# **Original Research Article**

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# **Evaluation of results of primary cementless total hip arthroplasty in osteoarthritis**

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#### **ABSTRACT**

**Background:** Total hip arthroplasty involves removal of diseased bone and soft tissue from both femoral and acetabular side and replacing it with mechanical components. It is one of the most successful surgical procedures. It relieves pain and functional disability experienced by patients with moderate to severe osteoarthritis of the hip, improving their quality of life. The success of THA is its ability to relieve the pain, while maintaining both mobility and stability of the joint. The purpose of this study was to evaluate the results of primary cementless total hip arthroplasty in patients with hip osteoarthritis.

**Methods:** This study was done in a tertiary care teaching hospital. Thirty patients with hip osteoarthritis who were treated with cementless total hip arthroplasty were included in the study. This was a prospective study with a minimum of 12 months follow up (maximum of 25 months). The patients' pre-operative and post-operative pain and functional status was compared using Harris hip score.

**Results:** Excellent or good pain relief and function was obtained in 83.33% of cases. The mean total pre-operative Harris Hip Score was 32.93 which improved to 88.967 post-operatively. There was a statistically significant improvement in all parameters except absence of deformity. The most common complication was persistent anterior thigh pain that occurred in two patients.

**Conclusions:** Our study suggests that the current generation of cementless implants provide satisfactory clinical and radiographic outcomes. Though the study was not free of complications, the overall clinical and radiological outcome showed encouraging results.

Keywords: Arthroplasty, Hip, Osteoarthritis, Replacement

#### INTRODUCTION

Osteoarthritis is a disease affecting the joint cartilage and subchondral bone. The disease is now considered to involve the entire joint, including ligamentous and muscular changes, as well as synovial inflammation. Patients describe symptoms that include joint pain, stiffness, and decreased range of motion. The first line of treatment is non-surgical consisting of patient education, analgesics, weight loss, and physiotherapy. Operations

for osteoarthritis can be divided into two groups.<sup>2</sup> First, operations that preserve the patient's own hip joint, such as excision of osteophytes and curettage of cysts, osteotomies, and muscle release, and second, operations that reconstruct the hip joint, such as arthrodesis, hemiarthroplasty, resurfacing arthroplasty and total hip arthroplasty.

Among these surgical options, the ultimate contemporary surgical solution for severe Osteoarthritis of the hip is

total hip arthroplasty.<sup>3,4</sup> The 1994 National Institutes of Health Consensus Statement on total hip replacement concluded that THA is an option for nearly all patients with diseases of the hip that cause chronic discomfort and significant functional impairment.<sup>5</sup> The report states that the aims of THA are relief of pain and improvement in function. Further, candidates for elective THA should have radiographic evidence of joint damage and moderate to severe persistent pain or disability, or both, that is not substantially relieved by an extended course of nonsurgical management.

Total hip arthroplasty results in pain relief, functional recovery, and improved quality of life.<sup>6</sup> Cemented total hip arthroplasty is still more common, but uncemented total hip arthroplasty is gaining in popularity.<sup>7,8</sup> Potential advantages of cementless over cemented total hip arthroplasty are, shorter operating time, reduced risk of infection, significantly reduced risk of aseptic loosening and hence reduced revision rates and avoidance of cement related complications.<sup>9-11</sup>

The aim of study was to evaluate the results of primary cementless total hip arthroplasty in osteoarthritis.

#### **METHODS**

This study was done in a tertiary care teaching hospital. Thirty patients were taken up for the study. We included the patients of age above 20 years, both Sexes, Patients with clinically and radiologically documented hip osteoarthritis, not responding to conservative measures and Dorr Type A or Type B femur. The patients with any evidence of an active infection, Dorr Type C femur and Patients having any medical contraindication to surgery were excluded.

On admission detailed history and examination with emphasis on the patient's age, sex, preoperative diagnosis, level of activity, and mental status; involvement of other joints; conditions precluding the use of crutches or walker; medical problems; and fever in the pre-operative period was noted. Any limb length discrepancy, range of motion changes and any deformity, if present, was recorded and hip function was assessed as per modified Harris Hip Score (HHS).

