

# COMMON LOWER LIMB DISORDERS



---

## 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

**Done by:** Hosam AlRuwaite, Abdullah AlEssa, Laila Alsabbagh

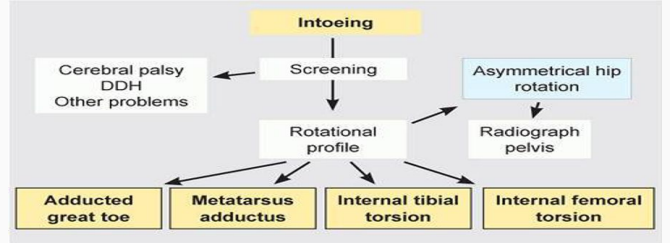
**Team Leaders:** Tareq AlAlwan, Elham AlAmi

**Revised by:** Sondos AlHawamdeh

**References:** Dr's slide & 437 Group A team, Toronto Notes'2020'

# INTOEING

دوران القدمين إلى الداخل  
اعوجاج القدمين إلى الداخل



## Evaluation

1. History
2. Screening examination
3. Rotational profile

## Evaluation

- **Detailed history** it is variation of the normal gait
  - Onset **definitely not seen in 2-3 months old**, it occurs after the child wals for few months
  - who noticed it, progression (it is developmental deformity)
  - **Fall a lot**, specially when runs tripping on their own feet. the main characteristic that they fall a lot and when they run they fall even more b/c they can't control the rotational profile of their lower limbs.
  - How runs "Egg-Beater" legs
  - How sits on the ground **W shaped sitting**, مثل الضفدع
  - Family history
  - Is it bilateral or unilateral **it is usually bilateral but more severe in one side**
    - **Screening examination** (head to toe) it might be associated with other neurological problems such as spina bifida , myelomeningocele or cerebral palsy.
    - **Pathology at the level of:**
      - Femoral anteversion
      - Tibial torsion
      - Forefoot adduction
      - Wandering big toe

## Asses rotational profile MCQ

1. **Femoral anteversion.** normally, the neck and the head of femur are not on the same level, there is about 13 to 15 degrees rotation. However in femoral anteversion the head in the acetabulum is directed more forward than normal

**Special test:** Hips rotational profile: How much internal and external rotation at the hip joint, can be done: Supine and Prone

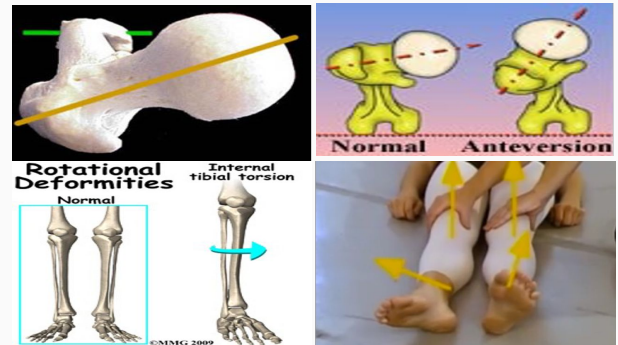
2. **Tibial torsion.** Normally, there is internal tibial torsion to some degree.

**Special test:** -Inter-malleolus axis: Supine and Prone  
-Foot thigh axis

3. **Forefoot adduction** kidney shaped foot

**Special test:** Heel bisector line

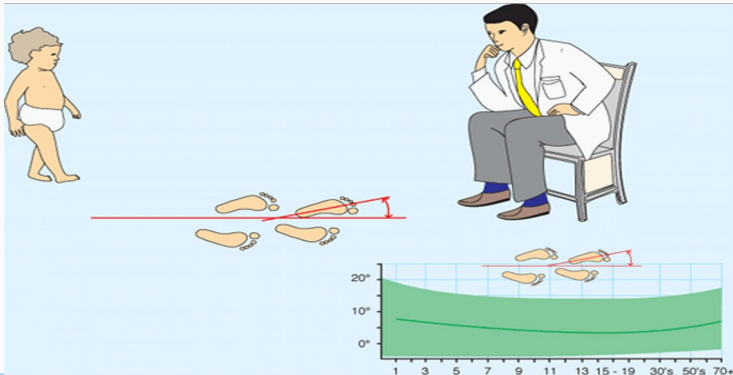
4. **Wandering big toe,** also called searching or adducted big toe, assessed by observation.



## Special test: MCQ & SAQ

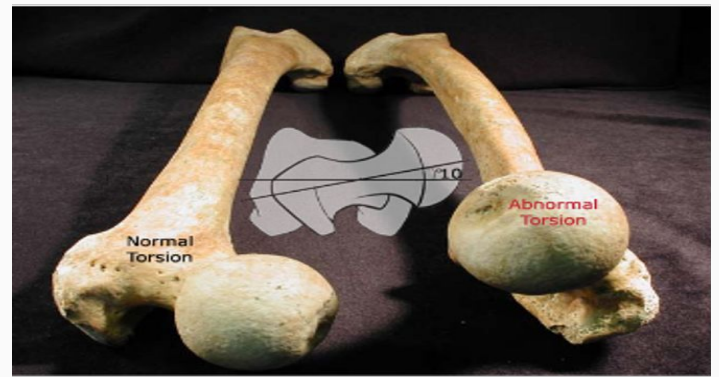
We won't give you the diagnosis you have to know it by the degree for example a Question: A child came to the clinic complaining of abnormal gait, his foot propagation angle is  $-25^\circ$ . You have to know this is a case of intoeing.

