Chapter 100
Legg-Calvé-Perthes Disease

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Description

Legg-Calvé-Perthes disease (LCPD) or else Idiopathic Avascular Osteonecrosis of the capital femoral epiphysis of the femoral head, is a self-limiting hip disorder caused by a varying degree of ischemia and subsequent necrosis of the femoral head. LCPD usually occurs in children aged 4–10 years [1]. The disease has an insidious onset and may occur after an injury to the hip. Several staging schemas are used to determine severity of disease and prognosis; these include the Catterall, Salter-Thomson, and Herring systems. [1–5]

Catterall Classification

Catterall's classification was introduced in 1971. It is based on radiographic appearances and specifies four groups during the period of greatest bone loss (Fig. 100.1).

Stage I: Histologic and clinical diagnosis without radiographic findings
Stage II: Sclerosis with or without cystic changes with preservation of the contour and surface of femoral head
Stage III: Loss of structural integrity of the femoral head
Stage IV: Loss of structural integrity of the acetabulum in addition

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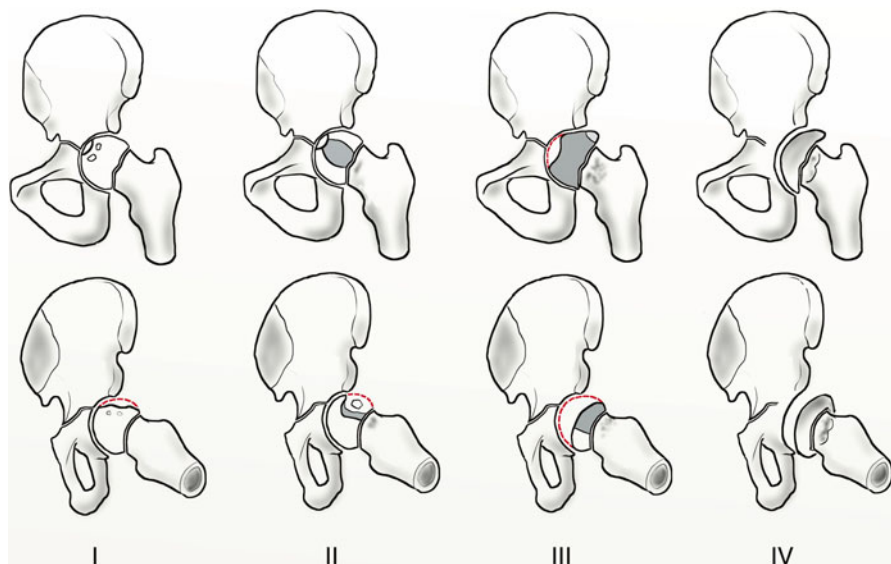e-mail: nikolaos@lasanianos.gr; Nikolaos.Kanakaris@leedsth.nhs.uk

Fig. 100.1 The four stages of the disease according to the Catterall classification system: stage I absence of radiographic findings; stage II sclerosis with preservation of the femoral head contour; stage III loss of structural integrity of the femoral head; stage IV loss of structural integrity of the head and the acetabulum

	I	II	III	IV
Site of epiphyseal involvement	Anterior part	Anterior part	Almost whole epiphysis	Whole epiphysis
Sequestrum	No	Yes	Yes	Yes
Crescent sign	No	Anterior	Anterior and extends posteriorly	Anterior and posterior
Collapse	No	Yes	Yes	Yes
Metaphyseal abnormalities	No	Localised	Diffuse	Diffuse

Salter-Thomson Classification

The Salter-Thomson classification simplifies the Catterall classifications by reducing the groups to two. The first, called group A, includes Catterall groups I and II and refers to less than 50 % of the head involvement. The second, called group B, includes Catterall groups III and IV and refers to more than 50 % of the head involvement. If less than 50 % of the ball is involved, the prognosis is better, whereas if more than 50 % is involved, the prognosis is potentially poor.
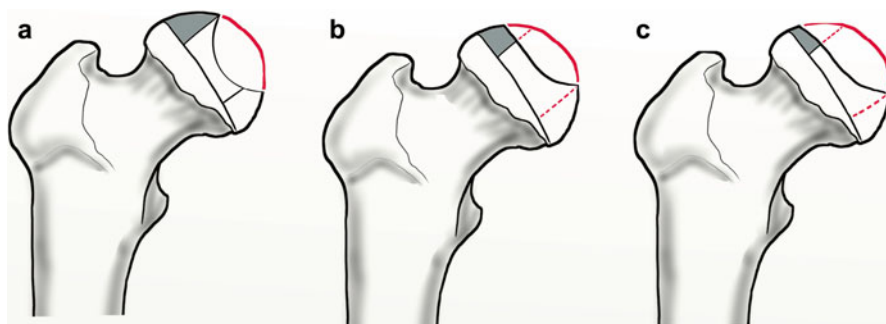
Fig. 100.2 The three types according to the Herring classification system: group A lateral pillar retains original height with slight radiological changes; group B lateral pillar shows increased density and loss of height 50%; group C lateral pillar with collapse >50% of the original height

