Total hip arthroplasty in patients with ankylosing spondylitis: challenges and midterm results

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Purpose
To assess the effectiveness of total hip arthroplasty (THA) in patients with ankylosing spondylitis (AS).
Introduction
The prevalence of hip disease in AS ranges from 19 to 36%, with 90% of patients affected bilaterally. Hip involvement in AS patients represents a substantial clinical challenge. While THA using cemented and cementless implants offers a valid treatment option, the complexities of AS-related osteoporosis, diminished spinopelvic mobility, reduced bone union, and femoral deformities necessitate tailored surgical strategies.
Patients and methods
This retrospective case series study involved 11 patients (equating to 20 hip joints). These patients were diagnosed with AS that affected their hips and underwent THA. The study spans from 2012 to 2018, with a minimum follow-up 5 years. The mean age at the time of operation was 25.2±4.6 years and the mean duration of follow-up was 5.6±0.6 yrs. Follow-up was assessed using Harris Hip Score (HHS) preoperatively, 6 months, 1 year, and at last follow-up postoperatively with a mean period of 6.4 (5–8) years.
Results
The mean preoperative HHS was 15.3±6.6, while in the last follow-up, the mean HHS was 76.3±4.2. The comparison between preoperative mean HHS and the last follow-up was highly significant. There were no postoperative complications except an iatrogenic fracture of the acetabulum.
Conclusion
AS is a painful and debilitating disease. THA in patients with AS causes a significant improvement in patient's pain and function. THA is a definitive solution for the crippling fate of these patients with advanced hip OA.

Keywords:
ankylosing, arthroplasty, hip, spondylitis

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Introduction

Ankylosing spondylitis (AS) is a type of chronic inflammatory arthritis whose etiology is still unknown, and it affects young males most frequently. The spine and the sacroiliac joints are primarily affected by new bone formation is created causing pain and decreased mobility [1]. AS can affect the hip joints, leading to a painful limitation in the range of motion (ROM) during the early stages of the disease, progressing to flexion contracture and absolute stiffness depending on the advancement of the disease [2]. Disease-modifying anti-rheumatic drugs such as anti-tumor necrosis factor agents have the potential to decelerate the disease advancement, but they have a minimal role in treating established arthritis of the joints [3]. Total hip arthroplasty (THA) is recommended as a treatment for alleviating the pain associated with the affected hip, deformities correction, and regaining ROM [4].

Numerous solutions have been developed to address ankylosis of the hip joint in patients suffering from AS. However, AS patients may have proximal femoral deformity and marked osteoporosis that can cause technical surgical difficulties [5].

The approach and exposure of the hip could be challenging due to the bony ankylosis. There is always the potentiality of implant malposition due to sagittal plane malrotation of the pelvis. Disuse of osteopenia can lead to poor bone quality, increasing the risk of fracture and the likelihood of joint re-ankylosis postsurgery [6].

Patients and methods

This retrospective study encompasses 20 hip surgeries performed on 11 patients diagnosed with AS. These

patients underwent primary cementless THA between the years 2012 and 2018. Fourteen (70%) hips were completely fused, and six (30%) hips were nonfused. In all cases, the surgery was indicated due to painful osteoarthritis and functional impairment as a result of AS. The mean age at surgery was 24.9 (20–37) years. All patients were followed up between 5 and 8 years after surgery (mean, 6.4 years).