**Foot Propagation Angle:** normal is  $(-10^\circ)$  to  $(+15^\circ)$  we normally walk with some extoing (up to 15 degree)

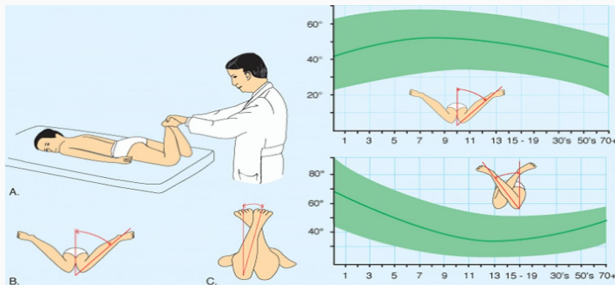


When we examine the patient by supine and prone "we will find each leg in a different direction.

**Hips rotational profile, supine** IR (internal rotation)/ER (external rotation) normal =  $40-45/45-50^\circ$



**Hips rotational profile, prone**



Supine and patellas are at the midline ( $0^\circ$ ) then we hold the tibia and apply internal and external rotation.

In cases of femoral anteversion patient will have **limited external rotation and excessive internal rotation**

## Inter-malleolus axis

Keep patellas in natural position.

**Normally:**

lateral malleolus is about  $20^\circ$  to  $30^\circ$  more posterior than medial malleolus

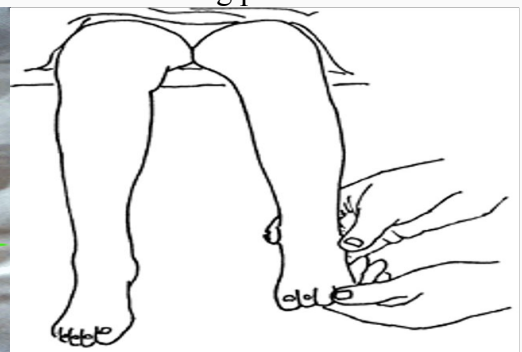
**Tibial torsion:**

Lateral malleolus is more forward than medial malleolus.

Supine position



Sitting position



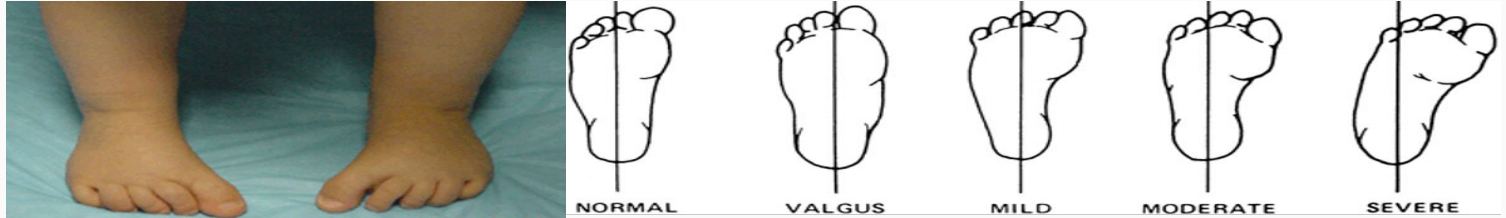
**Foot Thigh Axis, normal (0°) to (-10°)**

Patient is prone, you have to be in higher position so either stand on step or lower the bed. Then hold the leg Not the foot then measure the thigh axis and the foot axis.



- In-toeing: if the angle decreased caused by internal tibial torsion.
- Out-toeing: if the angle increased caused by external tibial torsion

**Heel bisector line, normal along 2nd toe or second web space.**



When you come and examine the patient you **have to look to the foot from plantar side** → kidney shaped foot → نطلع قلم من جيبينا ونحطه بالكعب و يكون مرتاح مو محرکها

In toeing: if it passes lateral to third toe.

Out toeing: if it passes medially.

**Adducted Big Toe**

Anti-version shoes won't correct it.

