Acta Ortopédica Mexicana 2015; 29(5): Sep.-Oct: 271-274

Clinical case

Hip resurfacing after iliofemoral distraction for type IV developmental dysplasia of the hip a case report

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ABSTRACT. Osteoarthritis secondary to developmental dysplasia of the hip is a surgical challenge because of the modified anatomy of the acetabulum which is deficient in its shape with poor bone quality, torsional deformities of the femur and the altered morphology of femoral head. Particularly in Crowe type III and IV, additional surgical challenges are present, such as limb-length discrepancy and adductor muscle contractures. This is a bilateral hip dysplasia case where bilateral hip replacement was indicated, on the left side with a resurfacing one and on the other side a two stage procedure using a iliofemoral external fixator to restore equal leg length with a lower risk of complications. This case report shows both the negative clinical outcome of the left and the excellent one of the right hip where the dysplasia was much more severe. Patient selection and implant positioning are crucial in determining long-term results.

Key words: Resurfacing, hip, dysplasia, congenital, bilateral.

RESUMEN. La osteoartritis secundaria a displasia del desarrollo de la cadera es un reto quirúrgico debido a la anatomía modificada del acetábulo que es deficiente en su forma, con mala calidad del hueso, deformidades de torsión del fémur y la morfología alterada de la cabeza femoral; en particular en los tipos III y IV de Crowe, retos quirúrgicos adicionales están presentes, tales como dismetría y contracturas musculares de los aductores. En este caso de displasia de cadera bilateral se indicó el reemplazo bilateral, en el lado izquierdo con una prótesis de resuperficialización y en el otro lado se realizó un procedimiento de dos etapas utilizando un fijador externo iliofemoral para restaurar la longitud de la pierna con un menor riesgo de complicaciones. Este caso muestra tanto el resultado negativo de la cadera izquierda como el excelente resultado de la cadera derecha, donde la displasia fue mucho más grave. La selección del paciente y la colocación del implante son cruciales en la determinación de resultados a largo plazo.

Palabras clave: Resuperficialización, cadera, displasia, congénita, bilateral.

Introduction

Osteoarthritis secondary to developmental dysplasia of the hip (DDH) is a surgical challenge because of the modified anatomy of the acetabulum, which is deficient in its shape, with poor bone quality, torsional deformities of the femur and the altered morphology of the femoral head.[1]

Moreover, particularly in Crowe type III and IV,[2] additional surgical challenges are present, such as limb-length discrepancy and adductor muscle contractures.

When restoring limb-length discrepancy greater than four centimeters, the risk of nerve palsy should be considered.

In order to minimize this complication, different surgical techniques, such as femoral shortening with subtrochanteric osteotomy or cup positioning with a high center of rotation, have been proposed for one-stage treatment. However, these procedures are inadequate to restore limb-length discrepancy.[3,4,5,6] A two-stage procedure using an ilieofemoral external fixator for soft-tissues distraction before total hip arthroplasty (THA) has been proposed[7,8,9,10] to avoid neurological impairment, achieve nearly equal leg length and restore the anatomical hip center of rotation, which is biomechanically advantageous.[6,11]

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Hip resurfacing (HR) has gained popularity during the past 15 years as a suitable solution for young and active patients affected by hip disease. Advantages[12,13] of HR over THA include: bone stock preservation, which facilitates conversion to a stemmed prosthesis, low dislocation risk due to the large diameter of the femoral head, restoration of hip geometry (head diameter, femoral offset, center of rotation), physiological hip loading –thus preventing stress-shielding– and the resumption of sporting activity.

However, HR introduced new mechanisms of failure, such as femoral neck fracture and increased serum concentrations of metal ions that may lead to either local effects (pseudo-tumor, osteolysis, ALVAL) or may theoretically produce systemic effects (renal failure, carcinogenity, cobaltism).[14,15]

Despite these complications several good results in terms of clinical outcome and implant survival ranging from 90 to 98% at 10 years[1] are reported in the literature regarding in patients affected by DDH grade I and II.

Case report

In October 2004, a 41-year-old female with severe hip pain affected by bilateral DDH type I in the left hip and type IV in the right hip according to the Crowe classification came to our institute for clinical examination.

The patient had a positive bilateral Trendelemburg sign and her hips were highly limited in their range of motion. Particularly, the right hip was limited to 60º in flexion and to 5º in internal and external rotations. Preoperative Harris Hip Score (HHS) was 53 for the right and 62 for the left hip, respectively.