Investigations were done. If the acute phase reactants were elevated i.e. ESR greater than 30mm/h and CRP greater than 10mg/L, a presumptive diagnosis of infection was made and surgery was deferred. Radiograph of the pelvis AP view with both hips and at least proximal 7 cms. of femur in addition to lateral view were done. The AP views were obtained with the patient lying supine on the table with the hips in 10° to 15° of internal rotation. Templating was done to assess proper size of implant.

Most of the cases were done under combined spinal epidural anaesthesia.

The patient was then placed in the lateral decubitus position on a standard operating room table. After scrubbing and painting and draping, hip was approached via posterolateral (Gibson) approach. The hip was then dislocated posteriorly. An osteotomy of the femoral neck was done as determined by preoperative templating, using the femoral neck cutting guide. The acetabulum was prepared by reaming. An acetabular component that was oversized by 1-2 mm over the last reamer was used, so that it can be press-fit into position. Augmentation of fixation with postero-superior quadrant screws was done at the discretion of the operating surgeon. The acetabular prosthetic shell was positioned between 15 to 25 degrees of anteversion and 40 to 45 degrees of inclination, after ensuring that the patient was in the true lateral position. The femoral canal was then prepared for femoral component. A trial neck and head was fitted onto the broach trunnion and the femoral component was reduced back into the acetabulum.

Assessment of stability of the hip was done. If the hip was stable, the trial components and broach were removed. The appropriate sized femoral component was inserted. The prosthetic head of appropriate size and neck length were placed onto the stem. The hip was again reduced and stability was assessed by moving the hip through a functional range of motion. The wound was closed in layers, with posterior capsular repair, over a suction drain and abduction splint was applied on table.

Post-operatively, Patients were put on I.V. antibiotics for two days followed by oral antibiotics for 3 days. Check X-rays were taken on 1st post-op day. Deep vein thrombosis (DVT) prophylaxis was started on 1st post-op day. And physical therapy program were started from 1st postoperative day. Patients were advised to ambulate using a walker/crutches with touchdown weight bearing started from the first postoperative day onwards and a progressive weight bearing program was started.

Suction drain was removed on 2nd post-op day and antiseptic dressing applied which was changed after every two days. Stitches were removed on the 10th or 12<sup>th</sup> postoperative day. On discharge patients were advised:

Not to combine two or more of the following movements: bending way over, turning toes inward, twisting body. When lying on side, making sure to have a pillow between the knees. Not to sit on a low toilet (Indian toilet) and use an elevated toilet seat.

Post-operative follow up was done at 2, 6, 12 weeks, 6 months and final follow up at 1 year, both clinically and radiologically. Final assessment of all patients treated by total hip arthroplasty was done by modified Harris Hip Scoring system.<sup>12</sup>

The radiographs that were made at the time of final follow-up were analysed for loosening of the implant.

#### **RESULTS**

This study was conducted on 30 patients with age ranging from 22 to 74 and a mean age of 50.4 years at the time of surgery. 8 patients were less than 40 years old, 9 were greater than 60 years old while 13 were 40-60 years old. In our study, 17 patients were male and 13 were female. Out of these 30 patients with osteoarthritis, 17 (57%) has this secondary to AVN, 10 (33.3%) patients had primary/idiopathic osteoarthritis. And 1 each had osteoarthritis secondary to rhematoud arthritis, tuberculosis, and developmental dysplasia. Out of the total 30 patients, 18 had a right sided involvement. The average duration of surgery in our study was 90 minutes.

The minimum duration of surgery was 70 minutes and the maximum was 130 minutes. The minimum follow up in our study was 12 months and maximum was 25 months. The average follow up was 17.56 months.

We used a metaphyseal fitting, proximal circumferentially plasma sprayed stem for this study. Stem sizes 10 and 12 were the most commonly used in this study.

Table 1: Femoral stem size.

Stem size	Frequency	Percent
5	4	13.33
7.5	1	3.33
9	3	10.00
10	7	23.33
11	4	13.33
12	7	23.33
13	1	3.33
14	3	10.00
Total	30	100

#### Femoral head

In 21 (70%) patients we used a size 36 head. 0 was the most commonly used head offset (56.67%).

