

Functional and radiological evaluation of primary total hip arthroplasty in less than 50 years old- A retrospective evaluation

Milind G. Kulkarni¹, Supreet Bajwa¹, Shrey Singh¹, Shekhar P. Malve¹, Nitish Arora¹, Deepak Garg¹

Abstract

Background: Performing primary Total Hip Arthroplasty in young is challenging. The increased physical demands predisposes them to early wear, osteolysis and subsequent loss of fixation. The main purpose of this study is to evaluate the radiological and functional outcome of uncemented and hybrid Total hip arthroplasty with different bearings, in patient less than 50 years of age.

Methods: We retrospectively reviewed all primary Total Hip Arthroplasty (65 uncemented and 19 hybrid) done in our institute from 1997 to 2010. There were 74 patients with 84 Hip joint operated with a mean age 38.37 years at the time of initial THA (range 21-49 years). Clinical evaluation was done with the help of Harris Hip Score. Radiological evaluation was done using an anteroposterior and lateral xray to look for the radiological loosening, osteolysis, polyethylenewear (eccentric positioning of femoral head), heterotrophic ossification, position of stem and acetabulum cup.

Results: The mean follow up time was 7.62 years with a mean Harris hip score of 87.8 ± 9.02 . Mean Harris hip score increases as the age group increases and the results are marginally significant ($P=0.09$). The overall implant survival rate was 94% with results slightly better in Hybrid group. Ceramic on Ceramic bearing proved significantly ($P=0.002$) better than ceramic on polyethylene and Metal on polyethylene in 5- 10 year follow up. In 10-20 year follow up ceramic on polyethylene ($P=0.009$) proved better than metal on polyethylene. We do not have cases of ceramic on ceramic in 10-20 year follow up. Complications included superficial infection, deep infection, Acetabular migration, femoral stem loosening, polyethylene wear, post traumatic dislocation and fracture. All were dealt appropriately.

Conclusion: The present study shows excellent outcome of Total hip arthroplasty in patients younger than 50 years, clinically better as the age advances but that might be because of the confounding effects produced by the systemic conditions in young patients. Ceramic on ceramic bearing proved better in a short term follow up 5-10 years clinically, Ceramic on polyethylene bearing proved better than Metal on polyethylene clinically in a long term follow up. The debate of hybrid versus uncemented needs further studies with large sample size.

KeyWords: Total Hip arthroplasty, Young patients, Hybrid Total Hip Arthroplasty, Uncemented Total Hip Arthroplasty, primary total hip arthroplasty

Introduction

The history of total hip arthroplasty (THAs) is not new. But performing a primary THA in young can be challenging sometimes. The increased physical demands in these patients predisposes them to early wear, osteolysis and subsequent loss of fixation. Increased loading cycles and higher activity over an increased lifespan, rather than time from prosthetic implantation alone, leads to early implant failure in highly active individuals.(1) Early implant failure predisposes them to multiple surgeries which can affect their life miserably. The valuable time and economic loss due to these multiple surgeries can have a great impact in their life. The reported outcomes of THAs in young patients are poorer compared to older patients, with a 10-year survival rate ranging from 49% to 95% in

the published literature.(2-4). Newer implant design, surgical techniques, alternate bearings such as ceramic on polyethylene (CoP) and ceramic on ceramic (CoC) have dramatically improved the outcome of THAs in young.(5,6). Cemented total Hip Arthroplasty in young is associated with its own complications. Although advances in cementing techniques have significantly reduced the incidence of femoral stem loosening, deterioration of acetabular fixation continues to be a problem for patients younger than 55 regardless of prosthesis model used, even more so for patients with osteoarthritis.(7-10).The main purpose of this study is to evaluate the radiological and functional outcome of primary uncemented and hybrid THAs with different bearings in patient less than 50 years of age.

