Total Hip Arthroplasty in Patients of Post Polio Residual Paralysis: A Retrospective Case Series

Abstract

Background: Poliomyelitis is a viral, nervous system disease that affects both the upper and the lower extremities. The treatment of severe coxarthrosis in these patients with total hip arthroplasty (THA) has been widely questioned because of the high risk of subsequent complications. The aim of the present study was to describe both radiological and medium term clinical results in a series of patients with post polio residual paralysis that underwent THA. **Materials and Methods:** We report a retrospective review of a series of 5 five patients diagnosed with severe coxarthrosis secondary to post polio residual paralysis who were operated between 2008 and 2012. Uncemented THA was performed in all cases by the same surgeon. Clinical evaluation was carried out using the Harris Hip Score (HHS) at the preoperative visit, at 6 months, and annually after surgery. **Results:** The median age was 47 years, and the median followup was 55 months (interquartile range P25–P75: range 31–72 months). According to the HHS, a significant clinical improvement was observed in all patients with a median score of 81 points (interquartile range P25–P75: range 74–89) at 1 year of followup. A case of relapsing dislocation that required revision surgery of the implant was recorded. No cases of component loosening were found. **Conclusion:** THA surgery in patients with post polio residual paralysis is a complex procedure with a significant complication rate, but a predictable clinical improvement may encourage surgeons to perform in patients with severe coxarthrosis and moderate functional expectations.

Keywords: *Paretic limb, poliomyelitis, total hip arthroplasty*
MeSH terms: *Poliomyelitis, hip, paralysis, retrospective studies, coxarthrosis*

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Introduction

Poliomyelitis is a viral disease of the nervous system currently eradicated in Western countries as a result of massive immunization policies. The World Health Organization recorded 359 cases in 2014. Nigeria, Pakistan, and Afghanistan are the only countries where it is still considered endemic in 2016.[1] According to the Spanish Institute for the Elderly and Social Services (IMSERSO) database from 2000, there are 42.651 people in Spain who have some degree of recognized disability and a diagnosis of poliomyelitis.[2] After acute disease, paralysis gradually improves over months or years, due to a process of collateral reinnervation by surviving neurons. In 50% of individuals surviving an acute paralytic disease, persistent weakness remains as a sequel.[3] The vast majority of orthopaedic surgeons have limited experience in surgical treatment of musculoskeletal lesions from post polio residual paralysis. It has traditionally been accepted that, since the forces through the hip joint are markedly diminished in limbs with flaccid paralysis, the occurrence of degenerative signs is relatively rare.[4] However, it is currently considered that muscle imbalance between abductors and adductors of the hip is the cause of the subluxation force of this joint and the main factor favouring dysplastic changes during childhood and its eventual degeneration.[5]

For several decades, total hip arthroplasty (THA) has been the gold standard treatment for severe refractory coxarthrosis in middle to advanced aged adults. However, many surgeons are still reluctant to perform this procedure in patients of post polio residual paralysis. The published literature to date describing its clinical results is scanty, limited to several case reports and a series that includes four paretic limb cases.[5-9]

The present study describes medium term clinicoradiological results in a series of patients with post polio residual paralysis who underwent THA in a paretic limb.

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Materials and Methods

This retrospective case series study was performed in patients with advanced coxarthrosis due to post polio residual paralysis, who underwent a total hip arthroplasty (THA) between January 2008 and December 2012, at our institution. The study was approved by the Research Ethics Committee of our hospital and patients gave their informed consent to participate in the study. The inclusion criteria were all patients with advanced coxarthrosis in paretic limbs due to post polio residual paralysis with a minimum followup of 24 months. The exclusion criterion was post polio residual paralysis treated with THA in non-paralytic limbs. No other exclusion criteria were considered. Flail limbs were included, as it is exposed. (Case 4, was a woman with complete abductor dysfunction and psoas strength of 3/5 who used a Thomas orthosis).

Demographic data were collected from medical records (age, sex, side, and previous hip surgery), as well as the preoperative assessment of physical status done during the anaesthesiology evaluation and quantified by the American Society of Anaesthesiologist classification system (ASA).[10] Medical Research Council (MRC) scale[11] for muscle strength (in flexion and abduction of the hip in the affected limb), and Harris Hip Score (HHS)[12] for functional status were recorded in all patients.