Table 2: Head size.

Head Size	Frequency	Percent
28	9	30
36	21	70
Total	30	100

# Acetabular component

We used a full hemispherical, modular, porous coated metal shell with a highly cross linked polyethylene liner. The minimum shell size used was 44 and the maximum was 60. The most commonly used shell size was 50.

Table 3: Shell size.

Shell size	Frequency	Percent
44	2	6.67
46	2	6.67
48	1	3.33
50	7	23.33
52	5	16.67
54	4	13.33
56	5	16.67
58	1	3.33
60	3	10
Total	30	100

#### Liner

The liner size used corresponded to the size of the head. Size 36 was the most frequently used.

Table 4: Pre and post-op scores according to the various parameters of the Harris hip score.

		N	Mean	Std. Deviation	Min	Max	'p' value
Pain	Pre	30	11.67	3.742	10	20	<0.001
raiii	Post	30	41.33	4.7946	30	44	<0.001
Function-Gait	Pre	30	10.233	8.1099	0	27	<0.001
runction-Gait	Post	30	27.1	4.31	13	33	<0.001
Function Activity	Pre	30	5.267	2.42	0	10	<0.001
Function-Activity	Post	30	12	1.3896	10	14	<0.001
Absence of	Pre	30	3.467	1.327	0	4	0.248
Deformity	Post	30	4	0	4	4	0.248
ROM Score	Pre	30	2.3	1.3684	0	4	<0.001
KOW Score	Post	30	4.667	0.4795	4	5	<0.001
Total Score	Pre	30	32.93	12.72	16	65	<0.001
Total Score	Post	30	88.967	6.9256	76	100	<0.001

#### Outcome

N represents the total number of patients included in the study. We used the Wilcoxon signed ranks and the McNemar tests to determine the p-value. For the total score and each of the parameters, higher score implies lesser disability. The mean pre-operative score was 32.93, the maximum score being 65 and the minimum being 16. Postoperatively the mean total score was 88.967, with 76 being the minimum and 100 being the maximum. With regards to the different parameters in the scoring system i.e. pain, gait, functional activity and ROM, there was a statistically significant improvement in the post-operative score when compared to the pre-operative score. But no statistically significant difference was found in the parameter- absence of deformity, post-operatively. This implies that most of the patients did not have any severe deformities pre-operatively.

Results assessed by the Harris Hip Score are graded as follows: 90-100 as excellent, 80-89 as good, 70-79 as fair and less than 70 as poor. Pre-operatively 100% of the

patients had a poor score. The results showed a significant improvement, wherein 83.33% of the patients had an excellent or good score post-operatively. No patient had a poor score post-operatively.

#### Outcome analysis

Table 5: Comparison of the pre-versus postoperative scores according to grading.

Grade	Pre-operative	Post-operative
Poor (0-69)	30 (100%)	0 (0%)
Fair (70-79)	0 (0%)	5 (16.67%)
Good (80-89)	0 (0%)	9 (30%)
Excellent (90-100)	0 (0%)	16 (53.33%)

## Final outcome according to indication for surgery

Out of the 17 patients who had a pre-operative diagnosis of AVN, 16 i.e. 94 % had a good or excellent result. 70% of the patients with idiopathic osteoarthritis had a good or excellent result.

Table 6: Outcome according to indication.

Outcome	Indication					— Total
Score	AVN	OA	DDH	RA	TB	Total
Fair	1 (5.88%)	3 (30%)	0	1 (100%)	0	5 (16.67%)
Good	6 (35.3%)	1 (10%)	1 (100%)	0	1 (100%)	9 (30%)
Excellent	10(58.82%)	6 (60%)	0	0	0	16 (53.34%)

# Post operative acetabular cup angle

In our study, the average acetabular inclination angle was  $49.77\pm8.003$ . Out of a total of 30 cups, 13 of the cups had an inclination angle of 50-59 degrees. The maximum angle of inclination was 65 degrees and the minimum was 31 degrees.

Table 7: Acetabular cup angle v/s outcome.

