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Assessment of clinical and functional outcomes following uncemented total hip arthroplasty in failed primary hemiarthroplasty

Pavankumar H. Patil[1]*, Srinivas Pamarathi[2]

[1]Department of Orthopedics, Dr. B R Ambedkar Medical College, Kadugondanahalli, Bengaluru, Karnataka, India
[2]Sri Padmavati Medical College for Women, Alipiri Road, Tirupati, Andhra Pradesh, India

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***Correspondence:**
Dr. Pavankumar H. Patil,
E-mail: drpavanortho@gmail.com

ABSTRACT

Background: Modern hip replacement has resulted in huge benefit for patients with arthritic hip disease, providing them with reduction of pain, return of function and consequently an improved quality of life. Evaluation of long term outcomes of an operative procedure is important to determine the durability of the procedures like uncemented total revision hip arthroplasty. In the present study, clinical and functional outcome and complications of uncemented total hip arthroplasty in failed primary hemiarthroplasty was assessed.
Methods: Patients with failed primary hemiarthroplasty with Unipolar or Bipolar prosthesis (cemented and uncemented) due to aseptic loosening, protrusio causing groin pain, dislocation, breakage of implant leading to loss of function, periprosthetic fracture and acetabular osteolysis were included. During each visit, medical history was taken and physical examination was done. Range of movements (ROM) was recorded. The clinical and functional outcomes were evaluated by Harris Hip Score evaluation. Statistical analysis: Student's paired t-test was used to find out the significance of difference between pre-operative and post-operative Harris Hip scores.
Results: In 7 cases modular series was used for uncemented total hip arthroplasty, of which calcar replacement was done in 4 cases, and in one case constrained liner was placed. The maximum stem size used was 15mm and the minimum stem size 11mm. Stem size 11 was most frequently used. About 30% of the cases presented with pain postoperatively till the last follow-up, of which two cases reported mild pain with no effect on average activities and one case reported with moderate pain with some limitation of ordinary activity or work. The difference between the average pre-operative Harris Hip Score post-operative score was found to be highly significant (p=0.0001).
Conclusions: This study has shown excellent results following the uncemented modular total hip arthroplasty in failed primary hemiarthroplasty in terms of pain relief, increased walking distance, and functional capabilities of the patients.

Keywords: Radiological assessment, Total hip arthroplasty, Failed primary hemiarthroplasty, Acetabular inclination angle

INTRODUCTION

Arthroplasty had its inception in the mid-19th century when surgeons attempted to produce extra articular pseudoarthrosis by "simple resection arthroplasty" of ankylosed joints. Hemiarthroplasty (unipolar/bipolar) of the hip is a commonly performed procedure in elderly patients with intracapsular displaced fractures of the neck of the femur with good short term results with regard to pain relief, return of activity, morbidity and mortality. Although bipolar hemiarthroplasty has been advocated for fracture neck of femur and few arthritic conditions of the hip joint the results have not been very gratifying and

it has largely been given up in favour of Total Hip Replacement.[1]

Long term problems associated with hemiarthroplasty include progressive acetabular cartilage degeneration and concomitant groin pain, protrusio, stem loosening and subsidence, and very poor results have been reported in active patients.[2] Current evidence is emerging that total hip arthroplasty may be a better choice for patients of intra capsular fractures of the neck of the femur in elderly age group 60-75 years, who are mentally competent, relatively healthy, active, capable of living independently and have a long life expectancy.[3]

The indications for conversion of hemiarthroplasty to total hip replacement include - acetabular erosions and protrusio causing groin pain, femoral stem loosening and subsidence causing thigh pain and the typical 'start-up'pain, dislocation, breakage of implant leading to loss of function, periprosthetic fracture and infection. Conversion of hemiarthroplasty is associated with high complication rates and loosening rates as against primary total hip arthroplasty.[4]

Evaluation of long term outcomes of an operative procedure is important to determine the durability of the procedures like uncemented total revision hip arthroplasty. Patient derived outcome scales have become increasingly important to surgeons and clinical researchers for measuring improvement in function after surgery. It provides a means for comparision of the results of different clinical interventions which may lead to changes in operative technique and implant design over time.[5-7] The Harris hip score is most widely used scoring system for evaluation of clinical and functional outcome.