Postoperatively, data were collected at 6, 12, and 24 months from medical records. The scale used to determine the functional status of patients over time was the Harris Hip Score (HHS),[12] taking as references for the comparative study the preoperative and 24-month postsurgery assessments. The presence of any complication (infection, dislocation, fracture, and neurovascular injury) was recorded.

A complete preoperative radiographic evaluation and at 3 months followup study was recorded, with lower limb anteroposterior computed radiography in the standing position and also an antero-posterior pelvic radiography [Figure 1]. The radiological evaluation was performed by two independent researchers who did not participate in any of the procedures assessing. The collected radiological data were: (I) length discrepancy between limbs which was, measured in millimeteres of shortening of the studied limb versus the contralateral. Anterior superior iliac spine and the apex of medial malleollus were used as landmarks for this purpose. Before imaging, the patient was standing and a radiology assistant put the patient's feet together in the symmetrical internal rotation in order to standardize measurements. An attempt was made to level the pelvis with an appropriately sized lift placed under the short limb. A lateral computed tomography (CT) scanogram may be useful and it is recommended in patients with flexion contractures of the hip or knee, in order to avoid underestimation of limb length. A CT scanogram has the advantages of displaying the entire lengths of the femurs and tibias while minimizing the measurement error. There is no magnification when the structure to be measured is centered in the computerized axial tomographic gantry.[13] (II) Tönnis *et al*. classification of osteoarthritis,[14] (III) Crowe *et al*. classification of dysplastic hip,[15] and (IV) radiological loosening with Engh *et al*. criteria for the femoral stem[16] and DeLee and Charnley zones[17] at the level of the acetabular component. Radiographic measurement with SyngoFastView® (Siemens®, Munich, Germany) was performed.

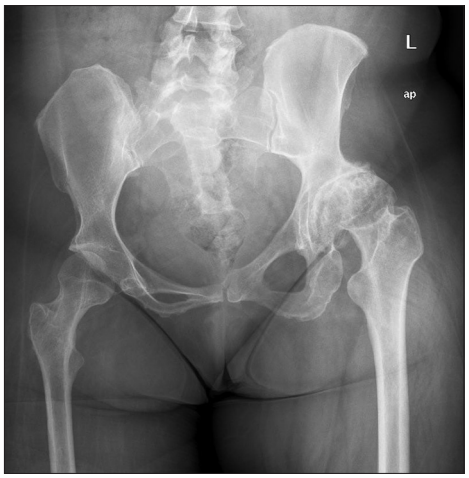

Figure 1: Preoperative pelvis anteroposterior X-ray of a patient with severe left coxarthrosis (Case 5)

CT scan was used to determine femoral and acetabular version, as well as acetabulum bone stock, during preoperative planning [Figure 2].

In June 2014, a telephonic survey was performed. Patients were asked about the presence or absence of hip pain and their degree of satisfaction with the surgery. This last issue was subjectively evaluated with the question: If you could go back in time, would you be operated again?[18]

Operative procedure

All procedures were performed by the same orthopaedic surgeon under spinal anaesthesia. A posterolateral approach to the hip was used in all cases, except for the first case, in which a transtrochanteric approach was performed. During surgery, the gluteus medius muscle was protected using a Hohmann retractor and the acetabulum was reamed seeking an orientation of 45º abduction and 15°anteversion in relation to the longitudinal axis of the patient, which is known as the operative definition of anteversion.[19] Pelvic obliquity was assessed preoperatively, and it was a major concern while reaming the acetabulum. Consequently, its orientation was adjusted in order to compensate this deformity and recreate a normal position of the cup. In one case, anatomical inclination and anteversion of the native acetabulum were preoperatively assessed using a CT, due to its severe degree of dysplasia. The transverse acetabular

