Fragility of bones in children with motor defficiency

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fractures in children

- Fractures are common in the pediatric population, with an incidence of approximately 50% in boys and 40% in girls.
  Fracture rate appears to be increasing over time, particularly at the distal radius, which remains the most common site of fracture in children and adolescents.
- Fracture rate peaks between ages 10 and 15 yr , corresponding to the period of maximum postnatal growth velocity
- Increased participation in competitive youth sports has also led to a concurrent rise in pediatric overuse injuries, such as stress fractures .

- Distinguishing a traumatic from pathological fracture is often **difficult** because the literature has not clearly defined what constitutes a **fragility** fracture
- Fractures of long bones WITH ABSENCE OF SIGNIFICANT TRAUMA

  fragility may be due to local pathology like bone cyst
- Repeated minor fractures of long bones, mainly metaphyseal
- compression fractures of the spine, usually as an atypical finding in an xray

Identification of the underlying etiology

- **Approach to the Child with Fractures**
- Alison M. Boyce and Rachel I. Gafni
- *Eunice Kennedy Shriver National Institute of Child Health and Human Development* Bethesda, Maryland
- J Clin Endocrinol Metab, July 2011, 96(7):1943–1952

Management of osteoporosis in children

Nicholas J Shaw

- Osteoporosis is defined by the World Health Organization as a systemic skeletal disorder characterised by low bone mass and micro-architectural deterioration of bone tissue with a consequent increase in bone fragility and susceptibility to fracture

define osteoporosis in children

- The International Society for Clinical Densitometry recently updated its official position on DXA evaluation in children and adolescents, recommending that the "**diagnosis of osteoporosis requires the presence of both a clinically significant fracture history and low bone mineral content or bone mineral density**".

- **Bianchi ML, Baim S, Bishop NJ, Gordon CM, Hans DB, Langman CB, Leonard MB, Kalkwarf HJ 2010**
- **Official positions of the International** Society for Clinical Densitometry (ISCD) on DXA evaluation in children and adolescents. Pediatr Nephrol 25:37–47

Disorders associated with fragility fractures in children

- **Primary conditions**
- Secondary conditions

TABLE 1. Disorders associated with fragility fractures in children

- **Primary conditions**
- Genetic disorders (selected)
- **Osteogenesis imperfecta**
- Osteoporosis pseudoglioma syndrome
- Ehlers-Danlos syndrome
- Marfan syndrome
- Homocystinuria
- Hajdu-Cheney Syndrome
- Pycnodysostosis
- Osteopetrosis
- Hypophosphatasia
- Polyostotic fibrous dysplasia
- Rickets (genetic forms)
- Idiopathic juvenile osteoporosis

TABLE 2. Disorders associated with fragility fractures in children Secondary conditions

- Chronic inflammatory conditions
- Systemic lupus erythematosis
- Inflammatory bowel disease
- Nephrotic syndrome
- Reduced mobility
- **Cerebral palsy**
- Duchenne muscular dystrophy
- Posttraumatic
- Infiltrative
- Leukemia
- Thalassemia
- Mastocytosis
- Endocrine
- Hypogonadism
- GH deficiency
- Cushing syndrome
- Hyperthyroidism
- Diabetes mellitus
- Female athlete triad
- Nutritional/malabsorptive
- Vitamin D deficiency
- Celiac disease
- Biliary atresia
- Cystic fibrosis
- Anorexia nervosa
- Renal
- Chronic kidney disease
- Secondary hyperparathyroidism
- Iatrogenic
- Glucocorticoids
- Anticonvulsants
- Methotrexate
- Radiation therapy
- Antiretrovirals

When to investigate for osteoporosis in children

Fractures of long bones WITH ABSENCE OF SIGNIFICANT TRAUMA

Repeated minor fractures of long bones

compression fractures of the spine, usually as an atypical finding in an xray

Management of osteoporosis in children

Nicholas J Shaw

- it is not possible to define osteoporosis in children on the basis of bone density measurements alone

- The diagnosis and management of osteoporosis in the pediatric patient must therefore be based on a combination of clinical and radiographic findings,

  rather than relying upon bone densitometry alone

Ευθραστότητα οστών σε παιδιά με κινητική διαταραχή

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Καθηγητής Ι Κύρκος

DXA measurements in children

- A comprehensive pediatric reference database for Hologic densitometers is available;
- it is important that only normative databases specific to the brand of densitometer be used for interpretation.
- Z-scores should be calculated as SD scores compared with age-, sex-, and ethnicity-matched controls.

DXA measurements in children

- The diagnosis of low BMD in a child **should never be made** on the basis of T-score (SD score compared with young adults at peak bone mass)
- This error has led to the overdiagnosis of low BMD in children
- 50% were

- measurement of bone turnover markers such as bone-specific alkaline phosphatase, osteocalcin, collagen cross-linked N-telopeptide, *etc., may suggest a "low-turnover" or "high-turnover"* state that can help guide therapy

- Additionally, elevated markers in the setting of acute fracture may be misleading.

Vitamin D

- The Institute of Medicine recently released recommendations stating that serum 25-hydroxyvitamin D levels should be maintained above 20 ng/ml (50 nmol/liter) to optimize bone health

All children with fragility of bones must be assessed

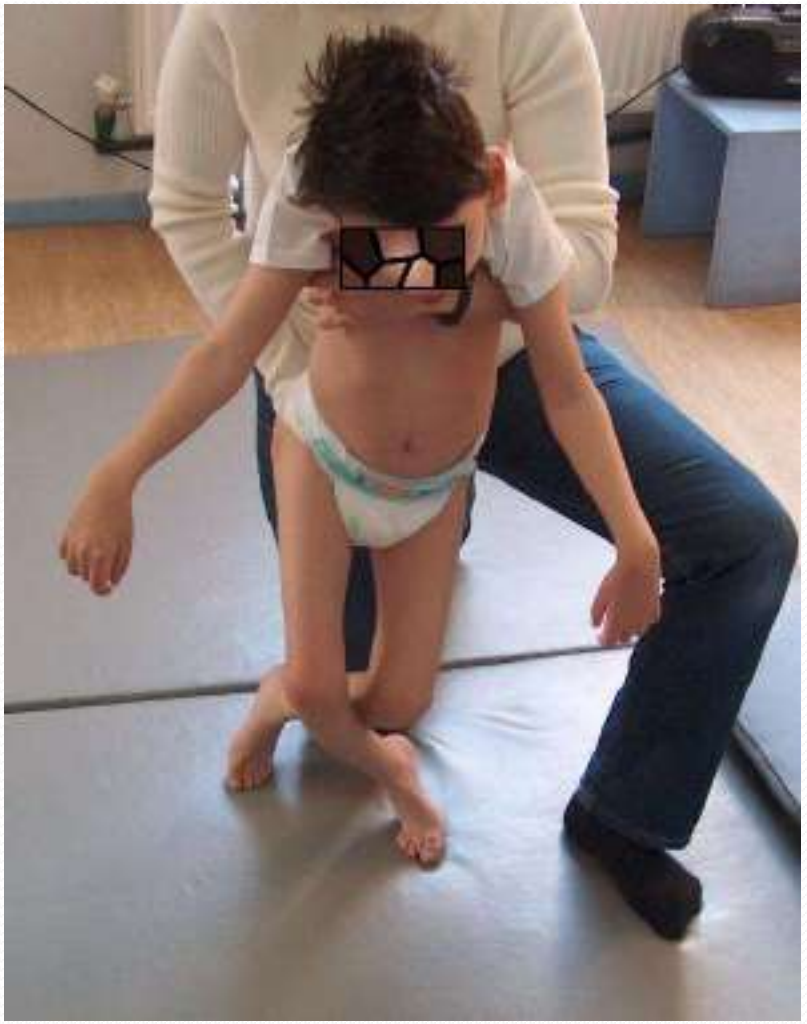
exercises

- Weight-bearing physical activity is critical for bone
- health, and children with reduced mobility have been
- shown to gain bone mass with physical therapy (48) and
- standing on vibrating platforms (49)

- **Chad KE, Bailey DA, McKay HA, Zello GA, Snyder RE 1999 The**
- effect of a weight-bearing physical activity program on bone mineral
- content and estimated volumetric density in children with spastic
- cerebral palsy. J Pediatr 135:115–117
- **Caulton JM, Ward KA, Alsop CW,Dunn G, Adams JE, Mughal MZ**
- 2004 A randomised controlled trial of standing programme on bone
- mineral density in non-ambulant children with cerebral palsy. Arch
- Dis Child 89:131–135

Cerebral palsy

Cerebral palsy , tetraplegic, spastic type



Cerebral palsy

Μη εξελισσόμενη διαταραχή στάσης και κίνησης, που οφείλεται σε βλάβη εγκεφαλική της προ περι και μετα γεννητικής περιόδου.

Non progressive lesion affecting posture ang gait, after a CNS lesion during pre, peri and post natal period

Cerebral palsy classification

- Τετραπληγία tetraplegia
- Διπληγία diplegia
- Ημιπληγία hemiplegia
- Διπλή ημιπληγία double hemiplegia

- Σπαστικότητα
- spasticity
- Δυσκινησία
- diskinesia
- Αταξία ataxia
- Μικτοί τύποι mixed

Εγκεφαλική παράλυση Αίτια

- Προωρότητα
- Διάρκεια εγκυμοσύνης έως 23-24 εβδομάδες
- Χαμηλό βάρος γέννησης
- **ΔΙΠΛΗΓΙΑ**

- Εγκεφαλική αιμορραφία
- Διαμαρτίες στην διάπλαση εγκεφάλου
- Κύστεις
- **Ημιπληγία**
- **Τετραπληγία**

Εγκεφαλική παράλυση
Εντόπιση της βλάβης

- **Βλάβες του φλοιού του εγκεφάλου**
- **Βλάβες παρεγκεφαλίδος βασικών γαγγλίων**
- **Βλάβες στελέχους**

Βλάβες λευκής ουσίας

Λευκοδυστροφία

- Λευκοεγκεφαλοπάθεια
- Μεταβολικές παθήσεις

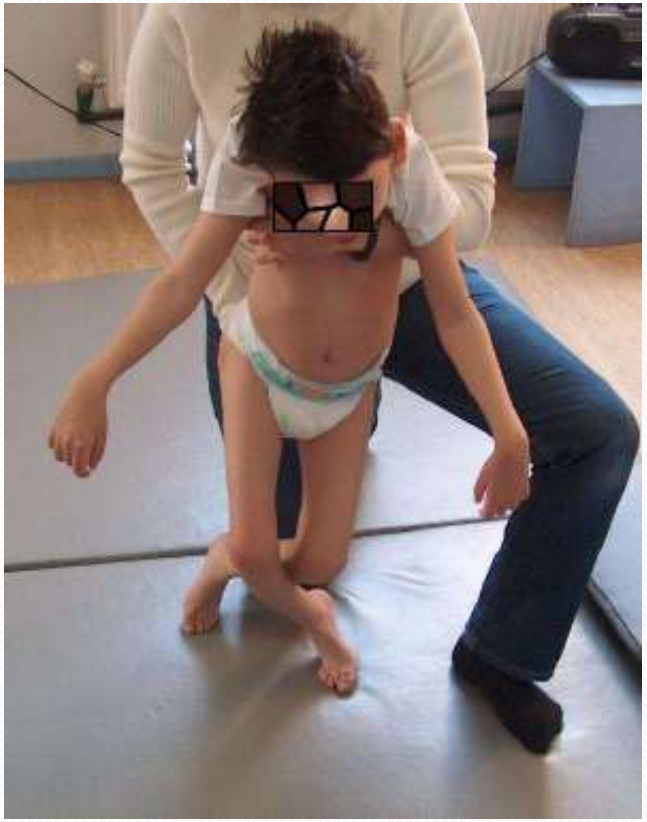
Cerebral palsy treatment modality

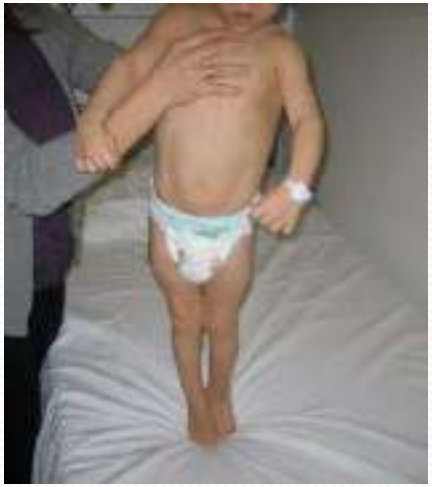
- Maximizing the possible motor development
- Physiotherapy REMAINS THE MAIN treatment
- Types of physiotherapy

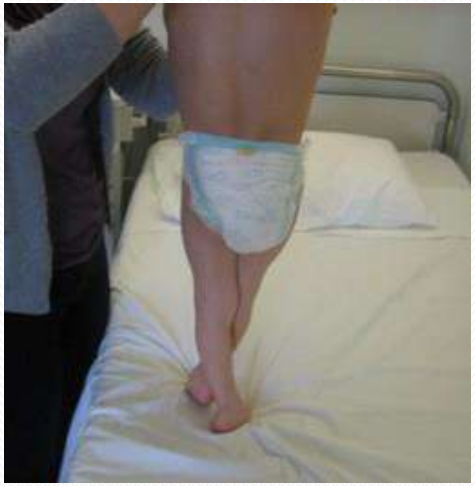
hydrotherapy

Tetraplegic spastic type GMCM 5

- Κάτω άκρα σε κάμψη και προσαγωγή στα ισχία
- Θέση ψαλλιδισμού σε ορθοστάτηση ή σε ύπτια θέση
- Δυσχέρεια απαγωγής ισχίων







Σπαστικότητα

- Spasticity is a MOTOR disorder, characterized by velocity-dependent increase in tonic reflexes that exaggerate tendon jerks, resulting in hyperexcitability of the stretch reflex.
- Η σπαστικότητα είναι κινητική διαταραχή, που χαρακτηρίζεται από αύξηση των τενόντιων αντανακλαστικών, εξαρτώμενη από την ταχύτητα.
- Αυξάνει τα τενόντια αντανακλαστικά, οδηγώντας σε υπερευσθητοποίηση του τενόντιου αντανακλαστικού

General Motor Function Classification System

- Palisano R, Rosenbaum P, Walter S

  Development and reliability of a system to classify gross motor function in children with cerebral palsy

  Dev Med Child Neurol 1997

General Motor Function Classification System

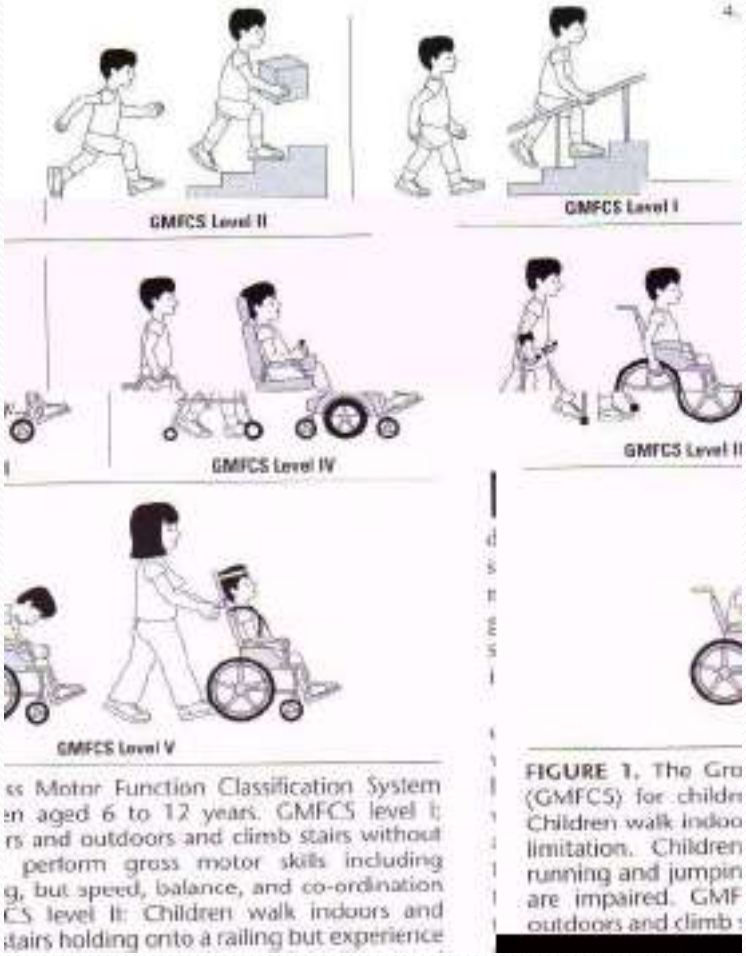
Carl L. Siminski, MD, Editor

Classifying Cerebral Palsy

H. Kerr Graham, MD, FRCS(Ed), FRACS

Each year, the *Journal of Pediatric Orthopaedics* publishes more papers dealing with orthopaedic issues of children with cerebral palsy (CP) than any other medical journal. However, it can sometimes be difficult for the reader to understand the defining features of the study population. Different authors use different terms, and the definitions of the terms are imprecise. CP is traditionally classified by motor type and topographical distribution. A classification based on motor type might include the terms *spastic, dyskinetic, ataxic, hypotonic,* and *mixed*. The most commonly used terms in classifications of topographical distribution are *hemiplegia, diplegia,* and *quadriplegia*, but the terms *monoplegia, paraplegia, triplegia, double hemiplegia* and *uniplegia* are also used. The terms vary considerably, but more importantly classifications by motor type and topography are known to be unreliable.[*]