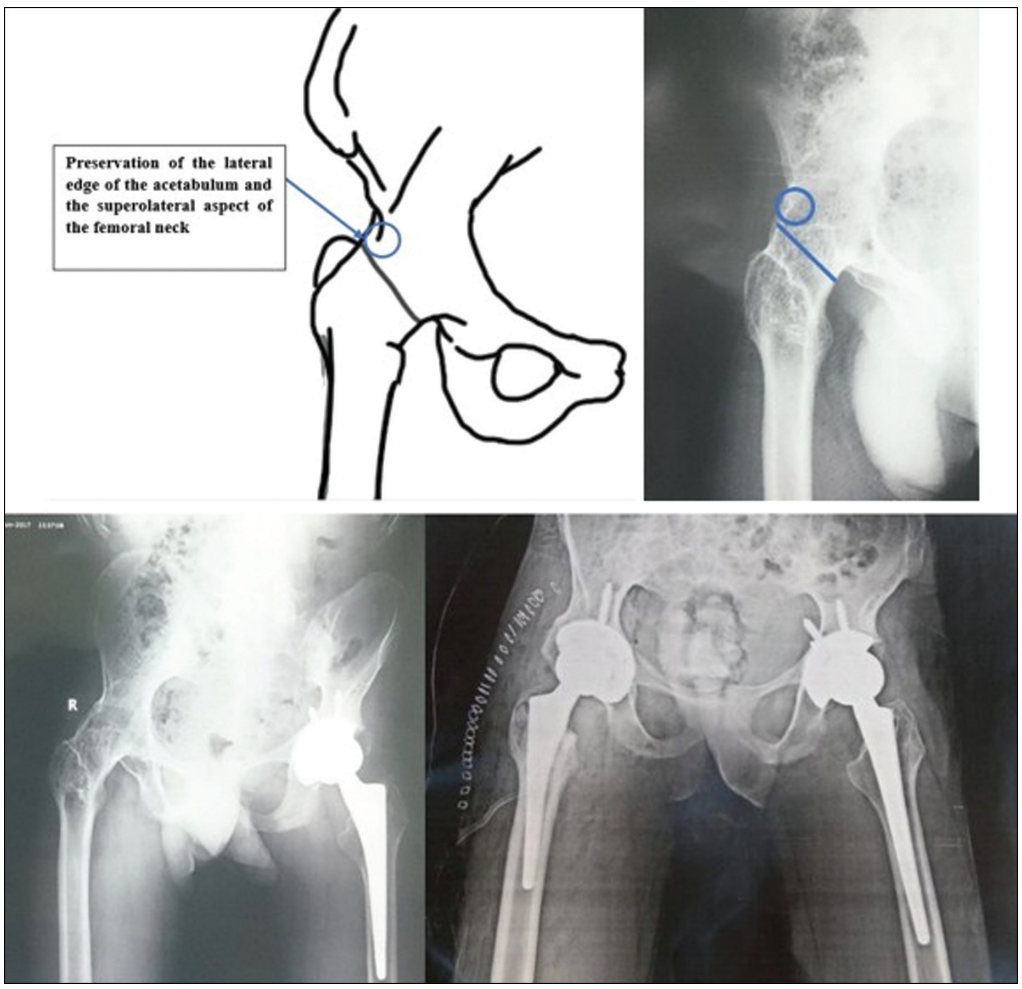
This study received ethical approval from the Ethics Committee of Helwan University, Faculty of Medicine Research Ethics Committee (REC-FMHU) under the protocol number (94-2023). Written informed consent was obtained from all patients.

Due to the ankylosed cervical spine that made neck extension difficult, all patients were intubated using a fibreoptic intubation.

Concerning positioning and surgical approach, patients were placed in the lateral position. Instructions were given to the operative team to avoid vigorous limb manipulations and extreme positioning during sterilization and draping to avoid iatrogenic fracture in the ankylosed hips. All operations were performed using cementless femoral and acetabular components. In 18 cases, we utilized the posterior approach. The lateral Hardinge approach was used in one case, and the trochanteric slide was used in another case. The sciatic nerve was identified and protected with posterior approach cases, but not formally dissected. After hip exposure, we found bony ankylosis of the hips in 14 cases with no ROM and fibrous ankylosis in six cases with minimal ROM. Femoral neck osteotomy *in situ* was performed (fusion osteotomy) with great care to preserve the lateral edge of the acetabulum and the superolateral aspect of the femoral neck (Fig. 1a, b).

The reaming was guided by the remaining superolateral stump of the neck and directed toward the true acetabulum. This was confirmed using an image intensifier to establish an anatomical hip center. Reaming was carried out sequentially until the true base of the acetabulum, identified by the pulvinar, was reached. Following this, a cementless acetabular component was implanted.

Figure 1



(a, b) Planning for fusion osteotomy, (c) preoperative pelvis radiograph, (d) postoperative radiograph.

