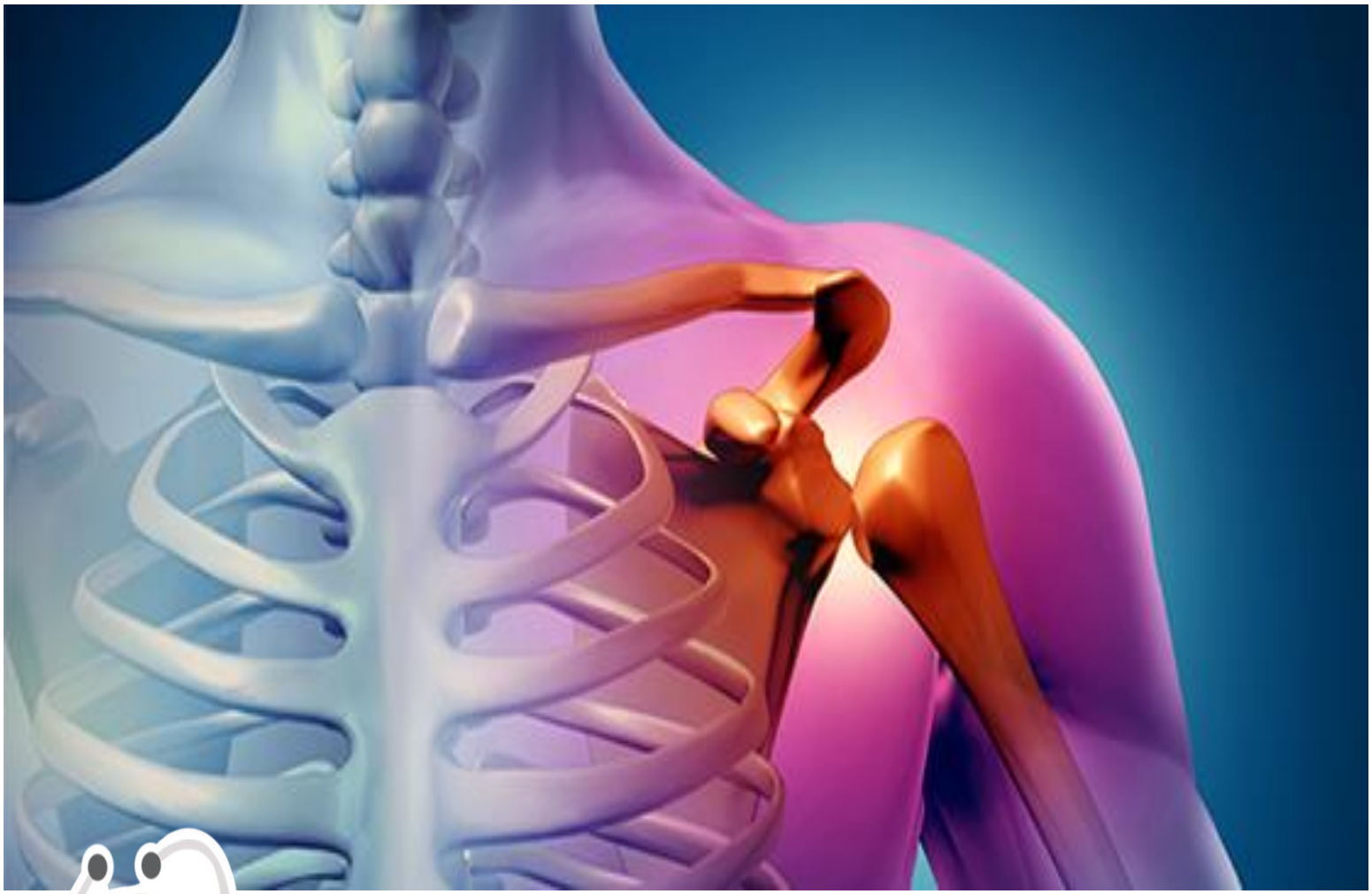
Orthopedics

10 Common Pediatric Lower Limb Disorder



1st Edition:

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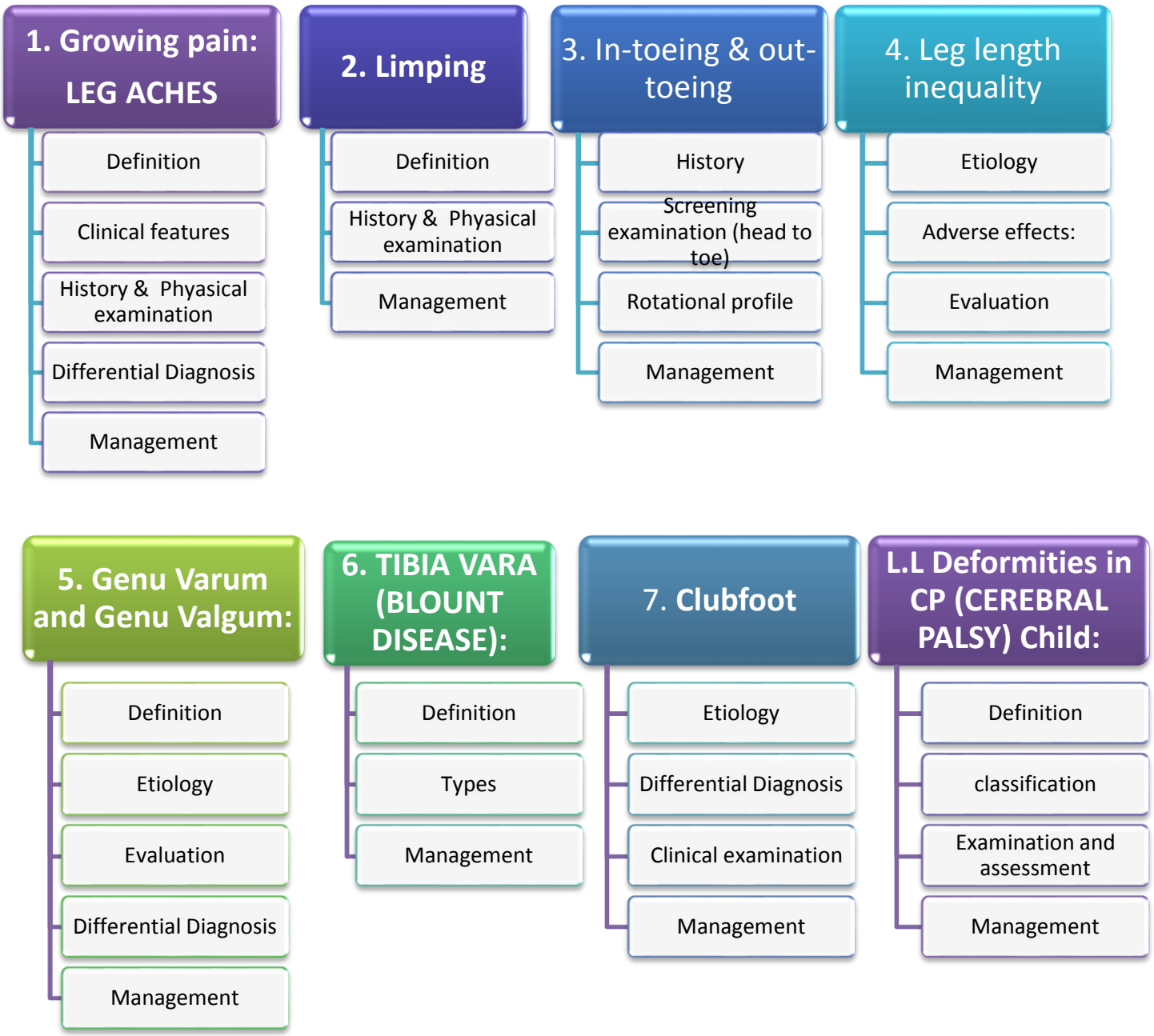
Color Code:

Slides	Doctor's Notes	Team Notes	Important
431 team work	Arabic Words	Books' notes	Other Sources

Objectives: Not given

Mind Map



1. Growing pain: LEG ACHES

What is leg aches? Cramping in both legs in 15% to 30% of normal children

- **Definition:**
  - Growing pain (cramping, achy muscle pains at age 2-12 yr)
  - Benign
  - In 15 – 30 % of normal children
  - No functional disability
  - F>M
  - Resolves spontaneously, over several years
  - Unknown cause
- **Clinical features**
  - Diagnosis by exclusion of other Causes of the pain (Tumor – Trauma – Infection)
- **History:**
  - pain at long bones of L.L (calf, shin, or thigh) usually bilateral
  - Dull aching pain, poorly localized
  - Can be without activity
  - At night (sometimes after intense childhood activities)
  - Of long duration (months) & there is no hx of trauma
  - Responds to analgesia (NSAID)
- **Phyasical examination**
  - Long bone tenderness → nonspecific, large area, or none
  - Normal joints motion
- **Differential Diagnosis** from serious problems mainly <u>tumor</u>
  - Osteoid osteoma
  - Osteosarcoma
  - Ewing sarcoma
  - Leukemia
  - SCA
  - Subacute Osteomyelitis
- **Management**
  - Symptomatic (Analgesia, rest, massage)
  - Reassurance

2. Limp:

- **Definition:**

  - Abnormal gait due to pain, weakness or deformity
  - **Types of Limp** (In one or both limbs):
  - **Painful gait: Antalgic gait** (usually unilateral)
    (Trauma – Tumor – Infection)
  - **Painless gait** (usually bilateral)
    (Syndromic – Congenital)
  - **Weakness** (general or nerve or muscle),
  - **Deformity** (bone or joint)

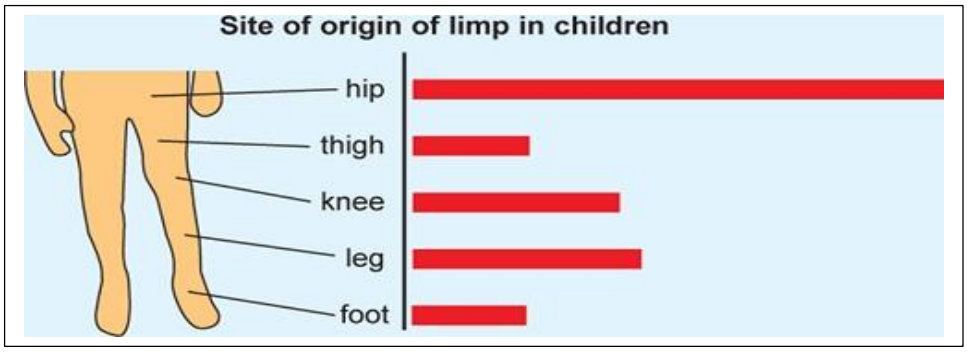
- **History** (Mainly age of onset)
- **Physical**

- Evaluate the limp by studying the child's gait while the child walks in the clinic hallway

  - Above pelvis → Back (scoliosis)
  - Below pelvis → Hips, knees, ankles, & feet
  - Waddling gait = abductors weak in both legs
  - Toe to heel gait (plantar flexion) = Equinus gait

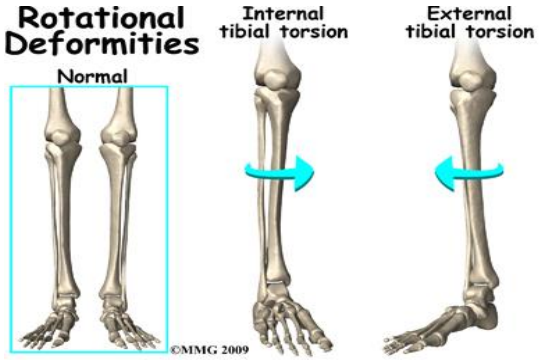
- Neuro.Vascular Ex

- **Management**
  - Generalization regarding management cannot be made
  - Treatment of the cause



3. In-toeing and Out-toeing: "Main Complain is frequent fall"

Normally we walk outside box 15 to 20 degree more than that will be out-toing/ less than that up to zero will consider In-toing