What can contributors to JPO do to improve communication? The answer is to



ss Motor Function Classification System
en aged 6 to 12 years. GMFCS level I:
rs and outdoors and climb stairs without
perform gross motor skills including
g, but speed, balance, and co-ordination
CS level II: Children walk indoors and
tairs holding onto a railing but experience

FIGURE 1. The Gro
(GMFCS) for childr
Children walk indoo
limitation. Children
running and jumpin
are impaired. GMF
outdoors and climb

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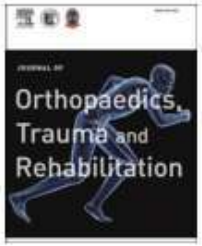

Review Article

Review of Fractures and Low Bone Mass in Children with Cerebral Palsy

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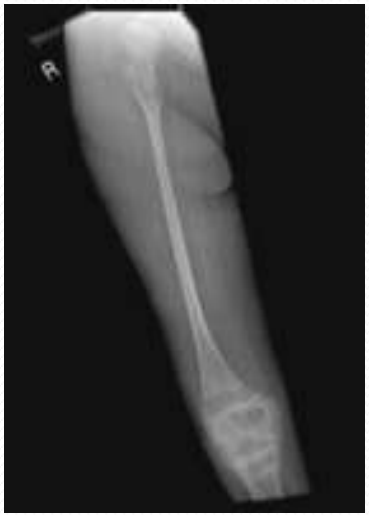
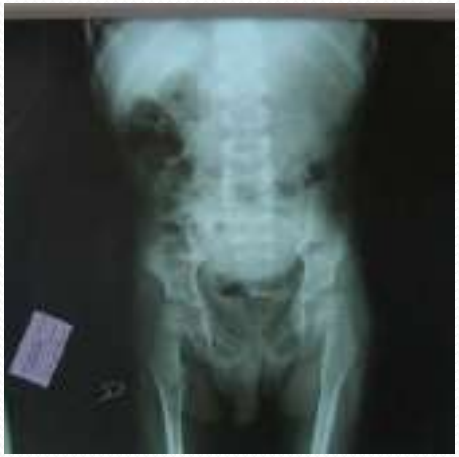
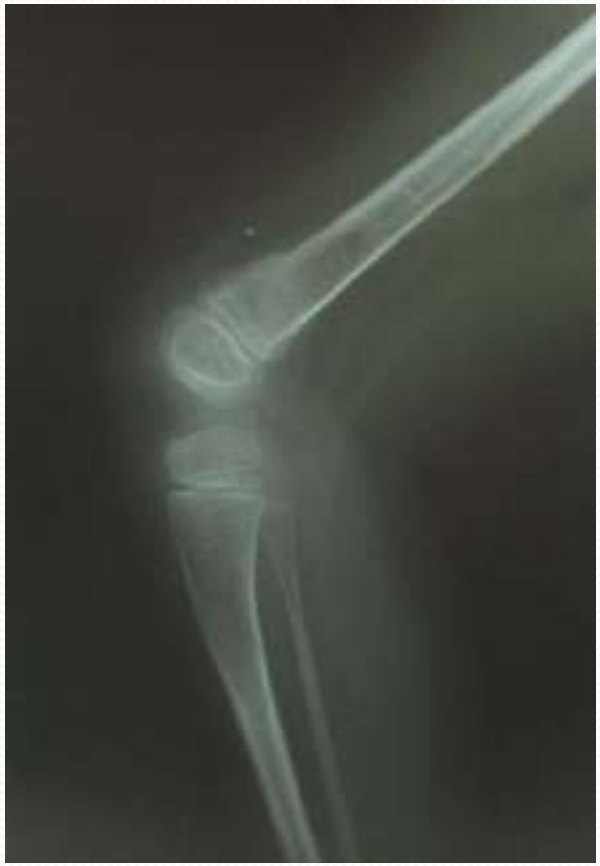
Osteoporosis in children

- neuromuscular diseases
- Cerebral palsy







incidence of fractures in CP

- Fractures are not uncommon in children with CP. In one series, 39% of children with quadriplegic CP gave a history of fracture.

- The prevalence rate was 6% in 1637 patients with CP, and 12% in another 763 children with CP.
- A higher prevalence rate of 23% was reported in 88 children with quadriplegic CP.

- Thus, the fracture incidence in children with CP is much higher than that in the general paediatric population.

- Mergler S[1], Evenhuis HM, Boot AM, De Man SA, Bindels-De Heus KG, Huijbers WA, Penning C.

- **Epidemiology of low bone mineral density and fractures in children with severe cerebral palsy: a systematic review.**
- Dev Med Child Neurol. 2009 Oct;51(10):773-8. do

osteoporotic fractures in CP

- The causes of fracture were not identified for 55% of individuals in one series.

- These fractures occur with minimal trauma or are ‘spontaneous’ with no apparent history of injury. The diagnosis is thus delayed or even missed in those patients who cannot communicate.
- Even when there is clinical suspicion of a fracture, some low-energy metaphyseal fractures do not show up on plain radiography and can only be diagnosed with whole-body bone scanning.

- Thus, bone fragility seems to be an underlying problem related to these ‘spontaneous’ fractures.

Pediatr Rehabil. 2006 Oct-Dec;9(4):396-403.

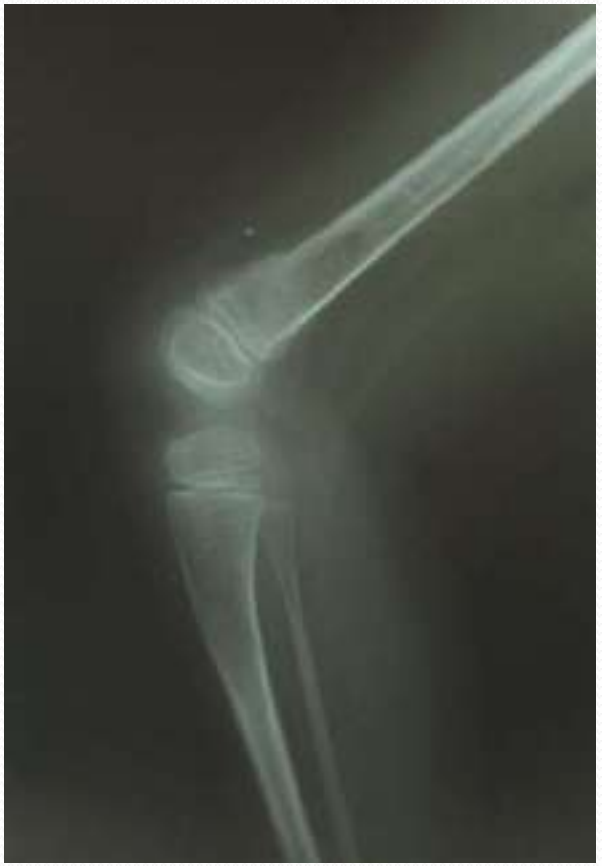
Fracture rate in children with cerebral palsy.

Stevenson RD[1], Conaway M, Barrington JW, Cuthill SL, Worley G, Henderson RC.

- As in most series, the most common site of fractures was

the lower limb, almost 80% of fractures occurring around the knee and being metaphyseal fractures of the lower limb.

One-third of children had recurrent fractures, and 17% of fractures occurred within 1 year after lower limb surgery.



Risk factors associated with fractures in children with cerebral palsy

- The severity of neurological involvement is an important factor.
- Children with CP who are non-ambulatory and classified as GMFC level V have the highest risk.
- Contractures and stiffness of the major joints create long lever arms also predisposed to fracture.
- The fracture rate increasing more than threefold after a previous fracture. Previous fracture is associated with increased fracture risk, the fracture rate increasing threefold after a previous fracture

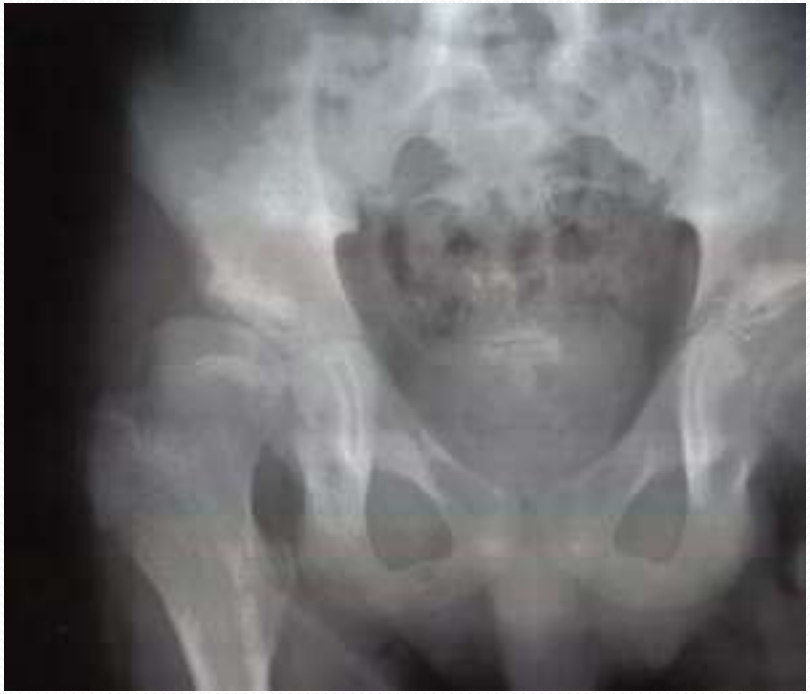
immobilization hip spica

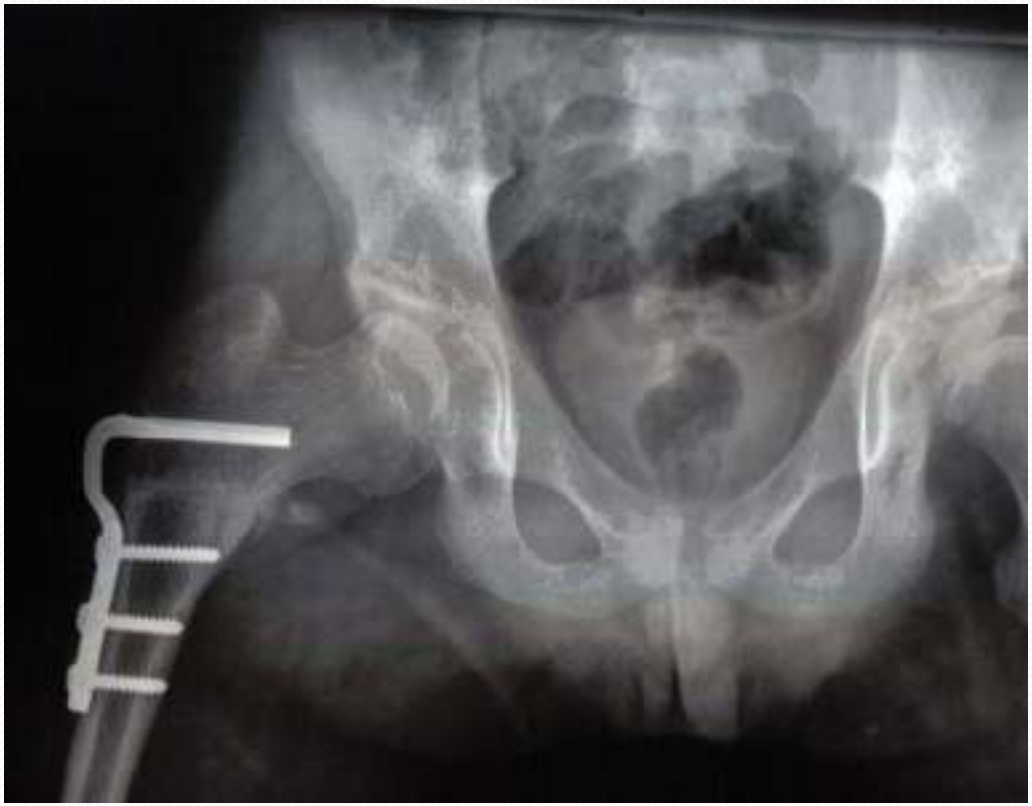
- Postoperative bone loss is found to be enormous even in normal children who are subject to a brief period of immobilization.

- In a study of preoperative and postoperative dual-energy X-ray absorptiometry (DXA) for 15 healthy children undergoing lower extremity surgery with a minimum of 4 weeks of either nonweight-bearing or cast immobilization, the average loss of BMD was 16.5% in cancellous regions, 11.5% in transitional bone and 4.8% in the cortical bone of the operated leg within 6 weeks, and the -score fell by 1.0 for cancellous bone, 0.75 for transitional bone and 0.45 for cortical bone.

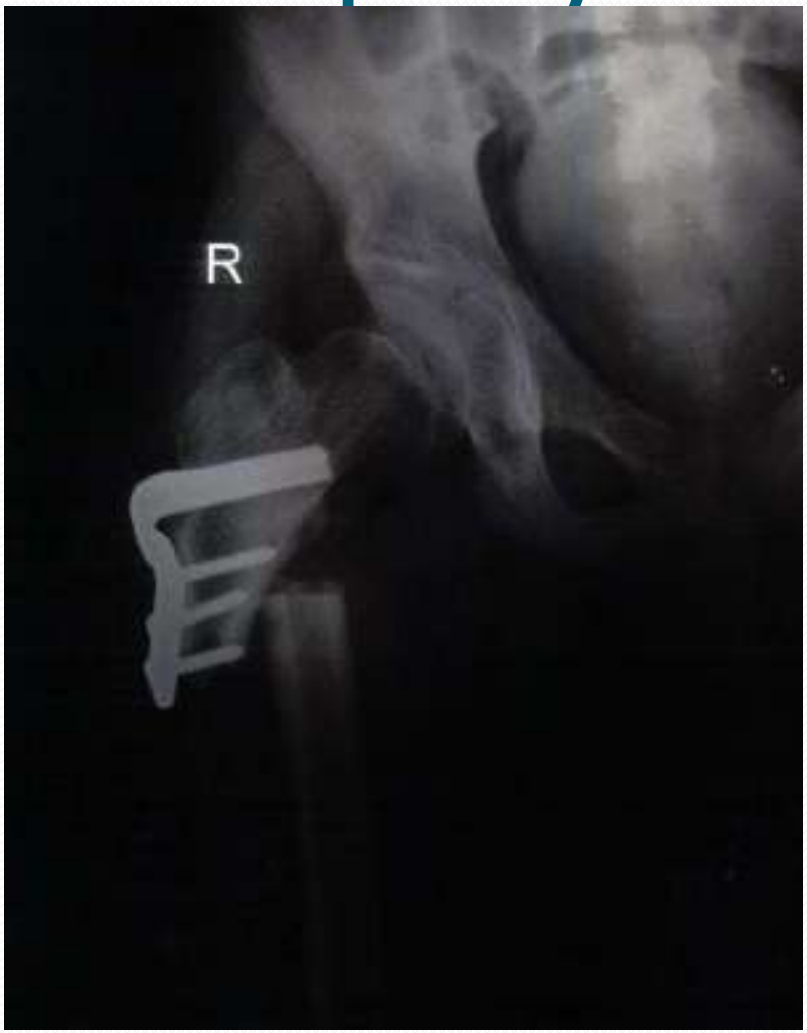
- Thus, prolonged immobilization with or without surgery can predispose to fracture in children with CP.