Methods and Methods

We retrospectively reviewed all primary Total Hip Arthroplasty (65 uncemented and 19 hybrid) done in our institute from 1997 to 2010. All relevant material was obtained from our hospital data base records with permission from the ethical society and informed consent from the patients was taken. There were 74 patients with 84 Hip joint operated with a mean age 38.37 years at the

¹Department of Orthopaedics Post Graduate Institute of Swasthiyog Pratishthan, Station Road, Extension Area, Miraj, Maharashtra – 416410.

Address for correspondence:

Dr. Supreet Bajwa,
Department of Orthopaedics Post Graduate Institute of Swasthiyog Pratishthan, Station Road, Extension Area, Miraj, Maharashtra – 416410
Email ID: bajwasupreet@hotmail.com



Figure 1: (a) X-ray of a 30 years old male with sequelae of Perthe's disease treated by (b) greater trochanteric osteotomy and uncemented Ceramic on Polyethylene Total Hip arthroplasty (c) final follow up of the patient at 7 years follow up

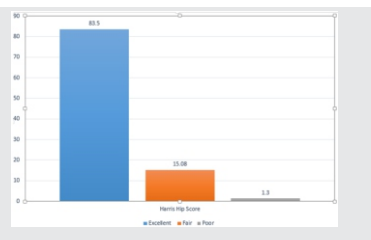


Figure 2: Classified mean Harris Hip Score. Excellent/good results were obtained in 61 out of 73 (83.5%) patients, fair results in 11 out of 73 patients (15.08) and poor in one out of 73 patients (1.3%)

records was not present in eight patients. One patient had intraoperative periprosthetic fracture which was treated with encirclage wire. Post operatively suction drain and abduction bar was placed and intravenous antibiotics were continued for five

time of initial THA (range 21-49 years). There were 59 males and 15 females in the present study. Left side was operated in 26 cases, while right side was operated in 30 cases, 18 had bilateral hip pathology, out of which 10 were operated bilaterally till 2010. The remaining eight bilateral cases in which one side was operated after 2010 was excluded from the present study. The preoperative diagnosis and other demographic data is shown in Table 1. Preoperatively all patients underwent X-ray hip anteroposterior and lateral views. Careful preoperative planning using digital radiographic templating was done and implants were inserted according to the preoperative planning. (11-13) Perioperative management was similar for all patients. All procedures were performed in a vertical laminar air-flow operating room. (14) Preoperatively all patients receive intravenous antibiotic one hour prior to incision. Lateral position and posterior approach (15) was used in all the patients. Trochanteric osteotomy (Fig 1) was required in one patient. Uncemented hydroxyapatite (HA) coated femoral stem (DePuy, Johnson & Johnson) was used in 45 Hip Joints, while cemented stem (Depuy, Johnson & Johnson) was used in case of Hybrid THAs in 19 hip joints. Porous uncemented acetabulum cup with supplemental screw fixation was used in all the cases. All components were inserted press fit in case of uncemented THAs. The bearing utilized was metal on polyethylene (MoP) in 40 Hip joints, ceramic on Polyethylene (CoP) in 22 hips while ceramic on ceramic (CoC) was used in only 12 hips. Maximum stem size used was 14 (range 8-14). Maximum acetabulum cup size used was 58 (range 48-58). Maximum head size used was 44 (range 28-44). Implant

days. Abduction bar is removed once the patient was shifted to the room and passive mobilization was started as per patient tolerance. Patient was made to walk on second post-operative day, drain was removed and dressing was inspected for soakage. Patient was discharged on post-operative day five and then called for follow up every month for first three months, then six monthly for a year, then every year. On follow up all patients were subjected to clinical and radiological evaluation.

