AVN of the young hip
Diagnosis and management

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osteochondritis

- Transient ischemic lesion of the active epiphysis, before the completeness of the secondary ossific nucleus
- Παροδική ισχαιμική βλάβη της επίφυσης, ΠΡΙΝ την ολοκλήρωση του δευτερογενούς πυρήνα οστέωσης

osteochondritis

- Σκαφοειδούς navicular
- Πτέρνας calcaneum
- Μεταταρσίων metatarsal
- Αστραγάλου talus
- Κνημιαίου κυρτώματος tibial tubercle
- Μηριαίων κονδύλων dissecans of the knee
- Ισχίου hip
- Κονδύλου βραχιονίου humerus condyle

Osteochondritis hip Perthes

- Idiopathic, self – limiting, avascular necrosis of the proximal femoral epiphysis D Wegner

Osteochondritis of the hip

- Short stature children, with small feet
- Social level- disease of financial recession
- Thrombophilia Leiden

Margretts et al J Bone Joint Surg B 1990
Bruce et al J Bone Joint 2012

Bull Hosp Jt Dis (2013). 2014;72(1):18-27.
Legg-Calvé-Perthes disease: an overview with recent literature.
Chaudhry S, Phillips D, Feldman D.

One explanation of pathogenesis involves the large cartilage anlage of the femoral head. As LCP patients tend to have delayed bone age, on average 2 years in girls and 1 year in boys, their femoral head ossific nuclei are smaller than those in children of similar chronologic age.

This makes the cartilaginous component of their epiphysis relatively larger, and the traversing blood vessels are more vulnerable to mechanical compression.

Comorbidities in Perthes' disease
A case control study using the General Practice Research Database

D. C. Perry.

- J Bone Joint Surg Am. 2012 Apr 4;94(7):659-69.
- Perthes' disease has a significant association with congenital genitourinary and inguinal anomalies, suggesting that intra-uterine factors may be critical to causation. Other comorbid associations may offer insight to support or refute theories of pathogenesis.

Bone Joint J. 2017 Aug;99-B(8):1102-1108.

A case control study to determine the association between Perthes' disease and the recalled use of tobacco during pregnancy, and biological markers of current tobacco smoke exposure.

Perry DC[1], Thomson C[2], Pope D[3], Bruce CE[4], Platt MJ[5]

- A hospital case-control study (n = 149/146) examined the association between tobacco smoke exposure and Perthes' disease, adjusting for area-level socioeconomic deprivation. Tobacco smoke exposure was assessed by parental questionnaire of smoking habits during pregnancy, and by quantitative assay of current exposure using the urinary cotinine-creatinine ratio, which is a widely used and validated measure of tobacco smoke exposure.
- **RESULTS:**
- The odds of Perthes' disease significantly increased with reported *in utero* exposure after adjustment for socioeconomic deprivation (maternal smoking odds ratio (OR) 2.06, 95% confidence interval (CI) 1.17 to 3.63; paternal smoking OR 2.09, 95% CI 1.26 to 3.46). The cotinine-creatinine ratio was significantly greater in cases, OR 1.63 (95% CI 1.09 to 2.43), suggesting a greater 'dose' of current tobacco exposure.
- **CONCLUSION:**
- An association exists between tobacco smoke exposure and Perthes' disease but we remain unable to disentangle the association with socioeconomic deprivation

Osteochondritis hip Perthes

- recent appearance in the brother and sister of 2 families
- One child of homozygotic twins