On the femoral side, a complete capsulectomy was carried out. The femoral canal was accessed using a straight reamer and prepared in the usual way with a rasp. The femoral component that best fits the femur was chosen. With the trial rasp in place, traction was applied to the femur for trial reduction. The stability was tested and confirmed. The definitive femoral component was then implanted.

After the operation, all patients were given 75 mg of indomethacin, divided into three doses daily for 2 weeks for pain management and to prevent heterotopic ossification (HO). This was administered alongside proton pump inhibitors. For the initial 6 weeks postsurgery, patients were permitted to bear weight partially with a walking frame or two walking sticks. Follow-up appointments were scheduled in the outpatient clinic at 6 weeks, 3 months, 6 months, and 12 months postsurgery, and then annually. Harris Hip Score (HHS) was recorded preoperatively and at 6 and 12 months postoperatively. During each follow-up visit, the patient's clinical and radiographic evaluations were conducted using anteroposterior and lateral radiographs (Figs 1c, d, 2), and any postoperative complications were recorded.

One case was complicated intraoperatively by fracture ischium and acetabulum, resulting in pelvic discontinuity. The decision to do arthroplasty was aborted, a large bony fragment was fixed, and the patient was left as girdle stone arthroplasty after achieving hip extension, with a long neck stump as bone stock for further future interventions (Fig. 3).

Results

Twenty primary cementless THA were performed on 11 male patients suffering from AS; the mean age at the time of diagnosis with AS was 20.5 years (16–25 years), and the mean age at the time of operation was 25 years (range 20–37 years). The mean follow-up period was 5.6 years (range, 5–6 years). There was only one (5%) complication (Table 1).

The mean preoperative HHS was 15.3 ± 6.6, the mean postoperative HHS in the follow-up after 6 months was 38.1 ± 4.6 and the mean HHS in the follow-up after 1 year was 64.3 ± 5.7, while in the last follow-up after a mean period of 6.4 years (5–8 years), the HHS was 76.3 ± 4.2. A paired samples *t* test was used to compare means for HHS in the scheduled follow-ups, comparison between preoperative mean HHS and 6 months postoperative and with the last follow-up were significantly high with a *P* value of 0.00001.

One case had an intraoperative fracture of the ischium and acetabulum that necessitated fixation of the fracture and delaying arthroplasty for a second session, which was done 9 months later. There was no nerve palsy, transient or permanent, infection, or dislocation during the follow-up period. No patient developed deep venous thrombosis. No patient needed revision for aseptic loosening at the last follow-up.

Discussion

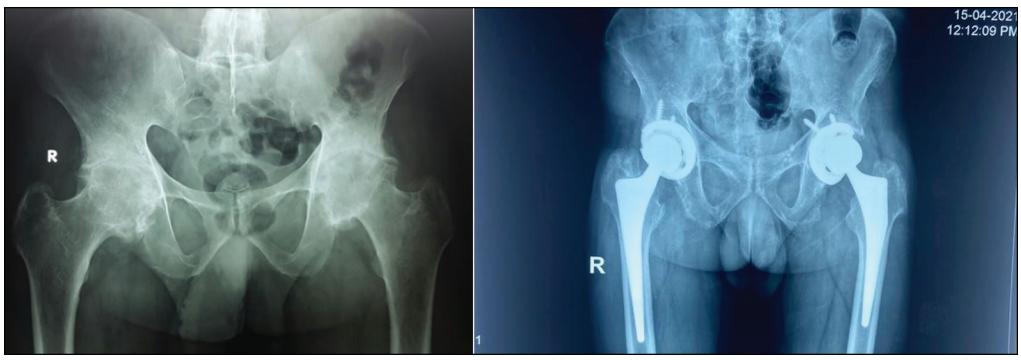
Indications for total hip arthroplasty in ankylosing spondylitis patients

In patients with nonfused hips, intense pain was the primary motivation for undergoing THA (six hips), with pain relief as the main expectation. Fourteen hips were fused, with problems of rigidity, deformity, and loss of mobility that even impaired household activities. The main goal of arthroplasty in those 14 patients was to solve the problems related to mobility and self-care. Patients with fused hip joints as a complication of AS can experience improved functionality after THA [7].