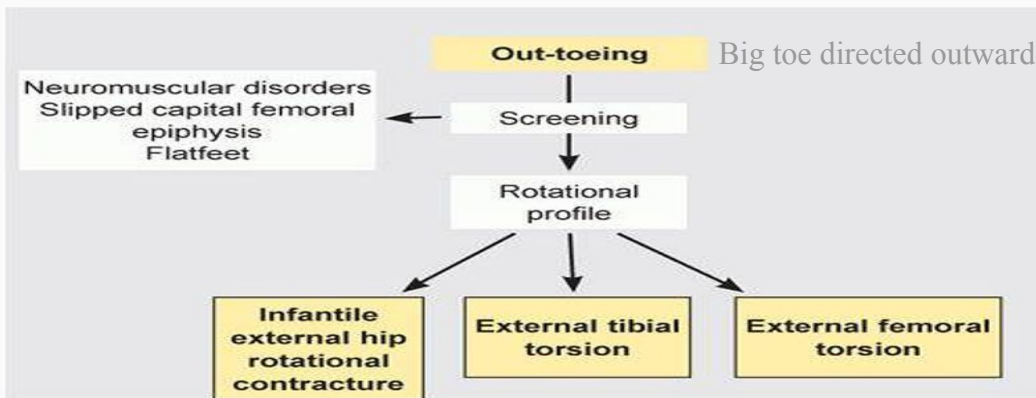


**OUT-TOEING**

دوران القدمين إلى الخارج  
اعوجاج القدمين إلى الخارج

**Evaluation**

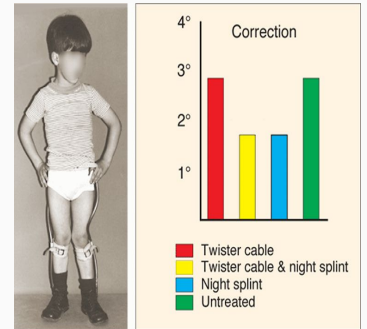
1. History
2. Screening examination
3. Rotational profile



# Management

## Management principles of In-toeing and Out-toeing:

1. Establishing correct diagnosis
2. Parents education it is developmental, no need for surgical intervention now
3. Allow spontaneous correction (observational management and annual F/U); asses degree of improvement
4. Control child's walking, sitting or sleeping is extremely difficult and frustrating
5. Shoe wedges or inserts are ineffective
6. Bracing with twister cables limits child's activities
7. Night splints have no long term benefit



Derotational straps are not recommended as they have long term psychological impact.

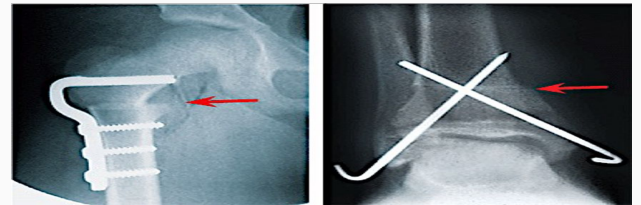
## Treatment:

1. Femoral anteversion; Reassurance and sit cross legged this will improve their femoral anteversion as we are encouraging the external rotation of hip
2. Tibial torsion, spontaneous improvement
3. Forefoot adduction, anti-rotation shoes, or proper shoes reversal, if older child physiotherapy strengthen peronii
4. Adducted big toe, spontaneous improvement

## Operative correction indicated for children:

Never operate whatever the level before 8 years

- (> 8) years of age
- With significant cosmetic and functional deformity → <1%



Correctable osteotomy for femoral anteversion

# GENU VARUS & VALGUS

Genu Varus رُكْبَةٌ فَحْجَاء  
Genu Valgus رُكْبَةٌ رَوْحَاء

## Definition:

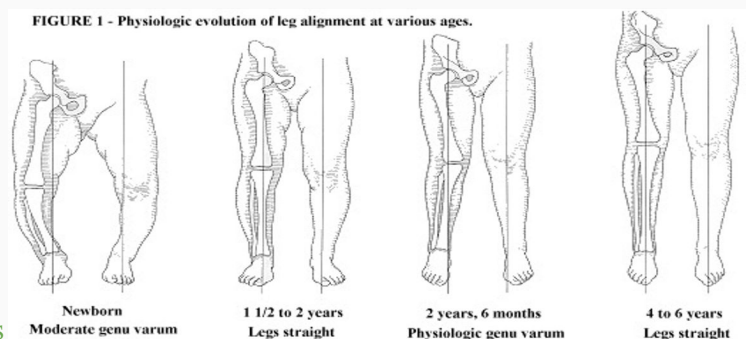
Bow legs & Knock knees



Normal Genu Varum and Genu Valgum



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



❖ **Types:**

1. Physiological is usually bilateral Femur and Tibia, long large C Shaped.
2. Pathological can be 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 $\pm 2$ SD