METHODS

This prospective and retrospective study was carried out on 20 patients of revision total hip arthroplasty operated in the tertiary care hospital, Balaji Institute of Surgery, Research and Rehabilitation for the Disabled (BIRRD) Tirumala Tirupati Devasthanams, Tirupati, Andhra Pradesh. This work was carried out between March 2014 to January 2016. Information on the patients was compiled from clinical details, case files and operation theatre records. Patient follow up was done for a minimum of 6 weeks to maximum of 24 months.

Patients with failed primary hemiarthroplasty with Unipolar or Bipolar prosthesis (cemented and uncemented) due to aseptic loosening, protrusio causing groin pain, dislocation, breakage of implant leading to loss of function, periprosthetic fracture and acetabular osteolysis were included. Patients with total hip arthroplasty with internal fixation of proximal femoral fractures and infected primary hemiarthroplasty (cemented or uncemented) were excluded.

Clinical assessment

Detailed history and proper clinical examination was done to find out – duration of illness, focus of infection in the body, sensory and motor examination, vascularity of the limb, ambulatory status of the patient, and deformities of the hip, Range of Movements (ROM) of the hip, limb length discrepancy and status of the other joints. The deformity, range of movements (ROM) and limb length discrepancy were measured for all the patients in the standard proforma made for each patient. All the patients were assessed using Harris hip score.

All surgeries were performed with absolute aseptic precautions in our operation theatre. In all cases a dose of intravenous antibiotic (ceftriaxone) was given prior to the incision. All patients were operated under combined spinal and epidural anaesthesia. In the present study, the posterior approach (Moore's) also labelled as "The Southern Exposure" was followed.

Exposure and preparation of the acetabulum

Using a trial cup impactor, a trial cup sizer is placed into the reamed acetabulum and assessed its position and cortical bone contact before the insertion of the acetabular component; ensure that the patient remains in true lateral position. The inferior rim of the trial cup should be level with bottom of the tear drop (the transverse acetabular ligament can also be taken as a guide). The trial cup angle of orientation should be normally 45 degrees of lateral opening (abduction) and 15-30 degrees of anteversion. The cementless regular or multihole cup was placed into the reamed acetabulum and stabilised by two or three screws in posterosuperior quadrant after attaining a presssfit, and desired liner is placed.

Exposure and preparation of the femur

The proximal femur was exposed markedly by internally rotating the femur so that the tibia is perpendicular to the floor, allowing the knee to drop towards the floor, pushing the femur proximally. Retract the posterior edge of the gluteus medius and minimus to expose the pyriform fossa, any remnant of the soft tissue was removed from the posterior and lateral aspect of the neck. A groove was made in the medial aspect of the greater trochanter to allow proper axial reaming of the canal.

If resistance is felt during insertion of the broach, then the area of impingement is most likely distally within the diaphysis. The distal canal was opened with a hand reamer or drill thus perforating the sclerotic bone at the tip of the loose prosthesis and utmost care was taken to avoid the tendency to go through the path of least resistance, which may have caused a cortical perforation. The canal was then prepared according to the hip system being used in a particular patient.

In patients where regular corail cementless femoral stem was used, beginning with the smallest size broach, with insertion in approximately 15 degrees of anteversion in relation to the axis of the flexed tibia. Maintaining correct alignment as the broach is inserted, alternatively impact and extract the broach to facilitate its passage. Use of progressively larger broaches to crush and remove cancellous bone in the proximal femur was done. Countersink the final broach approximately 2mm below the provisional femoral neck. The top of the cutting teeth resting the final broach should feel rotationally stable. Unlocking the broach handle and with the desired neck segment and head attached to the broach, we performed a trial reduction and evaluated the range of motion.