Acetabular	Enggionar	Outco	Outcome score			
angle	Frequency	Fair	Good	Excellent		
30°-39°	4 (13.33%)	2	0	2		
40°-49 °	10 (33.33%)	3	1	6		
50°-59 °	13 (43.33%)	0	6	7		
60°-69°	3 (10%)	0	2	1		

43.75% of the patients with an excellent score had an abduction angle between 50-59 degrees. All of those with a fair outcome had an abduction angle between 30-49 degrees.

Lewinnek and co-workers used a pelvic co-ordinate system with an anterior pelvic plane in order to define the so called "safe zone." They suggested a  $40^{\circ}\pm10^{\circ}$  inclination angle. Hirakawa et al. suggested that an inclination angle of less than  $40^{\circ}$  is associated with better

long term results and fewer complications as compared to an angle of 45° or above. With a cup angle greater than 45°, a 90% mechanical failure rate was seen 15 years after cup implantation.

In 16.67% of the patients, the femoral stem was implanted in a varus position. We had no valgus placements of stem in this study. Rest, 83.33% were central.

Three patients had shortening on the operated side postoperatively, two had shortening less than 1 cm. There was lengthening of the operated limb in 8 patients in our study, 6 had lengthening of less than 1 cm. The mean lengthening was 0.56 centimetres (range: 0.2-1.5 cm).

In our study, there was complications persistent anterior thigh pain occurred in 2 (6.67%) patient, superficial wound infection and heterotopic ossification occurred in 1 each (3.33%).

# **DISCUSSION**

Total hip arthroplasty is regarded by many to be the ultimate contemporary solution to osteoarthritis of the hip. It relieves pain and functional disability experienced by patients with moderate to severe osteoarthritis of the

hip, improving their quality of life. The age of the patients, in our study of 30 cases, ranged from 22 to 74 with a mean 50.4 years. The mean age of our study is comparable to other studies. In our study, male patients

made up 56.67% of the study population. Our study is compatible with the study of Archibeck et al. and Kim et al. in showing a male preponderance.<sup>15-18</sup>

Table 8: Mean age of surgeries.

Study	Kim et al. 15	Archibeck et al. 16	Mont et al. <sup>17</sup>	Kim et al. 18	Present study
Mean age (years)	48.4 (19-85)	52 (31-69)	39.9 (15-61)	46.8 (21-49)	50.4 (22-74)

In our study of 30 patients with Osteoarthritis of hip, osteoarthritis secondary to avascular necrosis of the femoral head was the most common cause (56.67%) followed by primary osteoarthritis (33.33%).

The results in our study show osteoarthritis secondary to avascular necrosis of the femoral head to be the most common diagnosis at the time of surgery. Our results are

similar to Kim et al.<sup>15-18</sup> Our results are different from those of Archibeck et al. and Hailer et al., which may reflect a different epidemiological pattern of disease in the Asian population as compared to the Caucasian population.<sup>16-18</sup> The Harris hip score was graded into excellent, good, fair or poor, as described by Marcheti et al.<sup>19</sup> In our study, excellent or good results were obtained in 83.33% of the patients.

Table 9: Aetiology of hip osteoarthritis.

Study	Archibeck et al <sup>16</sup>	Kim et al <sup>15</sup>	Hailer et al <sup>8</sup>	Kim et al <sup>18</sup>	Present study
	Idiopathic 61%	AVN 58%	Idiopathic 78%	AVN 65.8%	AVN 56.67%
	AVN 22%	DDH 14%	Fracture 13%	Idiopathic 15.2%	Idiopathic 33.33%
	RA 9%	Post Septic or TB 12%	Inflammatory disease 4%	Post septic 10.1%	DDH 3.33%
	Post traumatic 5%	Idiopathic 8%	AVN 3%	Ankylosing spondylitis 3.8%	Rheumatoid arthritis (burn out) 3.33%
Indication	Ankylosing spondylitis 1%	Ankylosing spondylitis 5%	Paediatric Hip disease 1%	Multiple epiphyseal dysplasia 2.5%	Healed tuberculosis 3.33%
		Multiple	Others 1%	DDH 1.3%	
		epiphyseal dysplasia 3%	Post Traumatic 0.3%	Rheumatoid Arthritis 1.3%	

Table 10: Pre and post-op HHS in various studies.