classification

Waldestrom classification 1922

Catterall classification 1971

Salter and Thomson 1980

- Herring classification 1992

Head at risk signs

Salter classification

- Extend of subchondral fracture

Salter and Thomson

J Bone Joint Surg A 1984

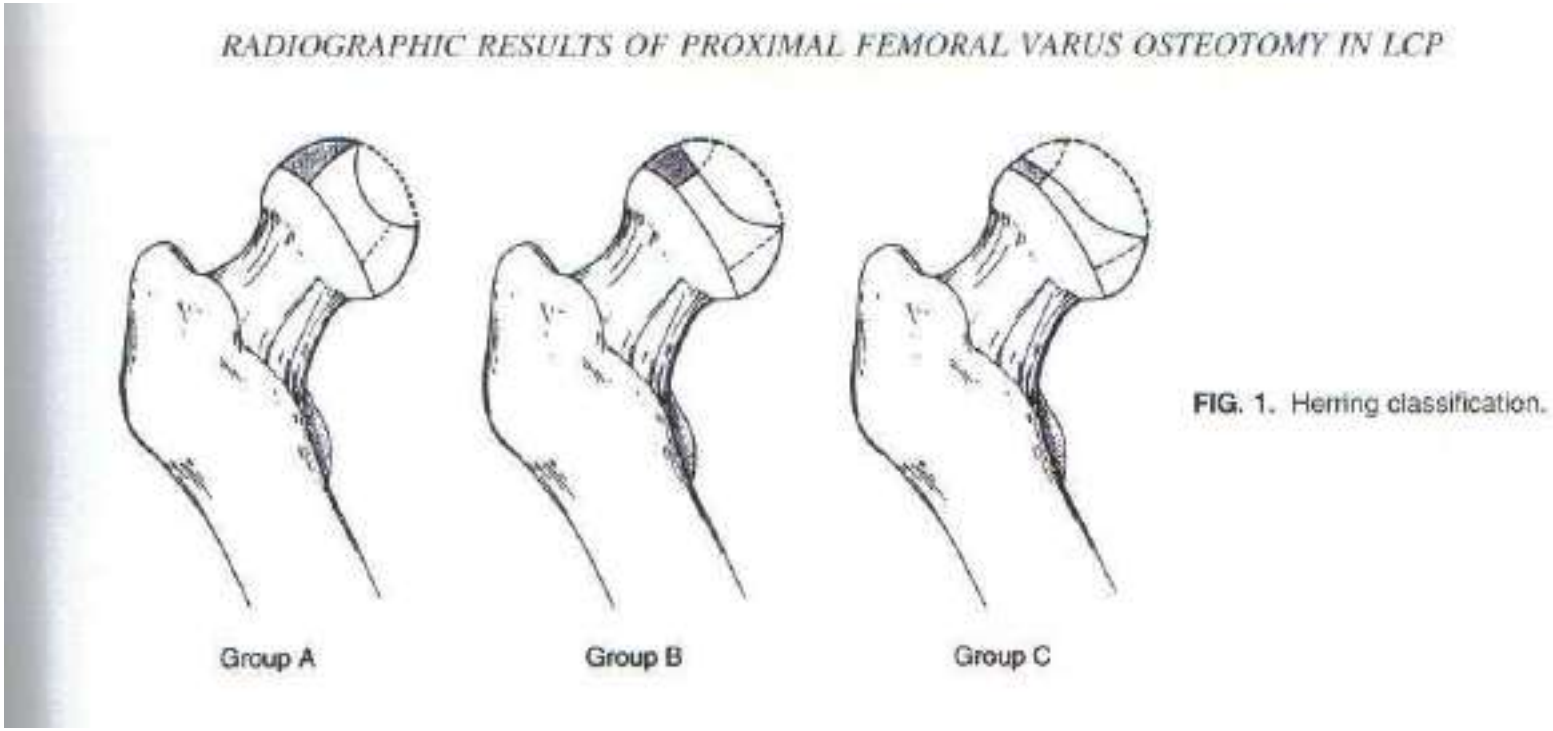
Herring classification

- Height of the lateral part of the epiphysis , in fragmentation stage
- Measurements on AP xray
- Estimation of the type
- Three types A B C
- Intermediate B/C

Herring et al
J Pediatr Orthop 1992

Herring classification

Classification of radiographs with use of the modified lateral pillar and Stulberg classification J Bone Joint Surg Am 86-A 2004



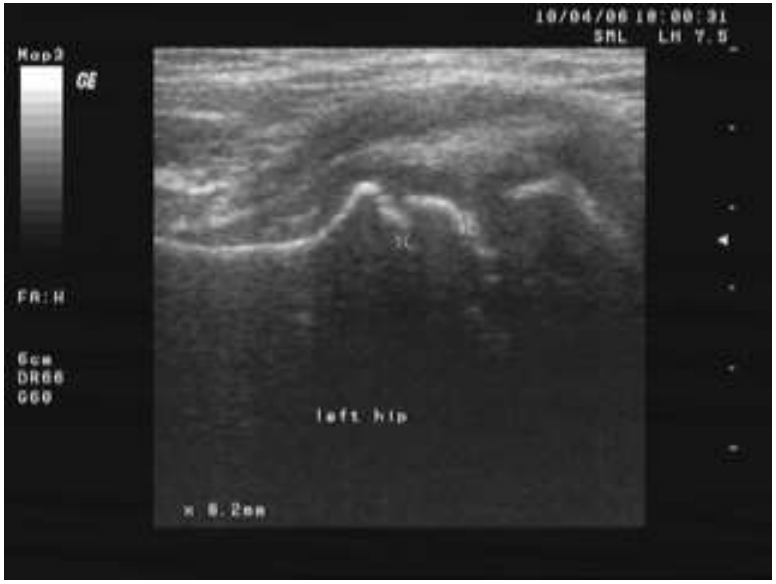
head at risk signs

- Subluxation of the head
- Calcification of the outer part of the epiphysis
- Metaphyseal cysts
- Transparency of the growth plate (Gage sign)
- Horizontal position of the growth plate