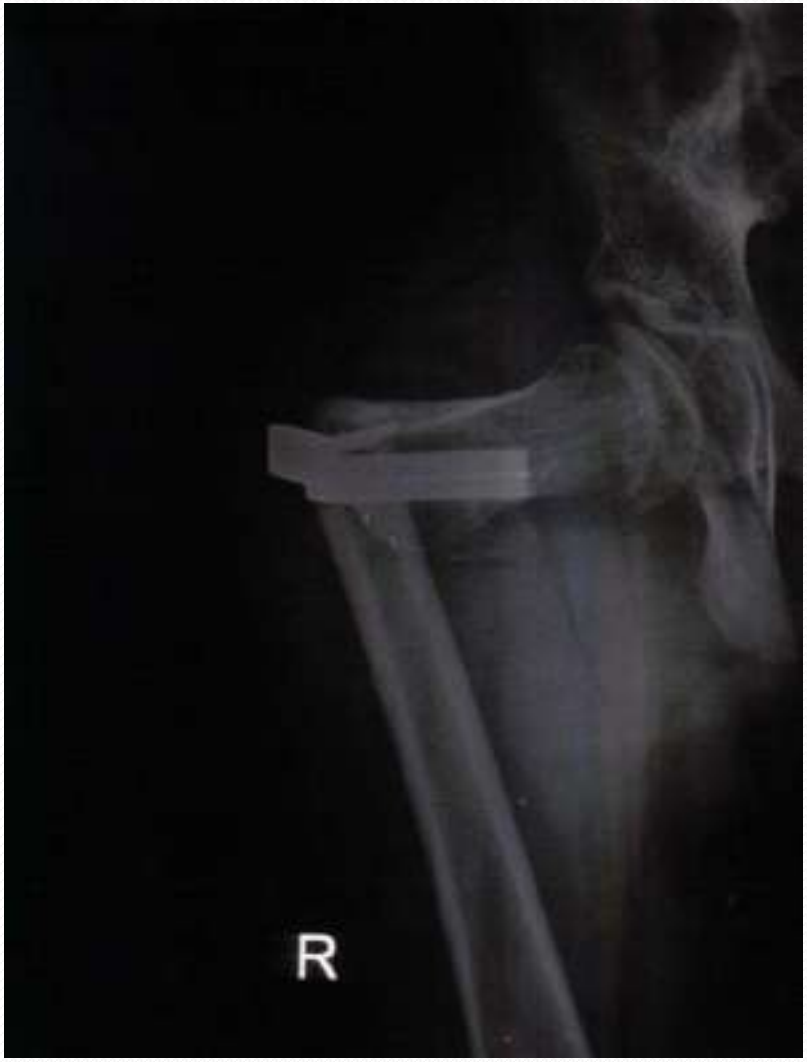
Celebral palsy 1



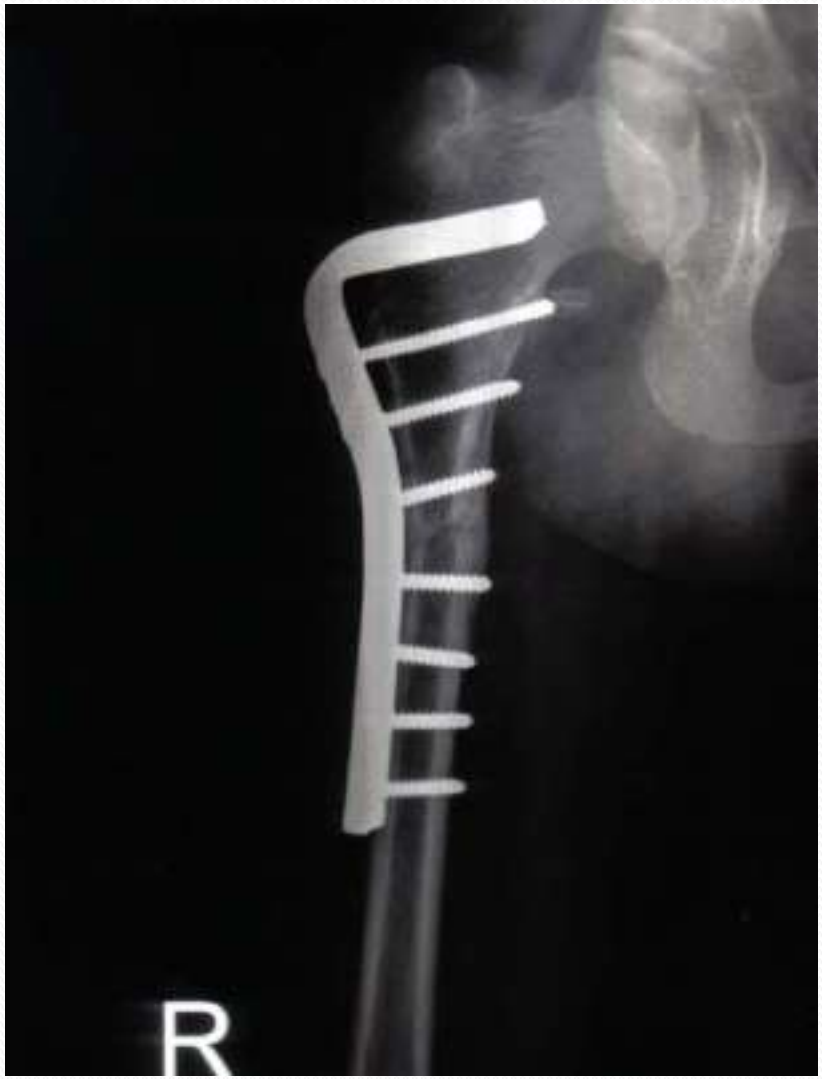


Celebral palsy 2

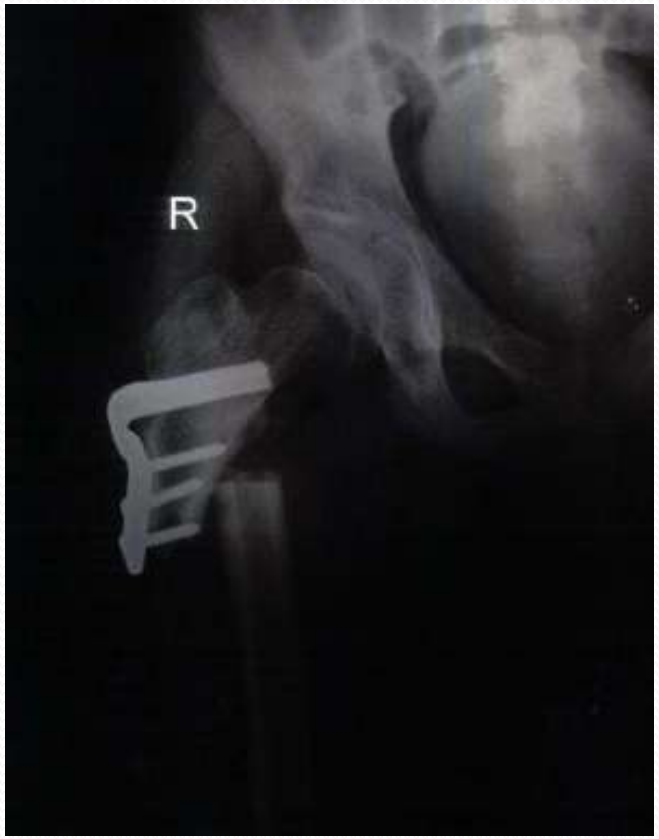


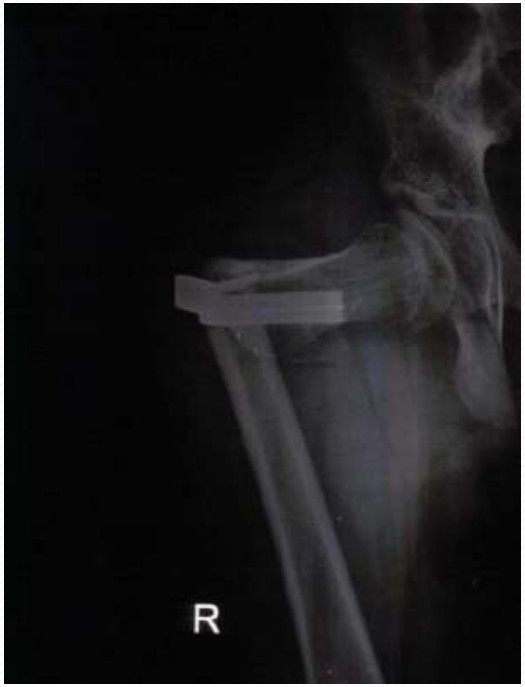


Celebral palsy 3

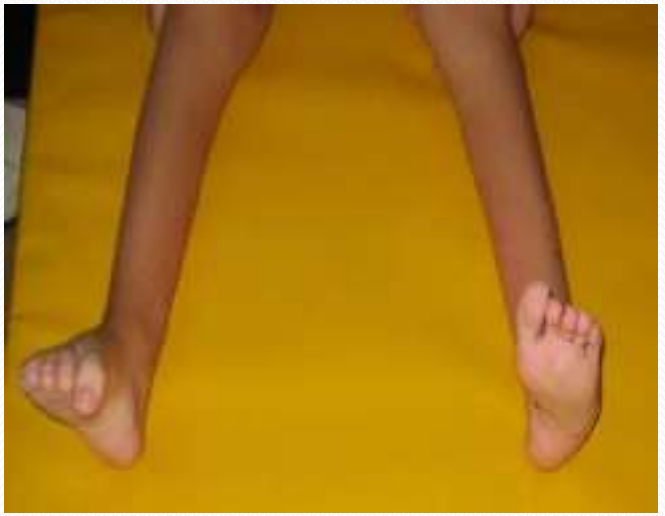


Celebral palsy





Treatment of foot deformities increase mobility



Body weight

- However, even mild feeding difficulty can result in malnutrition. In a survey of 235 children with moderateto-severe CP, 47% had a body weight below the fifth percentile,
- and one-third had an upper arm fat and muscle area below the 10 percentile.

- Weight-for-age z-score was one of the important independent predictors of fracture risk in a multivariate analysis of children with CP.

vitamin D

- Low vitamin D status is common in children with CP. Using a 25hydroxy vitamin D level of less than 20 ng/mL as a biochemical indicator of low vitamin D status, it has been found that the prevalence of low vitamin D status was 19% among children with CP

  living in a community, compared with less than 2% in the healthy paediatric population.
- 10
- Besides feeding difficulties and inadequate exposure to sunlight, the use of antiepileptic drugs (AED) also contributes to low vitamin D status.

AED

- Local studies in children with CP showed that 30% of children living in a community had epilepsy
- 16
- and 63% of children living in institutions were taking AEDs.
- 15
- In severely mentally retarded children who had been receiving AEDs for more than 10 years, up to 75% had osteomalacia.
- 17
- Furthermore, a significant relationship between the number of pathological long bone fractures and the use of AEDs was demonstrated in institutionalized residents with CP.

risk factors for fractures in CP

- In summary, severe neurological impairment (non-ambulatory status, GMFCS level V), severe joint contracture, a history of fracture,
- prolonged immobilization (particularly the use of a hip spica),
- malnutrition (Ryles tube feeding or gastrostomy, low body weight (z-score) and use of AEDs are known to be associated with an increased fracture risk in children with CP.

Prevention of bone fragility and fractures in children with cerebral palsy

- Physical activity and standing weight-bearing should be encouraged.

- Any stiffness of the major joints and extended periods of immobilization should be avoided. Stable internal fixation of any osteotomy, particularly of the hip, will minimize the postoperative duration of cast immobilization.

Lower limb joint deformities, particularly foot and ankle deformities not amenable to bracing, may make standing or physical activities painful and not well tolerated.

Orthopaedic operations to correct lower limb joint deformities in order to provide plantigrade feet and straight knees will allow standing weight-bearing and physical exercise in children with severe CP.

Assessment of bone mineral density in children with cerebral palsy

- A low BMD in a child may reflect the smaller body size or a lower
- bone density, and longitudinal changes in BMD can reflect changes
- in bone density, bone size or both. Thus, the use of DXA BMD
- requires adjustments for body size, pubertal status and skeletal
- maturity. Such adjustment may be difficult in children with CP as
- they are known to have a large variation in age of attainting
- puberty, with a high prevalence of both delayed and advanced
- skeletal maturity. In children with moderate-to-severe CP, 10% had
- a delayed and 7% had an advanced skeletal age (relative to chronological age) of more than 2 years.
- 29

Assessment of bone mineral density in children with cerebral palsy

- Total-body BMD and spinal BMD were found to be more accurate and reproducible than total-hip BMD, particularly in younger children.
- Spine and TBLH BMC and areal BMD, adjusted for absolute height or height age, or compared with paediatric reference data that provide age-, gender- and height-specific z-scores, was recommended for children by the International Society for Clinical Densitometry.

- Henderson RC, Lark RK, Renner RK, et al. Dual X-ray absorptiometry assessment
- of body composition in children with altered body posture. J Clin Densitom
- 2001;4:325e35.

- 34. Szalay EA, Harriman D. Adapting pediatric DXA scanning to clinical orthopaedics.
- J Pediatr Orthop 2006;26:686e90.
- 35.
- Zemel BS, Stallings VA, Leonard MB, et al. Revised pediatric reference data for
- the distal lateral femur measured by hologic discovery/Delphi dual-energy xray
- absorptiometry. J Clin Densitom 2009;12:207e18.

Assessment of bone mineral density in children with cerebral palsy

- Lateral distal femur scanning has been developed specifically for
- children with CP as it is the common site of fractures at least in
- children with CP. Around 36e80% of fractures in children with CP
- occur around the knee,
- 3,8
- and this is a more readily usable region in
- CP. The scanning region in the distal femur includes three areas: the
- metaphysis (mostly trabecular bone), the diaphysis (mostly cortical
- bone) and the diaphyseal-metaphyseal junction (the transitional site between the metaphyseal trabecular bone and the diaphyseal
- cortical bone)

Assessment of bone mineral density in children with cerebral palsy

- The pQCT holds all the advantages of QCTbut with less irradiation
- and a shorter scanning time. In addition, normative data for the
- young population have become available in recent years.
- However,
- a single-scan pQCT may reduce the reproducibility. In a study
- examining pQCT data for the proximal tibia in 35 children with CP,
- a large variability in bone morphology and trabecular bone density
- values along the length of the metaphysis was demonstrated, indicating
- the difficulty of obtaining reproducible pQCT measures from
- a single scan in the appendicular skeleton of children.

- Ashby R, Ward KA, Roberts AS, et al. A reference database for the Stratec XCT2000
- peripheral quantitative computed tomography scanner in healthy children
- and young adults aged 6-19 years. Osteoporos Int 2009;20:1337e46.

- Lee DC, Gilsanz V, Wren TAL. Limitations of peripheral quantitative computed
- tomography metaphyseal bone density measurements.
- J Clin Endocrinol Metab
- 2007;92:4248e53.

Treatment with pamidronate

- In a study focusing on the incidence of fracture before and after 1 year of treatment with pamidronate for 25 children with quadriplegic CP level GMFCS IV or V, the fracture rate significantly decreased from 30.6% per year to 13.0% per year.

- Bachrach SJ, Kecskemethy HH, Harcke HT, Hossain J. Decreased fracture incidence after 1 year of pamidronate treatment in children with spastic quadriplegic
- cerebral palsy.
- Dev Med Child Neurol 2010;52:837e42.
- In these studies, no adverse effects of treatment were noted.

