

Case Report

Two-Stage Total Hip Arthroplasty Management in Advanced Legg-Calvé-Perthes Disease: A Case Report

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Abstract: Introduction: Legg-Calvé-Perthes-Disease (LCPD) most commonly affects boys between the ages of 4 and 8. It is an avascular necrosis of the upper femoral epiphysis. Its etiopathogenesis is unknown. Advanced cases necessitate innovative approaches beyond conservative measures. We report a challenging case involving radical treatment for advanced LCPD already complicated by hip and knee stiffness, managed with a two-stage total hip arthroplasty. **Case presentation:** We report the case of a 14-year-old with chronic left hip impairment and concurrent knee stiffness due to advanced LCPD. Initial conservative interventions proved ineffective. We decided to opt for a two-stage surgical strategy. The first stage involved femoral head ostectomy, cervico-cephalic prosthesis placement, and soft tissue tenotomy. Subsequent intensive rehabilitation achieved improved joint mobility. The second stage comprised total hip replacement using a ceramic-ceramic prosthesis. At last follow up, a favorable functional outcome was observed, and radiographs demonstrated a well-positioned and osteo-integrated prosthesis. **Conclusions:** LCPD is a serious condition, and the prognosis is significantly influenced by early diagnosis and appropriate management. In cases of advanced staged LCPD, prosthetic replacement becomes a suitable option, even in younger patients. Despite potential complications, the use of a two-stage approach, integrating surgical intervention and tailored rehabilitation, proved effective in restoring joint function. This case highlights the importance of personalized planning and a staged approach in addressing the multifaceted aspects of LCPD.

Keywords: Hip; Legg-Calvé-Perthes; Total hip arthroplasty; staged surgical management; stiffness; Case report.

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INTRODUCTION

Legg-Calvé-Perthes-Disease (LCPD) was described almost simultaneously in different countries by Arthur Legg, Jacques Calvé, Georg Perthes, and Henning Waldenström (Wenger & Pandya, 2011a). It is identified by the necrosis of the femoral head, either unilaterally or bilaterally, impacting the hip's range of motion and most commonly affects boys between the ages of 4 and 8 (Rodríguez-Olivas *et al.*, 2022). Conservative surgical procedures, such as soft tissue releases and corrective osteotomies, can help improve joint alignment, stability, and overall function in the initial stages (Gent & Clarke, 2004; Karimi & McGarry, 2012). Nevertheless, total hip replacement is usually considered in cases of advanced osteoarthritis with unsuccessful conservative treatment.

We report a very rare and challenging case involving radical treatment for advanced Legg-Calvé-Perthes disease already complicated by hip and knee stiffness, managed with a two-stage arthroplasty.

CASE PRESENTATION

We report the case of a 14-year-old child with no prior medical history, who presented with a left limp persisting for two years, without any history of trauma or fever.

The initial examination revealed a fixed left hip a flexion of 90° position and a significantly limited range of motion in the corresponding knee, displaying a 50° flexum. The patient was unable to walk without his crutch (figure 1) and both joints mobilization was painful.



Figure1: Initial presentation of the patient

The patient dropped out of school due to this functional and aesthetic handicap. Pelvic X-ray highlighted an advanced LCPD of left hip (figure 2).



Figure 2: Pelvic radiographs (A) that showed a Legg-Calvé-Perthes-Disease and lateral radiograph of the knee (B) that was fixed in 90° of flexion.

A conservative treatment, involving traction and mobilization under general anesthesia, followed by the application of a pelvic plaster cast, was initially carried out. The progress was unfavorable, and the patient maintained the same mal-aligned position. Following the total hip destruction and the resistance to conservative treatment leading to persistent stiffness in

both the hip and the knee, we chose a two-stage radical surgical treatment.

The first stage involved femoral head ostectomy, and the placement of a cervico-cephalic prosthesis (figure3) associated with psoas and hamstring tenotomy.

