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Total Hip Replacement in Patients Younger than Thirty Years 7-10 Years Follow up

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Abstract

Background: Total hip replacement in patients of younger age with higher levels of activity increases the risk of loosening and mechanical failure.

Patients and Methods: Fifty patients 34 male and 16 (62 hips) with mean age of 24 years received a primary total hip replacement. The etiology for operation was juvenile rheumatoid arthritis in 10 patients, ankylosing spondylitis in 20, and posttraumatic hip arthritis in 20. Cementless total hip replacement was used in 36 patients (42 hips); hybrid (cementless cup and cemented stem) was used in 14 patients (20 hips). Merle d'Aubigne score was used for clinical evaluation preoperative and at the last follow up. DeLee and Charnley criteria of acetabulum were used to assess the acetabular stability. Gruen et al. zones of femoral stem were recoded to monitor loosening.

Results: The mean follow up duration was 9.5 years (range, 7 to 10.5 years). The mean pre-operative Merle d'Aubigne score was significantly improved from 6. 5 (SD 2.34) preoperatively to 16.5 (SD 1.56) 1-year postoperatively (P<0.001). Osteointegration of the stem was noted in 45 cases (57 hips) at the end one year of follow-up. By the end of follow up there were radiolucent lines in two to three of Gruen zones around the stem, and it was progressive in 10 patients without need of revision. Subsidence of more than 5 mm occurred in 8 hips 4 of them had revision and the other 4 were not revised until the end of follow up.

Conclusion: Total hip arthroplasty in very patients has an excellent long term results up to 89.7% survival after 10.5 years of follow up. We recommend other prospective studies with homogenous populations with the same pathology and the type of implant.

Keywords: Total hip; Arthroplasty; Young; Thirty years

Introduction

Secondary osteoarthritis in very young patients in the last decade has been treated using total hip arthroplasty with a proven long-term outcome [1]. Due to the underlying diseases in these young patients, the secondary osteoarthritis is often associated with loss of bone stock in the acetabular side (e.g. in developmental dysplasia of the hips and juvenile rheumatoid arthritis [2,3]. With the improvement of technology in total hip replacement (THR), it is accepted to perform (THR) in patients of younger age. The higher levels of activity among those patients increase the risk of loosening and mechanical failure [4]. The implant which can be used in the younger age group should have long-term clinical outcome easy revision without defect in bone stock. In the literatures there are few reports on (THR) in patients less than 30 years of age. Cemented prosthesis with advanced cementation techniques, cementless, hybrid prosthesis, metal-on-metal (THR) and resurfacing prostheses used in young patients and reported different rates of success [4-10]. Hydroxyapatite (HA) coating of cementless stem in THR is one of the methods to increase longevity of implantation [11,12].

Patients and Methods

The aim of this study was to evaluate clinical and radiological results of total hip arthroplasty in patients lower than thirty years of age and need of revision in a minimum of 7 years follow up.

In the period from January 2006 to July 2016, 50 patients (62 hips) received a primary total hip replacement. The etiology for operation was juvenile rheumatoid arthritis in 10 patients (Figure 1),

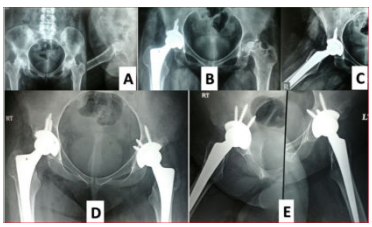

Figure 1: Female patient 19 years old with juvenile rheumatoid arthritis complaining of avascular necrosis and hip arthritis; A) Preoperative X-ray; B and C) X-ray after operating right side; D) X-ray after operating the left side; E) 3 years postoperative X-ray.

ankylosing spondylitis in 20 patients (Figure 2), and posttraumatic hip arthritis in 20 patients (Figure 3) (Table 1).

Figure 2: Male patient 22 years old with hip arthritis due to ankylosing spondylitis; A and B) preoperative X-ray; C) postoperative X-ray; D) 2 years postoperative X-ray.

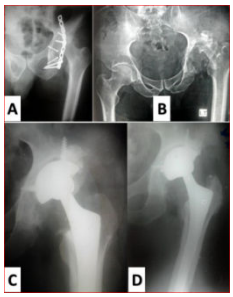

Figure 3: Male patient 24 years old with posttraumatic hip arthritis due to fracture acetabulum; A) X-ray after plate fixation of the acetabulum, B) X-ray after plate removal C) postoperative X-ray; D) X-ray 2 years postoperative.