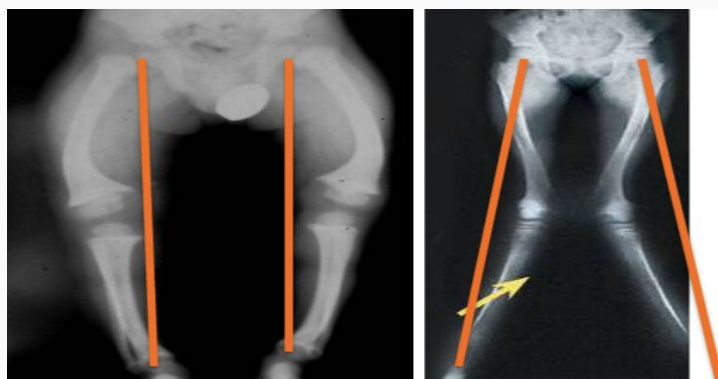
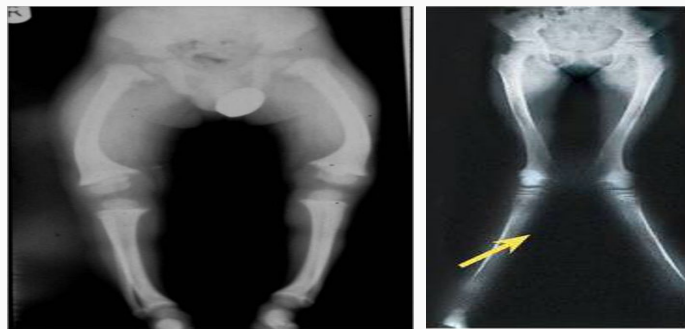
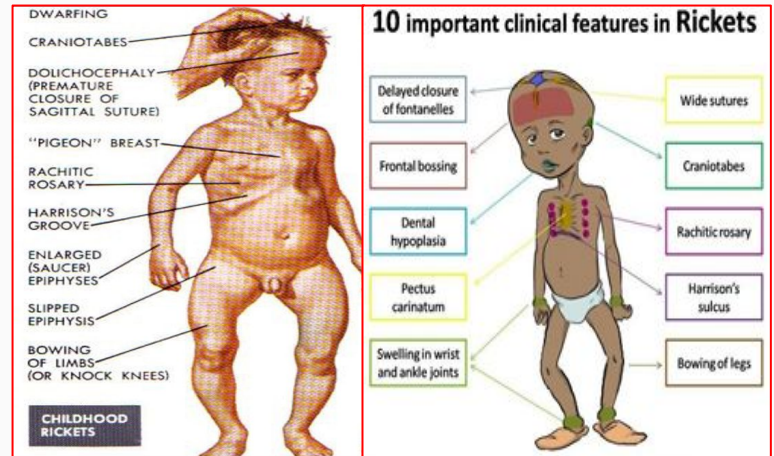
❖ **Evaluation**

1. History (detailed)
2. Examination (signs of Rickets)
3. Laboratory

It is very important to rule out metabolic causes such as rickets

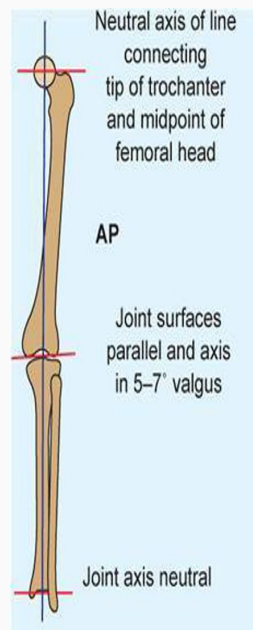
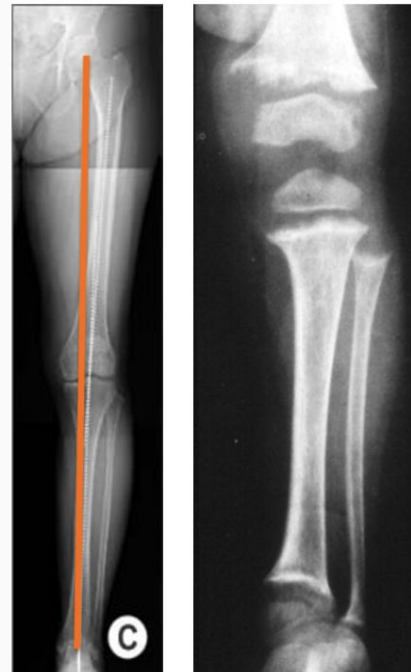
4. Imaging Centigram.

In x-ray of rickets they have all of the growth plates are wide (Widened epiphysis), cupping and fraying of metaphysis. If rickets hit in valgus age the child will have valgus legs, so it depends on what age vitamin D deficiency happened ونفس الشيء إذا جاء بوقت الفارز خالص يستمر معاه فارز



Normal

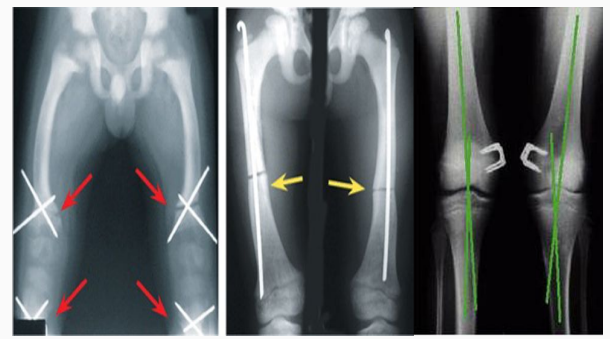
Rickets



Normal Axis: line from center of the hip to the center of ankle passing by center of knee

❖ **Management principles:**

- Non-operative:
  - Physiological: usually just follow up
  - Pathological: must treat underlying cause, as rickets **urgent referral to endocrine pediatrician (e.g. in Rickets give vit D)**
- Epiphysiodesis (temporary to hold the growth in one leg to maintain the alignment vs. permanent) **minimally invasive (day surgery)**
- Corrective osteotomies, **definitive method of fixation +k-wires**



# PROXIMAL TIBIAL VARA

“**Blount disease**”: Damage of proximal medial tibial growth plate of unknown cause.