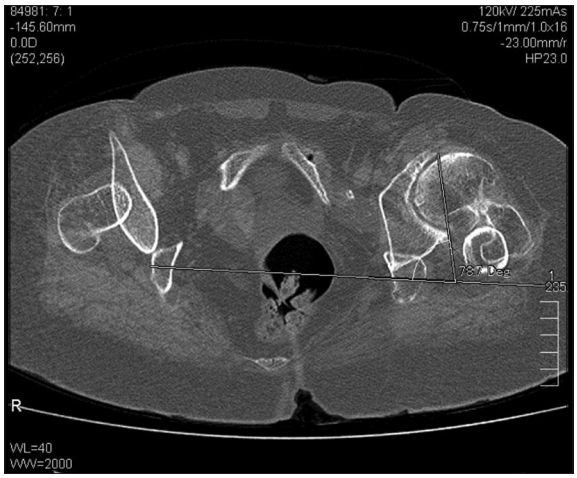

Figure 2: Computed tomography scan used for preoperative planning

ligament (TAL) was only used as a landmark during cup positioning in the two cases whose acetabula were less distorted. It has been reported that although TAL may be a good guide in hips with normal anatomy, TAL is not a reliable guide in hips with osteoarthritis secondary to dysplasia for determining optimal cup orientation during THA.[20] Anterior and posterior stability were evaluated routinely with the trial components. In the cases in which a modular stem was used, femoral anteversion was intraoperatively decided according to this trial stability assessment. In those patients whose anatomy was scarcely distorted, a non modular stem was implanted with usual anteversion of 15°–20°.

Uncemented and nonconstrained components were used in all cases. Screwed autologous bone graft was used if a superolateral defect was present in the neoacetabulum (n = 2), modular femoral stem was used if augmented femoral anteversion was noticed (n = 2) and dual mobility modular cup if intraoperative instability was noticed (n = 2).

The acetabular components used were: Pinnacle® (DePuy®, Warsaw, Indiana, USA) in 2 two patients, Trident MDM® (Stryker®, Kalamazoo, Michigan USA) in 2 two patients, and J-LOC® (DePuy®, Leeds, England) in one patient. The femoral components used were: Corail® (DePuy®, Warsaw, Indiana, USA) in 3 three patients, S-ROM® (DePuy®, Warsaw, Indiana, USA) in 1 one patient, and MP® (Waldemar Link®, Hamburg, Germany) in one patient. A metal-on-polyethylene combination was used in 4 four cases. Only one patient had a cup size big enough to use a ceramic head (ceramic-on-polyethylene).

Postoperative rehabilitation protocol was the same for all patients. Rehabilitation and physiotherapy started the 3rd postoperative day. The patients progressed from partial to full weight bearing using two crutches for 4 weeks, one crutch for 2 weeks, and one cane for at least 3 months postoperatively. Isometric and isotonic exercises for hip abductor and flexor muscles were encouraged since the 3rd week.

Statistical analysis

Statistical analyses were performed using the IBM SPSS Statistics® version 20.0 (IBM®, Armonk, USA).

The data were expressed as median (interquartile range, P25–P75). The differences between variables were analyzed using Fisher's exact test and McNemar's test for nominal data, and Wilcoxon signed-rank test. A $P < 0.05$ was considered statistically significant.

The interobserver reliability of the measurements by the two independent investigators was measured with the Intraclass Correlation Coefficient (ICC) for quantitative variables and the Cohen's kappa coefficient (κk) for qualitative ones.[21]

Results

Five patients were included, with a median patient age at the time of surgery of 47 years (range 38–64 years). The demographic and preoperative data are shown in Table 1. The median duration of followup was 55 (interquartile range P25–P75: range 31–72 months) months, and no patient was lost to the followup.

Preoperative radiographic evaluation in 4 patients was performed using lower limb computed anteroposterior teleradiography in the standing position with a marker. There was only 1 patient with a flexion deformity who needed a CT scanogram to be done.

Interobserver agreement in the radiological assessment was good in qualitative variables (κk = 0.91; confidence interval [CI] 95%: 0.75–0.96) and a very good in quantitative one (ICC = 0.83; 95% CI: 0.78–0.88). The median limb length discrepancy dropped 13 mm: from 30 mm (P25–P75: 30 30) preoperatively to 17 mm (P25–P75: 12–24) at three months visit (P = 0.068). No patients showed radiological osteolysis around femoral or acetabular component at the latest image control available.