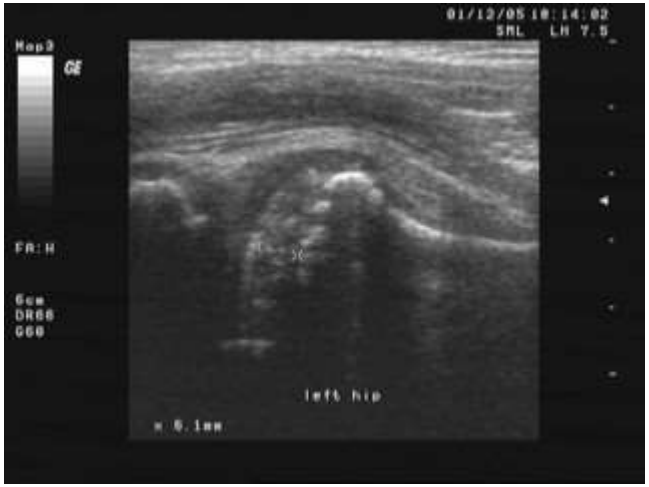
Diagnosis

- Xray (incidence)
- ultrasound
- MRI
- Bone scan

Petsi f



Herring b ultr (καρ) C



MRI in Perthes

Bone imaging in areas of avascular necrosis Perthes

- A scintigraphic classification of Legg-Calvé-Perthes disease.

Conway JJ.

Semin Nucl Med. 1993 Oct;23(4):274-95.

Division of Nuclear Medicine, Children's Memorial Hospital, Chicago,

PROGNOSIS

- **AGE at oncet**
- Classification (Herring)
- Sex
- Bone age

Stulberg, Cooperman, Wallenstein
The natural history of Perthes disease
J Bone Joint Surg A 1981

- Spherical congruity
- Aspherical congruity
- Asphgerical incongruity
- Subluxation , joint stenosis
- Arthritis

Perthes disease: evaluation and management

- Perthes disease refers to self-limiting idiopathic avascular necrosis of capital femoral epiphysis in a child. **There is no consensus for the optimum treatment** of Perthes disease even 100 years after the first description.
- The prime aim of the treatment is to maintain the sphericity of the femoral head and the congruency of the femur-acetabulum relationship to prevent secondary degenerative arthritis.
- Early diagnosis and management can help the collapse of femoral head, progressive femoral head deformity, and impingement

Shah H
Orthop Clin North Am. 2014 Jan;45(1):87-97

Conservative treatment

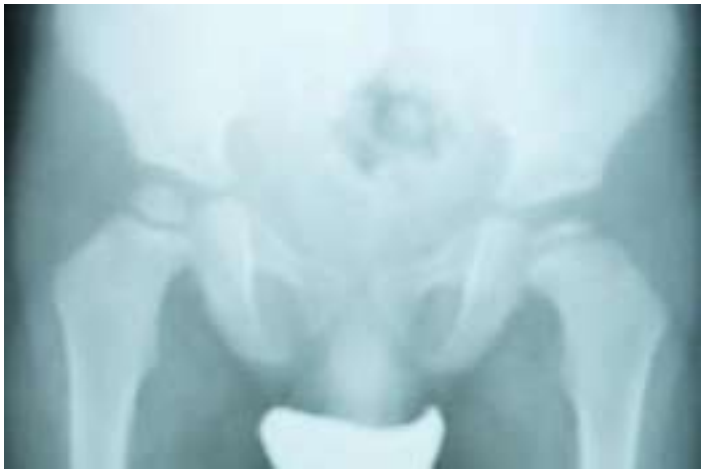
- Bed rest
- Skin traction
- braces
- **Non weight management – crouches**
- **Exercises**

Κηδεμόνες απαγωγής

Conservative treatment

- Age at onset < 6 yrs
- Lateral pilar height > 50%
- Abduction > 50 d.

Age at onset 2 yrs



Conservative treatment

8 yrs old

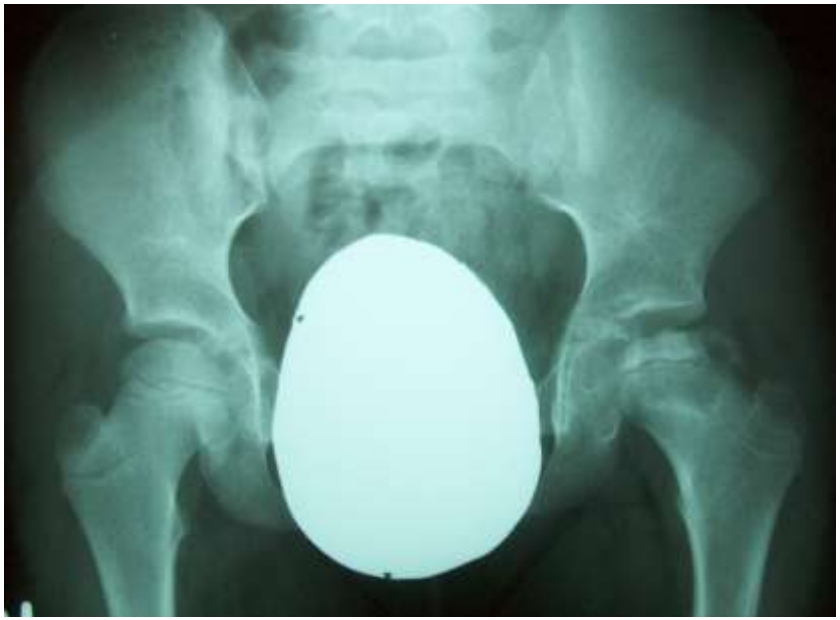
Consider surgical intervention

- Age at onset >6 yrs
- Herring C, height epiphysis <50%
- Reduced mobility abduction
- sex
- Bone age