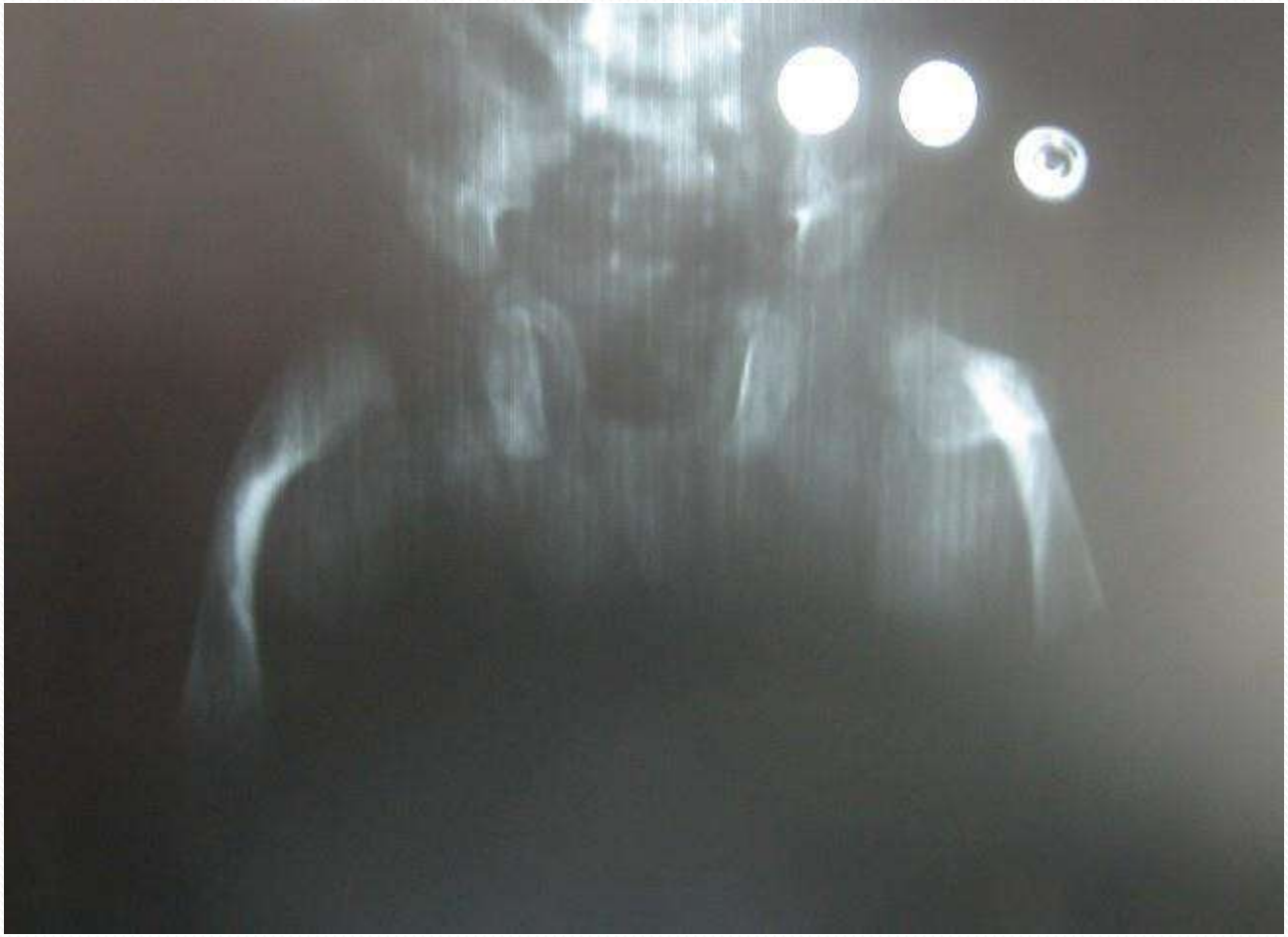
Bone health in cerebral palsy and introduction of a novel therapy

- M A Scheinberg[1] , R Golmia[1] , A M E Sallum ,

- We found strong correlation between significant motor impairment and reduced bone mass in cerebral palsy patients. The unique mechanism of action of denosumab and its easy administration may play a role in improving low bone mineral density secondary to cerebral palsy.

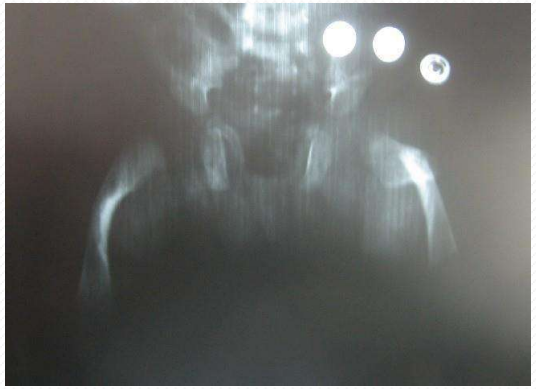
Νεογγνικά κατάγματα

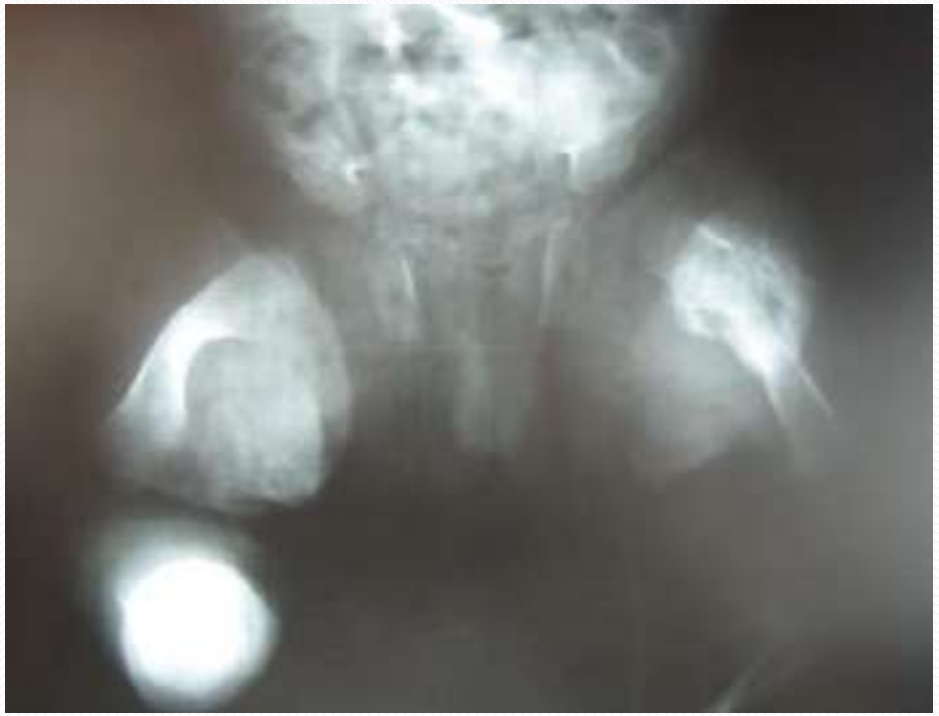
- Διόγκωση μηρού σε νεογνό
- Καισαρική τομή
- Τελειόμηνη
- Φυσιολογική κύηση



Εξέλιξη

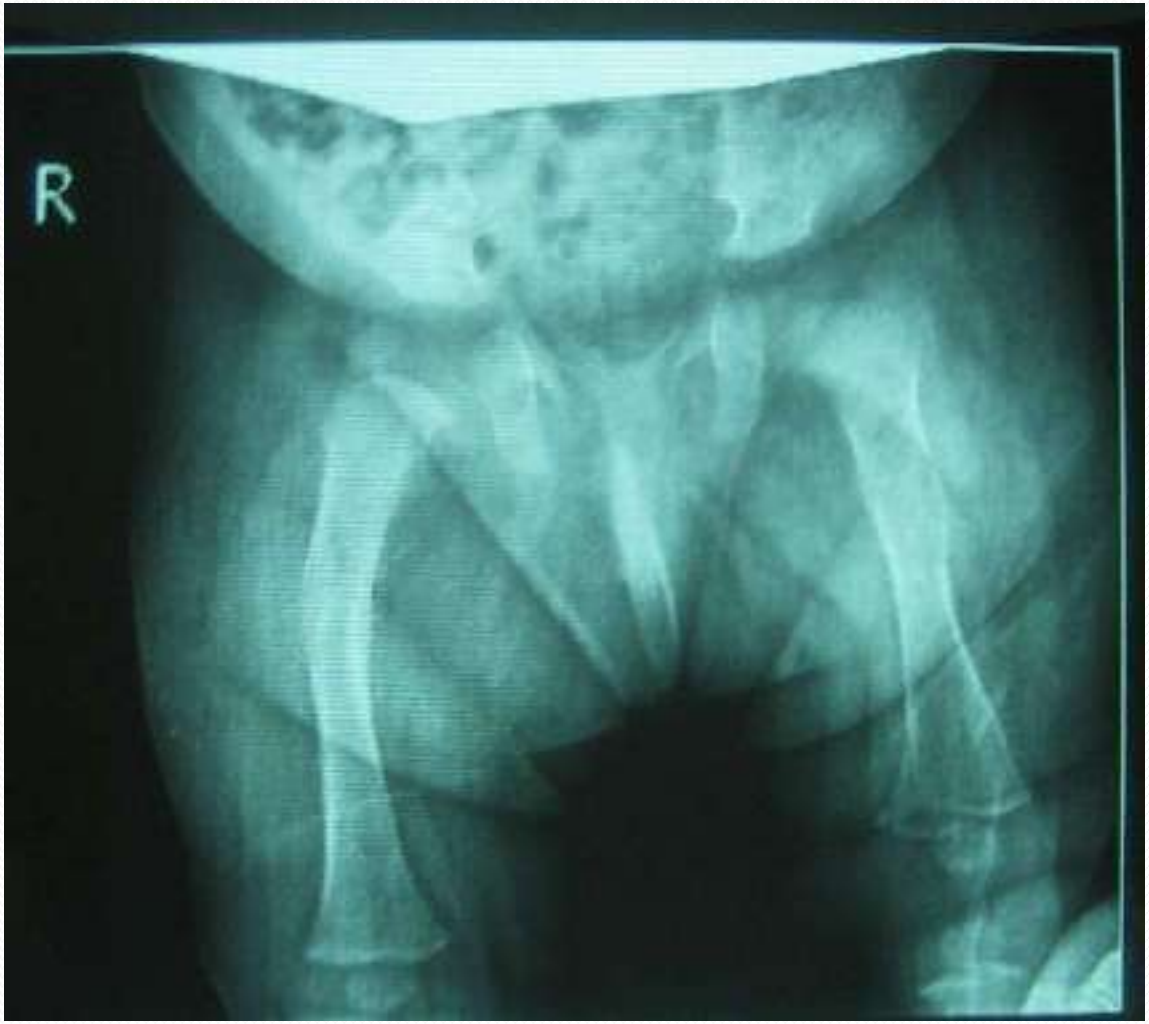
- Ευμεγέθης πώρος





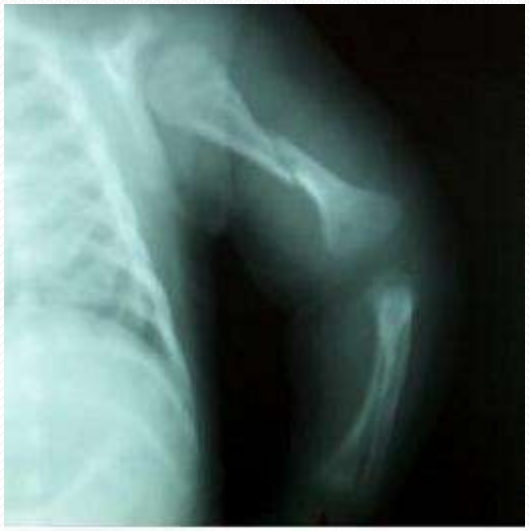
Γενικευμένη οστεοπόρωση

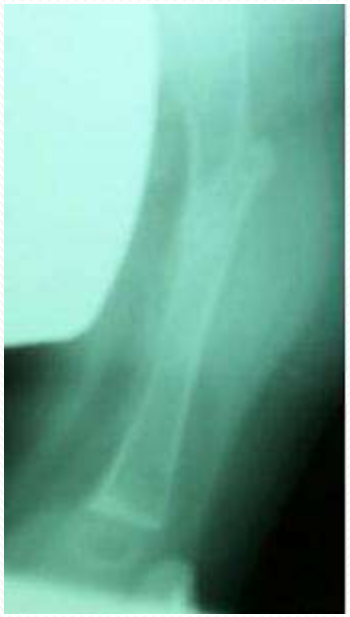
- 4 μήνες μετά



Ατελής οστεογένεση

- Δύο κατάγματα σε βρέφος,
  σε διάστημα 2 μηνών





Ατελής οστεογένεση

- Πρόκειται για μία γενετική διαταραχή που χαρακτηρίζεται από οστά που υφίστανται κατάγματα εύκολα, με ελάχιστη βία

Ατελής οστεογένεση

- Σπάνια πάθηση
- Σύνολο 50.000 ασθενών στις ΗΠΑ
- ΜΙΚΡΟΣ αλλά ΥΠΑΡΚΤΟΣ αριθμός παιδιών με την πάθηση στην Ελλάδα

Ατελής οστεογένεση
Βλάβη κολλαγόνου

- Φυσιολογικό κολλαγόνο τύπου 1
- Στα βρέφη έχει μεγαλύτερο ποσό τύπου 3 και 5
- Στην ατελή οστεογένεση έχει

  αυξημένο κολλαγόνο τύπου 3 και 5

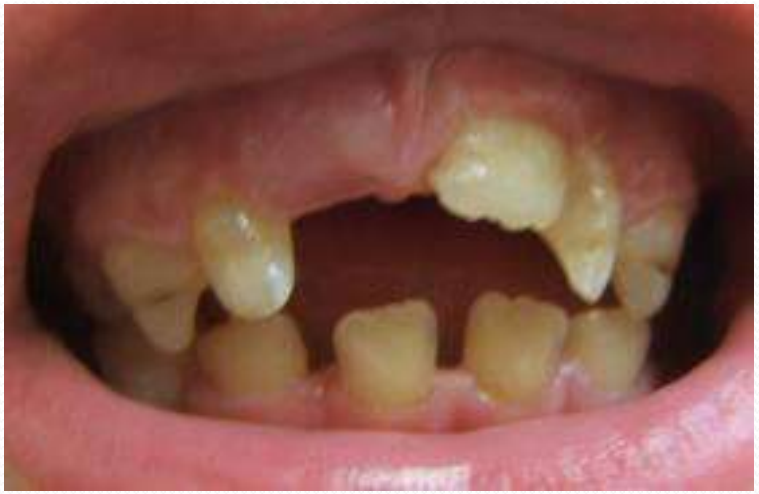
  Βλάβη στην σύνδεση των αλύσεων του κολλαγόνου

Ατελής οστεογένεση
Κληρονομικότητα γονιδιακή προσέγγιση

- Βλάβη Col A1 στο χρωμόσωμα 17 και στο 7
- Γονιδιακή θεραπεία
- Επικρατούσα κληρονομικότητα
- Έκφραση και με υπολειπόμενο χαρακτήρα
- 50 % των νέων περιστατικών είναι μετάλλαξη
- ΠΡΟΣΟΧΗ σε συγγενείς α βαθμού, που χρειάζεται να ελέγχονται γονιδιακά

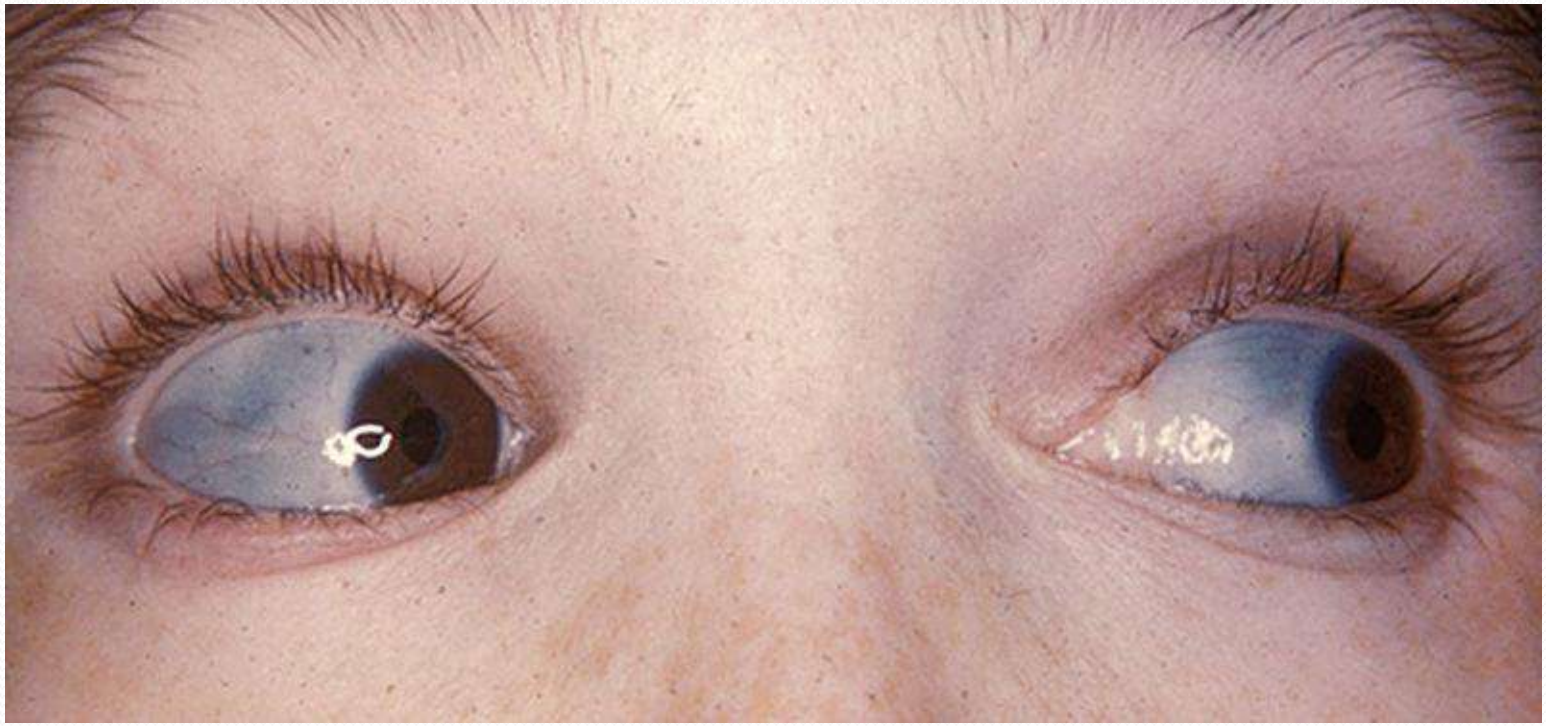
Ατελής οστεογένεση

- Νόσος του συνδετικού ιστού
- Παθολογική μορφή κολλαγόνου που βρίσκεται στο οστούν, οδόντες, δέρμα, οφθαλμούς
- Ποικιλία στην κλινική εμφάνιση της νόσου
- Κυρίαρχο σημείο τα συχνά κατάγματα, με ελάχιστη βία