Clinical evaluation:

Clinical outcome was measured with use of the Harris hip score (HHS) (16) at the recent follow up. The outcome was categorized as excellent or good (hip score ≥ 80 points, no use of a walking aid, and a nonpainful hip), fair (hip score of 70 to 79 points, occasional use of a walking aid and/or mild hip pain), or poor (latter category not satisfied). (17)

Radiological evaluation:

Serial anteroposterior and lateral radiographs of the operated joint were reviewed to assess aseptic loosening, position of stem and acetabulum cup, osteolysis, signs of infection and polyethylene wear (eccentric positioning of femoral head). The femur was divided into seven zones by Gruen et al (18) and the acetabulum into three zones by DeLee and Charnley (19) to evaluate the location of lucent lines. (20). Definitely loose components were defined as those that demonstrated a complete lucent line on any radiograph, femoral

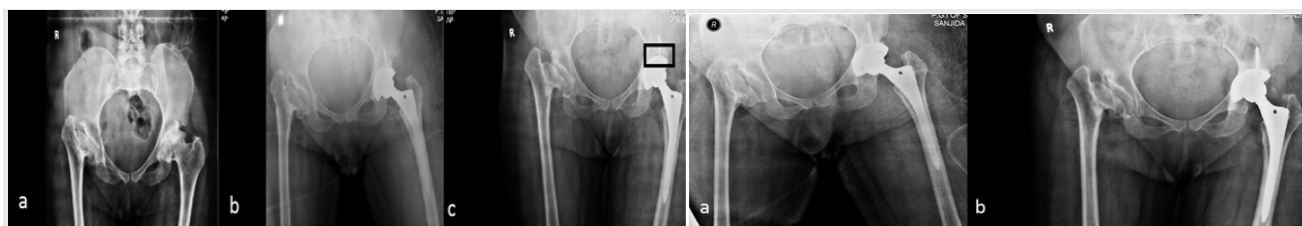


Figure 3: (a) X-ray of 45 years old male with right side perthes sequelae treated with Pelvic supportive osteotomy and left side Avascular necrosis (b) uncemented Total hip arthroplasty (c) three years follow up replacement **Figure 4:** (a) x-ray of the same above Patient was treated with cup (b) final follow up of the patient at 7 years post cup loosening was present in DeLee and Charnley zone 1 (shown in the second surgery)

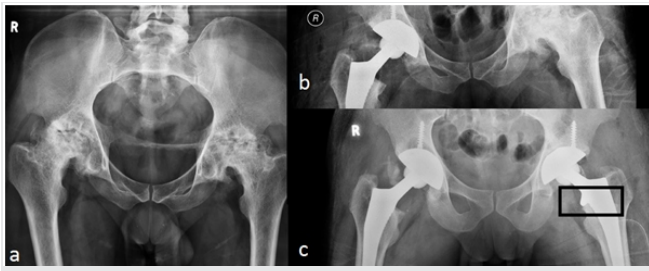


Figure 5: (a) xray of a 45 years old male B/L AVN treated with b) right uncemented Total hip arthroplasty c) one year later left uncemented total hip arthroplasty was also done.

subsidence of 2 mm or more, or acetabular component migration(17). Possibly loose components were defined as those with a >50% but <100% lucent line on any radiograph or those with a progressive radiolucent line. Radiographs were also evaluated for the presence of heterotopic ossification, which was classified according to the system of Brooker et al(17, 21, 22). In addition, the femoral offset, femoral height, cup offset, and cup inclination angle were recorded during each radiographic evaluation.(17)

Statistical analysis:

At the final follow up statistical test of analysis of normal variance were applied in comparing mean Harris Hip Score in different age group and different bearings. Radiological complications between bearings were compared using standard normal test of proportion. Results were considered statistically significant if the p values were less than 0.05. Inclusion criteria: All patients aged less 50 years who underwent primary uncemented and hybrid THAs in our institute with minimum follow up of at least five years. Exclusion criteria: Age more than 50 years, patient lost to follow up, patients who died during follow up, cemented THAs were excluded from the study. One patient who sustained multiple fractures after operated for THA was also excluded from the present study.