Anesthesia and surgical procedure

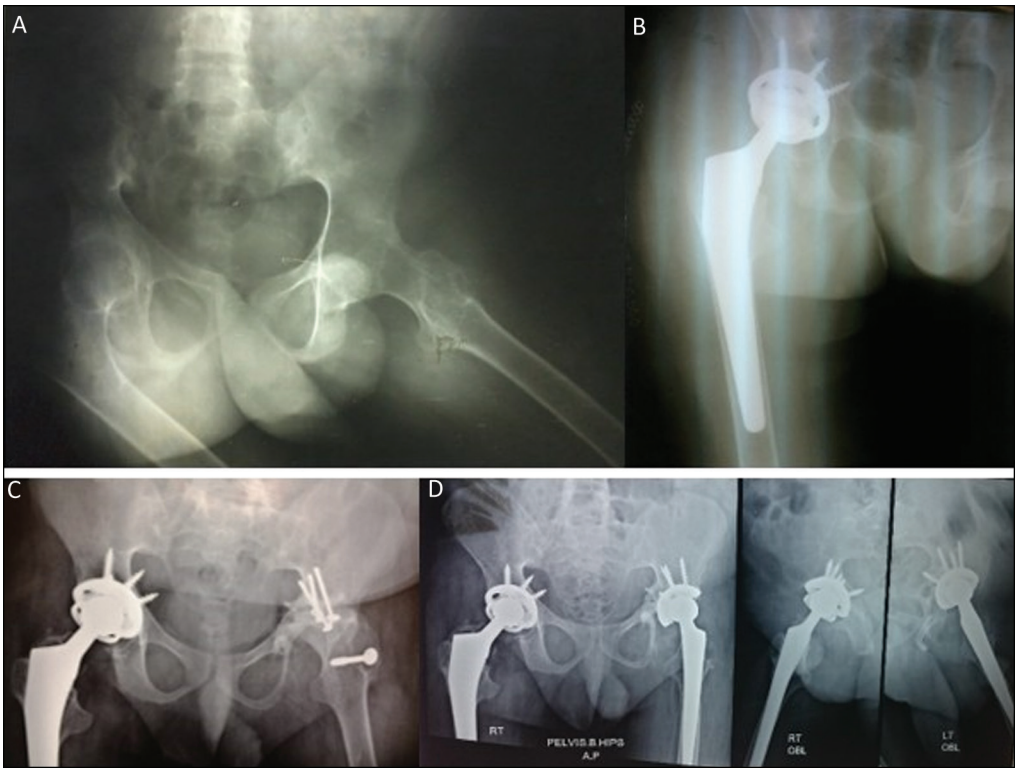
Regional anesthesia is not an option in patients with AS due to lumbar vertebrae ankyloses, leaving no space

Figure 2



Anteroposterior (AP) radiograph of the pelvis in 38-year-old male with AS. Right side: 8 years postoperative, left side: 2 years postoperative. AS, ankylosing spondylitis.

Figure 3



(a) Anteroposterior (AP) radiograph of the pelvis in 22-year-old male with AS with totally ankylosed hips (right hip in adduction, left hip in abduction). (b) Immediate postoperative for right side. (c) AP radiograph of the pelvis. Right side: 2 years postoperative, left side: immediate postoperative after intraoperative fracture complication. (d) Right side 4.7 years postoperative, left side: 2 years postoperative. AS, ankylosing spondylitis.

between vertebrae for the introduction of a spinal needle. A fibreoptic laryngoscope is necessary for intubation due to the restriction of neck extension and the risk of spine fracture with neck manipulation [8].

Almost all patients with AS experience fixed hip deformities, which complicates the exposure of the femoral head and neck. Although many surgical approaches can be used to perform THA in AS, a standard trans-trochanteric approach is recommended in some studies to prevent damage to the greater trochanter or posterior acetabular wall during resection of the femoral neck [9].

Brinker and colleagues utilized the posterior and Hardinge approaches in their series, while Feng *et al*. [4] employed the anterior and posterolateral approaches. Both studies reported favorable functional outcomes.