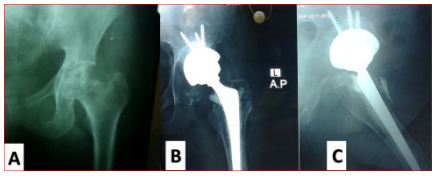

Figure 4: Male patient 27 years old with AVN head femur with hip arthritis due to rheumatoid arthritis; A) Preoperative X-ray; B and C) Postoperative X-ray with hybrid total hip replacement cementless cup and cemented stem.

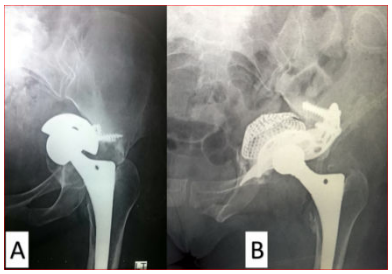

Figure 5: Female patient 29 years old (at time of first operation) with failure of the prosthesis (7 years after the operation of THR); A) Intrapelvic cup migration; B) X-ray after revision using acetabular reconstruction ring and cemented cup.

There were 34 male and 16 female with mean age of 24 years (range: 19-29) at time of surgery. The study began with 58 patients one of them died and 7 patients were lost during follow up, so the number of patients completed to last follow up are 50 patients. The right side was affected in 26 cases; the left in 12, and 12 patients were bilateral (Figures 4 and 5).

	Sex		Side affected			The etiology		
	Male	Female	Right	Left	Bilateral	Juvenile rheumatoid	Ankylosing spondylitis	Trauma
Number	34	16	26	12	12	10	20	20
Type of prosthesis					Bearing surface			
Cementless cup, stem		Hybrid (cementless cup, cemented stem)			Ceramic on ceramic	Ceramic on HC polyethylene	Metal on HC polyethylene	
36 (42 hips)		14 (20 hips)			20	6	36	

Table 1: Patients' data.

Surgical technique

All operations were performed at our institute after taking a written consent for operation and participation in the study. In lateral position and under epidural anesthesia all patients were operated on using lateral (Hardinage) approach. No trochanteric osteotomy needed in patients. Cementless total hip replacement was used in 36 patients (42 hips), hybrid (cementless cup and cemented stem) was used in 14 patients (20 hips). The stem was hydroxyl appetite coated in all cementless stems (42 hips). Third generation cementation technique (using cement gun, distal blug, and centralizer) was used in all cemented stems.

The bearing surface was ceramic on ceramic in 20 hips, ceramic on polyethylene high cross link in 6 hips and metallic head on polyethylene cup in 36 hips. The fixation of metallic shell of the

acetabulum was anatomic with screw fixation in all cases. The femoral heads were 28 mm in 36 hips, 32 in 26 hips. The mean time of operation was 100 minutes (range 80-130 minutes). Morcellized femoral head autografts was needed in 9 hips to fill bone defect of the acetabulum which classified according to American Academy of Orthopedic Surgeons (AAOS) as type II (cavitary defect).

Postoperative: The suction drain was removed 48-72 hours after operation. The low molecular weight heparins were used for prophylaxis in all patients from second day to 3 weeks postoperative. Indomethacin 50 mg daily for 7 days was administrated for prevention of heterotopic ossification. All patients were mobilized at the second postoperative day beginning with movements in bed then using two axillary crutches, then partial weight-bearing up to (2-3) months when full weight bearing were allowed.

Clinically: Merle d'Aubigne score was used for clinical evaluation preoperative and at the last follow up [13]. The Merle d' Aubigne score has 18 points of total score evaluating three items: pain, gait and mobility each item graded from 1 to 6. Excellent score (18 points), good score (15-17 points), fair score (12-14 points), and poor score when less than 12 points.

Radiologically, the serial plain X-rays (AP and lateral views of the hip and AP view of the pelvis) were assessed preoperatively and direct postoperative, then at 1.5 month, 3 months, 6 months, 1 year and annually up to the end of follow up. Brooker scoring system [14] was used to evaluate heterotopic ossification. Evaluation of the subsidence of the femoral component which measured by the vertical distance from lateral shoulder of the prosthesis to the tip of the greater trochanter (it was significant if more than 5 mm).

The bone remodeling, osteolysis and fixation of the stem were evaluated in serial X-rays [15]. DeLee and Charnley criteria of acetabulum were used to assess the acetabular stability [16]. Radiolucent lines in the three zones or migration more than 5mm in any direction is considered a radiographic failure. The stem alignment neutral, valgus or varus was recorded. Engh et al. [17] criteria were used to evaluate the fixation of the stem. Femoral bone remodeling was assessed and described as hypertrophy (cortical thickening), or atrophy (bone osteolysis around the prosthesis). Radiolucent lines were described if they were more than 2 mm wide and were defined as stable or as progressive lines in time. To evaluate the survivorship of the hips at the end of follow up, we used the Kaplan Meier method [18]. The primary end-point when revision of any the two components was done, and the secondary end-point was the clinical improvement of the patients.