At six months followup, the median HHS score was 75 points (interquartile range P25–P75: range 69–78) and at 24 months followup, it was 81 (P25–P75: 74–89). The median HHS raised 51 points from the preoperative to the 24 months followup (P = 0.043). Two patients out of five required a shoe raise after surgery, smaller than the previous one they had. Four patients out of five continued to use a cane for long walks. One patient preferred to use two canes and a Thomas' orthosis most of time, since she felt safer.

Complications were recorded in three patients: One intraoperative complication, one early complication, and one mid-term complication. There was one greater trochanter intraoperative fracture treated by osteosynthesis (internal fixation with plaque and cerclages), observing consolidation of the former on the followup X-ray 3 months after surgery. In the early postoperative,

Table 1: Preoperative demographic data

Case	Sex	Age*	Followup (months)	Tönnis	Crowe	Flexion strength	Abduction strength	Previous surgery
1	Female	64	31	3	III	2	2	FVO**
2	Female	60	24	3	II	2	3	FVO**
3	Female	47	72	2	III	3	3	No
4	Female	38	78	3	III	3	0	Three previous procedures
5	Female	47	55	3	II	3	2	No

*Age at time of surgery. **FVO=Femoral varising osteotomy

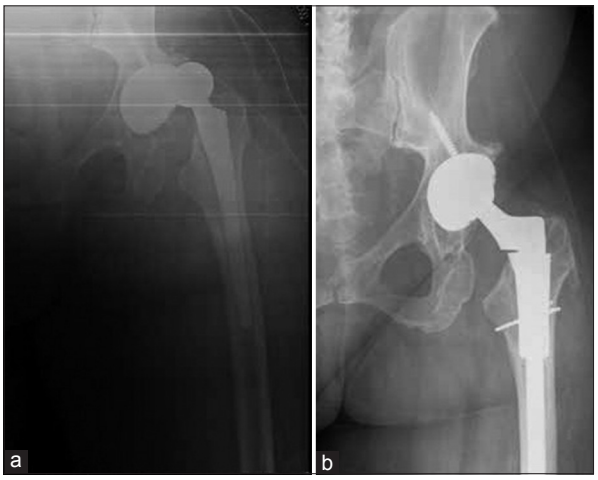

Figure 3: (a) X-ray pelvis anteroposterior view showing anterior dislocation of the left total hip arthroplasty at the early postoperative period (Case 5) (b) X-ray pelvis anteroposterior view at third- month visit (Case 5). Instability was managed by optimizing femoral version using a modular stem

one patient suffered two episodes of dislocation of the implant, being diagnosed as prosthesis instability due to insufficient femoral stem anteversion [Figure 3a]. The patient was reoperated two weeks after the first surgery, replacing the Corail® stem (DePuy®, Warsaw, Indiana USA) by a modular Emperion® stem (SmithandNephew®, Warsaw, Indiana, USA). A femoral anteversion of 40° was achieved [Figure 3b]. This patient eventually had the highest HHS of our series (94 points). She was able to walk with a cane, drove her vehicle daily, and had not experienced new dislocation episodes. The mid-term complication was one case of pseudoarthrosis of the greater trochanter osteotomy in the patient with the transtrochanteric approach [Figure 4]. Five years after surgery, the osteotomy had not healed, the patient was pain free and walked with the aid of two canes and a Thomas' orthosis, with a Trendelenburg gait due to gluteus medius muscle dysfunction, which already existed preoperatively.

During the telephonic survey, all the patients answered affirmatively to the question that they would have undergone the procedure knowing now their final outcome, though complications were suffered by some of them.

Discussion

As with other diagnoses, but probably more in this specific population, pain and disability should be severe enough to justify hip replacement arthroplasty according to Cabanela and Weber.[4] Many orthopaedic surgeons are concerned about THA on limbs affected by neuromuscular disorders due to the high rate of complications.[22] Apart from increasing the risk of dislocation and aseptic loosening, an imbalance in muscle tone across the hip, if present since early childhood, may result in abnormal femoral and acetabular anatomy.[23] It is important to take into account that weakness, muscle pain, as well as a limb length discrepancy, and a certain residual limp could compromise the clinical results according to the assessment scales, but in no case should be a contraindication for the procedure nor a reason to consider it a failure.[18,23]

Our study consisted of a retrospective cases series in which clinical and radiological results of THA in paretic limbs after post polio residual paralysis were assessed. We observed a statistically and clinically significant improvement in the functional status of operated patients, measured on the HHS. Four out of five patients were pain free at the end of followup and all considered that they were satisfied with the procedure, despite the complications experienced by some of them. These clinical results are comparable to those of the most recently published series by Yoon *et al*.,[5] except for the fact that in their study only 30% of patients completely considered themselves pain free versus the rate of four out of five in the present study.

