

EVALUATION OF CLINICAL AND RADIOLOGICAL RESULTS OF HYBRID TOTAL HIP REPLACEMENT (THR) IN VARIOUS DISORDERS

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Abstract

Background: The human hip joint is extremely complex as the consequence of the functional demands on it by the body. Because of its complex biomechanics and important function, a stable painless hip is required for normal locomotion for which Total Hip Replacement is one of the most advanced method. **Objectives:** To evaluate the clinical, functional, and radiological results of acetabular non-cemented and femoral cemented (hybrid) total hip replacement in various disorders of hip. **Materials and Methods:** This hospital based prospective observational study was conducted among 18 patients between April 2012 and June 2013 for various disorders of hip in the Department of Orthopaedics, Batra hospital and Medical Research Centre, New Delhi. **Results:** Mean Harris hip score improved significantly ($p=0.0001$) post-operatively (88.00 ± 8.78) as compared to pre-operative score (34.00 ± 11.12). Pain, limp, walking distance & deformity significantly improved with (hybrid) total hip replacement. **Conclusion:** This study provides evidence of excellent modality of treatment for various disorders of hip.

INTRODUCTION

Total Hip Replacement is indicated for pain & disability of the Hip & also as salvage for failed conservative or surgical treatment of hip trauma or arthritis.^[1] Arthritis of the hip may be a result of osteoarthritis, osteonecrosis, trauma, rheumatoid & various other inflammatory arthritis. The prevalence of hip osteoarthritis is about 3% to 6% in the Caucasian population and has not changed in the past four decades.^[2] Primary osteoarthritis is generally a polyarticular degenerative arthritis of unknown origin & rarely occurs before 35 years of age. In Indian population, osteoarthritis secondary to osteonecrosis is more common.^[4]

Rheumatoid arthritis affects 1% to 2% of world population with a female-male ratio of 3:1 is another important indication for total hip arthroplasty.^[5] Total hip replacement may also be indicated in the treatment of fracture of proximal femur or acetabulum, especially if joint preserving surgery has failed or the patient has come late for treatment. Harris hip score is the most frequently used score for evaluating the hip & will be used in pre & post operative evaluation of the hip in terms of pain, ability to walk, function & mobility.^[6]

Total hip joint replacement has many changes since it was first attempted in the early 20th century. It

was based on failures of previous surgeries and valuable clinical experience from it by the surgeons that these changes were introduced.

Initially, bone cement was used to fix the articulating surfaces of the Total Hip Arthroplasty (THA) to the bone ends. But high rates of loosening of implants, especially the acetabular component led to a change in the technique of fixation of implants. Thus, bone in-growth for biological fixation was introduced. This technique of cement less total hip arthroplasty could be used in younger patients in the hope that it might last longer. However, failures in femoral stem fixation on account of little bone ingrowths, thigh pain and subsidence of cement less femoral component made surgeons to rethink the ideal method of fixation of femoral stem. On the other hand, encouraging report was noted with the cement less acetabular component. Thus, the concept of Hybrid Total Hip Arthroplasty was evolved; where uncemented acetabular component and cemented femoral component were used.^[7]

Hence this study was conducted to evaluate the clinical, functional and radiological results of acetabular non-cemented and femoral cemented (hybrid) total hip replacement in various disorders of hip.

MATERIALS AND METHODS

This hospital based prospective observational study was conducted in the Department of Orthopaedics, Batra hospital and Medical Research Centre, New Delhi in 18 patients presenting to the OPD and Emergency of the Batra Hospital and Medical Research Centre between April 2012 and June 2013 for various disorders of hip.

Inclusion Criteria

1. Patient having either unilateral or bilateral hip arthritis.
2. Skeletally mature patients.
3. No medical contraindication for anesthesia.
4. Traumatic fracture neck femur.
5. Those patients who are willing to give written informed consent for participation in study.

Exclusion Criteria

1. Skeletally immature patient.
2. Active infection at operative site.
3. Medical contraindication to surgery or anesthesia
4. Lack of consent.
5. Septic arthritis.
6. Tubercular arthritis

Sample Size

In a study (Tennent et.al)^[8], use of an intramedullary plug, pulsatile lavage and a cement gun ,achieved excellent results. The sample size was calculated using the following formula (Charan and Biswas, 2013)^[3]:

$$n=4*pq/d^2$$

where n=Sample size, d= Margin of error

Assuming 80% power, 5% significance level with 95% confidence interval as well as assuming 0.07 margin of error, the required sample size was 16 patients.

Detailed history, clinical examination and radiological examination were carried out in all the patients. A detailed local examination of hip is graded by modified Harris hip score (mHHS).

