

# Primary Total Hip Arthroplasty on Complex Hips Conditions in a Low-Resource Setting

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## Abstract

**Introduction:** Total hip arthroplasty of complex morphology is a challenge for the orthopaedic surgeon. Careful analysis of the hip's anatomy helps to unravel the difficulties and anticipate the procedures to be performed and the implants to be planned. The aim was to identify the types of hip that make first-line THR difficult, specify the technical procedures to be used on these sites, and assess the functional results of the series. **Material and Methods:** This was a retrospective study that concerned patients operated on for total hip arthroplasty between January 2015 and December 2022 at the medical center “La Grâce” in Bobo-Dioulasso, Burkina Faso. Patients with coxarthrosis (on hip dysplasia, acetabular protrusion, acetabular malunion or neurological hip) and those with ankylosis of the hip, osteonecrosis secondary to neglected dislocation of the hip or hemoglobinopathy were included. **Results:** A total of 31 total hip replacements were performed in 30 patients. The mean age of patients at the surgery time was 36.2 years with extremes of 17 and 61 years. The male-to-female sex ratio was 1. The main indications for THA were the dysplastic hip osteoarthritis (11 cases) and the neglected hip dislocations (7 cases). *In situ* femoral neck osteotomy before hip dislocation was performed in seven cases. The acetabulum reconstruction techniques varied from the structural iliac bone graft (n = 3) and cancellous bone graft (n = 4) to the Kerboul plate (n = 1). After 45 months of mean follow-up, all hips were evaluated. The mean PMA score increased from 7.1 [4 - 8] before the surgery to 13.2 [13 - 17]. **Conclusion:** The large spectrum of challenges in complex hip management requires effective preoperative planning. Preoperative planning minimizes complications and ensures a better outcome.

## Keywords

Primary Total Hip Arthroplasty, Hip Dysplasia, Complex Hip

## 1. Introduction

Total hip arthroplasty (THA) is nowadays a frequent surgery in orthopedic practice surgery [1] [2]. The damaged joint replacement improves the patient's life quality. It suppresses pain and restores almost normal hip mobility [1]. Surgical technique and instrumentation have improved since Charnley [3] [4]. Advances made it possible to extend the indications for THA to previously considered difficult cases, and therefore ineligible for arthroplasty [5]. A complex hip condition is a hip with unusual bone and/or soft tissue disorder. It includes displastic hip, ankylosed hip, protrusio acetabuli, fractures about the hip, and some neuromuscular conditions [1] [2] [5] [6]. We added neglected hip dislocations and advanced hip necrosis in hemoglobinopathies patients. THA in these cases remains a challenge and requires good preoperative planning. It is often necessary to have custom implants or modular implants [5] [6]. In a low-resource setting, bringing together the technical logistical conditions conducive to this surgery is an additional difficulty.

This work aims are to: 1) determine the spectrum of conditions with difficult primary THA, 2) assess surgical strategies and 3) evaluate the outcome of our cases series.

## 2. Materials and Methods

This was a retrospective study that concerned patients operated on for total hip arthroplasty between January 2015 and December 2022 at the medical center "La Grâce" in Bobo-Dioulasso, Burkina Faso.

Patients with coxarthrosis (on hip dysplasia, acetabular protrusio, acetabular malunion or neurological hip) and those with ankylosis of the hip, osteonecrosis secondary to neglected dislocation of the hip or hemoglobinopathy with obstruction of the femoral canal were included. THA revisions were not included.

We collected information's from clinical files concerning age, sex, THA indications, operative planning and technique and post-operative evolution.

**Pre-operative Planning:** We used standard anteroposterior (AP) pelvic X-rays with 100% magnification. Hip dysplasia was assessed through coxometry. Acetabular dysplasia was described according to the Crowe classification [7]. The ilio-ischiatic line evaluated acetabuli protrusio. We graded protrusio minor (less than 3 mm overhanging), moderate or coxa profunda (between 3 and 5 mm overhanging), and major (more than 5 mm overhanging). CT scans weren't always available for all patients.