Conservative management in a girl with age at onset 8 yrs

Final result

Failure of conservative treatment
Πολ Γ female age at onset 8 yrs



Surgical treatment femoral osteotomy age at onset 7 yrs

Surgical treatment boy age at onset 6yrs Αλ Δημ

Surgical treatment girl 7 yrs old μαρ πηγ

Natural history in a surgically treated girl, 5 yrs old

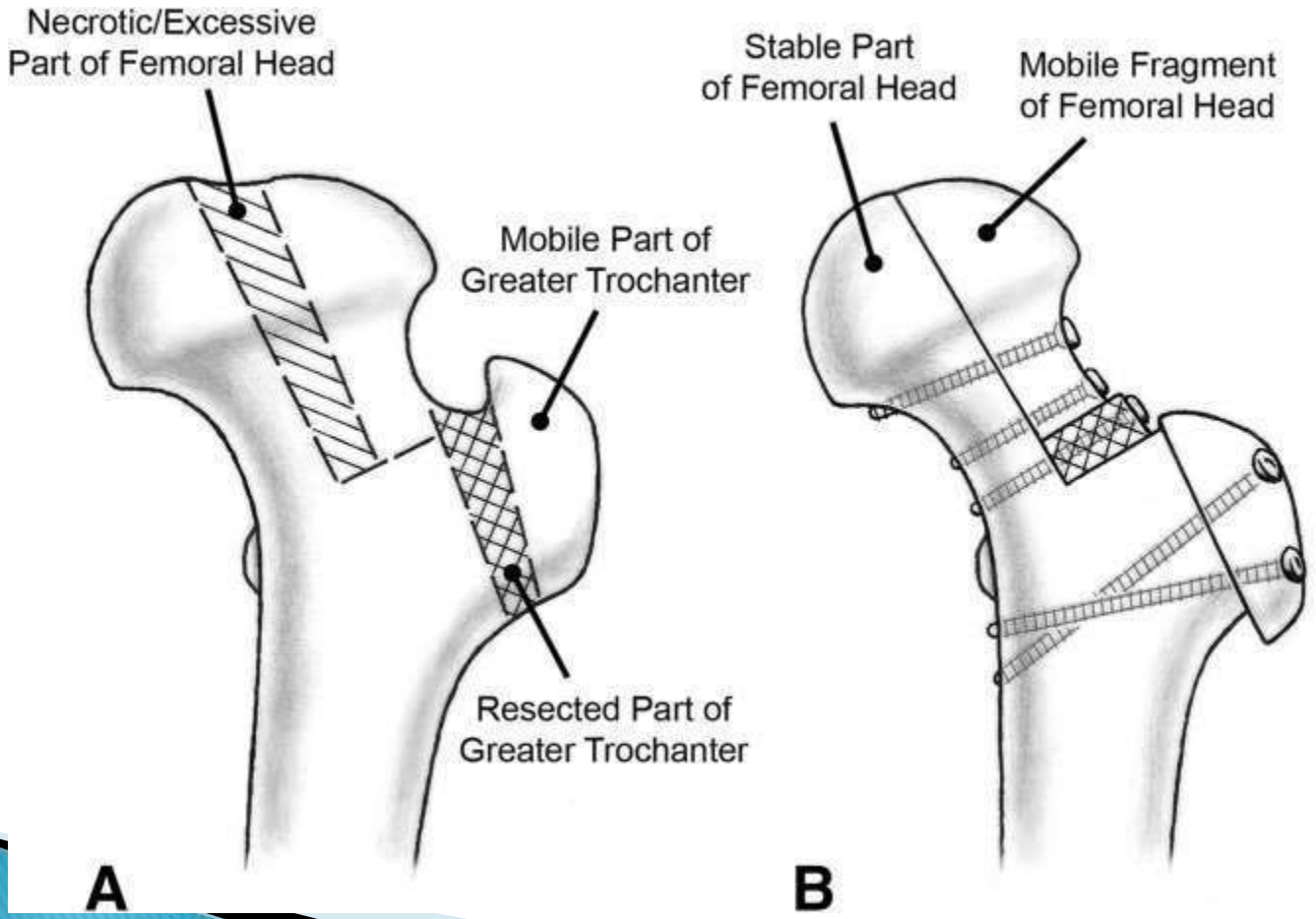
18 months post op

Final result !

