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Conservative Surgical Treatment in Hip Dysplasia: A Case Report of a Roy-Camille Bone Shelf Procedure

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Abstract: Hip dysplasia is a structural abnormality of the hip joint resulting from altered morphology of the acetabulum, the proximal femur, or both, which leads to insufficient coverage of the femoral head and abnormal joint loading. Advances in neonatal and pediatric screening programmes, particularly clinical and ultrasound-based protocols, have contributed to earlier diagnosis and a reduction in the incidence of severe, untreated dysplasia progressing to early osteoarthritis in many populations. However, residual or late-presenting dysplasia in adolescents and adults remains a major cause of pain and early hip degeneration, often necessitating joint-preserving surgery or, in advanced cases, total hip arthroplasty.

Among available surgical options for symptomatic acetabular dysplasia, the Roy-Camille shelf arthroplasty represents a conservative, extra-articular procedure that augments acetabular coverage using an iliac crest bone graft. Compared with more complex reorienting osteotomies such as periacetabular osteotomy, shelf procedures are technically less demanding, preserve the integrity of the pelvic ring, and are associated with relatively rapid postoperative recovery and low major complication rates when performed in appropriately selected patients with minimal osteoarthritis and a congruent joint. In this context, the present work reports the case of a 35-year-old woman with symptomatic right acetabular dysplasia treated by Roy-Camille shelf arthroplasty. The case is used to illustrate the indications, surgical technique, and early postoperative course, and is complemented by a literature review comparing the advantages, limitations, and long-term outcomes of shelf arthroplasty with other hip-preserving procedures for dysplasia.

Keywords: *Hip Arthroplasty, Acetabular Shelf, Hip Dysplasia.*

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I. INTRODUCTION

Hip dysplasia is the leading cause of coxarthrosis in young adults, and results from abnormal development and morphology of the hip joint, involving the acetabulum, the femur, or both. This structural deficiency reduces femoral head coverage, increases focal joint loading, and accelerates cartilage wear, leading to early osteoarthritis and often to total hip arthroplasty before the age of 60 [1].

In recent decades, the apparent incidence of hip dysplasia has evolved, partly due to the implementation of neonatal and youth screening programs using clinical examination, ultrasound, and standardized radiographic protocols [1, 2]. Systematic or selective screening allows earlier identification of developmental dysplasia of the hip and residual acetabular dysplasia, facilitating timely referral to specialized hip-preservation centers and the use of conservative or joint-preserving surgical procedures before advanced degenerative changes occur. Early diagnosis and management are essential, as delayed detection is associated with worse functional outcomes and a higher likelihood of requiring reconstructive surgery in adulthood [2].

Among the surgical options for symptomatic acetabular dysplasia in adolescents and adults, hip-preserving procedures such as periacetabular osteotomy have become widely used [3, 4]. However, shelf acetabuloplasty (including the Roy-Camille variant) remains an important conservative technique. By placing an extra-articular bone graft to increase acetabular coverage, shelf procedures can improve load distribution and delay osteoarthritis progression, with

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satisfactory long-term survivorship and relatively low complication rates when performed in carefully selected patients [4]. The Roy-Camille shelf arthroplasty in particular offers the advantages of a technically less demanding operation and relatively rapid postoperative recovery compared with more extensive pelvic osteotomies, while preserving future options such as total hip arthroplasty if needed.

II. CASE PRESENTATION

In this report, we describe the management of a case of acetabular dysplasia treated with the Roy-Camille shelf arthroplasty technique. The patient was treated in the Department of Orthopaedic Traumatology B at Mohammed VI University Hospital, Oujda. Functional status was assessed using the Postel–Merle d'Aubigné (PMA) score. The radiographic severity of osteoarthritis associated with hip dysplasia was graded according to the Mourgues and Patte classification: Stage 1 corresponds to dysplasia without radiographic osteoarthritis but with persistent pain; Stage 2 shows signs of hyperpressure with subchondral sclerosis and cysts (geodes) without joint-space narrowing; Stage 3 is defined by global joint-space narrowing of less than 50% or partial narrowing greater than 50%; Stage 4 corresponds to global joint-space loss exceeding 50%.