The problem in the upper medial physis of the tibia and it is most of the times **surgically treated**

❖ **Risk factor**, usually:

- Overweight.
- Dark skin.

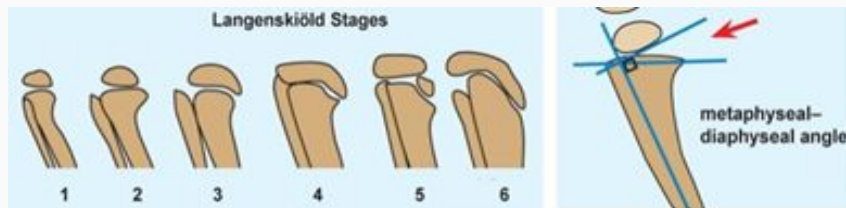


Peak appearance on x ray

❖ **Types:**

1. Infantile à < 3y of age, usually **Bilateral** and in early walkers. **Normal age of walking 10 months to 18 months**
2. Juvenile à 3-10y, Combination.
3. Adolescent à > 10y, usually **Unilateral**.very severe

❖ **Staging:** *مو مطلوبة منكم*



❖ **Investigation:**

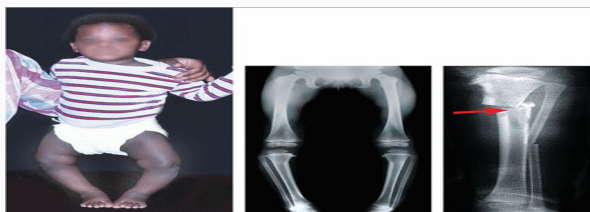
In severe cases, recurrence à **MRI is mandatory**

In severe cases, recurrence cases to check the growth plate



❖ **Treatment:** mostly surgical

**Bilateral**



**Unilateral: Types: 1- Infantile. 2- Adolescent**



# CLUB FOOT

حنف القدم

## ❖ Etiology: MCQ

1. **Postural:** Fully correctable, needs only intensive P.T, usually caused by the relaxin hormone which is produced in the 3rd trimester in pregnancy.
2. **Idiopathic (CTEV 1):** Partially correctable.
3. **Secondary (e.g MMC, Spina Bifida):** Rigid deformity, patient needs workup (e.g x-ray, MRI), and exclude differential diagnosis.



## ❖ Diagnosis: by exclusion, exclude:

1. Neurological lesion that can cause the deformity “Spina Bifida”. (Exclude by spine **x-ray**)
2. Other abnormalities that can explain the deformity “Arthrogyrosis<sup>2</sup>, Myelodysplasia<sup>3</sup>”.
3. Presence of concomitant congenital anomalies “Proximal femoral focal deficiency<sup>4</sup>”.
4. Syndromic clubfoot: “Larsen’s syndrome<sup>5</sup>, Amniotic band Syndrome<sup>6</sup>”.

## ❖ Clinical examination

### Characteristic Deformity :

- **Hind foot:**
  - **Equinus:** (Ankle joint, tight A.T). Severe equinus is indication of surgery.
  - **Varus:** inversion of subtalar joint (Subtalar joint).
- **Midfoot & Forefoot:**
  - Forefoot Adduction.
  - **Cavus** (pronation).
  - **Deep transverse creases**



<sup>1</sup> Congenital Talipes EquinoVarus: Club-foot. The term ‘talipes’ is derived from talus (Latin = ankle bone) and pes (Latin =foot)

<sup>2</sup> Congenital joint contracture in two or more areas of the body.

<sup>3</sup> Are a group of cancers in which immature blood cells in the bone marrow do not mature. EquinoVarus is the most common foot deformity in children with Myelodysplasia.

<sup>4</sup> A rare, non-hereditary birth defect that affects the pelvis, particularly the hip bone, and the proximal femur. The disorder may affect one side or both, with the hip being deformed and the leg shortened.

<sup>5</sup> A disorder of the development of the bones. Include clubfoot and numerous joint dislocations at birth with a distinctive appearance of the face & square-shape finger tips.

<sup>6</sup> A rare condition caused by strands of the amniotic sac that separate and entangle digits, limbs, or other parts of the fetus.



## ❖ 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



- 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



## ❖ Management:

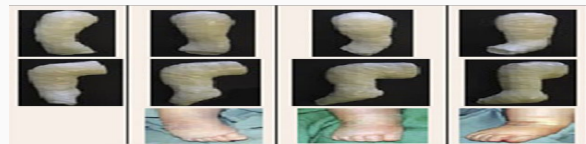
The goal of treatment is to obtain a foot that is **plantigrade, functional, painless, and stable** over time. A cosmetically pleasing appearance is also an important goal sought by surgeon and family.

### A. Manipulation and serial casts:

- **1-Ponseti technique** serial casting:

Change the cast **weekly** (usually 6-8 weeks).

Validity **up to 12 months** a soft tissue becomes tighter.



- 2- Maintaining correction "**Dennis Brown Splint**" 3-4y old. It is not optional it is part of treatment and mandatory
- **Follow up:** Watch and avoid recurrence, till **9 years** old
- **Avoid** false correction by going in **sequence**.
- When to **stop?** Not improving, pressure ulcers.