A 52-mm limb-length discrepancy was measured on anteroposterior preoperative radiographs *(Figure 1)*.

Considering the young age of the patient and the preserved femoral morphology, a HR was performed on the left hip (BHR, Birmingham Hip Resurfacing, Smith & Nephew, Birmingham, United Kingdom) in December 2004 (46-mm cemented femoral head, 52-mm uncemented acetabular cup). The acetabular shell was positioned with an inclination of 67º *(Figure 2)*.

Ten months later, the patient was completely satisfied with her HR, HHS increased to 91. Due to the resurfaced left hip, limb-length discrepancy increased to 57 mm. Considering the positive clinical outcome, the patient wanted to receive the same treatment in the contralateral hip.

Since the right limb was 57 mm shorter than the left one, an external iliofemoral fixator was used for soft-tissue distraction to reduce the risk of nerve palsy and to be able to implant the acetabular cup into the true acetabulum.

In October 2005 a capsulotomy through lateral approach was performed and an iliofemoral external fixator (Orthofix, Bussolengo, Verona, Italy) was implanted using three hydroxyapatite coated pins[16] on the lateral aspect of the iliac wing and two pins inserted into the femoral diaphysis with no distraction at the time of surgery. Percutaneous adductor tenotomy was performed to achieve further soft-tissue distraction. Postoperatively, progressive one mm distraction per day was planned, until the tip of the greater trochanter reached the upper border of the native acetabulum *(Figure 3)*. External fixator was well tolerated by the patient, with no signs of pin tract infection. After 55 days, the external fixator was removed, and through the same lateral approach, a HR was implanted (42-mm cemented femoral head, 50-mm uncemented acetabular cup). The acetabular shell was positioned with an inclination of 47º. The limb-length discrepancy was completely restored.

Six months after the second HR, the patient's clinical outcome was excellent, with HHS of 95 for the right hip and 91 for the left one.

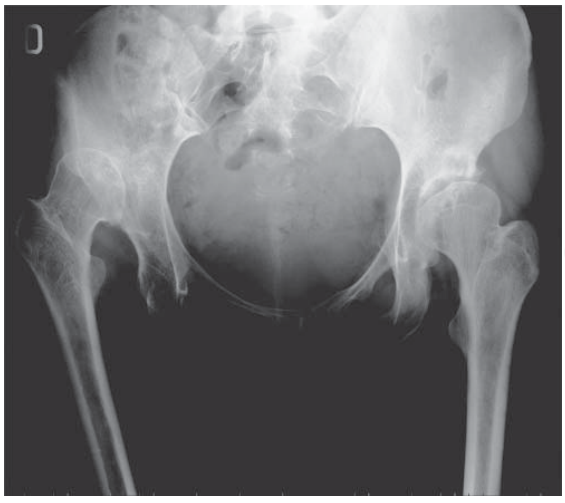

Figure 1. X-rays showing developmental dysplasia of the hip, type I in the left hip and type IV in the right one.

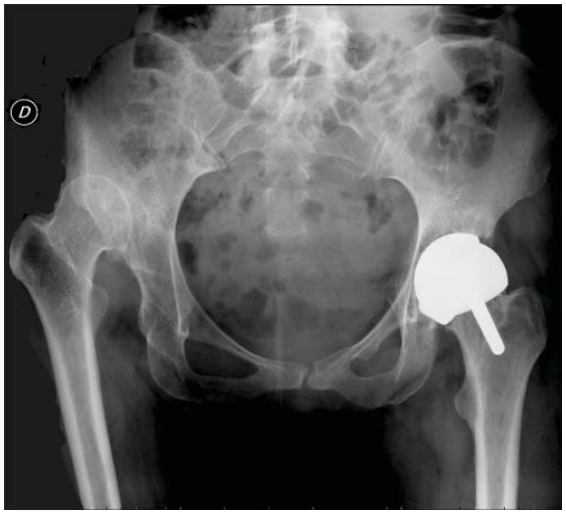

Figure 2. X-rays showing HR at one-year follow-up (October 2005).

Figure 3. X-rays showing no leg-length discrepancy 55 days after iliofemoral distraction. (November 2005).

Figure 4. X-rays showing severe osteolysis both on the acetabular side and femoral neck in the left hip (seven-years follow-up). Good osteointegration in the well positioned HR in the right hip (follow-up of eight years).

Annually scheduled follow-up for clinical and radiographical examinations showed excellent outcome until April 2011, when the patient started complaining of groin pain on the left side (HHS was 64). Radiographs showed severe osteolysis of both the acetabular and femoral sides with extensive neck narrowing *(Figure 4)*.