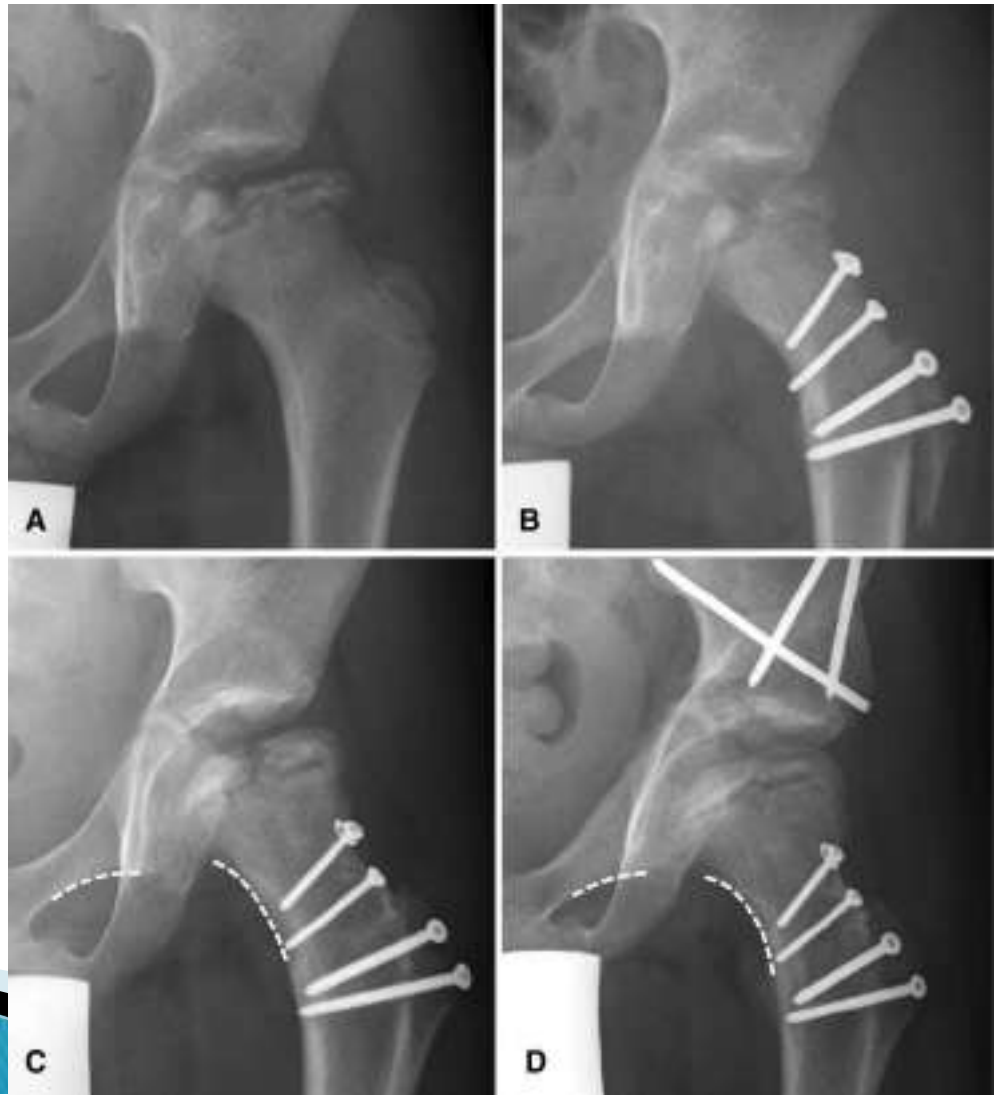
Head reduction osteotomy with additional containment surgery improves sphericity and containment and reduces pain in Legg-Calvé-Perthes disease.

- Clin Orthop Relat Res. 2015 Apr;473(4):1274-83.
- Siebenrock KA[1], Anwander H, Zurmühle CA, Tannast M, Slongo T, Steppacher SD

Head reduction osteotomy with additional containment surgery improves sphericity and containment and reduces pain in Legg-Calvé-Perthes disease.



Head reduction osteotomy with additional containment surgery improves sphericity and containment and reduces pain in Legg-Calvé-Perthes disease.



Head reduction osteotomy with additional containment surgery improves sphericity and containment and reduces pain in Legg-Calvé-Perthes disease.

- Over a 10-year period, we performed femoral head reduction osteotomies in 11 patients (11 hips) with severe head asphericities resulting from LCPD (10 hips) or disturbance of epiphyseal perfusion after conservative treatment of developmental dysplasia (one hip). Five of 11 hips had concomitant acetabular containment surgery including two triple osteotomies, two periacetabular osteotomies (PAOs), and one Colonna procedure.