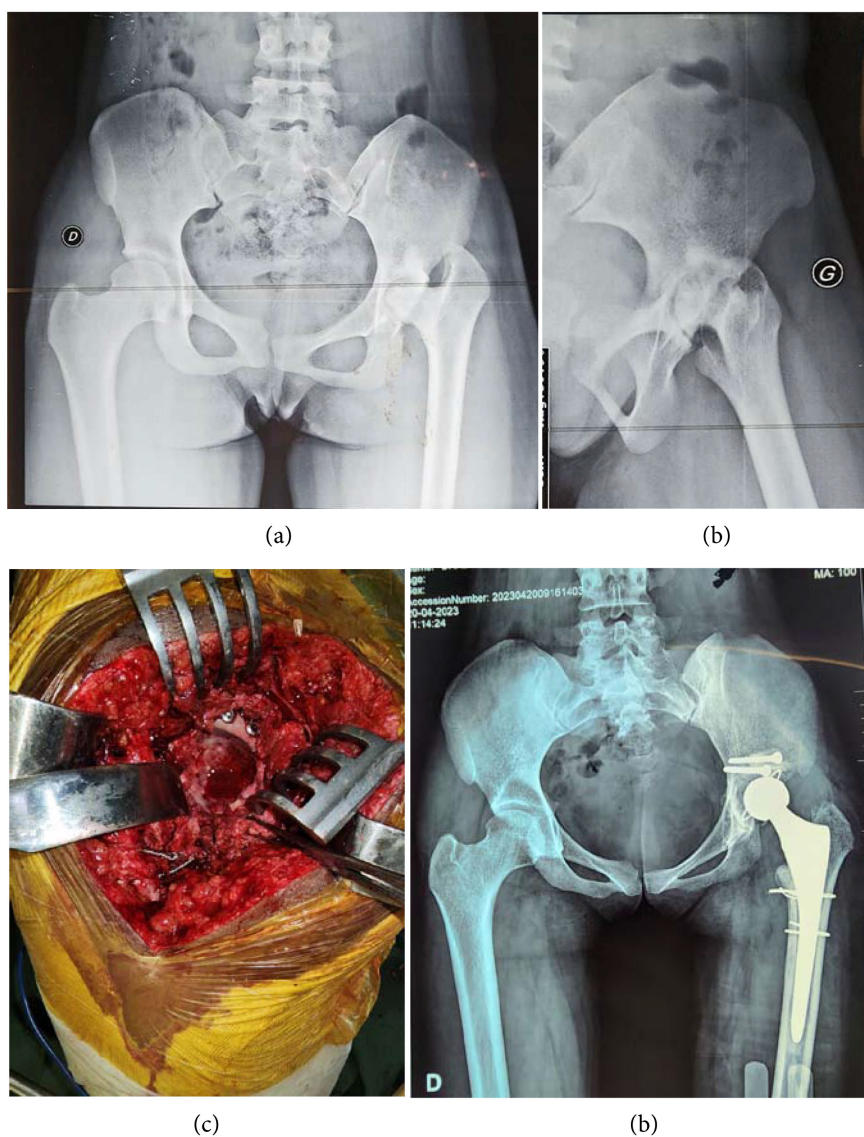
### 2.1. Procedures

All patients were placed in lateral decubitus position. The approach used was posterolateral in all cases.

Specific actions carried out depending on the difficulty encountered:

- In the case of hip dysplasia: when the acetabular depth obtained after milling did not allow optimum coverage of the acetabular part, an acetabular stop was

made. This was made from a cortico-cancellous graft harvested from the iliac crest or femoral head and secured with two 4.5-diameter cortical screws (Figure 1).

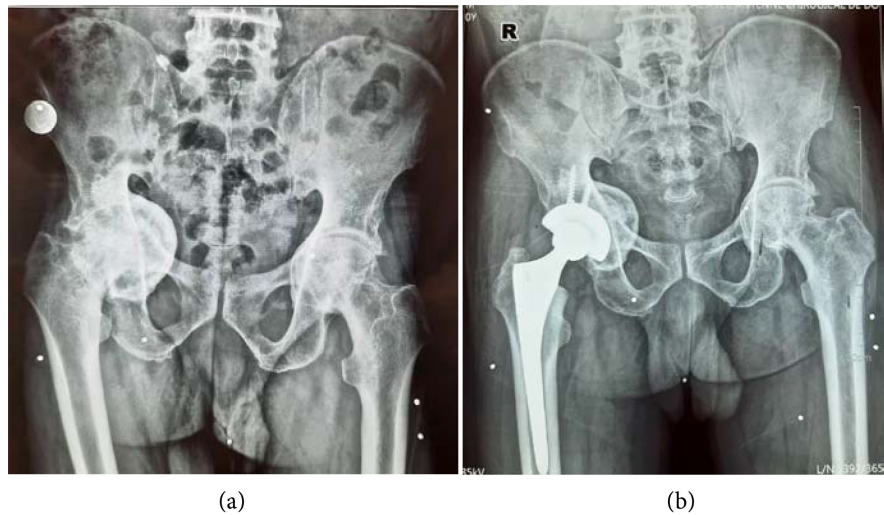


**Figure 1.** ((a) (b) Left coxarthrosis on dysplastic hip; (c) Intraoperative image showing the acetabuloplasty made from a graft taken from the femoral head, screwed and milled with the acetabulum; (d) Postoperative control radiograph.