In our study, we used the lateral Hardinge approach in first case and trochanteric slide osteotomy in second case, which was complicated by fracture acetabulum and ischium. The complicated case had a fused hip in severe abduction and flexion deformity at 40° (the most severe deformity encountered in this series) (Figs 3a, c and 4).

We attributed this complication to the incorrect direction of the fusion osteotomy and the unavailability of an intraoperative image intensifier. The orientation of the neck osteotomy is determined by whether the hip is ankylosed in a flexed or extended position. For hips that are fused in a flexed position, the osteotomy should be higher on the anterior side of the neck. Conversely, for hips that are fused in an extended position, the osteotomy should be lower on the anterior side of the neck.

In the subsequent 18 cases, we used a posterior approach, and intraoperative imaging was a routine step in our procedure. Consequently, we did not have any intraoperative iatrogenic fractures.

Bangjian *et al*. [5] found that the use of a posterolateral approach during femoral neck osteotomy facilitates the exposure of anatomical structures such as the femoral neck and head, ischial tuberosity, and the posterior border of the acetabulum.

The primary challenge we encountered after performing the neck osteotomy was extracting the femoral head from the acetabulum. We started reaming *in situ* over the femoral head starting with the smallest reamer (36 mm reamer) until reaching the joint plane. Even in hips that

Table 1 Demography, Harris Hip Score, prosthesis type

No	Sex	Age at time of diagnosis	Age at time of operation	Side	FU in years	Preoperative HHS	HHS at last FU	Prosthesis
1	Males	16	22	Rt	8	0	81	DPY-Pinnacle Esc/Corail
2		16	25	Lt	5	0	72	Zimmer-Triology/FMT
3		20	24	Rt	7	17	77	DPY-Pinnacle/Corail
4		20	26	Lt	5	15	78	Stryker-Trident PSL/Accolade TMZF
5		25	35	Rt	7	23	84	Zimmer-Triology/CLS
6		25	37	Lt	5	18	81	Zimmer-Biomet Triology/Exception
7		19	20	Lt	7	17	83	Zimmer-Triology/CLS
8		19	22	Rt	5	15	81	DPY-Pinnacle/Corail
9		21	27	Lt	6	21	86	DPY-Pinnacle/Corail
10		22	26	Rt	7	17	84	Zimmer-Biomet Triology/Exception
11		22	28	Lt	5	18	79	Zimmer-Biomet Triology/Exception
12		23	27	Rt	5	12	77	Zimmer-Biomet Triology/Exception
13		23	27	Lt	5	15	84	Zimmer-Biomet Triology/Exception
14		18	21	Rt	7	15	84	Zimmer-Biomet Triology/Exception
15		18	23	Lt	5	17	83	Zimmer-Biomet Triology/Exception
16		22	24	Lt	7	21	81	Zimmer-Biomet Triology/Exception
17		22	27	Rt	5	18	84	Zimmer-Biomet Triology/Exception
18		19	21	Rt	7	18	83	Zimmer-Biomet Triology/Exception
19		19	23	Lt	5	21	81	Zimmer-Biomet Triology/Exception
20		23	21	Rt	5	15	73	Zimmer-Biomet Triology/Exception

HHS, Harris Hip Score; FU, follow-up; Lt, left; Rt, right.

Figure 4

Clinical photo showing windswept deformity in cases 1 and 2.

are completely fused, the pulvinar can be identified, indicating that the true base of the acetabulum has been reached, which was confirmed by the image intensifier. Reaming was carried out until the optimal size was achieved, after which a cementless acetabular cup was inserted. The majority of patients with AS tend to have a kyphotic spine with a compensatory posterior pelvic tilt with a subsequent increased acetabular anteversion [6,7]. These alterations in the pelvis biomechanics could potentially lead to increased concerns regarding the increased incidence of anterior dislocation following THA if the cup is placed in the standard position of anteversion (~20°). In this study, we positioned the acetabular components with less anteversion than typically used. We also increased the anteversion angle of the femoral prosthesis to achieve the required combined anteversion. After trial positioning of the components, stability was assessed in all directions.