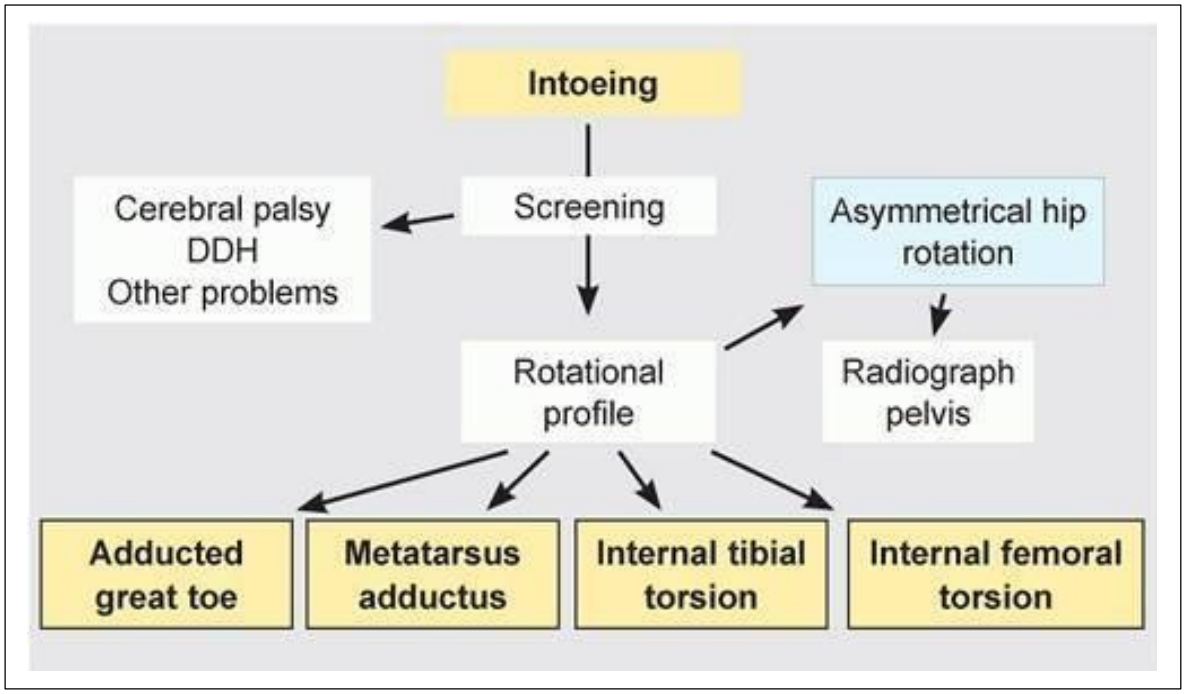
Terminology

- **Version:** Describes normal variations of limb rotation It may be exaggerated
- **Torsion:** Describes abnormal limb rotation Internal or external

A. In-toeing: most common cause of in-toeing is cerebral palsy and developmental dysplasia of the hip (DDH)

- Walking with toe inwards (Increase internal Rotation)

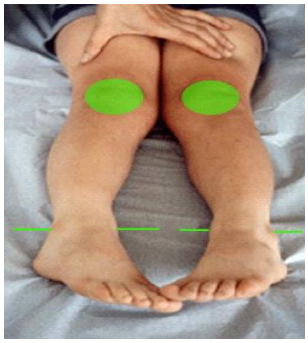
- **Evaluation:** you should look for the pathology and where (in toe, foot, leg, femur, hip)
  - **History**
  - **Screening examination (head to toe)**
  - **Rotational profile**

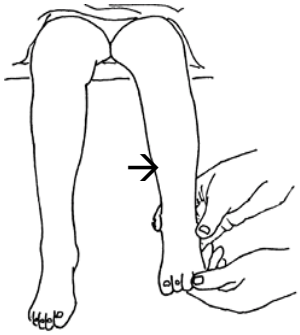


In-toeing conditions:

I. In-toeing: Femoral Anteversion

Femoral head is anterior in comparison of the femur condyles → Can't sit cross legged



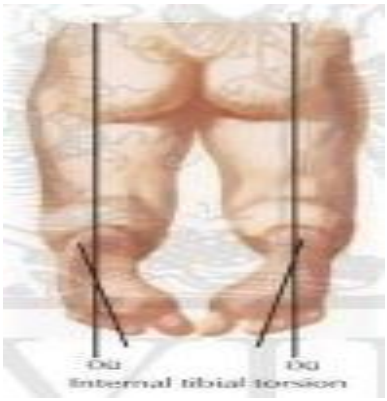


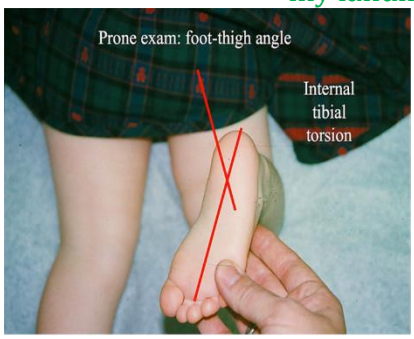
Supine position sitting position

my landmark is always patella

II. In-toeing: Tibial Torsion

spontaneous improvement

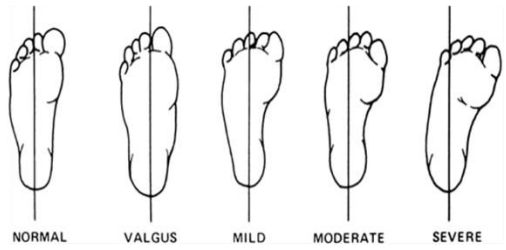




* Assess the intermalleolar axis
(normally lateral malleolus is posterior and the medial is anterior)
If the lateral malleolus was in the same level or more forward to the medial = Tibial torsion

III. In-toeing: Forefoot Adduction very rare

The severity depends on the heel bisector line normally in the 2nd big toe
→ anti-version shoes, or proper shoes reversal