The severity of acetabular dysplasia was further characterized using coxometry, in particular the lateral center–edge angle (LCEA). Dysplasia was classified as moderate for an LCEA between 20° and 0°, severe for an LCEA between 0° and −14°, and extreme for an LCEA less than −15°.

We report the case of a 35-year-old woman with a history of total hip arthroplasty of the left hip for dysplasia in 2018, who presented with a 4-year history of mechanical right hip pain, predominantly inguinal, with progressive worsening. The pain was exacerbated by physical activity.

Clinical examination revealed a normal body habitus, equal lower limb length, and no gait disturbance. Hip range of motion was preserved, and gluteus medius strength was graded 5/5 according to Daniel's scale. The neurovascular examination was unremarkable. The Merle d'Aubigné score was 14.

Anteroposterior pelvis and Lequesne false-profile radiographs of the right hip demonstrated severe acetabular dysplasia with marked deficiency of lateral coverage (LCEA −2°) and anterior coverage (ACEA 0°), associated with excessive acetabular roof obliquity (CDE 28°). There were no radiographic signs of osteoarthritis (Mourgues and Patte stage I), and the femoral head was well centered, without subluxation or dislocation.

Given the following criteria : age under 40 years, symptomatic acetabular dysplasia, centered femoral head, and preservation of joint space the indication for an acetabular shelf procedure was considered appropriate.

Peroperatively, a Smith–Petersen approach was used. After exposure of the joint capsule, an anchoring groove for the shelf was created with an osteotome, 3 cm in length and 2 cm in depth, along the anterior rim and superior acetabular margin, parallel to the anterior aspect of the capsule. Care was taken to reach the inner table of the iliac wing without penetrating it. A tricortical iliac crest graft measuring 3 cm in width and 6 cm in length was then harvested and inserted into the prepared groove, with its cortical surface placed against the joint capsule so as to cover both the anterior and lateral aspects of the femoral head. The graft was stabilized with a pre-contoured plate to ensure immediate stability and optimal support on the capsule (figure 1).