We prospectively followed up 18 patients over a period of 2 years who have undergone hybrid total hip replacement for primary hip replacement. Patients with hip pain are admitted and examined according to protocol both clinically and radiologically, and functional outcome is assessed by distribution of Harris hip score and pre-designed proforma both pre- operatively and post operatively. And the patients are reviewed with post op x-rays.

Patients were evaluated after 4 weeks, 6 weeks, 3 month, 6 month and 1 year after surgery. Results were evaluated and compared with previous results both clinically and roentgenographically.

Patient were evaluated according to modified Harris Hip score(mHHS)^[9] which gives points to pain, function which was assessed in term of gait and activities, deformities and range of motion. These scores were compared with pre-operative score and the score at the last follow up. Patient were also examined radiographically at discharge and at each follow up visit with anteroposterior and lateral views.

For assessing the acetabulum components, acetabulum is divided into 3 zones as laid down by Delee and Charnley.^[10] The acetabulum component was assessed on the radiographs of pelvis.

For evaluation of the femoral components, the grade of initial cement mantle.^[11] and the position of the component within the femur was assessed. The radiolucent lines at the bone cement and cement prosthesis interface were recorded and localized into seven zones as described by Gruen et al.^[13] Using criteria of Harris et al.^[14] categories of loosening were used to assess roentgenographic stability of the femoral component. Heterotopic ossification was assessed and graded according to the classification of Brooker et al.^[16]

Data Analysis

The results are presented in mean \pm SD and percentages. The change in scores from pre- to post-op was compared by Paired t-test. The Kendal's tau test was used to compare the change in categorical variables. The p-value<0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

RESULTS

Mean age of the patients was 42 years (range 26- 55 years). 55.6% patients were females & 44.4% males. Mean weight of operated patients was 60 kg (range 50- 75 kg). 11 patients (61.1%) were operated on left side, 05 patients (27.8%) were operated on the right side and 02 patients (11.1%) were operated on both sides. Mean period of follow up was 4.5 ± 0.56 months, where 06 patients (33.3%) were followed up to 06 months, 05 patients (27.8%) each up to 1.5 months & 03 months, 02 patients (11.1%) up to 12 months.

Table 1: Age distribution of patients (n=18)

Age (in years)	Frequency (percentage)
26-30	4 (22.2)
31-35	2 (11.1)
36-40	1 (5.6)
41-45	1 (5.6)
46-50	4 (22.2)
51-55	6 (33.3)

Maximum number of patients were in 51-55 years age group (33.3%) followed by 26-30 years and 46-50 years (22.2% each). Least number of patients were in the groups 36-40 years and 41-45 years (5.6% each). (Table 1).

Avascular necrosis was seen in 8 patients (44.4%). It was due to steroids in two patients, taken for skin disorder and nephrotic syndrome respectively. Two patients had developed the disorder after pregnancy. It was post-traumatic in two patients and idiopathic in two patients. Ankylosing Spondylitis was the preoperative diagnosis in 5 patients (28%). All had bilateral hip involvement. Two patients had already undergone cemented THA for one hip on previous date. One patient had already severe involvement both hips but underwent surgery for the painful hip. Painless fused hip will be operated on later date. Two patients had milder involvement of the other hip and could function adequately despite occasional pain in the less involved hip. All five patients had spine and sacroiliac involvement. Fracture Neck femur was present in 3 patients (16.5%). One was a case of failed osteosynthesis operated one year back. One was a case of neglected fracture neck femur presenting to us after 3 months of trauma. Third patient was a case of fresh trauma. One patient (5.5%) was a case of Rheumatoid Arthritis. She had bilateral hand deformities. One patient (5.5%) had Osteoarthritis as pre-operative diagnosis. (Table 2) Mean Harris hip score improved significantly ($p=0.0001$) post-operatively (88.00 ± 8.78) as compared to pre-operative score (34.00 ± 11.12).

Table 2: Diagnosis of patients undergoing THR (n=18)

Diagnosis	Frequency (percentage)
Avascular necrosis	08 (44.4)
Ankylosing Spondylitis	05 (27.8)
Fracture Neck femur	03 (16.7)
Rheumatoid Arthritis	01 (5.6)
Osteoarthritis	01 (5.6)

Preoperatively, marked pain was present in 50% of patients, moderate pain was present in 38.9 % of patients, and mild pain was present in 11.1%. At the last follow up, 94.4% patients had no pain. Only 5.6% patients had moderate pain for which occasional analgesics were required. The change was found to be statistically significant ($p=0.0001$). (Table3).

Table 3: Comparison of pain among patients undergoing THR(n=18)

Description of pain	Pre- operative n (%)	Post- operative n (%)	p- value
Marked pain	9 (50)	0	0.0001
Moderate pain	7 (38.9)	1 (5.6)	
Mild pain	2 (11.1)	0	
Slight pain	0	0	
No pain	0	17 (94.4)	

While 77.8% patients had a moderate limp preoperatively, only 11.1 % of the patients had moderate limp post-operatively. The change was found to be statistically significant ($p=0.0001$). (Table4).