IV. In-toeing: Adducted Big Toe

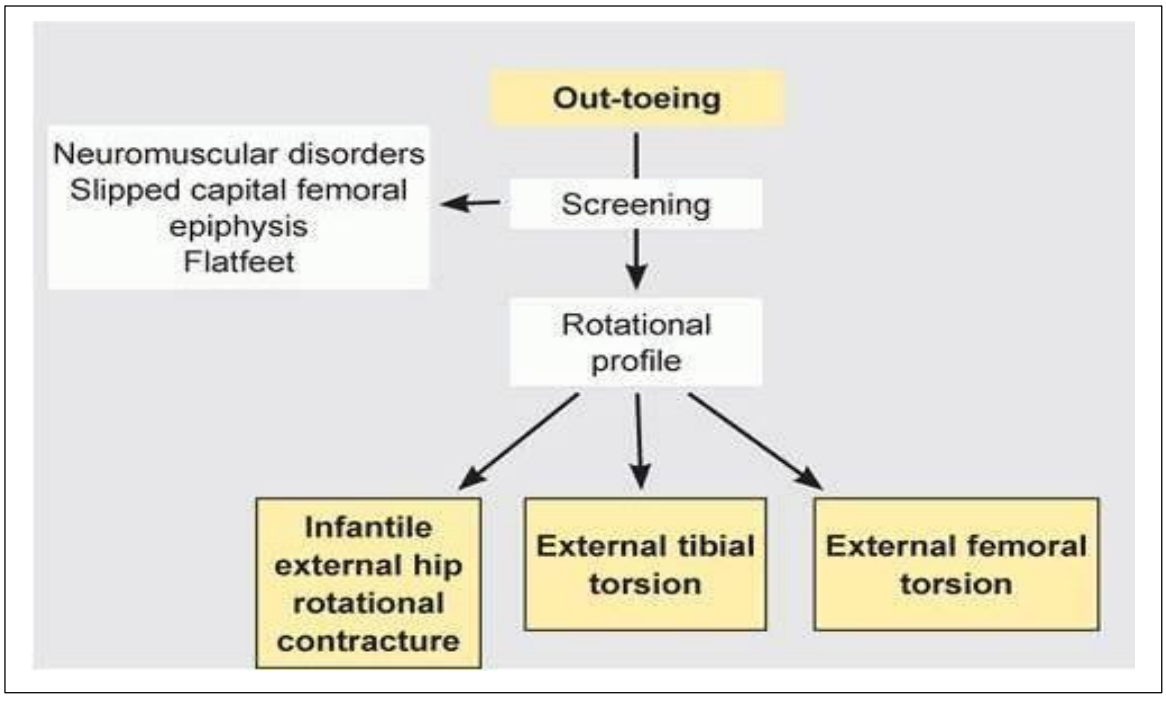
→ spontaneous improvement

B. Out-toeing: most common cause of out-toeing is SCFE and Neuromuscular disorders

- Walking with toe everted (Increase External Rotation)

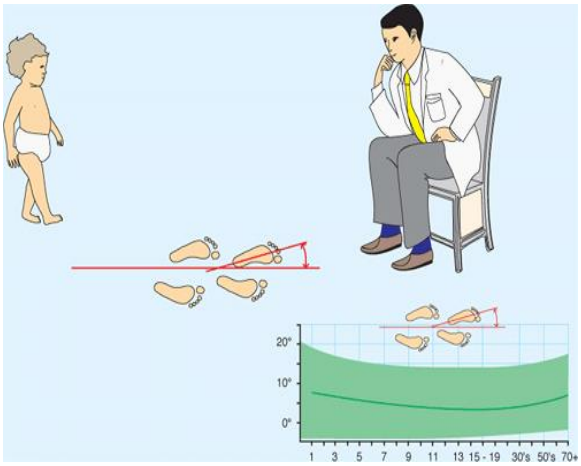
SCFE= Slipped capital femoral epiphysis: a fracture through the growth plate (physis), which results in slippage of the overlying end of the femur (epiphysis).

- **Evaluation:** you should look for the pathology and where (in toe, foot, leg, femur, hip)
  - **History**
  - **Screening examination (head to toe)**
  - **Rotational profile**



Physical Examination (Approach to assess a child with in-toeing or out-toeing)

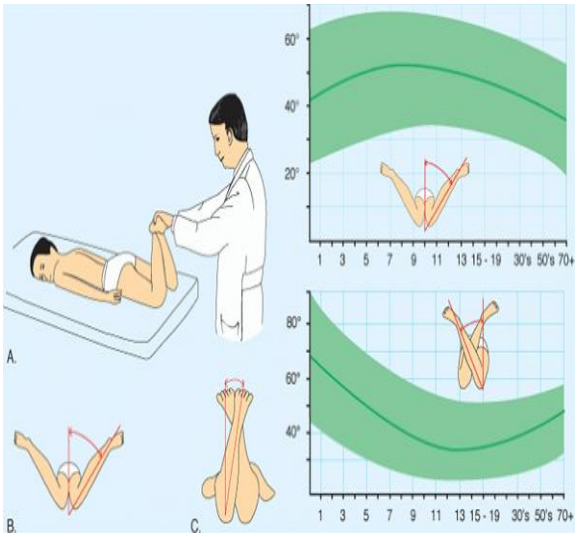
1st: ***Foot progression angle*** (To assess the direction of the foot when the child walks) (how much the foot is outward (Out-toeing) or inward (In-toeing) on an imaginary line on the ground



- The child should walk about 30 feet.
- Normally foot is everted (N= -5° to +15°)
  - If decreased > In-toeing > Internal rotation.
  - If increased > out-toeing > external rotation
- If mild > wait for spontaneous correction
- If severe or past the age of spontaneous Correction > surgical

2nd: ***hips rotational profile*** (Assessment of the hip range of motion, assessment of version of the hip)

- Normally, external rotation is similar to or slightly more than internal rotation. If internal rotation is more than external rotation, this indicates excess femoral anteversion.



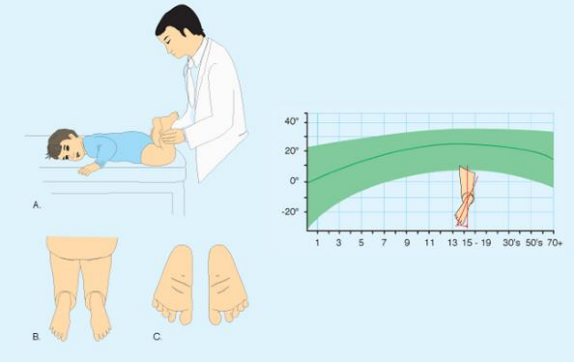
A. the pt is prone- internal rotation
B. increased internal rotation
C. decreased internal rotation

Increased internal rotation:
W position, cannot sit cross-legged
(The problem in the hip)

3rd: ***Assessment of the Foot Thigh Axis*** (assessment of the tibial torsion)

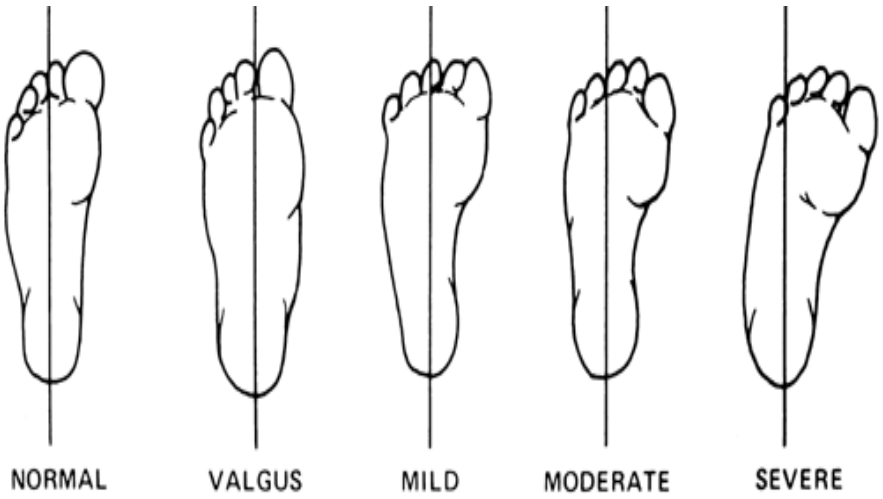
- The child lies prone on the table and the physician assesses the angle between the thigh and foot with the knee flexed (long axis of the foot should be on the same axis of the thigh) (N= 10°-15°)

- The thigh foot angle assesses the torsion of the tibia.
- By the age of 8 years, the torsion of the tibia reaches its adult value which is about 15° externally.