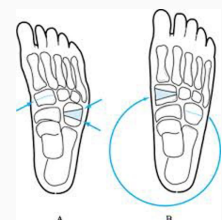
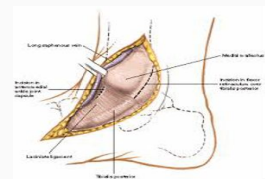


### B. Indications of surgical treatment:

- 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)

Types of surgery:

1. **Soft tissue (9-12 months)** 'can b 14 months': Lengthening soft tissues and tendons.
2. **Bony (>3-4 years)** 'can be 5 years': Wedge osteotomy: wedge removed of calcaneus.
3. Salvage: If sever & rigid à Arthrodesis (>10 years)



NEVER operate major surgeries before 9 months of age on the foot b/c we will harm the ossification center of mid foot bone and it will cause more deformities.

# L.L DEFORMITIES IN CEREBRAL PALSY (CP)

CP نقص الأوكسجين أو الشلل الدماغي

A non-progressive brain insult that occurred during the perinatal period.

## ❖ Causes:

Skeletal muscles **imbalance** that affects joint's movement, can be **associated with**:

1. **Mental retardation** (various degrees).
2. Hydrocephalus and V.P shunt.
3. **Convulsions**.

It's not uncommon.

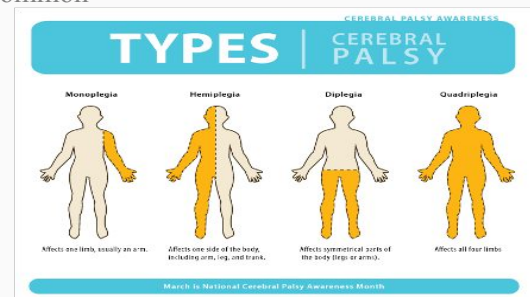
## ❖ Classification (Types) of cerebral palsy: MCQs

### A. Physiological classifications:


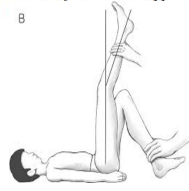

1. **Spastic**. The most favorable as the outcomes of surgeries and PT are predictable
2. **Ataxia**. Repetitive purposeless movement
3. **Athetosis**.
4. **Rigidity**.
5. **Mixed**.

### B. Topographic classification:

1. **Monoplegia**. Only one limb is affected
2. **Diplegia**. Lower limbs are affected more than the upper limbs , most common
3. **Paraplegia**. Only lower limbs , the upper limbs are normal
4. **Hemiplegia**. One side of the body is more affected
5. **Triplegia**.
6. **Quadriplegia or tetraplegia**. All limbs are equally affected



## ❖ Examination and assessment:

<p><b>Hip</b></p> <p>⇒ Flexion: Do Thomas test to assess fixed flexed deformity of hip.</p> <p>⇒ Adduction.</p> <p>⇒ Internal Rotation.</p> 	<p><b>Knee</b></p> <p>⇒ Flexion: Popliteal angle.</p> 
<p><b>Ankle</b></p> <p>⇒ <b>Equinus</b>.</p> <p>⇒ Varus/Valgus.</p> <p>⇒ Achilles tendon shorting.</p> 	<p><b>Gait</b></p> <p>⇒ In-toeing (femoral ante-version &amp; tibial torsion)</p> <p>⇒ <b>Scissoring tight hip adductors</b></p> <p>⇒ crouch</p>



#Right hemiplegia classic appearance: Flexed elbow, Flexed wrist, Foot equinus.

## ❖ Treatment:

• **Multidisciplinary** approach:

- Parents education.
- **Pediatric neurology diagnosis à Follow-up, treat fits.**
- **Physiotherapy** (home & center) à joints R.O.M, gait training. **Number 1** treatment + The most **integral** (essential) part of treatment.
- Orthotics à maintain correction, aid in gait.
- Social / Government aid.
- Other:
  - Neurosurgery (V.P shunt).
  - Ophthalmology (eyes sequent).

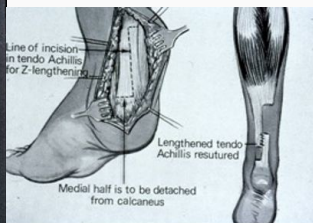
• **Surgery indications: MCQs**

- ◀ Severe contractures preventing physiotherapy.
- ◀ Physiotherapy is plateaued due to contractures.
- ◀ Perennial hygiene (**sever hips adduction**). (predispose to fungal infections and dermatitis) cerebral palsy with hip dislocation (it is not CP with DDH as DDH is idiopathic)
- ◀ In a non-walker, to sit comfortable in wheelchair.
- ◀ Prevent:
  - Neuropathic skin ulceration (as feet), to prevent skin ulceration
  - Joint dislocation (as hip)



**Options of Surgery:**

- Tendon elongation
- Tendon Transfer
- Tenotomy
- Neurectomy
- Bony surgery osteotomy / fusion



## LIMPING

عرج

- Abnormal gait due pain, Weakness (general like **hypotonia**, **myopathy** /nerve/muscle) or Deformity (bone or joint); in one or both limbs.