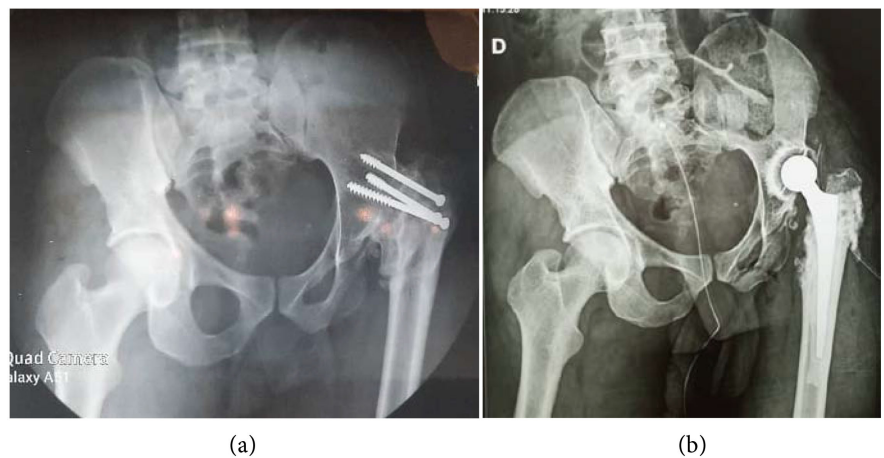
- In the case of protrusio acetabuli: since hip dislocation is difficult, an *in situ* femoral neck osteotomy was performed to allow dislocation. Extraction of the femoral head in a single block is sometimes impossible, in which case it must be broken up and extracted fragment by fragment. The bottom of the acetabular cavity is filled with cancellous bone grafts taken from the femoral head and impacted (Figure 2).

- In hip ankylosis (spontaneous or after arthrodesis): Disarthrodesis is performed after removal of the osteosynthesis material and *in situ* femoral neck os-

teotomy. The use of intraoperative X-rays is to locate the buried in the bone and localize the acetabulum. Collapse acetabuloplasty is performed using three landmarks: inferiorly the obturator foramen; anteriorly the anteroinferior iliac spine; and posteriorly the isciatic notch (**Figure 3**).



**Figure 2.** (a) Coxarthrosis on protrusive dysplasia, Crowe stage 3; (b) Follow-up radiograph after reconstruction of the acetabulum and total hip arthroplasty.



**Figure 3.** (a) Ilio-femoral arthrodesis; (b) Control radiograph after dearthrodesis and total hip arthroplasty.

- Sickle-cell hip: The medullary canal of the femoral shaft of sickle-cell disease is often obstructed. In this case, the use of graduated-diameter reamers was necessary to open the canal.

- In neglected hip dislocation: The difficulties that must be faced are the presence of very hemorrhagic fibrous tissues in the paleoacetabulum which remains disinhabited and the retraction of the gluteal muscles making reduction laborious. Patience must be required to excise the fibrosis magna to expose the acetabulum.

- In the event of a bone defect associated with malunion of the acetabulum,

reconstruction of the acetabulum was carried out by placing a Kerboull framework associated with one with bone graft.

- A trochanterotomy to descend the stem was performed *in situations* where reduction was laborious. Steel wire strapping ensured the synthesis (**Figure 1**).

- Implants: A large spectrum of implants was used (Asian and European brands). Uncemented and cemented stems were used. For stems, the anteversion was normal or 6° exaggerated. All acetabular cups were uncemented. We ensured their right inclination and anteversion.

## 2.2. Assessment

We evaluated patients clinically at the last recoil after the index procedure and obtained radiographs to assess implant positioning and stability. The Postel Merle d'Aubigné (PMA) score was used for functional assessment.

## 3. Results

A total of 31 total hip replacements were performed in 30 patients. The mean age of patients at the surgery time was 36.2 years with extremes of 17 and 61 years. The male-to-female sex ratio was 1.

### 3.1. THA Indications

We encountered 11 cases of dysplastic hip osteoarthritis, and seven neglected hip dislocations (n = 7). Hip dysplasia involving the acetabulum was classified as Crowe stage II in three cases. The other eight dysplastic hips were femoral and acetabular Hartofilakidis hypoplasia (**Table 1**). The left hip was involved in 18 cases.

