

## Research Article

# Long Term Outcomes of Total Hip Replacement in Patients with Ankylosing Spondylitis

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## Keywords

• Ankylosing spondylitis; Total hip replacement (THR)

## Abstract

**Background:** Total hip replacement (THR) is a reliable therapeutic intervention for patients with severe hip involvement. The aim of our study was to determine the long term outcome and associated risk factors of THR in patients with Ankylosing Spondylitis (AS).

**Materials and Methods:** A cross sectional study was performed. Patients  $\geq 18$  years diagnosed with Ankylosing Spondylitis (AS) according to modified NY criteria from the ESPAXIA (Estudio de Espondiloartritis Axial IREP Argentina) cohort were included. Demographic, clinical and data related to THR were recorded. Pain, patient global assessment (VAS), disease activity (BASDAI), functional capacity (BASFI), enthesitis (MASES), axial mobility (BASMI) and radiological damage (mSASSS) were assessed. Hips functional capacity was evaluated by the Merle d'Aubigné and Postel method and pelvis x rays were taken to determine: presence of periprosthetic osteolysis of the femoral and acetabular components, fracture, luxation and heterotopic ossification (HO).

**Results:** 190 patients were evaluated and 25 (14,53%) underwent THR. 16 patients were included in the analysis. Nine (56,2%) had bilateral THR with a median time of THR's evolution of 12,5 years (IQR 8.7-16.7). 25 prosthesis were evaluated. 3 (12%) prosthesis had surgery complications, 3 (12%) had revision surgery. Pain and functional capacity significantly improved after surgery (median VAS for pain previous to surgery was 10 cm (IQR 9.7-10) vs 0 cm (IQR 0-1.2) after surgery). Twenty twopelvis x-rays were taken, 15 prosthesis had heterotopic ossification, 15 femoral osteolysis, 11 acetabularosteolysis, 3 subluxation and 1 peri-prosthesis fracture. Younger age at disease onset was the main variable associated to THR in multivariate analysis [OR 0,91 (95% CI 0,85-0,97)  $p=0,001$ ].

**Conclusion:** A substantial relief in pain and improvement of functional capacity were seen inASpatients who underwent THR. Younger age at disease onset was the only predictor associated to THR.

## INTRODUCTION

Ankylosing Spondylitis (AS) is a chronic inflammatory systemic disease that mainly affects the sacroiliac joints and spine [1]. Hip involvement is commonly observed, with a reported prevalence from 19 to 36% and it is associated with functional disability decreased quality of life and employability [2-6]. Younger age at disease onset, axial involvement and enthesitis are associated with severe hip disease [3]. Total hip replacement (THR) surgery is a reliable therapeutic intervention for patients with severe hip involvement. However surgery outcomes have been subject of concern due to the high probability of ankylosis recurrence, mechanical failure and poor function [7]. Furthermore there are reports of a higher frequency of heterotopic ossification after THR in patients with AS [8]. Several studies have demonstrated that short and long term outcomes after THR in patients with AS are good, with long term survival of the prosthesis and low rates of complications and need of revision surgeries [6,7,9,10].

The aim of our study was to determine the associated risk factors and long term outcomes of THR in patients with AS.

## MATERIAL AND METHODS

Patients equal or greater than 18 years old, belonging to the

ESPAXIA (Estudio de Espondiloartritis Axial IREP Argentina) cohort with Ankylosing Spondylitis (AS) diagnosis according to modified New York '84 criteria were included in this cross sectional study. ESPAXIA is an observational prospective cohort of patients with axial spondyloarthritis from the Instituto de Rehabilitación Psicofísica in Buenos Aires. This ongoing cohort started in August 2008 and includes patients over 16 years of age fulfilling, New York '84 or ASAS axSpa criteria. At the time of this study the cohort included information of 190 patients who had annual schedule visits. Demographic data, disease duration, articular and extra articular manifestations, comorbidities and current treatment (usage of Non-steroidal anti-inflammatory drugs, analgesics, disease modifying antirheumatic drugs, anti-TNF therapy) were collected. Pain, patient global assessment by visual analog scale (VAS), enthesitis (MASES), functional capacity by Bath Ankylosing Spondylitis Functional Index (BASFI), disease activity by Bath Ankylosing Spondylitis Disease Index (BASDAI), axial mobility by Bath Ankylosing Spondylitis Metrology Index (BASMI), quality of life by Ankylosing Spondylitis Quality of Life (AsQoL) were assessed [11-14]. Radiological damage was evaluated using the modified Stoke Ankylosing Spondylitis Spine Score (mSASSS) by a single reader, who had previously shown an

excellent intraobserver correlation (Kappa=0.86) [15].