Ατελής οστεογένεση

- Χαρακτηριστικό μπλε χρώμα στους σκληρούς, μεταβάλλεται ανάλογα με την συχνότητα των καταγμάτων



Ατελής οστεογένεση κλινική εικόνα

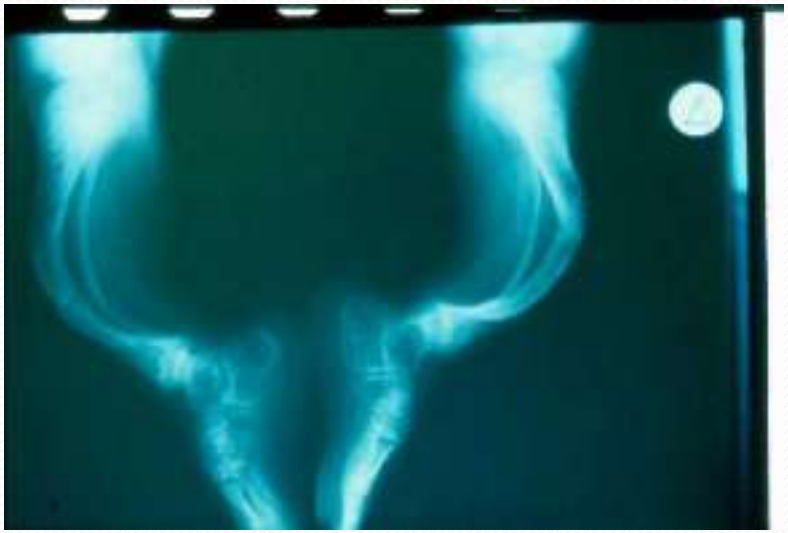
- Μεγάλες παραμορφώσεις στα άκρα
- Βραχύ ανάστημα
- Διαταραχή οδόντων
- Διαταραχή ακοής
- Γεροντικό προσωπείο (ευμέγεθες κρανίο, μικρό πρόσωπο)
- ΜΕΓΑΛΗ ευκαμπτότητα στις αρθρώσεις

Ατελής οστεογένεση ευκαμπτότητα συνδέσμων

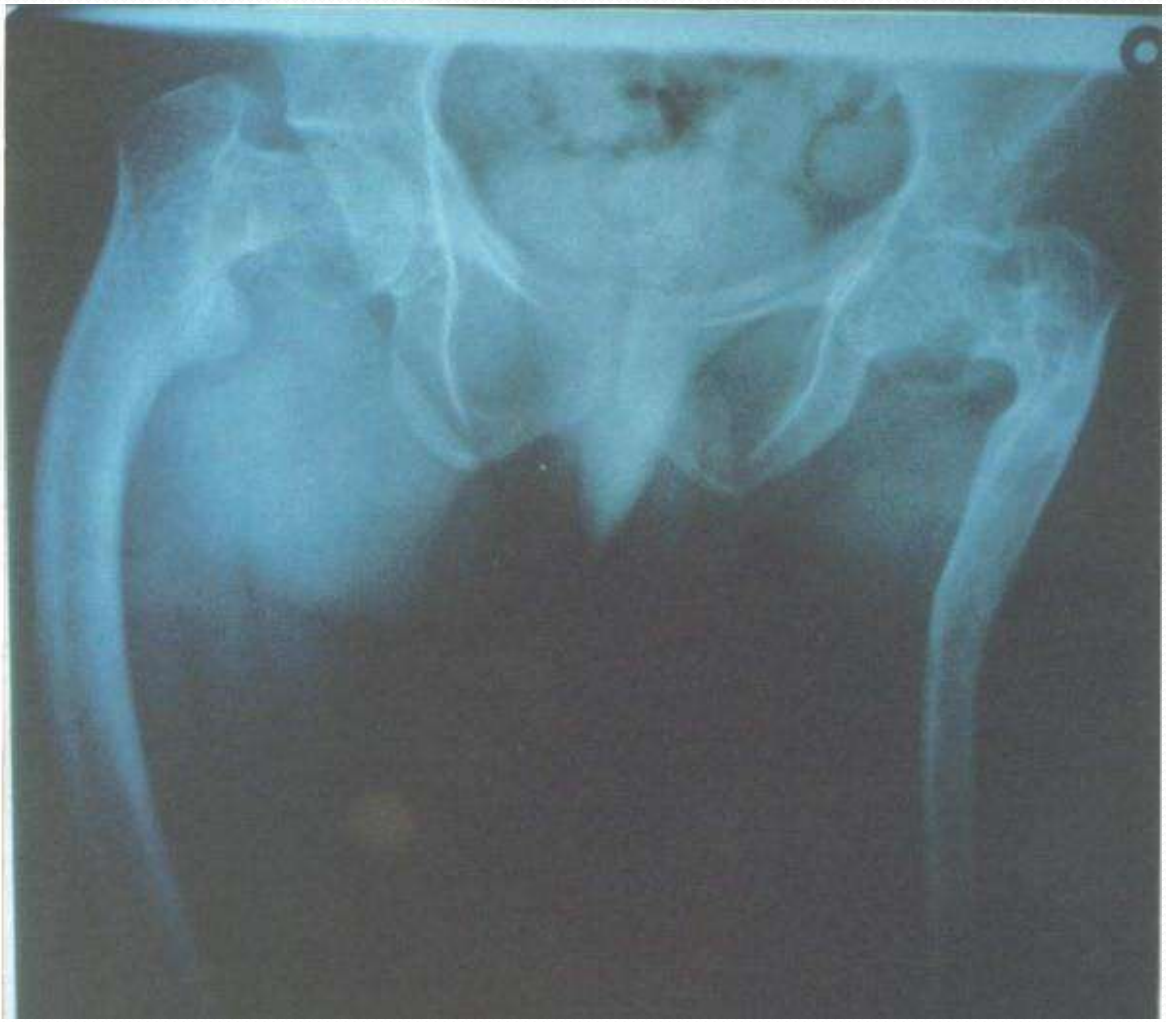
- Υπερελαστικότητα
- Εξαρθρήματα
- Κήλες
- Δέρμα που διατείνεται

Ατελής οστεογένεση κλινική εικόνα

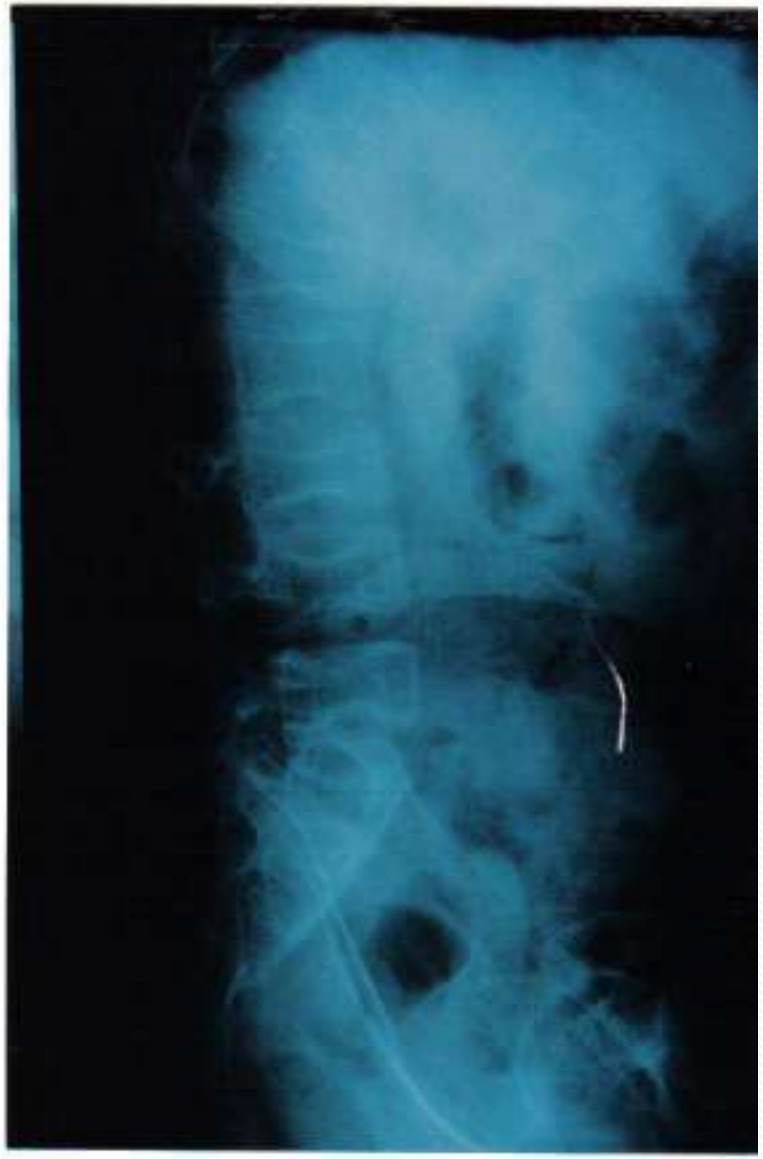
- Μεγάλες παραμορφώσεις στα άκρα



Ατελής οστεογένεση ενήλικος ζωή



Ατελής οστεογένεση σπονδυλική στήλη



Ατελής οστεογένεση ακτινολογική εικόνα

- **Οστεοπόρωση**
- Λεπτός φλοιός των μακρών οστών
- Παραμορφώσεις
- Πεταλιώδες οστούν στο κρανίο
- Κοίλανση των σπονδυλικών σωμάτων

Ατελής οστεογένεση Ταξινόμηση Silence

- Διάκριση σε 4 τύπους ανάλογα με τον συνδυασμό κλινικής και ακτινολογικής εικόνας
- Βαριά βλάβη ο τύπος 3
- Σήμερα έχουν περιγραφεί 11 τύποι της πάθησης
- Μεγάλη ποικιλία στην συνολική εκδήλωση της νόσου

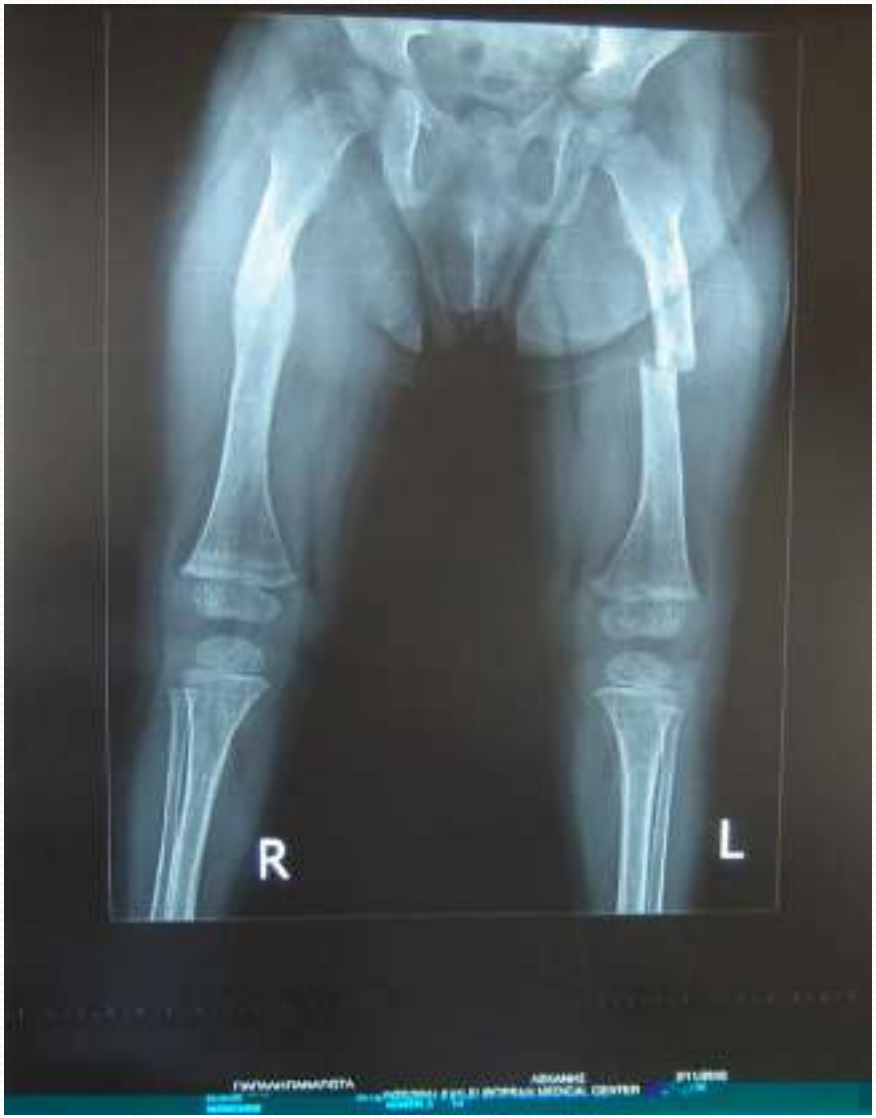
Ατελής οστεογένεση Εργαστηριακός έλεγχος

Οι εργαστηριακές μετρήσεις των δεικτών οστικού μεταβολισμού, είναι φυσιολογικές

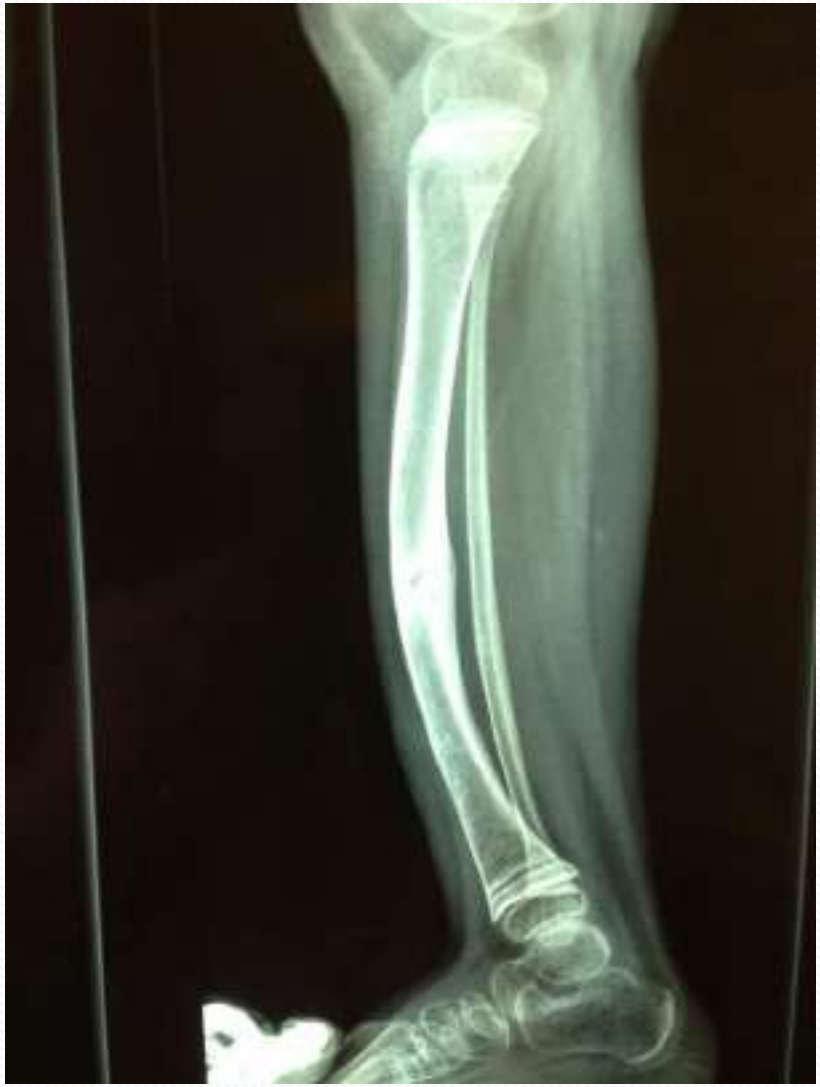
Ca, P, αλκαλική φωσφατάση, βιταμίνη D, PTH