Table 4: Comparison of limp among patients undergoing THR(n=18)

Description of pain	Pre- operative n (%)	Post- operative n (%)	p- value
None	0	4 (22.2)	0.0001
Slight	0	12 (66.7)	
Moderate	14 (77.8)	2 (11.1)	
Severe	4 (22.2)	0	

Walking with stick most of the time was in 61.1% pre-operatively which significantly ($p=0.0001$) decreased to 11.1 % . (Table 5).

Table 5: Comparison of support among patients undergoing THR(n=18)

Type of support	Pre- operative n (%)	Post- operative n (%)	p- value
None	0	4 (22.2)	0.0001
Walking stick for long walk	2 (11.1)	12 (66.7)	
Walking stick most of the time	11 (61.1)	2 (11.1)	
One crutch	0	0	
Two sticks	2 (11.1)	0	
Two crutches	0	0	
Not able to walk	3 (16.7)	0	

Table 6: Comparison of distance walk among patients undergoing THR(n=18)

Distance walk	Pre-operative n (%)	Post-operative n (%)	p- value
Unlimited	0	17 (94.4)	0.0001
500mts	2 (11.1)	1 (5.6)	
100mts	9 (50)	0	
Indoors	5 (27.8)	0	
Bed and chairs	2 (11.1)	0	

Most of the patients could walk till 500 meters preoperatively. Others were restricted to indoor activities or bed only. Post operatively, 94.4% patients could walk for long distances and only 5.6% were restricted to less than 500 meters only. The change was found to be statistically significant (p=0.0001). (Table 6)

50% of the patients had a significant deformity preoperatively (more than 30-degree fixed flexion, than 10-degree fixed adduction, more than 10 degree fixed internal rotation in extension, limb length discrepancy more than 3.2mm). Post operatively, only 10% of the patient had any significant deformity remaining.

Radiographic evaluation revealed cement mantle for femoral component was maximum in grade A (44%), followed by grade B (30%), grade C1 (16%), Grade C2 (10%). The femoral component was in neutral alignment in 17 hips (85%), in less than 10-degree valgus in 2 hips (10%) and in less than 5 degrees of varus in one hip (5%). At the last follow up, no radiographs showed any evidence of a new radiolucency, any shift in the position of any femoral component or any crack in the cement mantle. For acetabular component, two patients had gaps between the bone and the acetabular component on the initial postoperative radiographs. One was 1½mm wide zone 1 and zone 2 each other was 1 mm gap in zone 3. Cups were positioned on an average of 40 degree of abduction (range 30 degrees 55 degree). At the latest follow up none of the 20 acetabular components showed any evidence of horizontal or vertical migration. No radiolucent lines were seen at the bone cement prosthesis on any of the radiographs. There were no fractures and there was no evidence of movement of any screw. Heterotrophic ossification was present in two hips (10%). One was grade 2 in case of avascular Necrosis. Other was grade 1.

Superficial stitch infection was noted in one patient on routine wound inspection on 5th postoperative day. Wound was explored and communication was found beneath the deep fascia were debrided and they healed well on antibiotics.

DISCUSSION

Component loosening due to osteolysis is one of the major problems associated with THA. This results in reduced rates of survival of total hip components. With improved cementing techniques, it has been seen that cemented femoral fixation has provided

lasting results. However, acetabular component fixation showed loss of fixation in a number of cases after 10 years.^[11] This observation and the reported early encouraging results with uncemented acetabular fixation led to the consideration of using a cemented femoral stem with a non-cemented acetabular cup.^[18] This so-called Hybrid THA was thus based on the assumption that with this approach the acetabular fixation would be improved but there would be no compromise in femoral fixation.

While our study was limited to 20 THA, Berger et al.^[19] performed 150 THA, Harris et al.^[18] performed 126 THA and Goldberg et al.^[20] performed 125 THA. Because this study was limited to a very short duration, financial constraints and unawareness of this procedure by patients, leads to limited the number of patients for this study.