❖ **Diagnosis by:**

-History (detailed, specially age of onset)

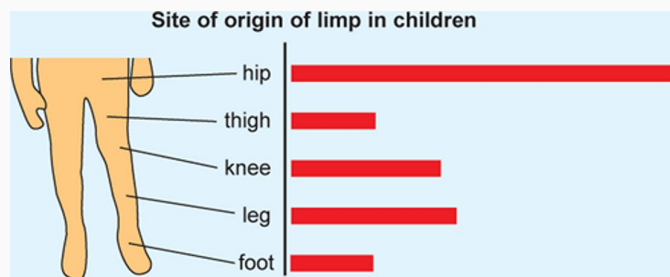
-Examination:

- Gait good analysis • Is it:
  - Above pelvis Back (scoliosis)
  - Below pelvis Hips, knees, ankles, & feet
- Neurovascular

❖ **Management:**

- Generalization can't be made.

- **Treatment of the cause:**



- **Painful gait:** Antalgic gait (usually unilateral): (short stance phase +long swing phase -Trauma. -Tumor. -Infection.
- **Painless gait** (usually bilateral)(normal stance phase): -Syndromic. -Congenital.(hip dysplasia, cerebral palsy)

Most common cause is due to hips then legs problems.

Normal gait cycle(two phase):

**Stance phase:** 60% of gait cycle

**Swing phase:** 40% of gait cycle

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

**After ruling out neurovascular causes:**

# LIMB LENGTH INEQUALITY

إختلاف طول الساقين - طول الساقين المتناقض

Limp				
Gait observation				
	Shortened stance phase	Abductor lurch	Toe-to-heel gait	Circumduction during swing phase
<b>Gait type</b>	<b>Antalgic Gait</b>	<b>Abductor Lurch</b>	<b>Equinus Gait</b>	<b>Circumduction Gait</b>
<b>Physical examination</b>	Tenderness Reduced range of motion	Trendelenburg sign	Heel-cord contracture Neurological exam needed	Assess limb lengths Neurological exam Check range of motion
<b>Tests</b>	Radiographs ? bone scan	Pelvis radiographs		Orthodiagrams
<b>Common examples</b>	Trauma Toddler's fracture Overuse syndrome Infection Inflammations	Hip dysplasia Cerebral palsy	Cerebral palsy Idiopathic toe walker Clubfoot	Painful foot Leg length inequality

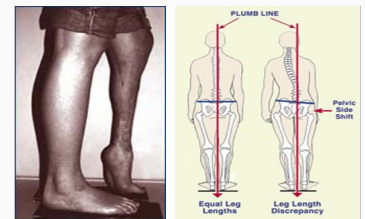
• True vs. apparent

## ❖ Etiology:

1. **Congenital** as DDH
2. **Developmental** as Blount's
3. Traumatic as oblique # (short), or multifragmented (long)
4. Infection stunted growth or dissolved part of bone
5. **Metabolic** as rickets (unilateral)
6. Tumor affecting physis some tumor crosses the growth plate

## ❖ Adverse effects & clinical picture:

- Gait disturbance
- **Equinus deformity** ex. Shortening in Rt. Side, child will involuntarily start to plantar flexion the Rt. foot (walk on tip toes) to compensate for The affected movement. With time, PF will become Fixed > cannot do dorsal flexion. Or he will put the left foot down to equalize the legs.
- Pain: back, leg
- **Scoliosis** (secondary)



## ❖ Evaluation:

- Screening examination
- Clinical measures of discrepancy
- Imaging methods (**Centigram**)



True	Apparent
<p>First, the leg length is <b>affected</b></p> <p>If you measure it: one leg will be shorter, with time this will lead to: pelvic tilt to adjust.</p> <p><u>Measure from ASIS</u> "anterior superior iliac spine" to medial malleolus.</p>	<p>The Leg length: will appear asymmetric but if you measure it: they are with the same length.</p> <p>Measure <b>from umbilicus to medial malleolus</b>.</p>

## ❖ Management:

depends on the severity (>2cm):  
We don't operate on less than 20 mm difference.

- **For shorter limb:**
  - Shoe raise
  - Bone lengthening
- **For longer limb:**
  - Epiphysiodesis (temporary or permanent)
  - Bone shortening we don't shorten more than 2 cm.



# LEG ACHES

آلام الساق

What is leg aches?