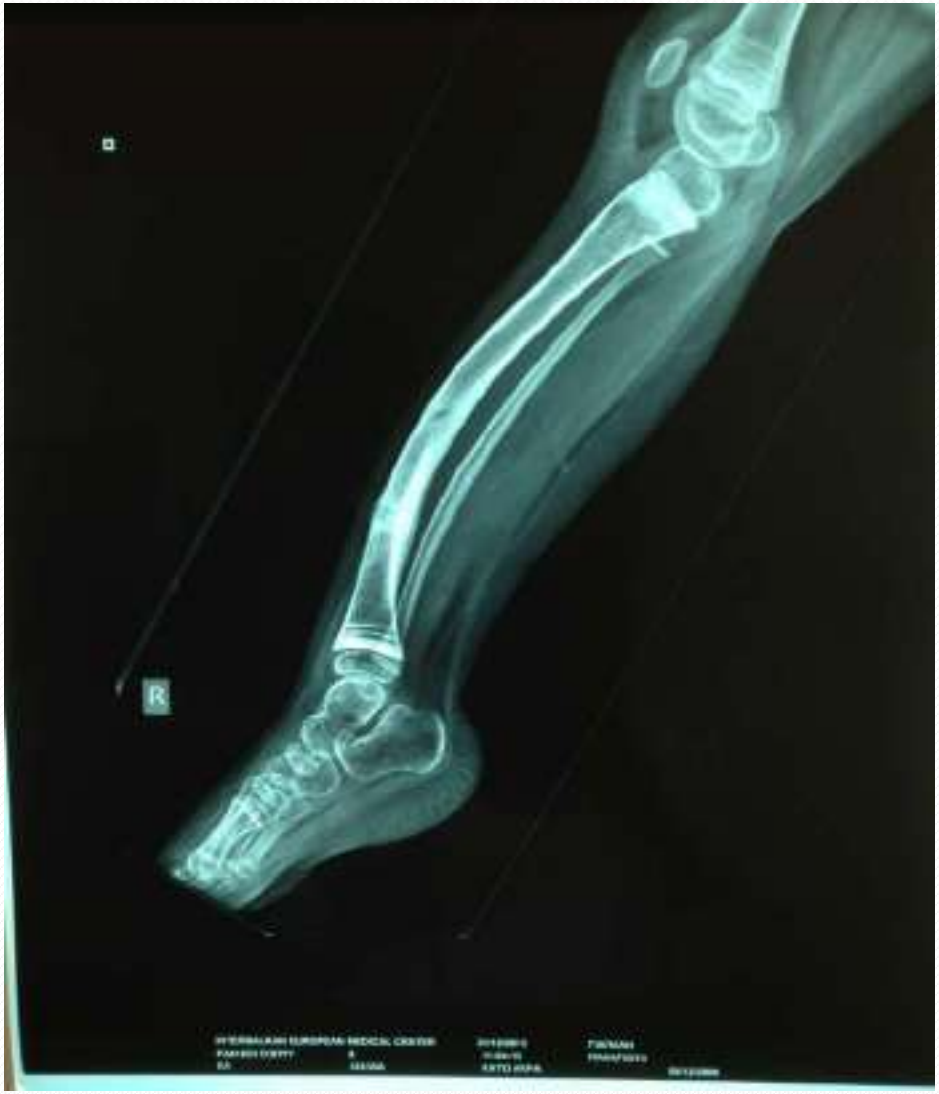
Γονιδιακός έλεγχος

Ατελής οστεογένεση πολλαπλά κατάγματα



Ατελής οστεογένεση πολλαπλά κατάγματα κνήμης





Ατελής οστεογένεση Θεραπευτική αντιμετώπιση

- Προσοχή στις δραστηριότητες
- Υδροθεραπεία

Ατελής οστεογένεση Θεραπευτική αντιμετώπιση

- Εφαρμογή ναρθήκων

Ατελής οστεογένεση Θεραπευτική αντιμετώπιση

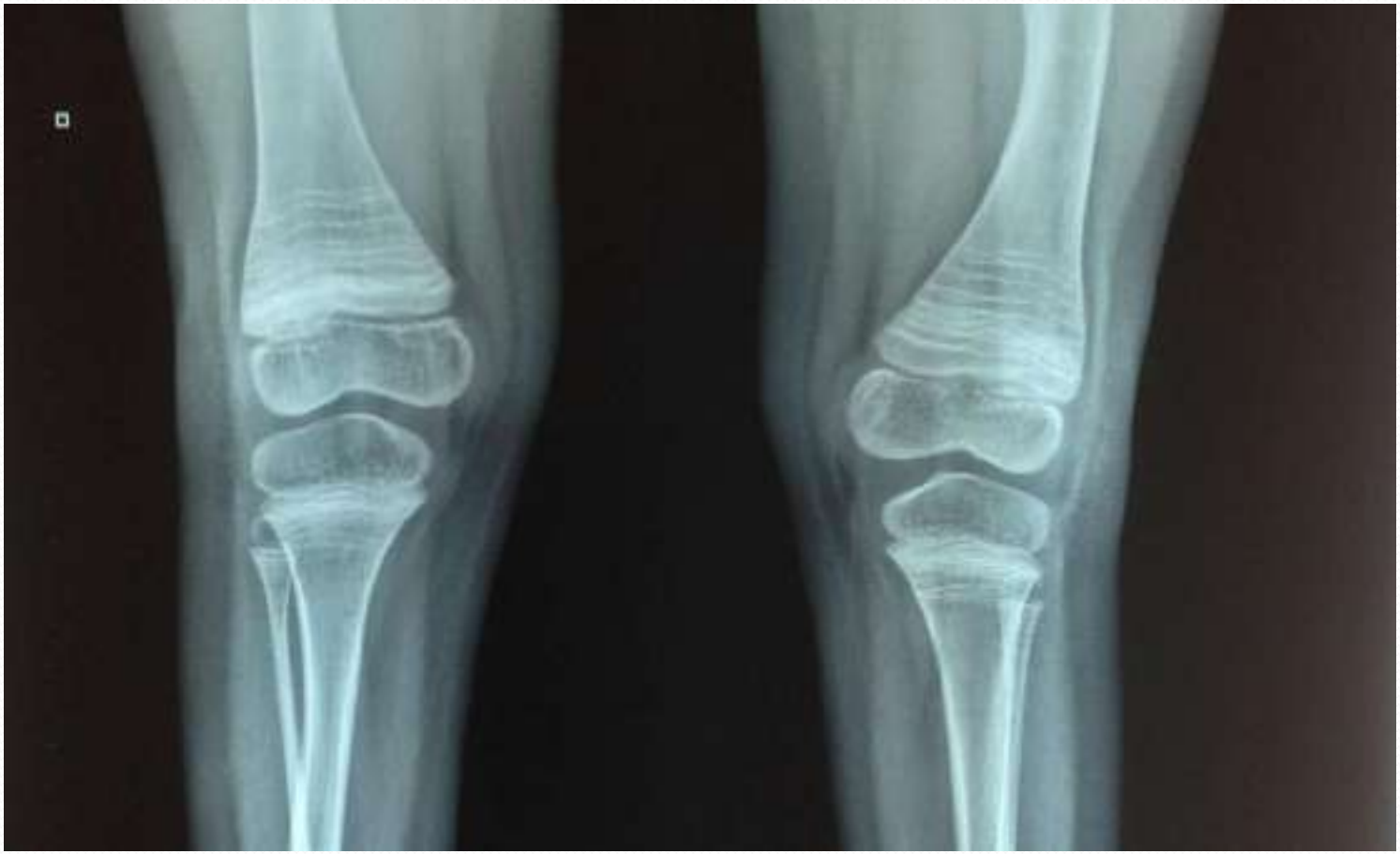
- Χορήγηση διφοσφωνικών αλεδρονάτη
- Χορήγηση παμιδρονάτης
- Συνεχής χορήγηση για την αύξηση της οστικής πυκνότητος
- Αναφέρεται ΣΑΦΗΣ ελάττωση της συχνότητος των καταγμάτων
- Άγνωστο το μακροχρόνιο αποτέλεσμα από την χορήγηση των φαρμάκων

Zebra lines

- **Al Muderis M, Azzopardi T, Cundy P 2007**
- **Zebra lines of pamidronate**
- therapy in children. J Bone Joint Surg Am 89:1511–1516
- 77.

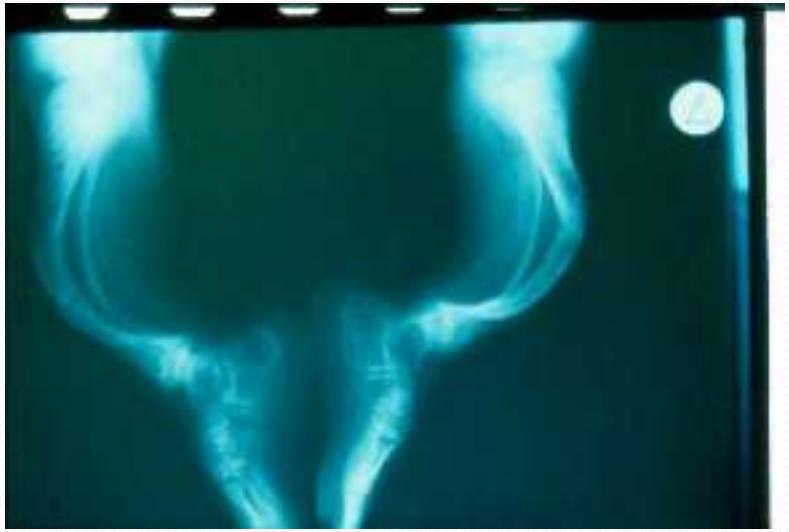
- **van Persijn van Meerten EL, Kroon HM, Papapoulos SE 1992 Epiand**
- metaphyseal changes in children caused by administration of
- bisphosphonates. Radiology 184:249–254