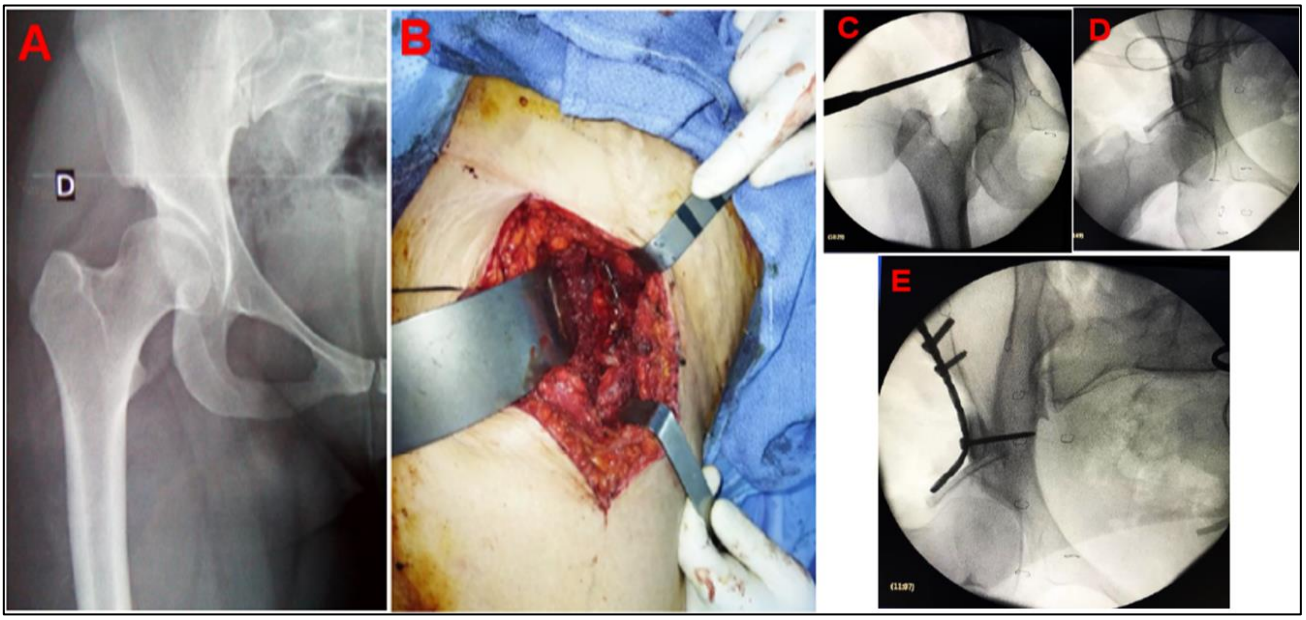

Fig 1: Results

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A : Right hip AP radiograph showing severe acetabular dysplasia with lack of external coverage quantified by a LCEA at -2°, and excessive obliquity of the roof of the acetabulum (CDE at 28°)
B : Intra-operative view of the final aspect of the acetabular shelf.
C : intraoperative radioscopy showing the use of the osteotome to perform an anchoring groove for the shelf.
D : intraoperative radioscopy showing placement of the graft inside the groove.
E : intraoperative radioscopy showing placement of the support plate

Postoperative recovery was uneventful. On the first postoperative day, after confirmation of implant position on pelvic radiographs, rehabilitation was initiated. Hip abduction was limited to 30° and flexion to 60° for 3 weeks. Partial weight-bearing was permitted from the 6th postoperative week.

III. DISCUSSION

The Roy-Camille acetabular shelf aims to enlarge the acetabular cavity to correct lateral and anterior hip dysplasia [5]. By increasing femoral head coverage with an iliac crest bone graft, it reduces focal joint overloading and improves stress distribution, potentially delaying osteoarthritis [6]. Over time, the graft undergoes fibrocartilaginous metaplasia, forming fibrocartilage, which is biomechanically inferior to hyaline cartilage but can provide durable coverage with slow degeneration and good radiographic adaptation [7].

Periacetabular osteotomy (PAO) described by Ganz is now a key joint-preserving procedure for skeletally mature patients [7]. Its advantages include preservation of the posterior column and pelvic ring stability, allowing early rehabilitation and future pregnancy, an important point in young women. Vascularity of the acetabular fragment is maintained, enabling later arthrotomy if needed [7]. The fragment can be widely reoriented without constraint from sacroiliac ligaments, improving three-dimensional coverage with limited mediolateral displacement [7, 8]. PAO through a modified Smith-Petersen approach achieves substantial correction of radiographic parameters (lateral and anterior center-edge angles, acetabular inclination) with good mid- to long-term functional outcomes and survivorship around 85–90% at 10–15 years in many series [9, 10, 11].

Other pelvic osteotomies show variable long-term survival. Shelf arthroplasty and Chiari osteotomy demonstrate survival rates ranging roughly from 70–80% or higher at 15–35 years in selected patients, with Chiari often slightly outperforming shelf procedures but both considered salvage options, especially in more advanced dysplasia or early osteoarthritis [12]. Salter, Steel, Sutherland-Greenfield and other classic redirectional osteotomies work well mainly in children or adolescents with open physes; their effectiveness in adults is limited, partly due to persistent ligamentous constraints on the mobilized fragment. Triple pelvic osteotomies (Tönnis, Van Hellemont and modifications) can also provide good long-term coverage and function but require more extensive osteosynthesis and longer rehabilitation than PAO [13, 14].

More recently, minimally invasive and arthroscopic shelf techniques have been explored to combine acetabular bone augmentation with labral repair and capsular preservation in moderate dysplasia, offering a less invasive alternative where full PAO may be excessive [15].

IV. CONCLUSION

Roy-Camille shelf arthroplasty technique is a conservative surgery with many advantages for treatment of hip dysplasia. This technique enables a quick postoperative recovery compared to other osteotomy techniques. Thanks to this technique among others, the incidence of hip dysplasia is in regression.

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