With the hip in 90 degrees of flexion and 0 degrees of abduction, internal rotation should be atleast 45 degrees with no tendency to dislocate. In extension, there should be full external rotation with no tendency to dislocate or impinge. Combined anteversion test measures the angle of internal rotation required for the femoral head to be coplanar with the face of the acetabulum with 10 degrees of flexion and 10 degrees of adduction. Combined anteversion of the socket and femoral head should be approximately 45 degrees to attain limb in neutral position and to prevent dislocation. The broach size and offset options of the desires components was noted. Dislocate the hip and remove the trial head, neck segment and broach by attaching the broach handle and a thorough saline wash was given before final reduction.

Implant insertion

In patients where regular corail cementless stem is used, the corail pressfit femoral stem attached with neck segment of the appropriate size is fixed into the femoral canal maintaining 15 degrees anteversion and femoral head is attached and fixed to the neck and the head of the prosthesis is reduced into the prepared acetabulum and range of motion is evaluated. In patients where Modular multi componenent system is used, the stem segment, metaphyseal segment, calcar segment (if required) and neck segment of the required size was assembled, the fluted stem segment fixed to metaphyseal and neck segment using a screw maintaining required anteversion and the assembled implant was fixed into the femoral canal and femoral head of required size is attached and fixed to the neck and finally the head of the prosthesis is reduced into the prepared acetabulum.

Test for motion and stability

Following reduction of the prosthesis into the socket, the hip is tested in flexion, abduction, adduction and rotations. The coverage of the femoral head and its relation to the cup is then evaluated with the hip in neutral position.

Post-operative protocol

Both the limbs were kept in abduction with a pillow in between the legs. Post-operative analgesia was adequately given in the form of epidural analgesia. Injectable antibiotics were used for 5 days, and then converted to oral antibiotics till suture removal. First post-operative day, check x-rays are taken. The patient is taught static quadriceps exercises; knee and ankle mobilisation exercised and made to sit. Epidural catheter removed after 24 hours and low molecular weight heparin (fragmin) was given subcutaneously for 10 days for prevention of thromboembolic events (deep vein thrombosis).

Second post op day, primary dressing was done and suction drain is removed and physiotherapy continued. Gradual weight bearing walk with walker was started from 3rd post op day after evaluation of post op check x-rays. In patients with trochanteric slide osteotomy of proximal femur, non-weight bearing was advised for first 6 weeks, followed by partial weight bearing and gradually full weight bearing in 3-6 months depending on clinical and post-operative radiological assessment of the operated hip. In patients with split fracture of proximal femur and fracture greater trochanter occurred intraoperatively during the process of metaphyseal reaming or during reduction of the prosthesis where circumferenial stainless steel wiring of proximal femur and tension band wiring of greater trochanter was done, in these cases, non-weight bearing was advised for 3 weeks followed by gradual weight bearing in 6 – 12 weeks depending on the assessment of post op x-rays at regular intervals. Alternate sutures are removed on 10th post op day and complete suture removal done on 12th post op day and patients were discharged on the same day with review after 6 weeks.

The patients were followed up at 6 weeks, 3 months, 6 months, one year and at yearly intervals. Patient follow up was for a minimum of 3 months to maximum of 24 months (2 years)

Clinical assessment

During each visit, medical history was taken and physical examination was done. Range of movements (ROM) was recorded. The clinical and functional outcomes were evaluated by Harris Hip Score evaluation.

Statistical analysis

Student's paired t-test was used to find out the significance of difference between pre-operative and post-operative Harris Hip scores. $P<0.05$ was considered the level of significance.

RESULTS

All the patients in the present study returned for clinical and radiological examinations subsequently. Patients were reviewed after 2 months, 4 months, 6 months, 12 months, 18 months and 24 months postoperatively. Male patients constitute 66.66% in our study group (Table 1). Age of patients in the present study ranged between 56 years to 70 years. Majority of the patients are in the middle age group with high functional demands (Table 2).

Table 1: Gender distribution of the patients recruited in the study.

Sex	No.of cases	%
Male	8	66.66
Female	4	33.33

Table 2: Age wise distribution of the patients recruited in the study.