**Table 1.** Repartition of indications of total hip arthroplasty.

Indication	n	
Osteoarthritis	Dislocating dysplasia	3
	Protrusive dysplasia	3
	Dystrophia	8
	Mal-unions	1
Hip ankylosis	4	
Neglected hip dislocation	6	
Hemoglobinopathies-related hip avascular necrosis (AVN)	4	
Neurologic hip	1	
Total	30	

### 3.2. Surgical Strategies

The posterolateral approach was used in all cases. We used standard hip prostheses. We didn't use any special or custom-made implants. The acetabular cup was cemented in 23 cases. We used cemented stems in 19 cases. *In situ* femoral neck

osteotomy before hip dislocation was performed in seven cases. The acetabulum reconstruction techniques varied from the structural iliac bone graft (n = 3), and cancellous bone graft (n = 4) to the Kerboull plate (n = 1). We performed two trochanterotomy procedures for hip reduction (**Table 2**). Postoperative rehabilitation was undertaken in 25 patients (25 hips).

**Table 2.** Specific surgical procedures.

Issue	Procedure	n
Acetabular dysplasia	Structured bone graft	3
Acetabular protrusio	<i>In situ</i> osteotomy + acetabular bottom graft	2
Acetabular malunion	Kerboull plate	1
Femoral dystrophia	Trochanterotomy	2

### 3.3. Outcome

Two superficial surgical site infections were reported among the 31 cases. Three acute postoperative dislocations were noted. No loosening was reported. After 45 months of mean follow-up, all hips were evaluated. The mean PMA score increased from 7.1 [4 - 8] before the surgery to 13.2 [13 - 17].

## 4. Discussion

THA surgery has become a routine procedure that can be challenging in low-resource settings [8]-[10]. Difficulties stretched from preoperative conditions, perioperative anesthesia, and surgical issues to postoperative rehabilitation. For example, spinal stiffness in ankylosing spondylitis is challenging for anesthesia positioning and rehabilitation [11]. Procedure planning and effective surgical anesthesia and pain control during the rehabilitation ensure a better functional outcome [1] [5].

In this study, the indications for THA were mainly made up of coxarthrosis secondary to hip dysplasia and aseptic osteonecrosis of neglected hip dislocation. In acetabular dysplasia, the challenge is to cover the cup anteriorly and superiorly [2] [12]. Cup coverage and proper positioning are the keys to its survival. To achieve these two objectives, Dunn and Hess proposed medialization of the cup positioned deep beyond the acetabular base, before performing a bone autograft for optimal coverage [13]. This technique guaranteed an acetabular cup survival rate of 100% at four years and 93.2% at 10 years [13]. According to Chougle *et al.*, the rate of loosening of the acetabular cup is proportional to the severity of the dysplasia [12]. We used the technique of Dunn and Hess [13] to have a deep cup but without going beyond the bottom. The structured bone graft was harvested from the femoral head screwed anteriorly and superiorly. Correct reaming resulted in an acetabular cup bed with uniform continuity (**Figure 1**). After 45 months, we had a cup survival rate of 100% for all dysplastic acetabula.

An acetabular protrusio is a form of central acetabular dysplasia resulting

from the migration of the femoral head beyond the Kohler's line [14]. This acetabular bone deficiency requires reconstruction of the acetabular bottom. It can be done with fragmented bone grafts harvested from the femoral head. This reconstruction prevents medialization of the hip rotation center [15] [16]. The hip rotation center restoration is important in cup survival [17] [18]. Baghdadi demonstrated that there is a 24% risk of acetabular cup revision in patients with a 1 mm medial or lateral difference between the native hip center and the prosthetic head center [16] [18] [19]. After grafting, an uncemented cup can be impacted. If the bone quality is not sufficient, it is preferable to choose a cemented cup alone or with a metal reinforcement plate [14]. A failure to assess bone quality can lead to early migration of the acetabular cup [20] [21]. After 29 months of mean follow-up time, no cup migration was observed in acetabular protrusion.

THA in hip ankylosis was mainly driven by the patient's desire to recover from certain functional activities (driving, work, etc.). Loss of hip mobility also leads to soft-tissue retractions [22]. The ideal approach gives large access to the femoral neck and allows the femoral neck osteotomy and location of the paleo-acetabulum [22]. Posterolateral, direct anterior, and lateral approaches with trochanterotomy are discussed [22] [23]. Some authors recommend the use of fluoroscopy [1] [5].

In low-resource settings, chronic trauma injuries are common especially neglected hip dislocations [24]-[26]. THR in neglected hip dislocations has two main issues: the paleo-acetabulum access and the muscular retractions. The paleo-acetabulum is filled with vascularized fibrous tissues and muscular retractions prevent hip relocation. Some authors suggest primary skeletal bone traction in these cases with fair results [27] [28]. We prefer large muscular release and the help of an iliofemoral distractor to achieve prosthetic hip reduction.

## 5. Conclusion

The large spectrum of challenges in complex hip management requires effective preoperative planning. Also, the lack of custom-made implants and acetabular reconstruction solutions in our daily practice might be kept in mind to find safe and effective alternatives. Preoperative planning minimizes complications and ensures a better outcome.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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