- CONCLUSIONS:
- Femoral head reduction osteotomy can improve femoral head sphericity. Improved head containment in these hips with an often dysplastic acetabulum requires additional acetabular containment surgery, ideally performed concomitantly. This can result in reduced pain and avascular necrosis seems to be rare. With the number of patients available**, function did not improve**. Therefore, future studies should use more precise instruments to evaluate clinical outcome and include longer followup to confirm joint preservation

Influence of the sex in the final result

- Closure of affected proximal femoral epiphysis in boys at 15.8 and in girls at 12.9
- Girls have a shorter potential period for remodeling

Guille et al J Bone Joint Surg 1998
A d Ponte Wilmigton

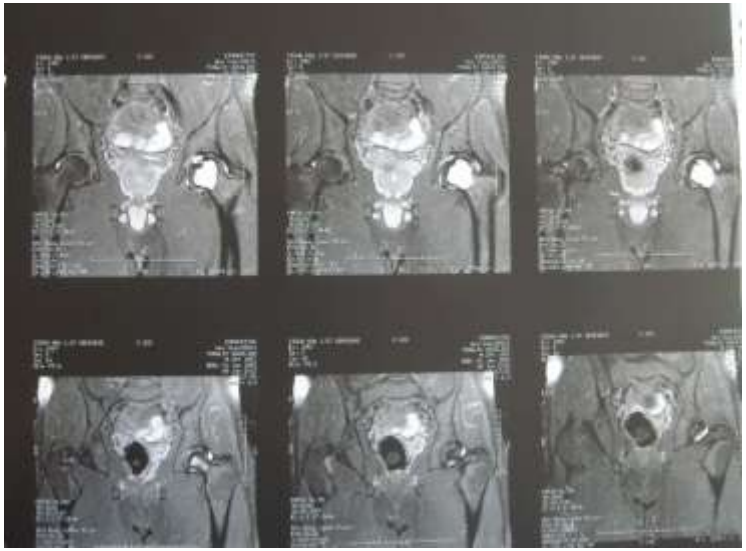
Οστεοχονδρίτιδα Caterall periacetabular augmentation 2

Caterall periacetabular augmentation 3

Caterall periacetabular augmentation 4

Caterall periacetabular augmentation 5

Caterall periacetabular augmentation 6



our case salacha…

Osteochondritis in adolescense
Late onset Perthes

- Partial remodeling, flat head
- Central head necrosis
- Catastrophic type

Perthes disease in adolescent B Joseph

J Bone Joint Surg Br 2001

report in 62 children

Late onset Perthes

Osteochondritis in adolescence
Late onset Perthes Solution?

Osteochondritis in adolescence
Late onset Perthes karav

Arthrokatadysis AVN

Arthrokatadysis AVN – Solution?

Osteochondritis in adolescence Late onset Perthes

- The repair process of containment, appears GROSSLY impaired, in adolescents. They didn't benefit by ANY method of containment

Perthes disease in adolescent
B Joseph J Bone Joint Surg Br 2001
report in 62 children