- "Growing pain" (achy muscle pains at age 2-12 yr),
- Benign
- In 15 – 30 % of normal children
- F>M
- Unknown cause
- No functional disability, or limping
- Resolves spontaneously, over several years

❖ **Clinical features:** diagnosis by **exclusion**

☐ H/O:

- At long bones of L.L (Bilateral)
- Dull aching, **poorly** localized
- Can be without activity
- At night **in the end of the day**
- Of long duration (months)
- Responds to analgesia **oral or local**

☐ O/E:

- Long bone tenderness → nonspecific, large area, or none
- Normal joints motion

❖ **Management:**

1. Reassurance
2. Symptomatic: (pain will disappear once growth plate close)
  - Analgesia (oral, local)
  - Rest
  - Massage

**D.D:** from serious problems, mainly tumor:

- Osteoid osteoma **benign**
- Osteosarcoma (pain at night & constitutional symptoms)
- Ewing sarcoma (pain at night & constitutional symptoms)
- Also could be:
  - Leukemia
  - SCA
  - Subacute O.M

## TAKE HOME MESSAGES

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

## Congenital Talipes Equinovarus (Club Foot)

### Definition

- congenital foot deformity
- muscle contractures resulting in CAVE deformity
- bony deformity: talar neck medial and plantar deviated; varus calcaneus and rotated medially around talus; navicular and cuboid medially displaced

### Etiology

- intrinsic causes (neurologic, muscular, or connective tissue diseases) vs. extrinsic (intrauterine growth restriction); may be idiopathic, neurogenic, or syndrome-associated
- fixed deformity
- 1-2/1000 newborns, 50% bilateral, occurrence M>F, severity F>M

### Physical Exam

- examine hips for associated DDH
- examine knees for deformity
- examine back for dysraphism (unfused vertebral bodies)
- diagnosis is often from physical exam findings alone, radiographs not always required

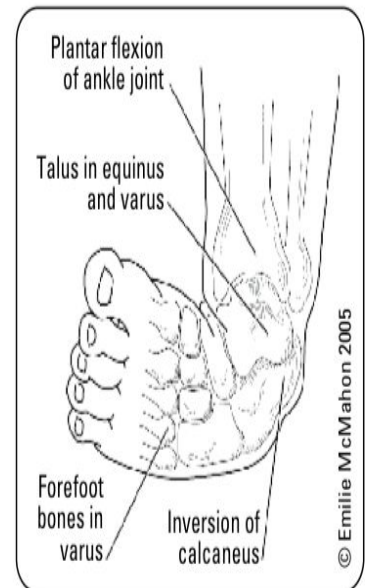


Figure 54. Club foot - depicting the gross and bony deformity



### CAVE deformity

- Midfoot Cavus
- Forefoot Adductus
- Hindfoot Varus
- Hindfoot Equinus

### Treatment

- largely non-operative via Ponseti Technique (serial manipulation and casting)
  - correct deformities in CAVE order
    - ♦ change strapping/cast q1-2wk
    - ♦ surgical release in refractory case (rare)
      - delayed until 3-4 mo of age
- 3 yr recurrence rate = 5-10%
- mild recurrence common; affected foot is permanently smaller/stiffer than normal foot with calf muscle atrophy

# MCQS

1- in toeing management of a 4-year-old child with W sitting position?

- A. Reassurance
- B. Night brace

Ans: A

2-Child was brought by his mother and she's complaining of leg deformity, was noted to have in toeing. What is the management?

- A. Spontaneous correction.
- B. Corrective osteotomy.

Ans: A

3-6-month-old boy presented with "picture of clubfoot" No other back problem, no treatment. what is the best management?

- A. Dennis brown cast
- B. Manipulation and casting
- C. Soft tissue release

Ans: B

4-5year old boy came with clubfoot what type of surgery would you do?

- A-bone and Soft tissue only
- B-Soft tissue only
- C-bone only
- D-Salvage

Ans: A

5-A 1-week-old infant is brought to the office for a routine follow-up. After the birth of their newborn, the parents note that their baby's "foot looks funny." Physical examination shows that the right foot is extremely plantar-flexed, but that it returns to a normal, neutral position with gentle manipulation. There is also some inversion of the arch that the parents have noticed. The rest of the baby's exam is appropriate. Which of the following may be what caused this deformity?

- A.Cerebral palsy
- B.Atypical positioning of the foot in utero
- C.Aneuploidy
- D.Toxic ingestion by the mother during pregnancy

Ans: B

6-A 5-day-old neonate has a mild congenital deformity of the talus. Soft tissues of the medial side of the foot are underdeveloped with a concomitant displacement of the talo-calcaneo-navicular joint. There is reduction in length of the gastroc-soleus and posterior tibial muscles and their tendons. The feet are adducted and supinated but otherwise normal. An image of the observed deformity is depicted below and the diagnosis of talipes equinovarus is made. Which of the following is the best step in management?

- A. Cast and bracing
- B. Surgical correction
- C. Orthotic splint
- D. Reassurance



Ans: A

7-An 8-year-old boy comes to the clinic with his newly adoptive mother because of difficulty walking. The mother informs you that her son was adopted from a country with low resources and he has only been in the United States for 1 week. She believes he was not fed well before he was adopted. His temperature is 37.1°C (98.8°F), pulse is 90/min, respirations are 20/min, and blood pressure is 100/70 mm Hg. Physical examination shows a small appearing boy for his age with a protuberant abdomen and bleeding gums. Gait analysis shows his knees contact often and his lower legs extend laterally. A Q-angle measurement is taken. Which of the following is the most likely cause of his gait abnormality?

- A. Vit D deficiency
- B. Vit c deficiency
- C. Folate deficiency
- D. Protein deficiency

Ans: A