Patients with AS and THR were identified and the following data were recorded: date of each total hip arthroplasty (right, left), type of prosthesis (cemented, cementless or hybrid), surgery complications, cause and number of revision surgeries. Actual hip pain by VAS and Steimbrocker functional classes (Functional Class (FC) I: complete ability to carry out all usual duties without handicaps, FCII: adequate for normal activities despite handicap of discomfort or limited motion of one of the joints, FCIII: limited to little or none of the duties of usual occupation or selfcare and FCIV: incapacitated, largely or wholly bed ridden or confined to a wheelchair with little or no self care) were evaluated. As all the surgeries had already been performed, patients were asked to recall and rate the pain previous to the surgery by VAS (0-10 cm). Hips functional capacity was evaluated by Merle d'Aubigné and Postel method modified by Charnley [16]. This instrument evaluates pain, gait and mobility on a Likert scale from 1 to 6 for each item, where 1 indicates the worst and 6, the best state of the patient. The total score ranges from 3 to 18. In the modified version, the patients are also categorized by the alphabetical prefixes A: patient with one hip involved; B: patient with two hips involved and C: patient with systemic disease that interferes with normal gait.

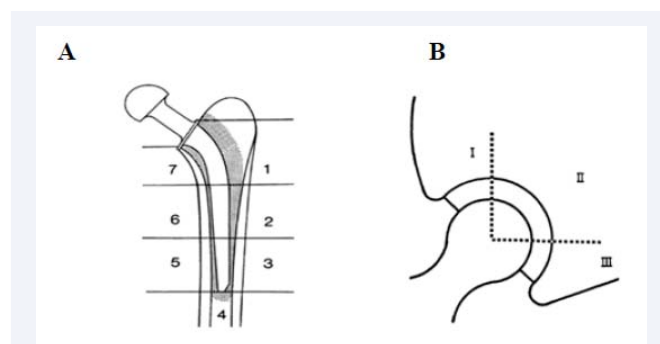
Panoramic pelvic plain X-ray was performed on each patient, taking into account the following requirements: anteroposterior view with focus on the pubic area, and inclusion of both up to the distal part of the femoral shaft. We determine the presence of periprosthetic osteolysis of the femoral and acetabular component. Acetabular osteolysis was defined as the appearance of a radiolucent zone in the pelvic area around the acetabulum and femoral osteolysis as the appearance of the same lesions in the femoral zone. The margins of each lesion had to be sufficiently clear as to be delineated with a pencil. In order to determine the location, the femoral component was divided into 7 zones (GruenZones) and the acetabular component into 3 according to De Lee and Charnley [17,18] (Figure 1). We also evaluated the presence of fracture, luxation and heterotopic ossification (HO) according to Brooker's classification that categorized patients into 4 groups; group 1 when there are islands of bone within the soft tissue around the hip and group 4 when there is apparent bone ankylosis of the hip [19]. All radiographs were read by a single independent reader blinded to patient's clinical data.

### Statistical analysis

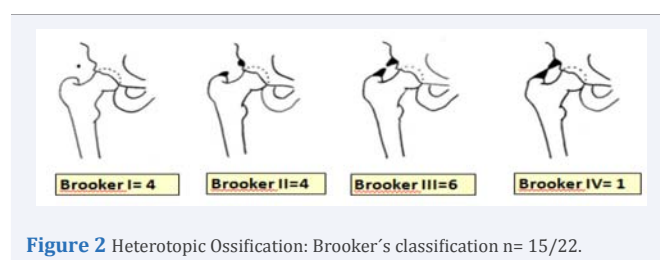
Descriptive statistics were referred as median and interquartile range (IQR) frequencies and percentages. Continuous variables were compared using T test and Mann Whitney U test, according to distribution and categorical variables by Chi2 and Fisher's exact test. Wilcoxon Sing Rank test was used to compare pain intensity before and after surgery. Multiple logistic regression analysis was performed to explore risk factors associated to THR (odds ratio (OR) and 95% confidence intervals (95% CI) were calculated).

### RESULTS

190 patients from the ESPAXIA cohort were evaluated, 172 had AS and 25 of them (14,53 %) underwent THR. Sixteen patients



**Figure 1** Radiologic osteolysis according to (A) Gruen zones and (B) De Lee and Charnley zones.



**Figure 2** Heterotopic Ossification: Brooker's classification n= 15/22.

were included in the analysis because 2 died and 7 were lost to follow-up. Nine (56,25%) had bilateral THR. Fifteen (93,8%) were males, with a median age of 45 years (IQR 35-44), median disease duration 28,5 years (IQR 18-35,25). Eleven (68,8%) were HLA-B27positive. Two (12,5%) patients had psoriasis and two (12,5%) Juvenile AS. The median time since THR was 12, 5 years (IQR 8.75-16.75). Demographic and clinical data are presented in (Table 1).