Results

Clinically: The mean follow up duration was 9.5 years (range, 7 to 10.5 years). The mean pre-operative Merle d'Aubigne score was significantly improved from 6.5 (SD 2.34) preoperatively to 16.5 (SD 1.56) 1-year postoperatively ($P<0.001$). There were 22 patients with excellent score, 18 good, 6 fair, and 4 patients with poor results. At the end of the first year, pain relief and gait correction were recorded. Before the operation 16 patients had limited walking ability using a walker (32%), twenty patients (40%) had severe pain and were unable to walk, and 14 patients (28%) had moderate pain. Postoperatively, no pain or residual mild pain in 30 patients (60%), 12 patients (24%) had trochanteric pain and anterior thigh pain in 8 patients (16%). Residual limb shortening was detected in 18 patients with average of 20 mm and ranged 15 to 25 mm. DVT was proven by Doppler examination in five patients and all of them were treated medically. Thirty six patients (72%) had been able to walk freely outdoors using a cane or elbow crutch. Limited walking ability was found in 14 patients (28%) using two axillary crutches.

By the end of follow up we had revision in seven hips; six due to aseptic loosening at (8-9.5 years); and one due to implant failure after 3 years. This patient had intra-pelvic migration of acetabular cup and revision was done using acetabular reconstruction ring and cemented cup.

The radiographic results found in the all non-revised hips were recorded by the end of follow up. Twenty cups with radiolucent lines were observed and were progressive in 4 hips. Osteointegration of the stem was noted in 45 cases (57 hips) at the end one year of follow-up. By the end of follow up there were radiolucent lines in two to three of Gruen zones [19] around the stem, and it was progressive in 10 patients without need of revision. Subsidence of more than 5 mm occurred in 8 hips 4 of them had revision and the other 4 were not revised until the end of follow up. Bone atrophy in six stems was found in Gruen zones 1 and 7. Hypertrophy in endosteal bone was found around 29 stems in Gruen zone 4 and 5. Bone osteolysis was found in Gruen zones 1 and 7 around six stems, and around two stems in zone 2. The survival rate according to with a 10-year survival of 90%, the highest among similar studies in the published literature. Aseptic loosening was the only reason for revision.

Discussion

Orthopedic surgeons still have a challenge performing hip replacement in very young patients. Many factors as the underlying pathology, the deficiency in acetabular bone stock can affect the results. In those patients with younger age, the future revisions are inevitable. Preservation of bone stock and biological reconstruction of defects in primary surgery is very important in these situations [6-9]. In this study 9 hips with cavitary defect of the acetabulum were reconstructed with morcellized bone graft during primary operation.

In this study we had a survival rates of 88.7% by the end of 10.5 years. The reason for revision in 6 cases was aseptic loosening. The study included several patients with medical problems due to the underlying disease which affected the hip biomechanics and the patient's mobilization as juvenile rheumatoid and ankylosing spondylitis. In spite of these medical problems, the survival rates were comparable to the other similar reports in patients of older age with less requirements [15,20-23]. There was statistically significant improvement in clinical scores in all patients comparing the preoperative to the postoperative.

In the very young patients, there are different indications of THA which differ from those in older patients. The juvenile rheumatoid arthritis, ankylosing spondylitis, and posttraumatic osteoarthritis are the common indications for THA in the younger population in the literature [24-27].

There are few reports on the outcome of (THA) in young patients under the year of 30 with survival rates ranged from 49% to 95% [28-31]. The main reason for revision in all literature was aseptic loosening, but the majority of these studies are small number of cases and short-term follow up [32-34].

Girard et al. [35] reported on 896 patients in a large multicenter study. They evaluated factors influencing the revision rate of (THA) when performed in younger patients. Four factors had affected the rate

of revision: first: (the use of hard-on-soft bearings - Odds Ratio 3.42), second: (the younger ages at the time of primary surgery - Odds Ratio 1.14), third: (patients have more than two previous surgeries - Odds Ratio 5.41), fourth: (one dislocation at least occur after the primary surgery - Odds ratio 3.98).

The limited sample size, and different underlying pathology are the main limitation of this study. Putting in mind the relatively small number of cases doing THA in age younger than 30, this study has 50 patients (62 hips) with 7 – 10.5 years follow up is considered a useful study in evaluation of THA in patients younger than 30 years of age.

Conclusion

Based on the results of this study THA in very patients has an excellent long term results up to 89.7% survival after 10.5 years of follow up. We recommend other prospective studies with homogenous populations with the same pathology and the type of implant. The recent component designs of cementless implants with bearing surfaces as ceramic on ceramic implants can give more longevity and implant survival.

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