4th: ***Assessment of the relation between the forefoot and the hindfoot*** (assessment of metatarsus adductus).

- Draw an imaginary line bisecting the ankle, this line should pass by the second toe If it passes lateral to the third toe, this indicates metatarsus adductus.



Management principles:

- Establishing correct diagnosis
- Determine site to determine the cause
    - If mild > wait for spontaneous correction
    - If severe or past the age of spontaneous Correction > surgical
- 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

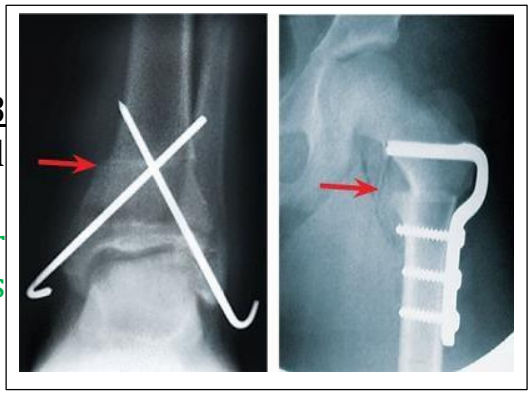
"Allow spontaneous correction (observational management) until 8 years of age"

- **In-toeing:**
    - Annual clinic F/U → asses degree of deformity
    - Femoral anti-version → sit cross legged (to give more space for external rotation)
    - Tibial torsion → spontaneous improvement
    - Forefoot adduction → anti-version shoes, or proper shoes reversal
    - Adducted big toe → spontaneous improvement

- **Out-toeing:**
    - <u>Usually does not improve spontaneously</u>
    - Will need an operation:
        - After the age 8y
        - Foot propagation angle >30°

Operative correction:

- Indicated for children above the age of <u>8 years</u> with significant cosmetic and functional deformity
- Doing osteotomy and rotate it the other direction and fix it in place with K-wires then remove them.



4. Limb Length Inequality:

True (what you Measure) and apparent (what you observe) (tip toe walking)

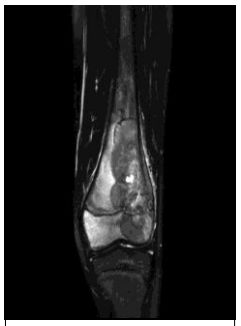
- **Etiology:**
  - Congenital → as DDH
  - Developmental → as Blount's (is a progressive bow-leg deformity associated with abnormal growth of the posteromedial part of the proximal tibia. The children are usually over- weight and start walking early)
  - Traumatic → as oblique # (short), or multifragmented (long)
  - Infection → stunted growth or dissolved part of bone
  - Metabolic → as rickets (unilateral)
  - Tumor → affecting physis

DDH

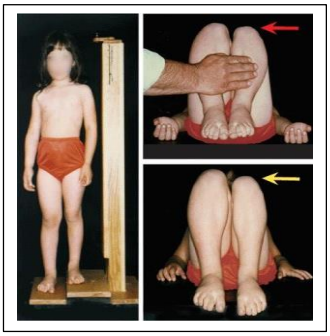

Blount's

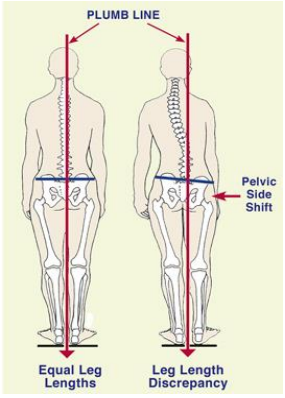

Traumatic


Infection

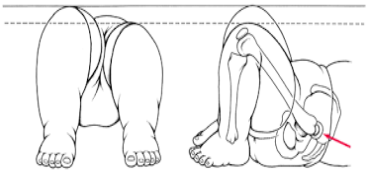

Tumor

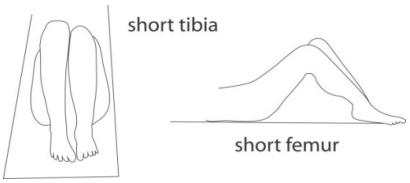
- **Adverse effects:**
  - Gait disturbance
  - Equinous deformity: Shortening in Rt. Side, child will involuntarily start to plantar flextion the Rt. foot (walk on tiptoes) to compensate for The affected movement. With time, PF will become Fixed > cannot do dorsal flextion. Or he will put the left foot down to equalize the legs
  - Back pain: Child with back pain think about Length Inequality
  - Scoliosis (secondary)





- **Evaluation:**
  - Screening examination
  - Clinical measures of discrepancy
    - Measuring tape from Medial malleolus to anterior superior iliac spine.
      *(if there is problem with ASIS, measure from Xiphisternum)
    - Giliazi test: when pt supine and both knee flexed look at the knees from front and side if one knee goes backward= problem in the femur
      If one knee goes downward = tibia problem





  - Imaging methods (Centigram): a type of x-ray, is one of the most imp. methods of determining LLD. A long film of the 2 limbs from hip to toes is taken, while a ruler is put in the x-ray to measure the difference b/w the 2 limbs in length & to locate where the difference is (femur/tibia)

- **Management principles:**
- **For shorter limb:**
- Depends on the Severity
  - **LLD < 2 cm:** Observe (the body with it's muscles can compensate)
  - **LLD 2-5 cm:** Shoe lift (Shoe raise) (for the whole foot NOT only heel)
  - **LLD > 5 cm:** Consider surgery or active treatment

Bone Lengthening

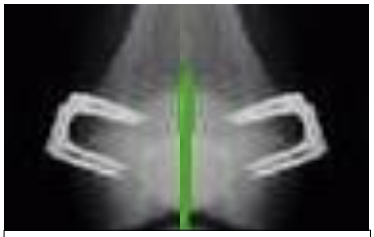
Shoe raise

- Lengthening: More common

Osteotomy then insert a device that will start to lengthen bit-by-bit 1 mm per day (or so), by having the patient manipulate a screw of the external apparatus. (Observe the patient because of the neurovascular structure)

- Lifts

- **For longer limb:**
- Shortening (remove part of bone. usually we don't use it)
- Epiphysiodesis (temporary or permanent) (stop the growth)
  - temporary Epiphys. is done when you want to do shortening in young children that still have growth potential



Epiphysiodesis

- Permanent method is done for children that are close to skeletal maturity (12-13 y/o). They'll have around 4-5 cms of growth potential left to reach.