Twenty five prosthesis were evaluated (14 right y 11 left). 12 (48%) were cemented and 13 (54%) were noncemented. Three (12%) prosthesis had surgery complications (1 had loosening, 1 luxation and 1 fracture), 3 (12 %) had revision surgery (2 aseptic loosening and 1 luxation). A significant relief in pain was observed after THR surgery. Median pain (VAS) previous to surgery was 10 cm (IQR 9.75-10) vs 0 cm (IQR 0-1.25) after surgery ( $p=0.001$ ). There was also an improvement after the surgery in functional class. Previous to the surgery 6 patients (24%) were in functional class II, 16 (64%) in class III and 3 (12%) in class IV, while in the last visit 15 (60%) were in class II and 10 (40%) in class III. Median score of Merle d'Aubigné and Postel assessing functional status was 15, 21 (IQR 13,5-17). We evaluated 22 THR x rays. Eleven, (50%) prosthesis had acetabular osteolysis, 3 (13, 63%) subluxacion, 1 peri-prosthesis fracture, 15/17 (88,2 %) femoral osteolysis, and fifteen heterotopic ossification (4 grade I, 4 II, 6 III y 1 IV) (Figure 2).

THR was associated with longer disease duration ( $27,1 \pm 10,6$  vs  $19,6 \pm 13,4$  years,  $p= 0,03$ ), younger age at disease onset ( $17,4 \pm 7,6$  vs  $26,2 \pm 11, 9$  years,  $p= 0,0001$ ), lower MASES score ( $0,6 \pm 1,2$  vs  $1,6 \pm 2,3$   $p= 0,007$ ) and with a higher frequency of biologic treatment (50% vs 23,6%,  $p=0,03$ ) in the univariate analysis (Table 2). In the multivariate analysis, the only variable independently associated with THR was younger age at disease onset. [OR 0,91 (95% CI: 0,85-0,97)  $p=0,001$ ] (Table 3).

## DISCUSSION

In the present study 25 (14, 53%) of 172 patients with AS underwent THR and 56% of the patients included had bilateral hip replacement. The prevalence of THR in our cohort is slightly superior of that observed in the study of Vander Cruyssen et al., that included patients with AS from several countries (Belgium, Spain, Chile, Argentina, Venezuela, Costa Rica, Mexico, Peru, Ecuador and Uruguay). In this study 5 to 8% of the patients had THR and approximately half of the patients had both hips replaced [3]. This data shows the high probability of having a bilateral hip involvement in patients with AS.

We found a substantial relief in pain after the surgery and this is consistent with previous studies [6,7,9,10,20,21]. The functional capacity of the hip was evaluated according to the Merle d'Aubigné and Postel method. Although we were not able to use this instrument previous to the surgery to compare the later results, the median value observed in our patients indicate a good

**Table 1:** Demographic and clinical features of 16 patientes with AS.

Variables	N=16
Male n (%)	15 (93.8)
Age years <i>m</i> (IQR)	45 (35-54)
Age at symptoms onset years <i>m</i> (IQR)	24 (16-36)
Disease duration years <i>m</i> (IQR)	28.5 (18-35.25)
Time since THR years <i>m</i> (IQR)	12.75 (8.45-15)
JuvenilAxSpA n (%)	2 (12.5)
HLA-B27 n (%)	11/16 (68.8)
BASDAI <i>m</i> (IQR)	3.95 (1.41-6.33)
BASFI <i>m</i> (IQR)	4.5 (2.84-7.75)
ASQoL <i>m</i> (IQR)	4.5 (1-9)
Bilateral THR n (%)	9/16 (56.25)
Merle d'Aubigné and Postel method <i>m</i> (IQR)	15.21 (13.5-17)

THR (total hip replacement), BASDAI (Bath Ankylosing Spondylitis Disease Index), BASFI (Bath Ankylosing Spondylitis Functional Index), ASQoL (Ankylosing Spondylitis Quality of Life)