Post leukemia hip necrosis

SCFE Ets Eft 1-2011

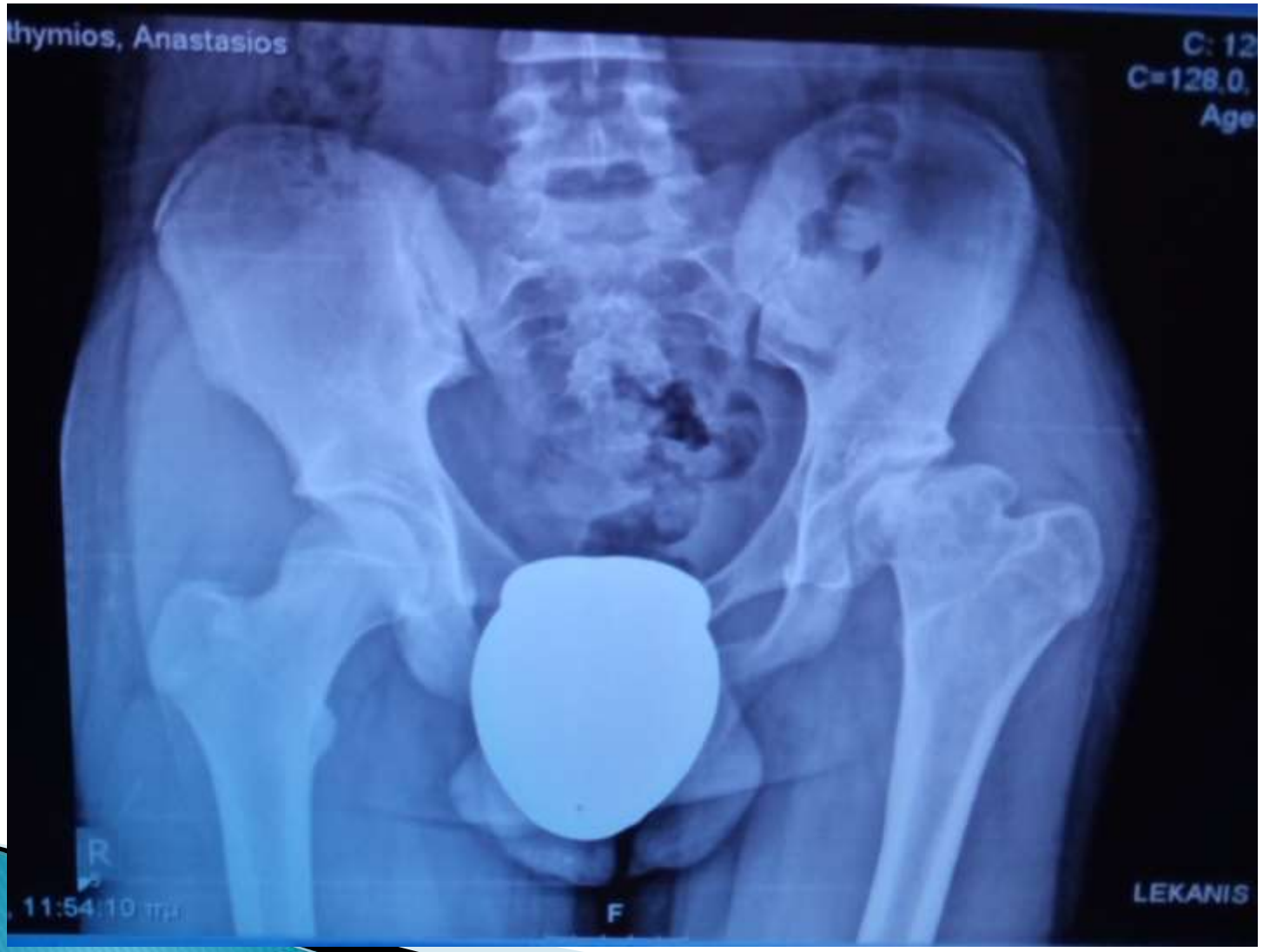
SCFE Ets Eft 9-2011

SCFE Ets Eft 1-2012

SCFE Ets Eft 11-2012

SCFE Ets Eft mri 11-2012

SCFE Ets Eft mri 2016



SCFE Ets Eft 2016

Bilateral Perthes disease. Initial diagnosis with US

Bilateral Perthes disease. Different from unilateral disease?

- The majority (39 out of 50) treated conservatively
- 80% presented as Herring B, C or Catterall 3,4
- 48% rated Stulberg 4,5 at maturity

Moens, Dimeglio et al Leuven et Montpellier JPO 1999

The outcome and prognostic factors in children with bilateral Perthes' disease: a prospective study of 40 children with follow-up over five years.

- Bone Joint J. 2016 Apr;98-B(4):569-75.
- Wiig O[1], Huhnstock S[1], Terjesen T[1], Pripp AH[1], Svenningsen S[2]
- We identified 40 children with a mean age of 5.9 years (1.8 to 13.5), who were **managed non-operatively** for bilateral Perthes' disease from our prospective, multicentre study of this condition, which included all children in Norway who were diagnosed with Perthes' disease in the five-year period between 1996 and 2000.
- All children were followed up for five years.
- The hips were classified according to the Catterall classification.
- A modified three-group Stulberg classification was used as an outcome measure, with a spherical femoral head being defined as a good outcome, an oval head as fair, and a flat femoral head as a poor outcome.

The outcome and prognostic factors in children with bilateral Perthes' disease: a prospective study of 40 children with follow-up over five years.