5. Genu Varum and Genu Valgum:

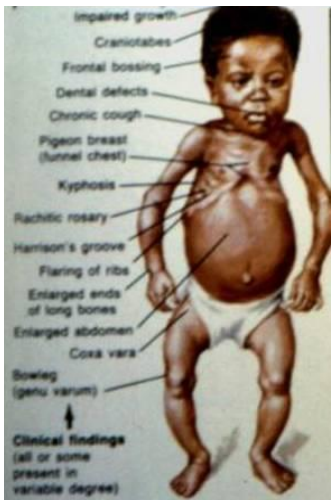
- **Definitions**
  - Bow legs (genu varus)
  - Knock knees (genu valgus)

- **Etiology**
  - Physiologic: observe and reassure the parents. (usually bilateral)
    < 2 y/o: physiological Genu Varus
    >2 y/o: physiological Genu Valgus
    ~4 y/o: straightening

Intrauterine Babies they are cross legged, when they born they will have normal bowing as they grow older at 1 and half or 2 years they will be in maximum bowing then at the age of 3-4 they will be in maximum valgus, after 4 they improve to adult angle (normally men about 5-7 degrees and women up to 10 of valgus). If rickets developed in a 2 y/o he will have Varus deformity and Older than 2 y/o will have valgus deformity

  - Pathologic. (usually unilateral)

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



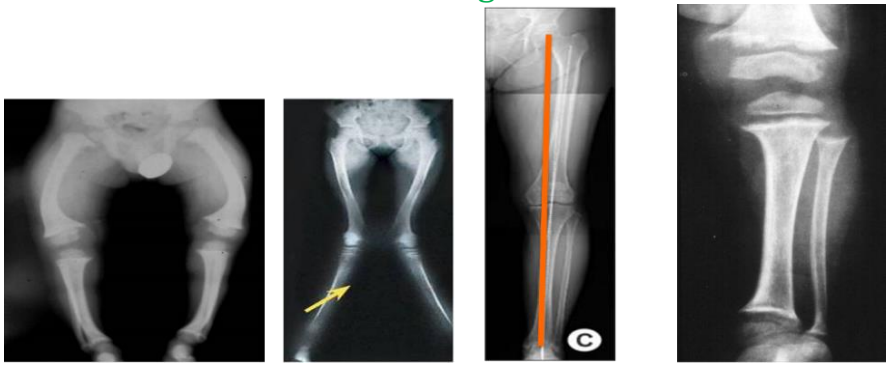
- **Evaluation**
  - History
  - Examination

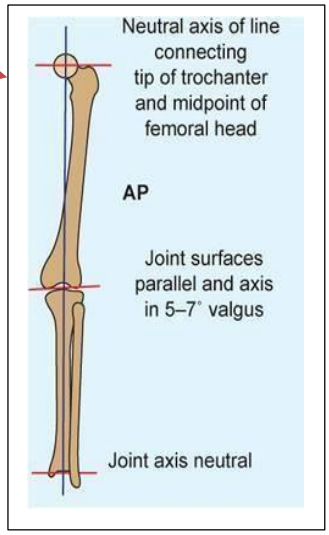
(Signs of Rickets) If the pt Still has active rickets, you do not Touch the pt

  - Laboratory (Ca level and vit.D)

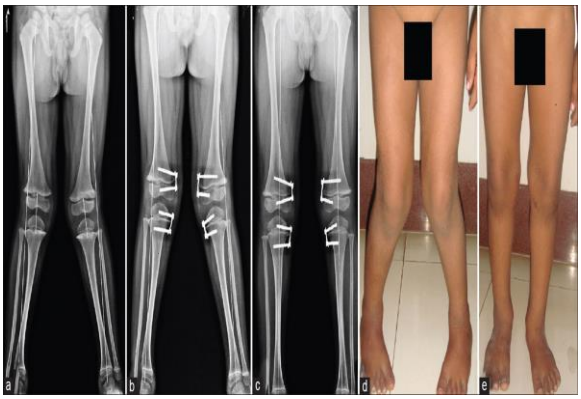
  - Imaging: Centigram
    - neutral mechanical axis of the limb, the line that passes through the center of all 3 joints in a straight line (Normal = straight)

*Varus =knee outside line *Valgus = knee inside line

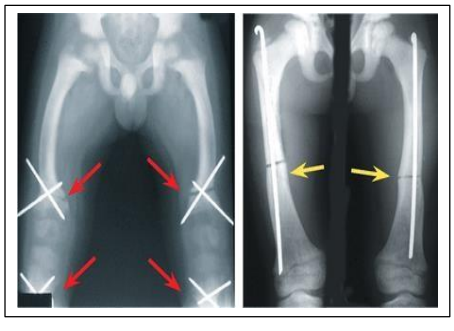




- **Management:**
  - **Non-operative:**
    - ✓ Physiological → Observation
    - ✓ Pathological → must treat underlying cause, as rickets
  - **Epiphysiodesis**
    - **Valgus:** Insert clip on medial side of bone to stop it from growing and allowing the lateral side to continue growing
    - **Varus:** Insert clip on lateral side of bone to stop it from growing and allowing the medial side to continue growing
  - **Corrective osteotomies** (tibia & femur together)