**Table 2:** Comparison of sociodemographic and clinical variables between patients with and without THR.

Variable	Without THR n=174	With THR n=16	P
Disease duration years X (SD)	19.6 (13.4)	27.1 (10.6)	0.03
Age at symptoms onset X (SD)	26.2 (11.9)	17.4 (7.6)	0.021
MASES X (SD)	1.6 (2,3)	0.6 (1.2)	0.007
Biologic treatment n (%)	41 (23.6)	8 (50)	0.03
BASDAI X (SD)	4.3 (2.6)	3.9 (2.1)	0.07
BASFI X (SD)	3.8 (2.8)	4.6 (2.1)	0.085
ASQoL X (SD)	6.8 (4.9)	4.9 (4.2)	0.31

MASES (Maastricht Ankylosing Spondylitis Enthesitis Score), BASDAI (Bath Ankylosing Spondylitis Disease Index), BASFI (Bath Ankylosing Spondylitis Functional Index), ASQoL (Ankylosing Spondylitis Quality of Life)

**Table 3:** Variables associated with THR.

Variable	$\beta$	Standard Error	P	OR	95 % CI Inferior Superior	
Positive Family History	0.292	0.585	0.617	1.339	0.426	4.213
Type of AxSpA	0.451	0.262	0.086	1.569	0.939	2.623
HLA-B27	-0.549	0.594	0.355	0.577	0.180	1.850
Enthesitis	-0.165	0.619	0.790	0.848	0.252	2.853
Age at symptoms onset	-0.091	0.033	<b>0.006</b>	<b>0.913</b>	<b>0.856</b>	<b>0.974</b>

AxSpA (Axial Spondyloarthritis)

functional status after THR. Joshi et al., evaluated 180 patients that underwent hip replacement, 96% of them did not have pain, 65% had good to excellent function and 67% had excellent to good mobility [21]. Sweeney et al., also demonstrated that out of 340 patients with AS that underwent THR, 83% reported none/mild pain, 52% good/very good movement and 58% high/very high success [6]. In another study, from 24 hips replaced, all improved function and flexion deformity was corrected [20].

Even though THR surgery is a challenging procedure because patients with AS often have ankylosis of the spine and involvement of other joints and systems such as the pulmonary and cardiovascular, the rates of postoperative complications in our study was low. Other studies had reported complications in 19/181 hips replaced (10.5%) [21] and in 5/24 hips (20.8%), and the number of hips that had to be revised was only 3 (12%), similar to previous studies [6,9,20,21]. Three prosthesis had surgical complications and revision was required only in the one that had loosening.

Active lifestyle and spinal stiffness of young patients with AS may be risk factors for increasing stress on the prostheses and thus resulting in early aseptic loosening, the main reason for a revision surgery in this patients [5]. In our study we found a high frequency of periprosthetic osteolysis, 50% had acetabular osteolysis (11/22 hips) and 88% (15/17 hips) femoral osteolysis. This values are higher than those published in the study of Sochart et al. [7]. This difference may be explained by a more strict criteria of periprosthetic osteolysis used in their study. In a previous study done in our hospital evaluating the prevalence of periprosthetic osteolysis after THR in patients with rheumatic diseases we found that 11 out of 17 hips of patients with AS, had periprosthetic osteolysis [22].

Patients with ankylosing spondylitis have an increased prevalence of heterotopic ossification (HO) compared with the general population [8], possible leading to increase pain, reduce mobility and function of the hip replaced [6,9]. In the study of Sochart et al., in patients with AS and THR, they found 6 hips (14%) with heterotopic ossification grade I or II [7]. Goodman et al, reported in 3 of 17 radiographs the presence of bone formation after THR in patients with AS, being two of them grade IV of the Brooker classification [10]. In our study, we found a high frequency of HO, in 15 of 22 hips evaluated although it should be

noted that the functional capacity of the hips remained good in most of the patients. We were not able to recall if the patients had additional risk factors for HO like multiple operations of the hips, the surgical approach used or if prophylaxis for HO with non steroidal anti inflammatory drugs or perioperative radiation therapy was given.

Early onset of disease, axial and enthesal involvement are associated with hip replacement surgery in AS [3]. In our study younger age at disease onset was the only predictor associated to THR. This may be explained because juvenile AS cases are more prone to have peripheral joint involvement, both at presentation and during the disease course, while adult AS onset cases are more likely to present with axial disease [23].

Limitations of our study were that ESPAXIA is not an inception cohort, therefore most of the data collected were retrospective, not being able to analyse specific recall data previous to the surgery. A recall bias of pain before the surgery must also be contemplated. Radiographs were evaluated by a single observer, and we had missing radiographs of some patients to assess the mSASSS. Besides, it is also important to remark a probably selection bias in our study because 36% of patients with THR from our cohort were lost follow up.

In conclusion, a substantial relief in pain and improvement of functional capacity were seen in AS patients who underwent THR. Younger age at disease onset was the only predictor associated to THR.

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