Age group	No. of cases	%
50 – 59	3	25
60 – 69	7	58.33
70 – 79	2	16.66

Table 3: The various indications for the revision of uncemented total hip arthroplasty in failed primary hemiarthroplasty.

Indication	No. of cases	%
Hemiarthroplasty with AMP with arthritic pain	2	16.66
Hemiarthroplasty with AMP with protrusio/ loosening of prosthesis	2	16.66
Hemiarthroplasty with AMP with periprosthetic fracture	1	8.33
Bipolar hemiarthroplasty with pain and prosthesis loosening	6	50
Bipolar hemiarthroplasty with prosthetic fracture	1	8.33

Table 4: Pre-operative duration from the primary hemi arthroplasty.

Duration (No. of years)	No. of cases	%
1 – 2	2	16.66
2 – 3	3	25
3 – 4	-	-
4 – 5	2	16.66
5 – 6	1	8.33
6 – 7	1	8.33
7 – 8		
8 – 9	-	-
9 – 10	2	16.66
10 – 11		
11 – 12	1	8.33

Table 5: Pre-operative duration from the primary hemi arthroplasty.

Type of implant	No. of cases	%
Modular series of uncemented Total Hip Replacement	7	58.33
Uncemented regular Total Hip Replacement	5	41.66

Table 6: Stem sie in different cases of primary hemi arthroplasty.

Stem size	No. of cases	%
11 mm	5	41.66
12 mm	1	8.33
13 mm	3	25
14 mm	1	8.33
15 mm	1	8.33

The main indication for surgery was pain in all the patients associated with the problems related to the implant used in primary hip arthroplasty (total or hemi arthroplasty) is shown in Table 3. About 50% of cases in the present study who undergone uncemented revision total hip arthroplasty are less than 5years old of post-operative case of primary hemiarthroplasty (Table 4). In 7 cases modular series was used for uncemented total hip arthroplasty, of which calcar replacement was done in 4 cases, and in one case constrained liner was placed (Table 5). The maximum stem size used was 15mm and the minimum stem size 11mm. Stem size 11 was most frequently used (81.25%, Table 6).

Table 7: Number of case with femoral head for primary hemi arthroplasty.

Femoral head size	No. of cases	%
28	10	83.33
32	2	16.66

Table 8: Number of case with acetabular component (shell size/crown cup) for primary hemi arthroplasty.

Shell size	No. of cases	%
48	1	8.33
50	2	16.66
52	4	33.33
54	3	25.0
56	1	8.33
58	1	8.33

In 10 patients we used head size 28 and in 2patients, head size 32 was used (Table 7). In majority of the cases in our study where modular prosthesis was used, neck segment with high offset was used and in few cases where regular corail stem was used, neck with standard offset was preferred. The maximum shell size used was 52 and the

minimum shell size 48. In majority of the patients shell size 52 and 54 was used in our study (Table 8). About 30% of the cases presented with pain postoperatively till the last follow-up, of which two cases reported mild pain with no effect on average activities and one case reported with moderate pain with some limitation of ordinary activity or work. Two cases presented with anterior thigh pain and one case with foot drop which was not recovered till their last follow-up (Table 9). The average pre-operative Harris Hip Score was 45.25 and the Harris Hip Score at most recent follow-up was 81.66. It was found to be highly significant (p=0.0001). The result was excellent in 3 patients, Good in 5 patients, fair in 2 patients and poor in 2 patients (Table 10).

Table 9: Number of cases with various complications encountered postoperatively in primary hemi arthroplasty.

Complication	No. of cases	%
Deep vein thrombosis	Nil	0
Dislocation	1	8.33
Infection	Nil	0
Hoof stress fracture	Nil	0
Periprosthetic fracture	Nil	0
Loosening	Nil	0
Pain in the operated hip	3	25
Limb length discrepancy (>2 cms)	4	33.33
Nerve injury	1	8.33
Anterior thigh pain	2	16.66
Heterotopic ossification	nil	0

Table 10: Details of harris score in different cases recruited for primary hemi arthroplasty.