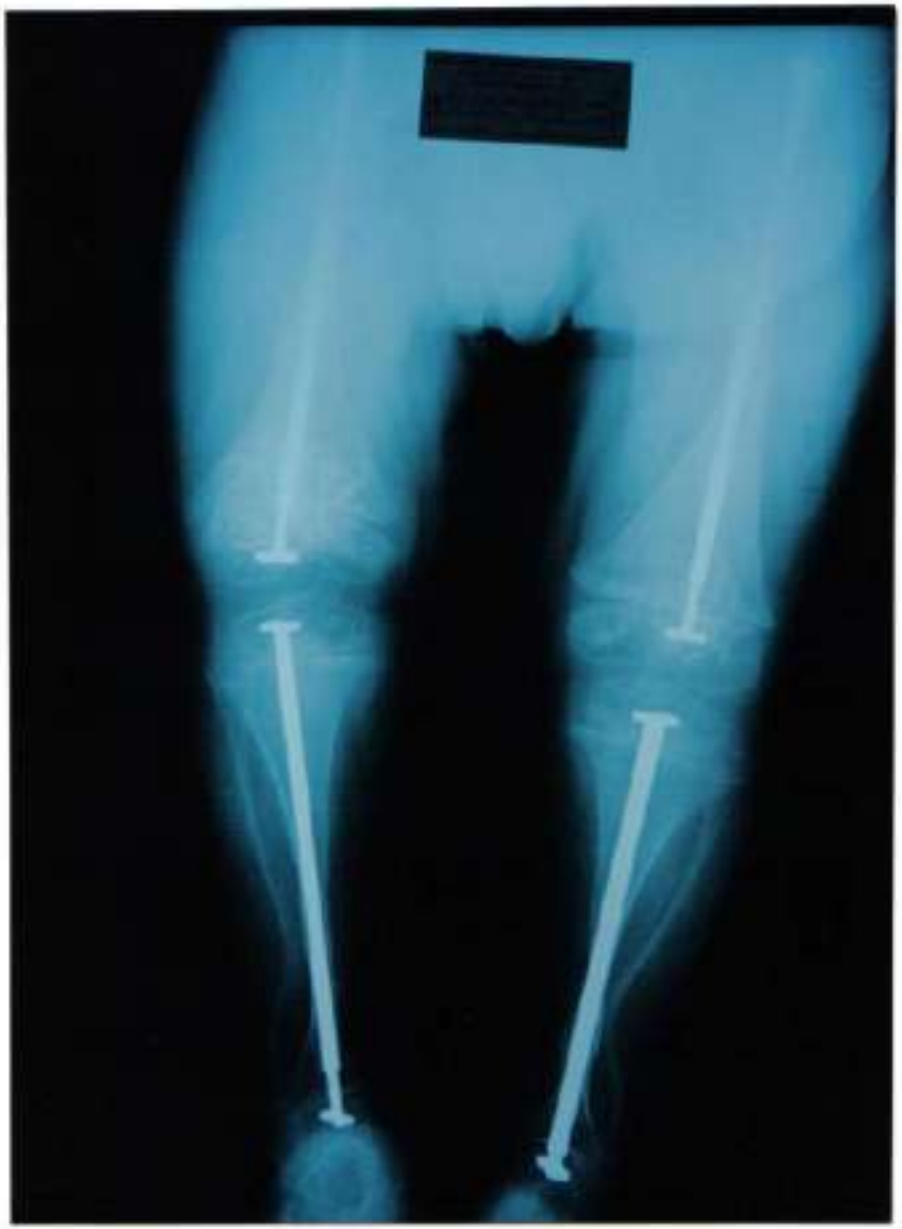
Zebra lines



Ατελής οστεογένεση χειρουργική αντιμετώπιση

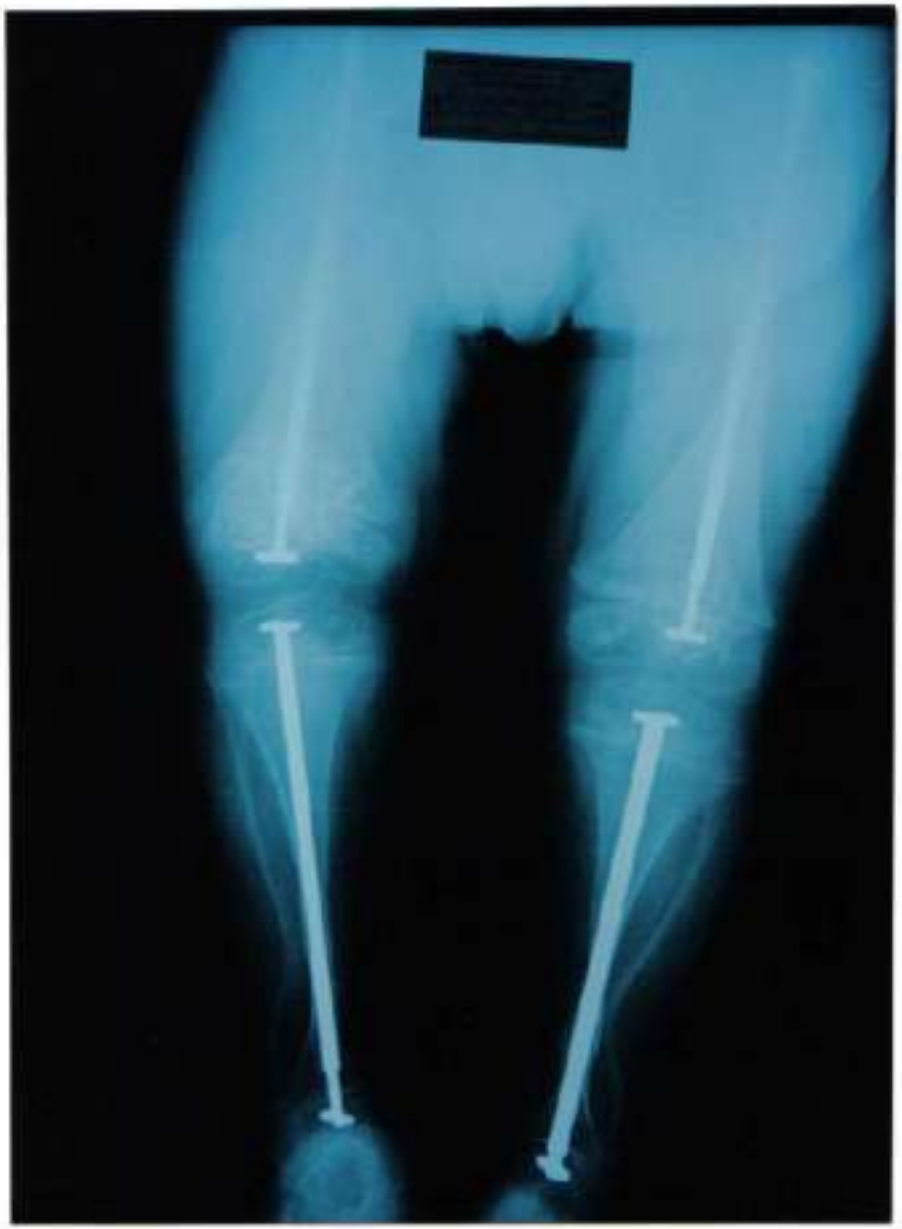
- Εκπτυσσόμενοι ήλοι



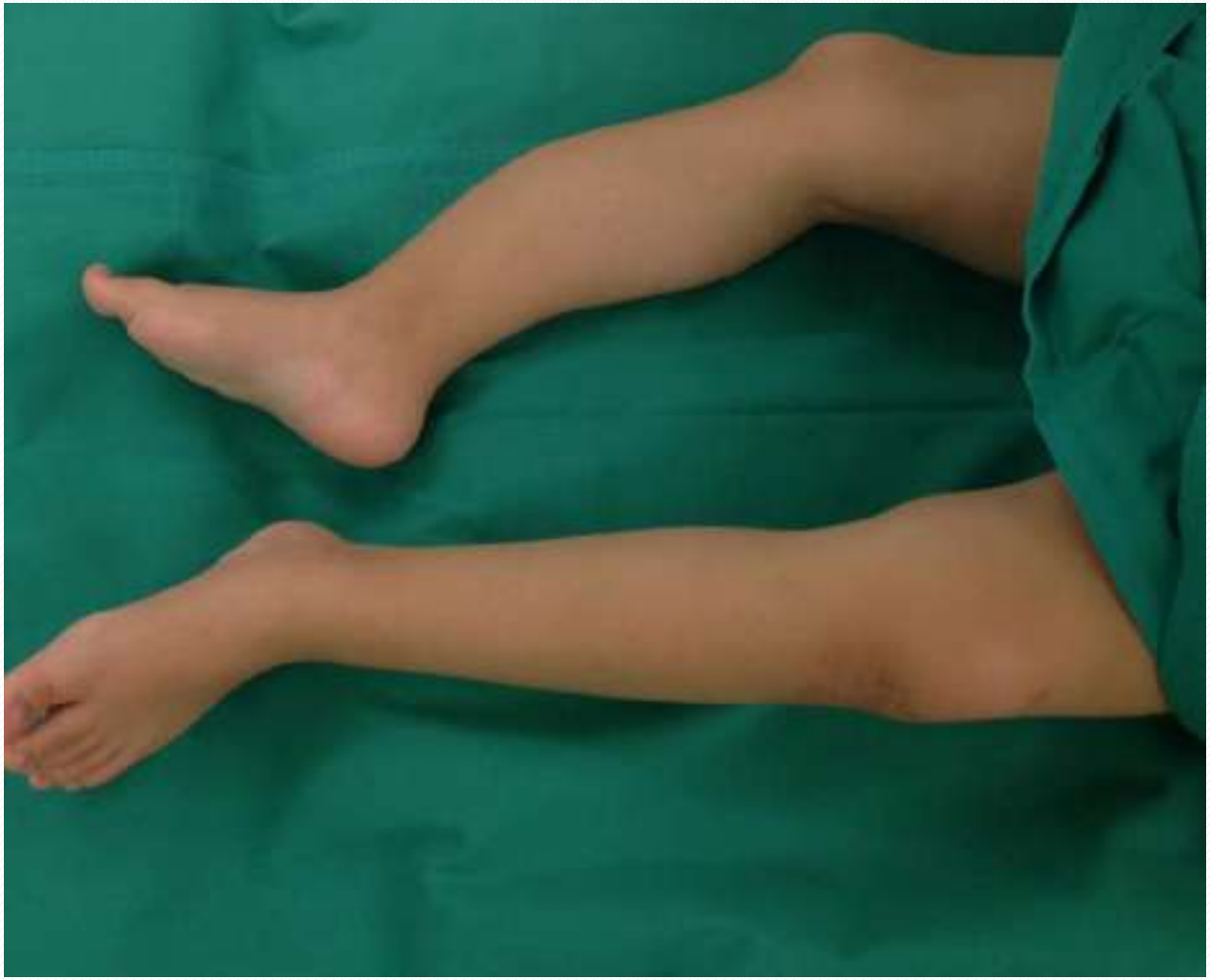


Ατελής οστεογένεση χειρουργική αντιμετώπιση

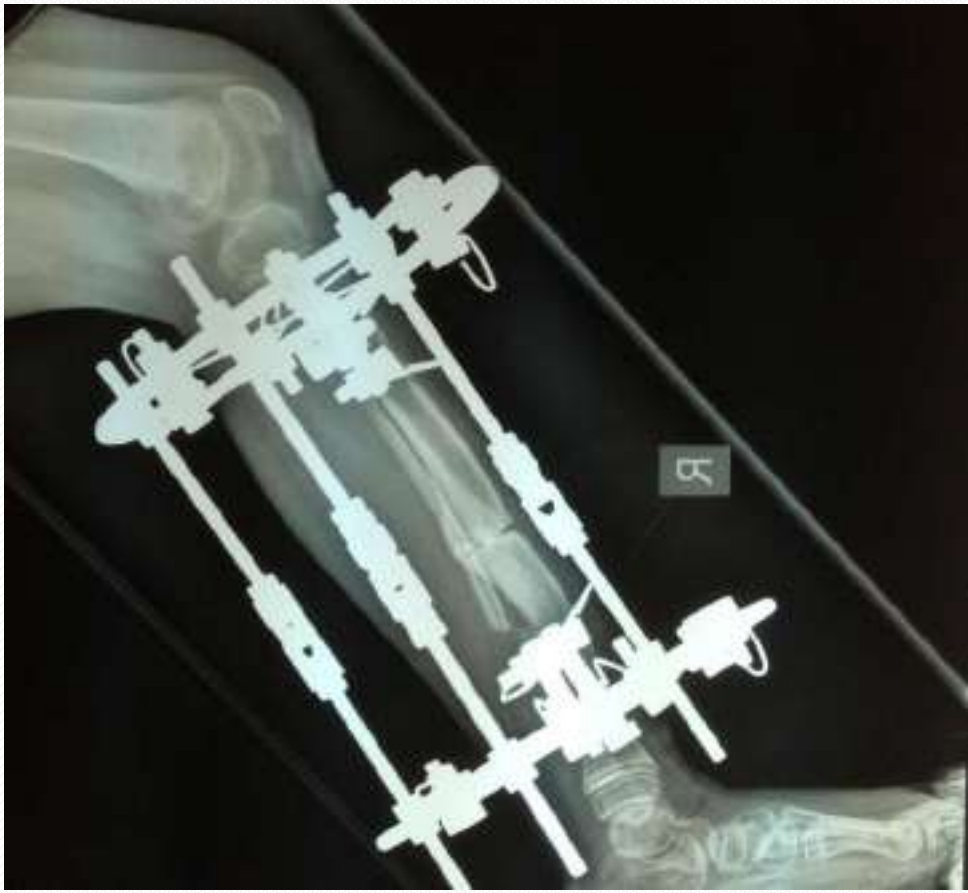
- Εκπτυσσόμενοι ήλοι



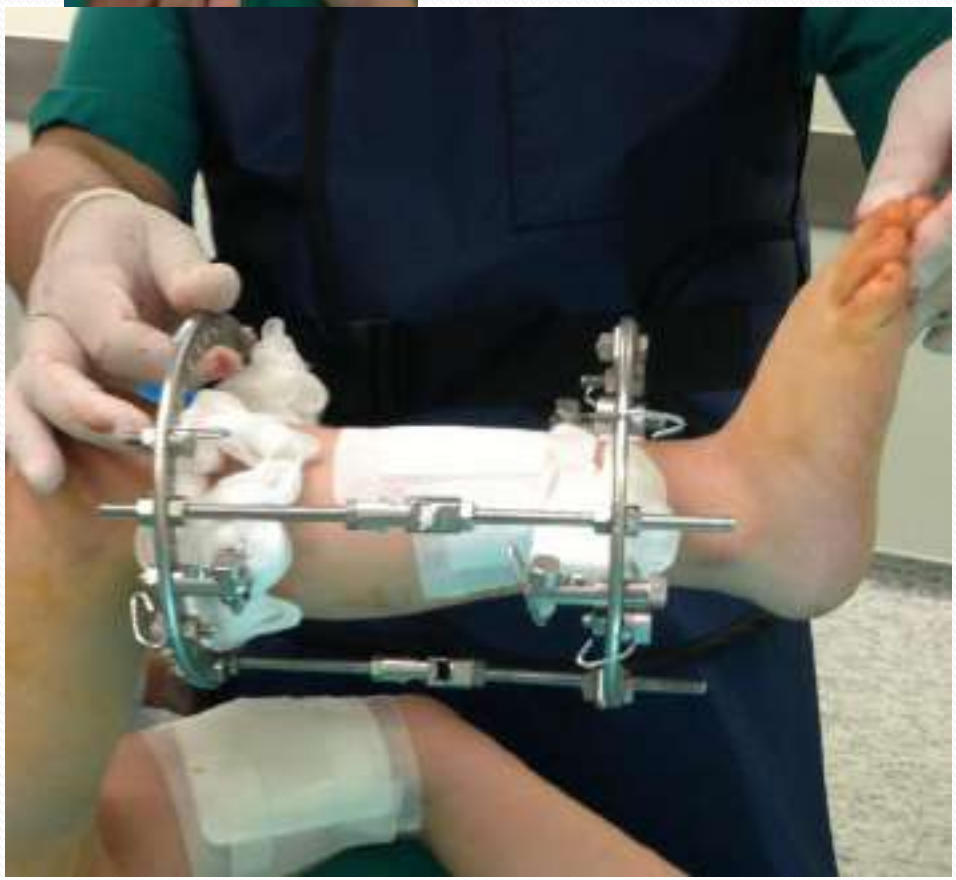
Αντιμετώπιση με συσκευή Ilizarov



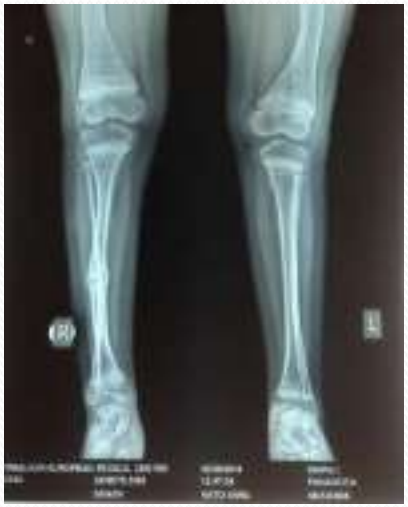
Αντιμετώπιση με συσκευή Ilizarov

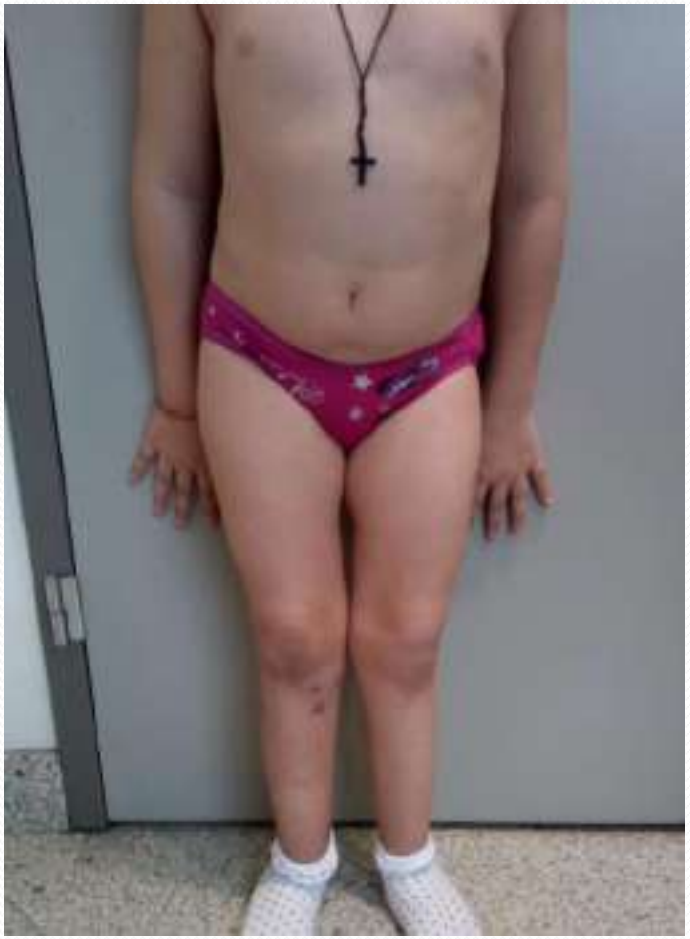


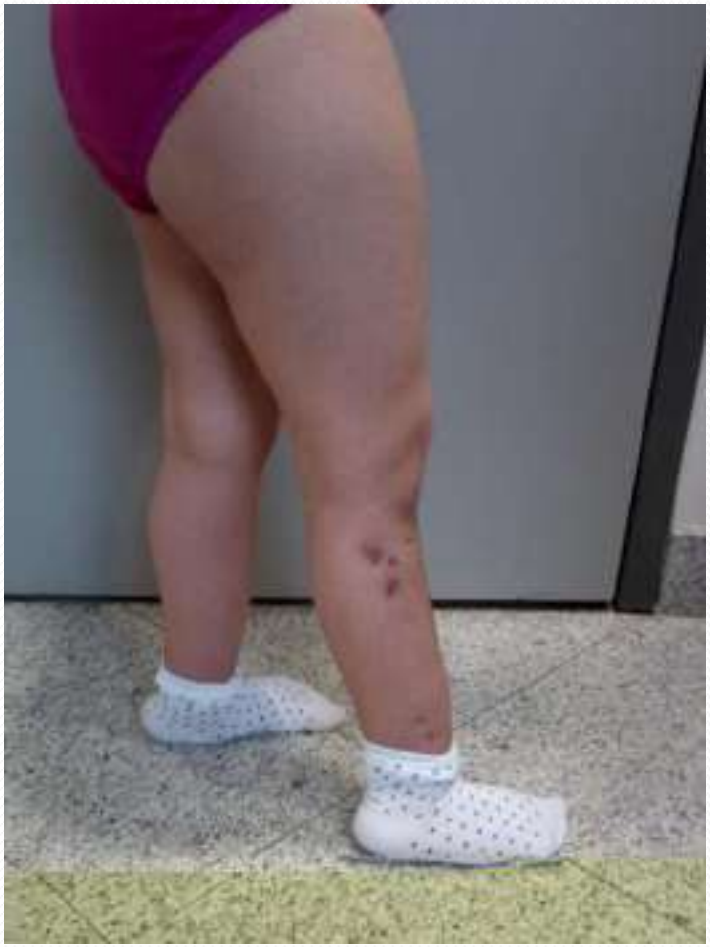
Αντιμετώπιση με συσκευή Ilizarov



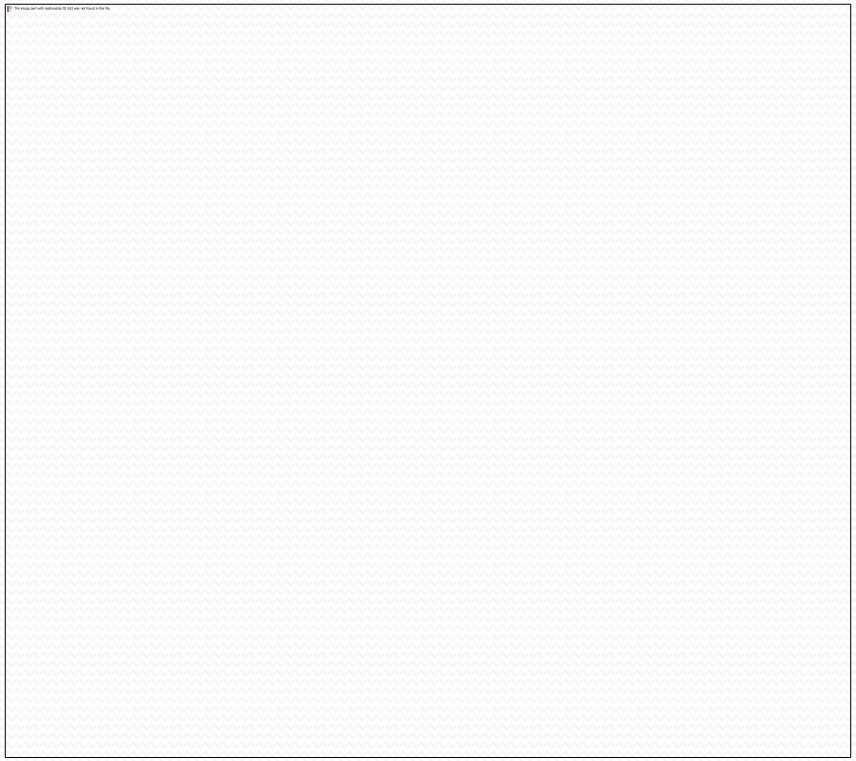
EIKONA 2015

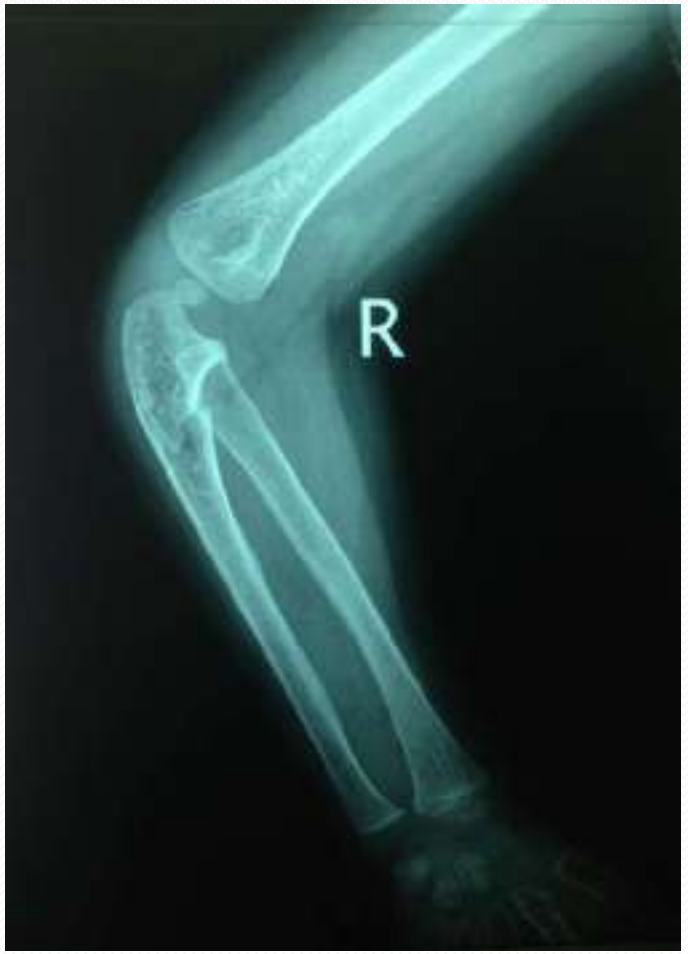






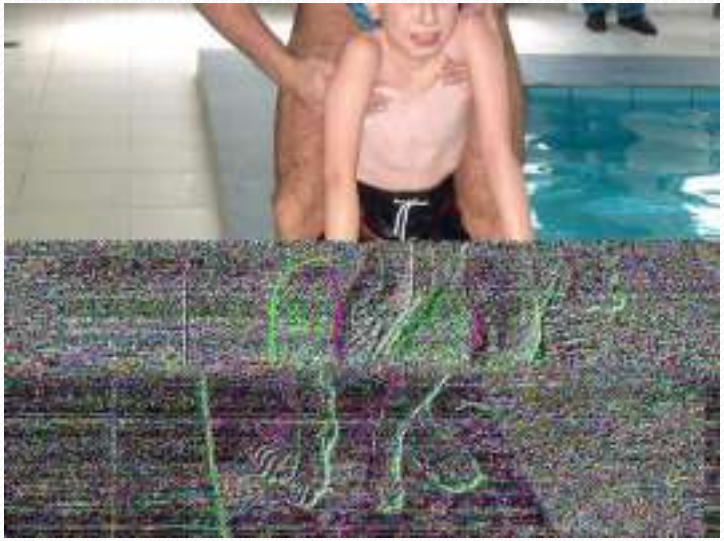
Nousc άτυπο κάταγμα χωρίς βία





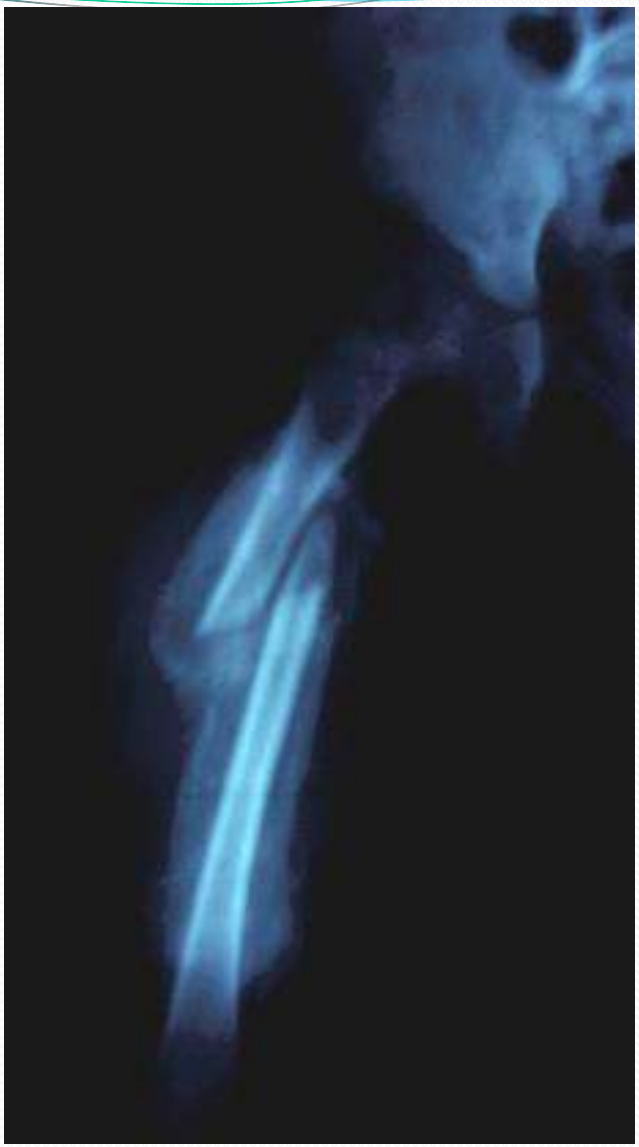
Οστεοπόρωση στα παιδιά

- Duchenne muscular dystrophy
- Αντιμετώπιση των καταγμάτων



meningocele

- absence of pain
- Swelling
- N Laliotis Orthopaedic management of meningocele
- Orthopaedics 2000



Οστεοπόρωση στα παιδιά

- Παθήσεις του αίματος
- Λευχαιμία, μεσογειακή αναιμία

Οστεοπόρωση σε παιδιά με λευχαιμία

- Hippokratia. 2011 Jan;15(1):43-7.
- **Alterations of bone mineral metabolism of children with different cell lineage types of acute lymphoblastic leukaemia under chemotherapy.**
- Tragiannidis A, Dokos Ch, Sidi V, Papageorgiou T, Koliouskas D, Karamouzis M, Papastergiou Ch, Tsitouridis I, Katzos G, Rousso I, Athanassiadou-Piperopoulou F

Οστεοπόρωση σε παιδιά με μεσογειακή αναιμία

- **Bone mineral density in beta - thalassemic Lebanese children.**

  Yazidi et al J Musculoskelet Neuronal Interact. 2002 Sep;2(5):463-8.

  Beta-thalassemic children have a significantly lower BMD than their healthy counterparts due, in part, to their slower physical development

Οστεοπόρωση στα παιδιά

- Crohn disease
- Σύνδρομα δυσαπορρόφησης
- Παθήσεις θυρεοειδούς
- Cushing syndrome
- **Αντι επιληπτικά φάρμακα**
- Χημειοθεραπεία

Οστεοπόρωση στα παιδιά