Study		Barrack et al <sup>20</sup>	Bourne et al <sup>7</sup>	Archibeck et al <sup>16</sup>	Kim et al <sup>15</sup>	Kim et al <sup>18</sup>	Present study
Harris	Pre-op	38	42	51	48.8	48.8	32.93
hip score	Post-op	93	97	94	92	90	88.967

Table 11: Ant. thigh pain in various studies.

Study	Archibeck et al <sup>16</sup>	Kim et al <sup>15</sup>	Kim et al <sup>18</sup>	Present study
Anterior thigh pain	9%	10%	11.4%	6.67%

Our results are consistent with those of Archibeck et al., who reported an excellent or good result in 86% of their subjects. 16

The Harris hip score in our study had improved from a mean of 32.93 pre-operatively to a mean post-operative score of 88.967, at a minimum one year follow up. Pain and function account for a majority of the Harris hip score. <sup>12</sup> The average pre-operative Harris hip score was

lower in our study as compared to the other studies. This may reflect that the patients in this part of the world, report only when the disease is advanced i.e. pain is severe and functions are compromised. In our study 10 patients developed limb length discrepancy. Limb length discrepancy is a common cause of patient dissatisfaction following total hip arthroplasties. The limb length discrepancy was deemed insignificant. Anterior thigh pain has been reported to be a common complication in a cementless stem.

Archibeck et al. reported an incidence of mild to severe anterior thigh pain of 9%. They found thigh pain to be related to the size of the stem. <sup>16</sup> Kim et al. in two separate studies reported the incidence of anterior thigh pain to be 10% and 11.4% respectively. <sup>15,18</sup> We had 2 cases (6.67%) of anterior thigh pain persisting at one year follow-up.

One had a stem size 9 implanted at surgery and the other had size. 11

We found no relationship between the stem size and thigh pain. Also out of these two stems, one had been placed in a varus of 40 and the other in a neutral position. Thus, we found no association between a varus stem placement and anterior thigh pain. Our incidence of anterior thigh pain is comparable to the other studies. In all of the above mentioned studies, no patient had anterior thigh pain two years after the operation. In our study, we had a single case of superficial wound infection. It settled with an extended antibiotic course and daily antiseptic dressings. She was painless at the last visit and her ESR and CRP were normal. Heterotopic ossification is a commonly cited complication of total hip arthroplasty.

Table 12: Heterotopic ossification in various studies.

Study	Haddad et al <sup>22</sup>	Callaghan et al <sup>23</sup>	Barrack and Lebar <sup>20</sup>	Kim et al <sup>15</sup>	Present study
Heterotopic ossification	50%	80%	24.49%	5%	3.33%

At a minimum 12 months follow-up we noted one case with radiological evidence of heterotopic ossification (Brooker grade 1) in our study. The patient was asymptomatic and no intervention was done for this. This low rate is related to the surgical approach we used (posterolateral) and possibly to some genetic factors, which need further study.

We did not have any dislocation in our study of 30 cementless total hip arthroplasties using a posterolateral approach with posterior soft tissue repair. Archibeck et al. reported a 5% incidence of dislocation in their study. <sup>16</sup> Kim et al. also reported a 4% incidence of hip dislocation in their study of 114 cementless total hip arthroplasties.

Both of these studies used a posterolateral approach.<sup>15</sup> A meta-analysis comparing posterior approach with and without soft tissue repair showed an almost tenfold reduction in dislocation rates from 4.46% to 0.4% with soft tissue repair.<sup>2</sup> The result in our study is attributable to the soft tissue repair and also may be a reflection of the less number of cases.

## **CONCLUSION**

The outcome of cementless total hip arthroplasty is determined by multiple factors, including the operative technique. Our study suggests that the current generation of implants without cement can provide satisfactory early clinical and radiographic outcomes, however the results of the procedure must be evaluated in long term studies. Though our study was not free of complications, the

overall functional and clinical outcome showed favourable results.

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