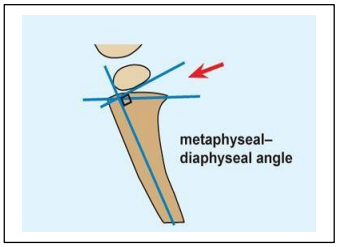


Epiphysiodesis



Corrective osteotomies

6. TIBIA VARA (BLOUNT DISEASE): medial physis

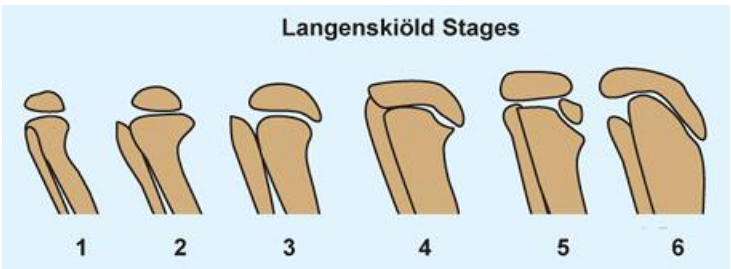


- A special entity of Genu Varus
- "Blount disease": Damage of proximal medial tibial growth plate of unknown cause
- Usually the child: Overweight & Dark skinned
- Staging: Radiological (M.D.A = metaphyseal diaphyseal angle)
- Has 6 stage and you don't have to know it ☺
- MRI is mandatory to know the stage (How severe – recurrence)

- Types:
  - Infantile → < 3y of age, usually in over weight & early walkers (bilateral)
  - Juvenile → 3 -10 y, combination (bilateral)
  - Adolescent → > 10y, usually over weight & (unilateral)

Classification (radiological):

- XR (M.D.A)
- M.D.A < 11° → observe closely
- M.D.A > 15° → operate



- Treatment:
  - Mostly surgical
  - More late more damage
  - High stage; bad prognoses

Bilateral Unilateral

7. Clubfoot:

- **Etiology**
  - Postural: Abnormal posture of uteru, begin no need for treatment (fully correctable)
  - Idiopathic (CTEV): Congenital Talipes Equino Varus (partially correctable)
  - Secondary: Neurological and muscular problems (rigid deformity),
    Most common cause (Spina Bifida)

- **Diagnoses: imp**

  - Diagnosis by exclusion the DDx
    - If deformity is identified after delivery, try to do correction manually:
    - If corrected successfully > Postural
    - If not > Idiopathic or secondary
    - If there's no syndrome or underlying pathology > Idiopathic

- **Differentiate by exclusion (DDx):**
  - Neurological lesion that can cause the deformity "Spina Bifida"(excluded by spine x-rays)
  - Other abnormalities that can explain the deformity: "Arthrogryposis, Myelodysplasia" Arthrogryposis= multiple joints contractions (stiff joints) and the muscles are fibrous

- Presence of concomitant congenital anomalies: "Proximal femoral focal deficiency" tibial hemimelia, exclude by XR
- Syndromatic clubfoot: "Larsen's syndrome, Amniotic band Syndrome"

* tibial hemimelia: a rare congenital anomaly characterized by deficiency of the tibia with a relatively intact fibula.

* Larsen's syndrome= multiple joint dislocation, it can give the appearance of clubfoot.

- **Clinical examination**
  - Characteristic deformity:

Hind foot: (Calcaneus, Ankle, Tibia)

- Equinus (Ankle joint) (fixed plantar flexion of ankle Joint (FPF)
- Varus (Subtalar joint) (inversion of subtalar joint)

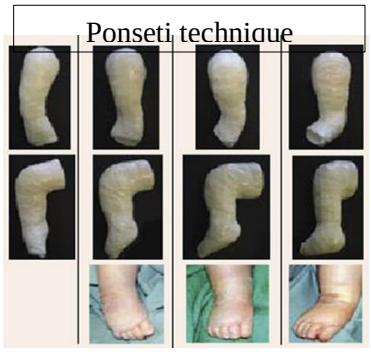
Mid and Fore foot:

- Midfoot Cavus (high-arched foot)
- Forefoot Adduction (of talus) (supination)

- **Additional findings on Clinical examination**
  - Short Achilles tendon (due to FPF)
  - High and small heel (due to FPF)
  - No creases behind Heel (due to FPF)
  - Abnormal crease in middle of the foot (due to forefoot add.)
  - Affected foot is smaller (obvious if unilateral)
  - Callosities (dead skin) at abnormal pressure areas
  - Internal torsion of the leg
  - Calf muscles wasting
  - Deformities don't prevent walking

- **Management:**

The goal of treatment for is to obtain a foot that is plantigrade, functional, painless, and stable over time, which looks cosmetically acceptable and fits normal shoes. A cosmetically pleasing appearance is also an important goal sought by surgeon and family



- Manipulation and serial casts

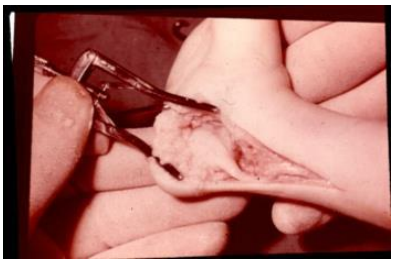
Ponseti technique: 3 stages, weekly basis (usually by 6-8w)
Age limit is up to 12 months (after 12 the soft tissue will become more tight. The younger they are the better the result)

Manipulation is maintained by a plaster cast: 99% of the cases management (good result). It's changed periodically, weekly at 1st, then every 2 wks.> until full correction is obtained (4-6 casts)

Then maintain correction by:

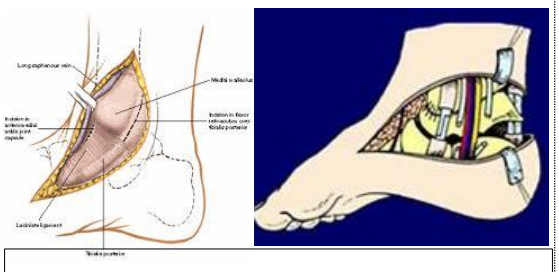
Dennis Brown splints → until 3-4y old
(To maintain external rotation of the feet)
-Success rate is very high

- Follow up → watch and avoid recurrence, till 9y old (the foot at age of 9 will be fully developed, not maturing anymore after 9 it will only increase in size)
- Avoid false correction → by going in sequence
- When to stop? → not improving, pressure ulcers



- **Indications of surgical treatment**
  - Late presentation, after 12 months of age!
  - Complementary to conservative treatment
  - Failure of conservative treatment
  - Recurrence after conservative treatment