No. of cases	Pre-op score	Post-op score (at last followup)	P value
1	48	78	P=0.0001
2	39	92	
3	58	84	
4	42	82	
5	47	80	
6	49	84	
7	31	70	
8	72	90	
9	32	70	
10	51	92	
11	45	74	
12	29	84	

DISCUSSION

The purpose of the present study was to review the clinical results of uncemented revision total hip arthroplasty in cases with failed hemiarthroplasty. The technique of revision was constant throughout the study period and involved the use of modular prosthesis in the majority of the patients (58.33%). It was hoped that the use of components without cement would partially eliminate the problems associated with revisions performed with cement.

The present prospective and retrospective study comprising of 12 patients. The mean age of patients in the group is 59.53 years, which is comparable to the study done by Engelbert and his colleagues who reported the results in 134 patients mean age of 59.2 years.[8] The average pre-operative Harris Hip score in our study is 45.25 which is similar to the pre-operative average Harris Hip score in the studies done by Mulliken and his colleagues.[9] They studied 52 cementless total hip arthroplasties in 51 patients with average pre-operative Harris Hip score of 46. Valle and his associates studied 131 patients of cementless acetabular reconstruction in revision total hip arthroplasty with average pre-operative Harris Hip score of 49.[10]

In the present study the average pre-operative Harris Hip score of 45.25 improved to 81.66 post operatively at last follow-up. The increase in Harris Hip score is attributed to the surgical technique, type of the implant used, post-operative care and physiotherapy advised to the patients. The post-operative Harris Hip score observed in our study is comparable to the study conducted by Valle and his associates who reported increase in the Harris Hip score from 46 points pre operatively to 80 points at the most recent evaluation. It is also comparable to the study conducted by Peters and his colleagues who reported improvement from 54 points preoperatively to 84 points at the time of the latest follow-up.[11]

In our study excellent results were obtained in 25% of the cases, good in 41.66%, fair in 25% and poor in 8.33%. 26/32 (81.25%) patients could walk unlimited distance, 9 (75%) patients walked without support, 7 (58.33%) patients could use public transport. 90% of the patients who were employed prior to the surgery returned to work. 8 patients were completely pain free and 3 patients complained of slight pain and 1 patients with moderate pain. Headley and his colleagues reported the results of 136 cementless revision arthroplasty performed for various failed hip arthroplasties, 56 hips of the uncemented total hip series were rated clinically excellent or good, 3 hips were rated fair, and 3 were considered poor. In the 35 cases with uncemented PCA sockets (porous coated anatomic component), 34 hips were rated clinically excellent or good and one was rated poor.[12]

Engelbrecht and his colleagues reported the results of 138 revision hip arthroplasties in 134 patients. 123 (92%) reported satisfactory reduction of pain, the others being unhappy with the degree of pain relief. In our study, the results were similar to the study done by Christopher L. Peters and Valle but long term follow-up is awaited.[10,11]

Extended slide trochanteric osteotomy was done for 2 patients in our study (2 cemented bipolar) and closed by circumferential stainless steel wiring at three levels. The extended slide trochanteric osteotomy allows extensive acetabular and femoral exposure, facilitates removal of distal cement or a well fixed porous-coated stem, and allows reliable attachment and healing of the trochanteric fragment. Union of the osteotomy site with callus formation was noticed in all patients at last follow up. Chen and his colleagues reviewed the results for 46 hips in 45 patients who underwent a revision total hip arthroplasty with an extended slide trochanteric osteotomy between December 1991 and December 1996.[13] At a mean of 44 months after operation, the rate of union of the distal osteotomy site was 98% (44 of 45 hips), with no change in the femoral component position, which is comparable to our study. The limitation in our study is a relatively short follow-up and therefore we could not come to a conclusion about the late complications and long term results of uncemented revision total hip arthroplasty.

CONCLUSION

This study has shown excellent results following the uncemented modular total hip arthroplasty in failed primary hemiarthroplasty in terms of pain relief, increased walking distance, and functional capabilities of the patients. Splintering of the proximal femur occurred in few cases during trial reduction and it was stabilised by circumferential stainless steel wiring before placement of the final implant provided stable situation in the proximal femur.

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