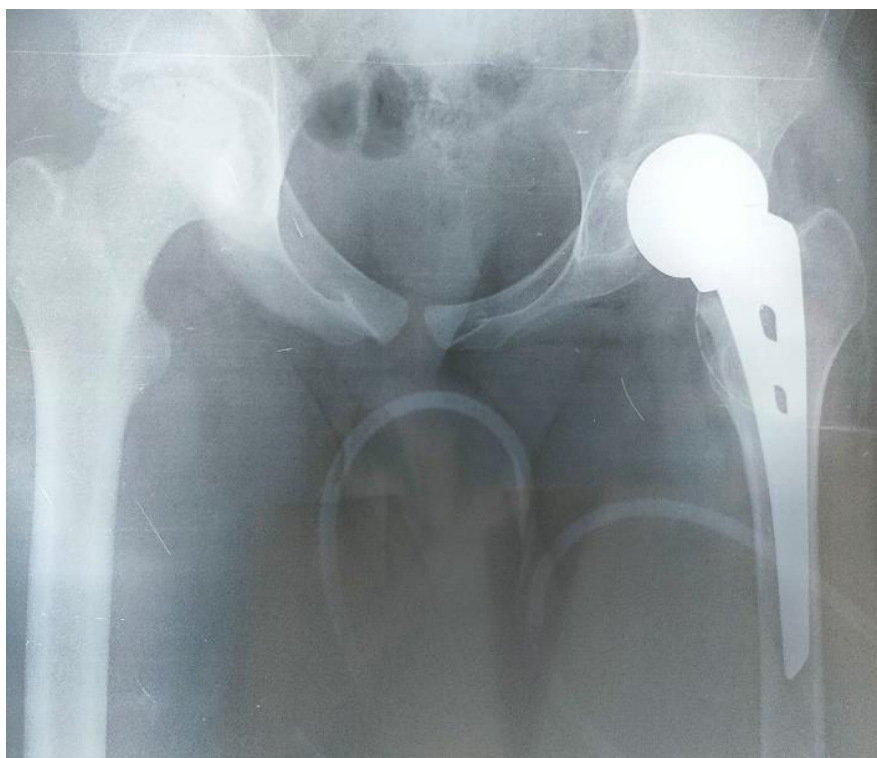


Figure 3: Radiographs after first stage of treatment

Subsequently, an intensive physical and rehabilitation program involving successive mobilization followed by plaster cast and limb traction was initiated to regain full mobility of the left hip and knee. After 8 weeks of hospital rehabilitation, a

significant improvement in the mobility of both joints was achieved. Then a second stage was performed, and the patient had a total hip replacement using a cementless ceramic-on-ceramic bearing surfaces prosthesis (figure4).



Figure 4: Post total hip arthroplasty radiographs

No postoperative complications were noted. Full weight bearing was admitted 3 weeks after the surgery. At last, follow up, 3 years after surgery the patient has regained a normal walk without assistance.

Both hip and knee joints are painless and without a restricted range of motion (figure5). Last follow up radiographs showed an osteo-integrated prosthesis in a good position.



Figure 5: Patient at last follow up

DISCUSSION

The incidence of LCPD varies significantly across different countries ranging from 0.4 to 29.0 cases per 100,000 children. Like our case, Boys are more affected than girls(Loder & Skopelja, 2011).

Recent findings affirm the development of LCPD is associated with at least two episodes of ischemia, known as a "double insult (Leroux *et al.*, 2018; Rodríguez-Olivas *et al.*, 2022). Despite being identified as a disease about a century ago, its pathogenesis remains unclear and not yet fully elucidated. In a recent review, Armando and al have identified Various factors contribute to LCPD and categorized them into environmental factors, such as urbanization, race, gender, and smoke exposure, metabolic factors like tissue-plasminogen activator, resistance to activated protein C, abnormalities in factor V and genetic factors, such as those related to the Receptor Activator of Nuclear factor Kappa-B (RANK), Osteoprotegerin (OPG), and other. Understanding this multifactorial interplay sheds light on the complex nature of the disease (Rodríguez-Olivas *et al.*, 2022).