- Νεανική ρευματοειδής αρθρίτιδα

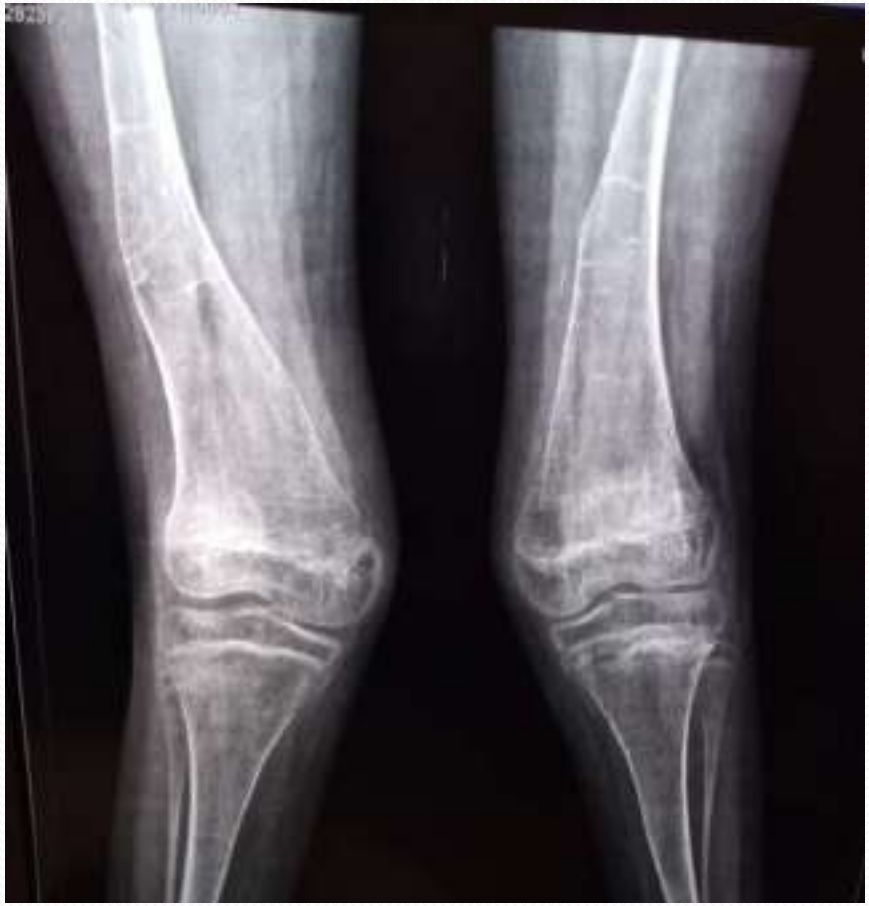
Οστεοπόρωση στα παιδιά

- Life style in anorexia nervosa

- **Two-year cyclic infusion of pamidronate improves bone mass density and eliminates risk of fractures in a girl with osteoporosis due to Hajdu-Cheney syndrome**
- Minerva Endocrinologica [2012, 37(3):283-289]
- Galli Tsinopoulou A, Kyrgios, Laliotis N

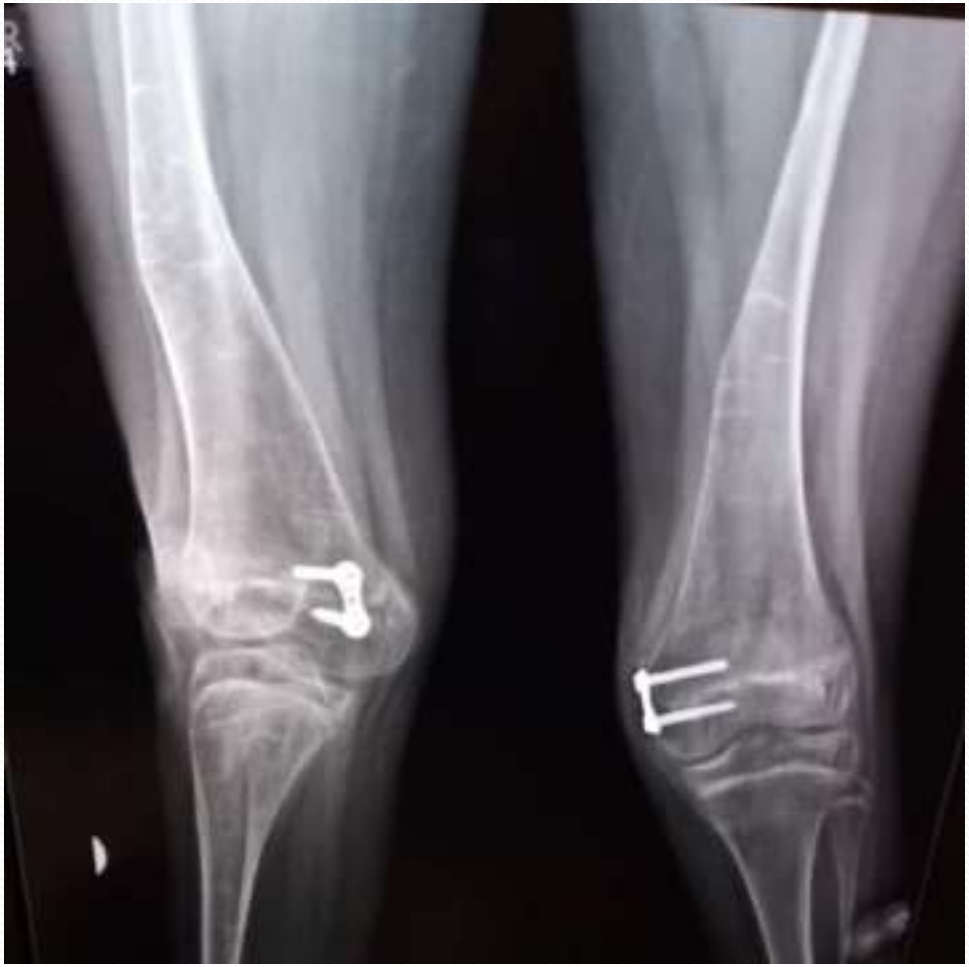
Ψυχοκινητική υστέρηση

- Αδυναμία αυτόνομης βάδισης



Ψυχοκινητική υστέρηση

- Αδυναμία αυτόνομης βάδισης



Σπονδυλικά κατάγματα

- [**New diagnostic criteria for pediatric osteoporosis--spinal compression fractures are an underdiagnosed problem**
- Valta H, Mäkitie O Duodecim. 2011;127(9):921-9 Vertebral fractures without high-energy injury in children are usually indicative of increased bone fragility. In chronically ill children, these fractures are surprisingly common and often asymptomatic

Conclusion 1

- Fragility fractures in children may be due to a wide variety of genetic, medical, or nutritional disorders. The decision to perform screening densitometry in a child or adolescent must be made on an individual basis, taking into account fracture history and risk factors.

- The clinical implications of low BMD in the pediatric population have not been well-established, and the diagnosis of osteoporosis must be made in association with clinical history rather than relying upon bone densitometry alone.

Conclusion 2

- The primary step in treatment should include management of underlying conditions as well as conservative measures including vitamin D and calcium supplementation and weight-bearing physical activity.

- The use of bisphosphonates in children and adolescents is controversial due to lack of long-term efficacy and safety data and should be limited to clinical trials and as compassionate therapy in children with significantly compromised quality of life.

Ευχαριστώ για την προσοχή σας