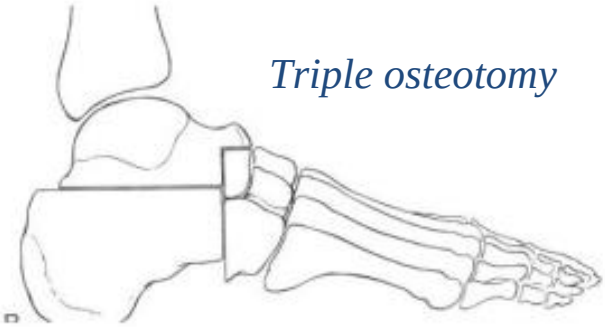
- **Types of surgery**
  - Soft tissue only (regain function) > before 4 years
    - Posteromedial Release (PMLR)
    - Achilles tendon Lengthening
  - Bony + soft tissue (regain function) > after 4 years
    Wedge osteotomy: wedge removed of calcaneus



Posteromedial Release

Wedge osteotomy

- Salvage (regain appearance)
  If sever, rigid, and in an older child
  - Triple osteotomy (talus – calcaneus – navicular)
  – Most common salvage procedure
  – Loss of inversion or eversion. Pt will feel pain walking on uneven ground; otherwise, they will walk normally



Triple osteotomy

8. Lower Limb Deformities in CP (CEREBRAL PALSY) Child:

A non-progressive brain insult that occurred during the peri-natal period. Cause by skeletal muscles imbalance that affects joint's movements.
- Its not-un-common

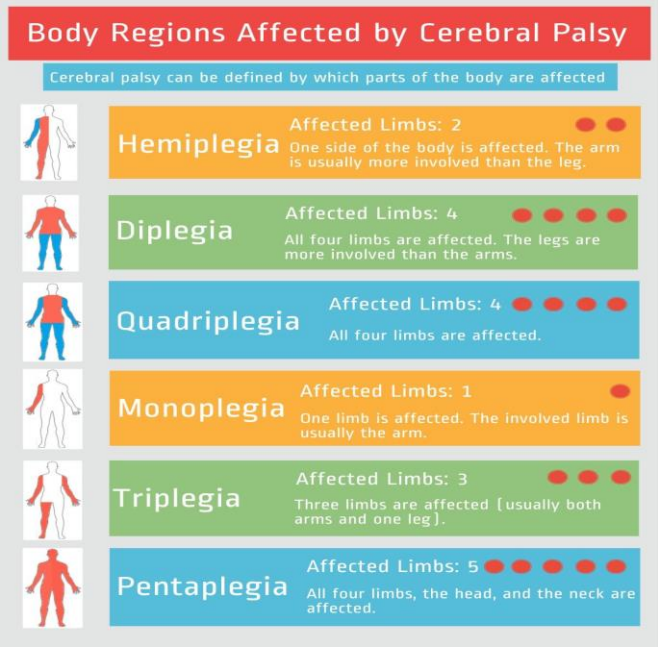
Can be associated with: Mental retardation (various degrees)
, Hydrocephalus and V.P shunt, Convulsions

Physiological classification

- Spastic: (commonest) Spastic is the MC that goes to surgery (it has the best predictable results)
- Athetosis slow, involuntary, convoluted, writhing movements of the fingers, hands, toes, and feet
- Ataxia: In ataxia and athetosis > surgery is contraindicated (imp)
- Rigidity
- Mixed

Topographic classification: imp

- Monoplegia>one limb affected
- Diplegia> all limbs are affected but the lower limbs are more
- Paraplegia>only lower limbs
- Hemiplegia>one side of the body (arm &leg) affected
- Bilateral hemiplegia> both sides are affected but uppers more than the lowers
- Triplegia>three limbs affected
- Quadriplegia or tetraplegia>all four limbs (+/- trunk, tongue and windpipe) affected



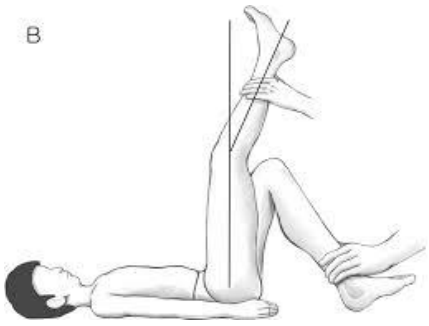
* The usual is Spastic Diplegia

Examination and assessment:

- Hip:
  - Flexion: Do Thomas test to assess fixed flexed deformity of hip
  - Adduction: Scissoring gait (Hip ROM)
  - Internal Rotation: In toeing (Hip ROM)

- Knee:
  - Flexion

Popliteal angle: Flex hip then extend knee > normally angle of knee extension is 0°. If not, we subtract the measured angle on examination from 180°. That will give us the popliteal angle.



- Ankle
  - Equinus (Ankle ROM)
  - Varus/Valgus Podoscope

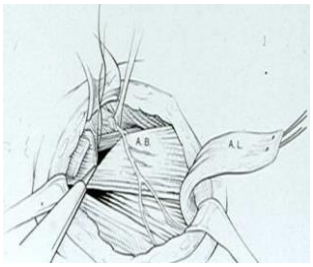
- Gait
  - Intoeing (they usually have femoral
  - anterversion and tibial torsion)
  - Scissoring

Management principles (physiotherapy is the most imp)

- Multidisciplinary approach
  - 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

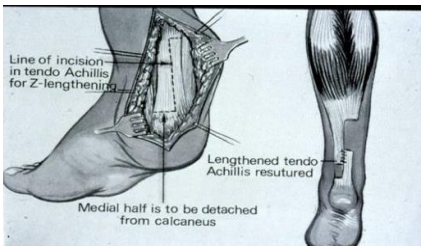
  - Others:
    - Neurosurgery (V.P shunt),
    - Ophthalmology (eyes sequent),
    - …etc.

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



➢ **Options of Surgery**

- Neurectomy
- Tenotomy
- Tenoplasty
- Muscle lengthening
- Tendon Transfer > rarely done
- Bony surgery Osteotomy/Fusion > for longstanding deformities.



Summary

1. Leg aches → of exclusion, D.D, long bone, activity ±, symptomatic treatment
2. Limping → due (pain- week- deformed), uni or bi, , proper assessment
3. In & out toeing → torsion vs. version, proper assessment to know cause & level, mainly observe, operate >8y old
4. L.L.I → true vs. apparent, proper assessment to know cause & level, if not treated, >2cm, options of treat
5. Genu varus & valgus → physiological vs. pathological, rickets, when operate
6. Blount → medial physis, D.M.A, MRI, types, surgery
7. CTEV → 3 types, diagnosis of exclusion, clinical picture, Ponseti, better to avoid surgery
8. L.L in C.P → muscle imbalance, of different types, proper pt assessment, PT ± surgery

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