Various classifications, such as Catterall's and Herring's, help predict and guide the treatment for LCPD based on the affected region and severity [2, 6]. Our patient exhibited an advanced LCPD classified as Herring C, Catterall IV, and Stulberg IV, indicating its poor prognosis. Furthermore, the late onset age, delayed time to diagnosis, and hip stiffness contribute as

additional factors pointing to the severity of the disease form in our patient (Leroux *et al.*, 2018; Nelitz *et al.*, 2009; Rodríguez-Olivas *et al.*, 2022).

The choice of treatment is influenced by the radiographic characteristics of the patient. In certain cases, surgical intervention may not be necessary, and a favorable outcome can be expected, especially if proper functional treatment is instituted, particularly in the early age of onset (Leroux *et al.*, 2018; Rodríguez-Olivas *et al.*, 2022). Various surgical techniques, including procedures on the femur or pelvis, have been proposed, such as Femoral varus osteotomy (Joseph *et al.*, 2003), triple pelvic osteotomy, or Salter's osteotomy (Wenger & Pandya, 2011b). Additionally, lateral shelf acetabuloplasty (Ghanem *et al.*, 2010) is considered. All of these surgical interventions aim to prevent the loss of joint congruence and focus on repositioning the epiphysis centrally within the acetabular cup.

Our patient presented a contraindication to conservative surgical methods, as extensive and prolonged physical rehabilitation failed to restore a minimum of 30° abduction in the hip [7]. Considering these factors, we chose a radical approach, opting for total hip arthroplasty (THA).

Performing THA in patients with sequela of LCPD presents increased technical challenges and a higher risk of complications, as noted in previous studies (Baghdadi *et al.*, 2013; Hanna *et al.*, 2017; Seufert & McGrory, 2015). Deformities are often observed in both

the femoral and acetabular aspects, posing technical complexities during primary THA. For the femoral component, the flattened shape of the femoral head, the excessive anteversion of the head-neck relationship, and the short neck, which complicates exposure, all contribute to challenges and potential complications in placing the femoral stems (Costa *et al.*, 2011). On the acetabular side, secondary acetabular dysplasia is frequent, characterized by a lateralized and retroverted acetabulum (Costa *et al.*, 2011).

All these challenges may explain the less satisfactory mid- and short-term results in THA in Legg-Calvé-Perthes Disease (LCPD) reported in the literature when compared to other cases of primary arthritis (Baghdadi *et al.*, 2013; Costa *et al.*, 2011).

In addition, the patient's persistent stiffness in the homolateral knee, resistant to physical rehabilitation program, introduced an additional factor contributing to the potential failure of the THA (Hofstede *et al.*, 2016; Röder *et al.*, 2007). The stiffness in our patient's knee was explained by the prolonged antalgic flexion of the knee in response to the pain radiating from his hip (Leroux *et al.*, 2018).

For the previous reasons, we pursued a two-stage surgical strategy. In the initial stage, our objective was to facilitate addressing the hip and knee stiffness by conducting a soft tissue tenotomy (Peterson, 2022). Additionally, we performed a femoral head ostectomy and placed a temporary cephalic prosthesis to alleviate both hip and radiating knee pain (Kobayashi *et al.*, 2023). All of this, facilitated by a well-conducted physical treatment, prepared the patient for the second stage arthroplasty under favorable conditions.

For implant selection, we opted for cementless ceramic-on-ceramic bearing surfaces. Numerous studies have demonstrated their superior longevity compared to other types of prostheses (Peagler *et al.*, 2023).

CONCLUSION

LCPD is a serious condition, and the prognosis is significantly influenced by early diagnosis and appropriate management. While conservative treatment is typically favored, in cases of advanced ankylosed hip, prosthetic replacement becomes a suitable option, even in younger patients. However, successful outcomes depend on careful and tailored planning specific to each patient.

Statements:

- 1) Informed consent: Informed consent was obtained from the patient or guardian
- 2) Authorship: All authors attest that they meet the current ICMJE criteria for Authorship.

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