During the radiological assessment, measurement of limb length discrepancy, grade of coxarthrosis, and hip dysplasia may have a subjective component, which we attempted to prevent by examining the X-rays by two independent investigators, obtaining a very good interobserver agreement (κk = 0.91, ICC = 0.83). Given the small sample size in these series, it is difficult to find statistically significant differences in the correction of limb length discrepancy. In our series, this was considerably reduced in most cases (with a 13 mm median decrease), comparable to the degree of correction found in the series of paretic limbs of the article wrote by Yoon *et al*.[5] of 14 mm. However, it is important to point out the higher grade of dysplasia, and therefore, a greater increase in the centere of rotation in patients from our study, mostly Crowe Type III, compared to the above study where Crowe Type I was predominant. This could explain the greater residual postoperative limb length discrepancy in our series. It should be noted the agreement with the previous studies[4-7,9] in terms of the lack of aseptic loosening in patients with this neuromuscular

disease, in contrast to those suffering from Parkinson's disease, cerebral palsy, and stroke.[23,24]

The dislocation rate in our series was one patient out of five. This proportion is in the upper limit of the range reported in the literature according to the different series of THA in patients with neuromuscular disease, located between 5% and 20%.[24] However, most of these studies included patients with flaccid and spastic paralysis.[4,22,24] Hernigou *et al*.[24] reported a significantly higher cumulative risk of dislocation at 10 years for cases with increased muscle tone, reaching a 27% dislocation rate for unconstrained implants. Considering all the cases reported in the literature, THA with unconstrained implants in paretic limbs after post polio residual paralysis, the dislocation rate would be 16.7%, as shown in the Table 2.

In our experience, and in accordance with authors such as Cabanela and Weber, surgeons should attempt to optimize the position of the components as the primary measure to prevent implant instability.[4] This may require the use of modular stems in some cases. After correction of the femoral version in the patient who suffered dislocation of the implant, no more episodes of instability occurred again in the series. The new acetabular cups with the dual mobility system could be useful to reduce the dislocation rate in these cases, but there is not adequate evidence in the current literature supporting its use as a first choice in this specific population. Queally *et al*. state that in patients with an increased tendency to sublux or dislocate, such as those with poliomyelitis, the use of constrained components should be considered.[23]

Figure 4: X-ray pelvis anteroposterior view showing pseudoarthrosis of the greater trochanter osteotomy 5 years after total hip arthroplasty (Case 4)

Table 2: Dislocation rate of unconstrained total hip arthroplasty in paretic limbs due to post polio residual paralysis

Study	Number of hips	Dislocation (%)	Mean followup (years)
Cameron[6]	1	0	3
Wicart *et al*.[9]	2	1 (50)	5
Spinnickie and Goodman[8]	1	1 (100)	0.6
Hernigou *et al*.[24]	5	0	12
Yoon *et al*.[5]	4	0	7
Current study	5	1 (20)	4.3
Total	18	3 (16.7)	5.3

The main limitation of this study is the short duration of the followup period and its heterogeneity in the series. Every patient had a minimum followup of 24 months with clinical evaluation and X-ray images. The last followup consisted of a telephone interview, so our series had a median followup of 55 months and a maximum of 78 months. In addition, it suffers from the characteristics inherent to all retrospective studies, such as the possibility of incurring information or selection bias in the treatment allocation. Finally, it lacks a control group that would let us draw conclusions with a higher level of evidence regarding the results obtained, and that would enable us to compare them with our routine clinical practice.

Conclusion

This study is the most extensive series published to date describing the results of THA in paretic limbs after post polio residual paralysis. Based on our experience, THA surgery in patients with post polio residual paralysis is a complex procedure with a significant complication rate, but a predictable clinical improvement may encourage surgeons to perform it in patients with severe coxarthrosis and moderate functional expectations.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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