Herring's Classification

The femoral head consists of three pillars (medial 20–35 %; central 50 %; lateral 15–30 %). Studies by Herring et al. showed that the amount of loss of the height of the lateral pillar can predict clinical outcome (Fig. 100.2). This classification system provides diagnostic and prognostic criteria based on anteroposterior radiographs only. It compares the lateral pillar of the affected side with the intact contralateral side. The criteria are easy to define and there is efficient inter-observer agreement. There are three types of involvement.

Group A: Lateral pillar retains the original height and shows slight radiological changes.

Group B: Lateral pillar shows an increased density and a loss of height, but retains 50 % of the original height.

Group C: Characterizes the lateral pillar by a collapse of over 50 % of the original height.

Type B/C refers to in between type B and C.

Treatment Strategy

Treatment of LCPD does not aim to the cure of the disease but to the protection of the femoral head until the self-limited disease concludes its circle. Several treatment methods exist for Perthes disease because the best treatment option depends on the age at onset of the disease, the amount of the femoral head involvement and the radiographic stage of the disease. No single treatment method will work on all patients. Further to this no single treatment consistently prevents the development

of femoral head deformity at this time. Thus, treatment is individualized and several factors influence the doctor's decision-making: the age of the patient, the stage of the disease, the physical and X-ray findings and the patient's ability to comply with a doctor's recommendation. The categorization that follows refers to the majority but not the total of cases.

Non-operative treatment's principles are maintenance of ROM and containment of femoral head through the evolution of healing of the epiphysis. Initial therapy includes minimal weight bearing and protection of the joint, which is accomplished by maintaining the femur abducted and internally rotated so that the femoral head is held well inside the rounded portion of the acetabulum. Non-operative measures for containment of the head into the acetabulum include the use of orthotic devices while maintenance of ROM is ensured by physiotherapy. Catterall I and II stages or Herring's Group A and B patients are mostly amenable to non-operative treatment.

Results of surgical containment appear to be better than those of nonsurgical containment (orthosis). Surgery is indicated particularly when the prognosis suggests a prolonged period of healing (big child with severe involvement of the femoral head). Surgical approaches include either femoral osteotomy to redirect the involved portion within the acetabulum or innominate (Salter) osteotomy. Both procedures produce equal results, but femoral osteotomy may cause shortening of the limb, leading to a chronic limp. Surgery does not speed healing of the femoral head, but it does cause the head to re-ossify in a more spherical fashion. Catterall III and IV stages or Herring's Groups B/C or C will usually need surgery. Lately surgery has gained ground against orthosis, especially in risk groups and children over 6 years.

Legg-Calvé-Perthes Disease – evidence according to type of treatment			
Type of treatment	Meta-analysis	Systematic review	Cochrane library
Bisphosphonates	Not available	No definite conclusion from clinical studies. Experimental studies suggest they protect the infarcted femoral head from deformity, but it lacks bone anabolic effect [6]	Not available
Operative vs non-operative	Patients >6 years of age: operative treatment is more likely to yield a spherical congruent femoral head, regardless of treatment with femoral or pelvic procedures	Not available	Not available
	Patients <6 years of age: operative and non-operative methods have the same likelihood to yield a good outcome; pelvic procedures were more likely to result in a good radiographic outcome than femoral procedures [7]		

Legg-Calvé-Perthes Disease – evidence according to type of treatment

Type of treatment	Meta-analysis	Systematic review	Cochrane library
Femoral or salter innominate osteotomies	In patients older than 6 years of age, during or before the fragmentation phase, these interventions improve femoral head sphericity [8]	Not available	Not available
Shelf procedure	Not available	While radiographic measurements indicate improved coverage of the femoral head, available evidence does not document the procedure prevents early onset of osteoarthritis or improves long-term function [9]	Not available

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