Choice of total hip arthroplasty

Patients with AS typically exhibit the full spectrum of the disease and its complications at a young age, necessitating arthroplasty earlier in life. AS patients tend to have sagittal imbalance due to kyphotic deformity with a downward and forward shift of the center of gravity, which is compensated by extension of the hips, flexion of the knees, and plantar flexion of the ankles [8].

The abnormalities in the anatomy and biomechanics of patients with AS, along with their young age, can lead to higher rates of loosening and wear of THA components and negatively affect the prosthesis lifespan. So, choosing prosthesis is a critical issue to obtain satisfactory long-term outcomes regarding fixation and hip function. Yang *et al*. [9] found that AS patients have significant osteoporosis with associated loss of the upper femoral cortical bone, which results in morphological alterations in the proximal femur. Hence, their suggestion was to utilize cemented stems.

The use of cemented THA in patients with AS has been associated with positive outcomes in short to long term [10,11]. Other studies have shown significant improvement in clinical function, pain, posture, ROM, and ambulation after using cementless THA [1,3,4,6].

In the study we conducted, all patients received cementless THAs. All patients in our study experienced satisfactory to excellent outcomes postsurgery. These results are consistent with other findings reported in scientific literature for short to medium-term follow-ups. Notably, there was a significant enhancement in the patient's capacity to carry out daily activities and self-care. In all the patients, we utilized conventional primary cementless components for both the acetabulum and the femur, except one case (fist case in our series) where we used constrained liner (DPY-Pinnacle Esc constrained liner) (Fig. 3b–d) as the patient had windswept deformity with severe flexion and adduction deformity in the right hip and flexion and abduction deformity in the left side (Figs 3, 4).

We started by operating on the right adducted side to help the patient with self-care and perineal hygiene. Our concern was that the long-standing severe adduction deformity could lead to abductor insufficiency with stretch on the abductors. This could potentially have a negative impact on their excursion and the function of the abductor mechanism after arthroplasty. The fact that gluteus medius and minimus may be atrophied or replaced by fibrous tissue and fat in patients with AS [12,13] added to our concern regarding postoperative prosthesis stability, so we planned to use constrained liner in this case.

In this study, all patients had stable fixation of cementless prostheses, and no aseptic loosening of the cup or stem was encountered at the last follow-up. Our findings are in line with, and compare well to, other studies that have utilized cementless THA [1,2,4,6]. This may be attributed to the shorter follow-up in our study compared to others.

Different studies have reported that patients with AS experience substantial improvements in function and pain relief, ranging from good to excellent, following THA. Yim *et al*. [10] observed an increase in the average HHS from 58 points before surgery to 92 points after surgery. Kim and colleagues conducted THA on 19 (31 hips) patients who were diagnosed with AS. They observed that the HHS improved from 50 points before the operation to 87 points at the final follow-up [14]. Brinker *et al*. [3] noted that out of 20 patients with AS who underwent THA, 18 experienced complete or nearly complete relief from pain.

HO, a common complication in AS patients post-THA, may limit movement postoperatively [15]. In this study, no patient developed HO. Our results compare favorably with Thilak *et al*. [16], who reported HO in 14.9% (7/47 cases), and Saglam *et al*. [17], who reported 13.3% (14/59 cases). This may be attributed to the use of indomethacin as pharmacological prophylaxis against HO and the use of the posterior approach in 90% (18/20) of our cases. Numerous studies have found a lower occurrence of HO when using the posterior approach for THA, compared to the Hardinge direct lateral approach or other approaches such as the anterior, anterolateral, or trans-trochanteric approach. [18–22].

Some limitations to our study need to be acknowledged: first, the relatively small number of patients. Second, we did not compare our results with cemented THA. Third, continued long-term monitoring is necessary, but this presents a challenge due to the relatively low survival rate of AS patients, who often face additional health issues, including cardiovascular and gastrointestinal problems. Lastly, this is a retrospective study, which inherently introduces certain limitations, such as potential biases in data collection and analysis, which should be taken into account when interpreting the results.

Conclusion

THA in patients with AS presents a significant challenge for reconstructive hip surgeons. Although the procedure is technically demanding, the results are rewarding, leading to an improved quality of life for these patients. Furthermore, the rate of complications associated with this procedure is relatively low.

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Conflicts of interest

There are no conflicts of interest.

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