Revision surgery was performed in June 2012 and a stemmed THA with modular dual mobility (MDM) system (ceramical 28-mm femoral head, 60-mm acetabular cup, metal insert and a 48-mm UHMWPE liner) (Stryker, Michigan, USA) was implanted. A good implant stability was achieved using autologous bone graft and two screws *(Figure 5)*.

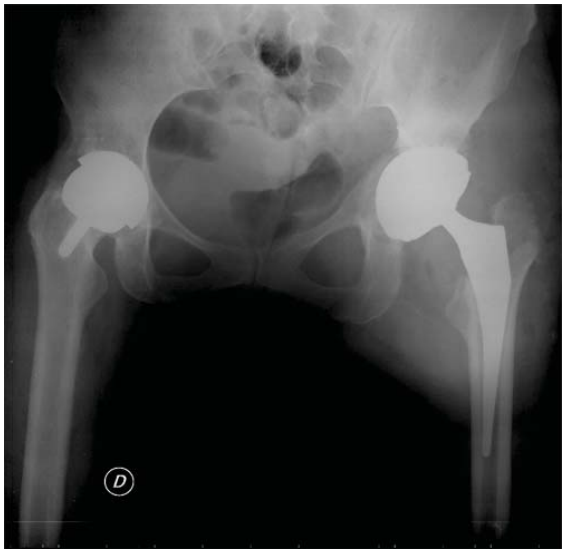

Figure 5. X-rays showing a stemmed THA at one-year follow-up with good osteointegration. Eight-years follow-up of the well-functioning HR on the right side without radioluciencies.

One year after revision surgery, the patient is doing well; hip pain has disappeared on the left side (HHS 95), while the right one has still an excellent clinical outcome (HHS 98), with radiographs showing a complete osteointegration of the implant.

Discussion

THA represents an effective solution for patients affected by hip osteoarthritis secondary to DDH.

Nevertheless, these patients are usually younger than those affected by primary osteoarthritis of the hip; therefore, long-term implant survival still remains a concern.[17]

Excluding large-diameter metal-on-metal THA, which recently experienced a high revision rate, a similar good survival for stemmed prostheses and the BHR resurfacing system has been reported in young patients affected by low grade DDH.[18]

BHR prostheses, either implanted in primary osteoarthritis or secondary to DDH, have been reported to have a similar positive survivorship.[16,19,20,21,22]

HR is a bone-preserving solution suitable for young and active patients with a long life expectancy where revision surgery is more probable to become necessary. However, it may not be possible to restore severe limb-length discrepancy nor to correct important deformities on the femoral side, which characterize high-grade DDH.

In this patient, since the deformities of the left hip were minimal, a HR was implanted. At the time of the first operation, the edge wear phenomenon was not completely known; therefore, the steep cup inclination (67°) due to the high stability provided by the large-diameter femoral head was not considered a major concern. Now, it is well known that metal-on-metal coupling does not tolerate cup malposi-

tioning, which must have an inclination between 40º and 50º and an anteversion from 10 to 20º. We believe that in our patient, incorrect cup orientation was been the main cause of implant failure.

Considering the patient's characteristics and the radiological features of both of the acetabular and the femoral sides, severe limb-length discrepancy represented the major limitation to perform a HR.

The two-stage procedure using an iliofemoral external fixator to distract soft tissue before the THA is indicated in Crowe type III and IV to restore equal leg length with a lower risk of complications.

By using this technique, the hip center of rotation can be restored to a more anatomical position and may lead to improve hip biomechanics, avoiding excessive joint reaction forces.

The use of a small-sized iliofemoral distractor with hydroxyapatite coated pins provides a stable and, at the same time, non-cumbersome system which allows discharging the patients, permitted non-weight bearing walking on the affected side, between the first and the second stage.

In our patient, we performed this two-stage procedure combined with a HR, thus achieving a good clinical outcome and an excellent implant survival. By using a HR instead of THA, the infection risk may be eventually reduced due to the higher distance between the femoral component and the pin tracts.

This case report shows both the negative clinical outcome of the left hip and the excellent one of the right one, hip where the dysplasia was much more severe. Patient selection and implant positioning are crucial in determining long-term results.

Conclusion

In our patient, affected by grade IV DDH after restoring limb-length discrepancy using external fixator, HR allowed to obtain excellent results in terms of functional improvement and implant survival.

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