The age limit for this series was up to 55 years. Many series have shown that the rate of loosening revision of total hip arthroplasty is high in younger patients.^[11] The cemented acetabular component has been the source of most of these failures. The short-term results of the cementless acetabular reconstruction have been encouraging in young patients. Berger et al reported a 10-year survival of 98.8% in patients younger than 50 years.^[21]

Most common diagnosis in the present series was avascular necrosis (44%) followed by Ankylosing Spondylitis (28%). There were 3 cases of fracture neck femur 1 case each of rheumatoid and osteoarthritis. Studies in the west report Osteoarthritis as the most common diagnosis. (77% by Berger et al^[19]). Avascular necrosis is the second most common diagnosis in the western literature (10% by Harris et al.^[14] & 7% by Berger et al^[19]). In this series, the difference in diagnosis might suggest a high rate of AVN. and a low rate of Osteoarthritis in Indian patients. A study for longer period of time and with longer follow up is needed to establish this fact and to determine the reasons for this difference. Chemoprophylaxis was routinely carried out in all patients. No patient developed deep infection and only one case of superficial infection was detected. All surgeries were performed in conventional operating Theatre. Wilson et al^[23] reported a significant fall in the infection rates when prophylactic antibiotics were used from 11% to 1%. Goldberg et al.^[14] reported a rate of 0.8% of deep infection using vertical laminar flow operating rooms and body exhaust systems. No case of deep infection in the present study room highlights the importance of proper operating room discipline

along with prophylactic antibiotics can significantly reduce infection rates. Patients were evaluated after discharge at 6 weeks, 3 months, 6 months, 1 year intervals. Average follow-up was 4.5 months in this study as compared to larger follow-ups available in the western literature (42 months by Harris et al.^[18], 8.6 years by Goldberg et al.^[20], & 103 months by Berger et al.^[21]) Mean Harris hip score improved from 34 preoperatively to 88 points postoperatively. 94.4% of hips were graded as good or excellent in this study. 5.6% were graded as poor. Harris et al.^[18] reported improvement in Harris hip score from 57 preoperatively to 93 points postoperatively. 96% good to excellent results, 4% fair and no poor results were reported. Goldberg et al.^[20] reported improvements in Harris hip score from 47 preoperatively to 88 points postoperatively. 85% good to excellent results, 13% fair and 9% poor results obtained in his series. These figures are comparable to our results.

Pain relief was also dramatic following Hybrid THA. 50% Patients had marked pain preoperatively and 31% had moderate pain. Postoperatively 94.4% patients were completely relieved of pain and only 5.6% patients had moderate pain. Similar results were obtained by Harris et al.^[12] (94% complete pain relief) and Berger et al.^[21] (94.5% complete pain relief).

Slight limp was seen in 72% of the patients in this study. Moderate limp was present in 6% of patients. In study by Harris et al.^[18] 63% patients had no limp and 28% had slight limp.

Berger et al.^[18] also reported low rate of limping. This difference is due to the sliver of greater trochanter taken in all patients in Liverpool approach. This limping improves over a period of five years with trochanteric union and progressive abductor exercise. As this study has a follow-up of only 4.5 months, percentage of patients limping are expected to decrease with time. 94.4% patients needed no support or only occasional cane for walking long distances while 5.6% patients required cane full time. This finding is comparable to the results obtained by Harris et al.^[18] (95% patients used cane occasionally).

Radiographic results were also excellent. Second generation cementing techniques (without centrifugation) were used. Grading the initial appearance of the cement mantle column in all hips resulted in 44% hip with grade A technique, 30% with grade B, 16% with grade C-1 and 10% with grade C-2 and 1% grade D cementing technique. This result was comparable to results by Berger et al.^[19] (41% grade A, 24% grade B, 7% grade C-1, 27% grade C-2 and 1% grade D cementing technique). No hip showed any evidence of loosening or osteolysis in femoral and acetabular component.

Harris et al.^[18] reported femoral component as definite or probably loose and one acetabular component migration in his series. Goldberg et al.^[20] reported revision of one acetabular component for

recurrent dislocation (0.8%) and one stem revision (0.8%) for mechanical loosening one stem radiographically loose. However, as our study has a very short follow up, definite conclusions can only be drawn after a longer follow up. Low complications were in our series, only one superficial infection.

Harris et al.^[18] reported 5 cases of trochanteric non-union (8%), 19 cases of deep vein thrombosis, (15%), 9 dislocations (7%), 2 partial femoral and sciatic nerve paralysis and 2 patients had peroneal nerve paralysis (1.5% each). Goldberg et al.^[20] had 3 dislocations (2.4%), 1 deep infection (0.8%) and 3 dislocations (2.4%).

Heterotopic Ossification was present in 10% of our cases, whereas high incidence was obtained by Harris^[18] & Berger.^[19] etc. This low rate is due to routine radiotherapy given post operatively in all high-risk patients. Also longer follow up is required for ossification to develop.

CONCLUSION

Excellent to good results were obtained postoperatively according to Harris hip criteria (mHHS). No radiological loosening was noted in femoral or acetabular component. Hence, this study provides evidence of excellent modality of treatment for various disorders of hip.

However, because of short period of study and a smaller number of subjects, longer study is required to make definite conclusion. At present, it can be concluded that in properly selected cases, Hybrid THA offers a better alternative than any other procedure currently available for hip joint pathologies.

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