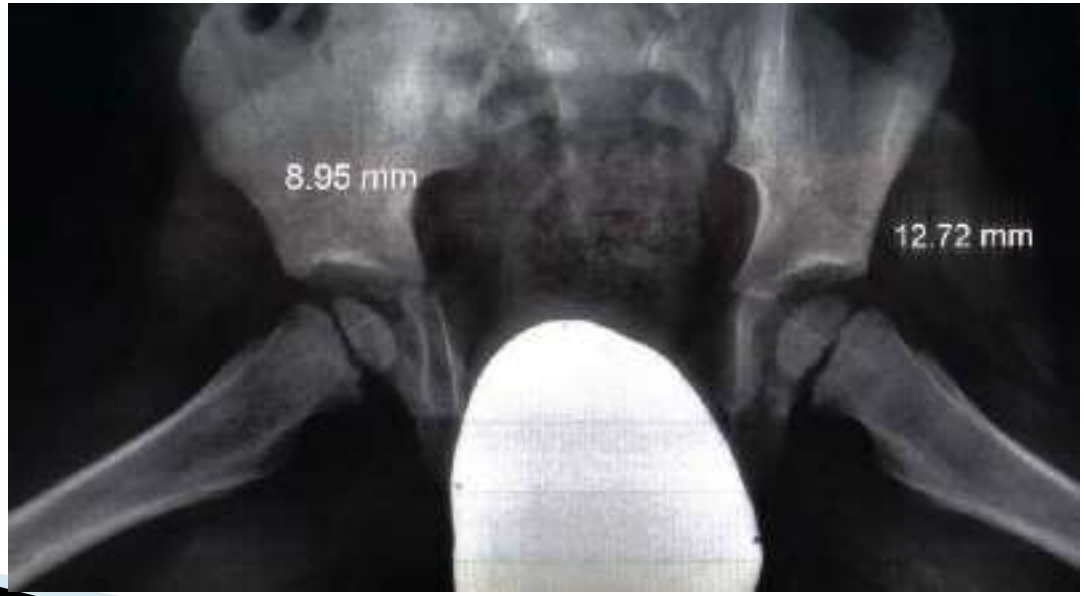
- Bone Joint J. 2016 Apr;98-B(4):569-75.
- Wiig O[1], Huhnstock S[1], Terjesen T[1], Pripp AH[1], Svenningsen S[2]
- **Concurrent**, simultaneous bilateral Perthes' disease was seen in 23 children and 17 had the **sequential onset** of bilateral disease.
- **The mean delay in onset for the second hip** in the latter group was 1.9 years (0.3 to 5.5).
- The five-year radiographic outcome was good in 30 (39%), fair in 25 (33%) and poor in 21 (28%) of the hips. **The strongest predictors of poor outcome** were > 50% necrosis of the femoral head, with odds ratio (OR) 19.6, and age at diagnosis > 6 years (OR 3.3).
- Other risk factors for poor outcome were the timing of the onset of disease, where children with the sequential onset of bilateral disease had a higher risk than those with the concurrent onset of bilateral disease ($p = 0.021$, chi-squared test). Following a diagnosis of Perthes' disease in one hip, there was a 5% chance of developing it in the contralateral hip.

Bilateral Perthes disease.

Bilateral Perthes disease ? DYSPLASIA.

Οστεοχονδρίτιδος πορεία
natural history of osteochondritis

- Γιατί ορισμένες μορφές εξελίσσονται καλά και άλλες φαίνονται ανεξέλεγκτες από την θεραπεία?
  Π Μελίσσης



- J Pediatr Orthop. 2012 Oct-Nov;32(7):697-705. doi: 10.1097/BPO.0b013e318269c55d.
- **Operative versus nonoperative treatments for Legg-Calvé-Perthes disease: a meta-analysis.**
- Nguyen NA[1], Klein G, Dogbey G, McCourt JB, Mehlman CT

- Twenty-three studies, 1232 patients, and 1266 hips met the inclusion criteria.
- Among patients younger than 6 years, operative and nonoperative treatments are equally as likely to results in a successful radiographic outcome
- In patients older than 6 years, operative treatment is nearly twice as likely to result in a successful radiographic outcome
- Among patients ages 6 or older, pelvic procedures were equally as likely as femoral procedures to yield a successful radiographic outcome

Legg-Calvé-Perthes disease at 100: a review of evidence-based treatment.

- J Pediatr Orthop. 2011 Sep;31(2 Suppl):S137-40.
- Herring JA

- The reviewed studies noted 3 factors related to outcome in patients treated for LCPD as follows: the age at onset, the classification of severity of femoral head involvement, and the type of treatment.

Legg-Calvé-Perthes disease at 100: a review of evidence-based treatment.

- J Pediatr Orthop. 2011 Sep;31(2 Suppl):S137-40.
- Herring JA

- In patients over age 8 at onset, surgical treatment with femoral varus osteotomy or Salter innominate osteotomy was associated with improved Stulberg outcomes compared with nonoperative treatment, in those who had lateral pillar B or B/C border class involvement.
- Children under age 6 at onset had a good prognosis except for a small number of patients between age 4 and 6 years with lateral pillar C involvement.

Legg-Calvé-Perthes disease.

- Orthop Traumatol Surg Res. 2017 Nov 16.
- Leroux J[1], Abu Amara S[2], Lechevallier J

- Current knowledge of the causes and risk factors of Legg-Calvé-Perthesdisease (LCPD) does not allow effective preventive strategies. The outcome in adulthood is usually good. **Hip osteoarthritis rarely develops before 50 years of age**. The risk of osteoarthrosis depends chiefly on the final degree of joint incongruence. **Age at onset and the lateral pillar classification are the two main outcome predictors** and serve to guide the surgical indications based on the studies by Herring's group. Non-operative treatment is not effective. In contrast, femoral varus osteotomy and Salter's innominate osteotomy provide good outcomes. In severe forms, however, combining these two techniques or performing a triple pelvic osteotomy seem preferable.
- Surgery is now **performed considerably less often than in the past**, as it is **effective only in patients** with lateral pillar group B or B/C disease with onset after eight years of age. In other situations, therapeutic abstention is recommended