Results:

Clinical outcome:

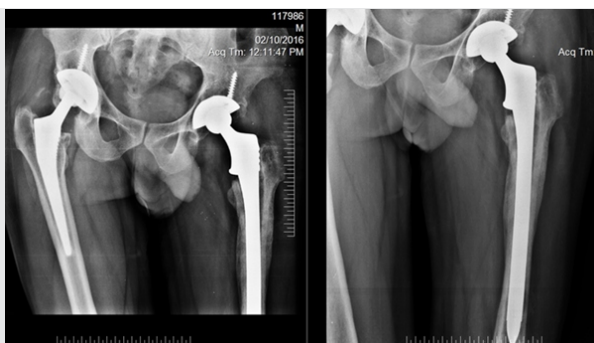


Figure 7: Final xray with follow up of the patient at three years post second surgery

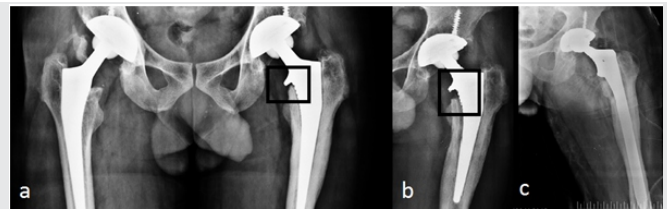


Figure 6: (a) Four years post-surgery xray shows stem loosening in Gruen zone 1 on the left side but patient was asymptomatic. b) one year later patients starts developing pain on the lateral aspect of thigh which was gradually increasing and xray shows further loosening with femoral subsidence of 3 mm (shown in the box) c) eventually the patient was treated with revision long stem THA

The mean follow up time in the present study was 7.62 years with a mean Harris hip score of 87.8 ± 9.02. (Fig 2). Mean Harris hip score increases as the age group increases (Table 2). In a follow up time of 5-10 years (Table 3) the functional mean Harris hip score is higher in ceramic on ceramic group(93.3 ± 5.4), followed by CoP group (90.9 ±9.8) followed by MoP group (84.2 ±9.9). Analysis of variance shows that this gradual increases in Harris hip score with respect to type of procedure is statistically significant (F= 7.08, p <0.002). In a follow up time of 10-20 years (Table 4) mean Harris hip score was 87 ± 5.05 in MoP group while it was 94.1 ±0.46 in CoP group. Analysis of variance shows that mean Harris hip score differs with type of procedure for follow up time of 10-20years and the difference is statistically significant (F= 9.05, p <0.009). We do not have 10 years follow up of CoC cases. In a 15 year follow up with revision for any reason as the end point, the implant survival rate was 100% (19 out of19) in hybrid group while the survival rate in uncemented group was 93.8 % (61 out of 65 patients).The overall implant survival rate was 94%.

Radiographic findings:

Evaluation of radiograph at the time of latest follow up reveals that varus alignment of stem was present in two cases (2.3%) and valgus alignment was present in five cases (5.95%). The position of acetabulum component was optimal (abduction angle between 35 and 50 degrees) in 81 out of 84 patients (96.4%). Cup Loosening was present in three patients. In a 5-10 year (seven year) follow up only one patient in MoP group presented with

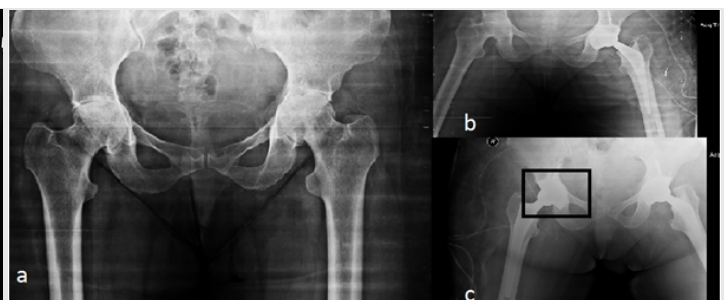


Figure 8: (a) xray of a 38 year old female B/L Avascular necrosis of femoral head treated with b) left Total hip arthroplasty c) one year later right Total hip arthroplasty was also done. Inset shows the position of the well centralized cup with adequate coverage (shown in the box)



Figure 9: (a) four years follow up patient start developing pain on the anterior aspect of hip joint with migration of the acetabulum cup and increase in acetabular inclination of 60 degrees. b) Revision cup replacement was done using a cemented up

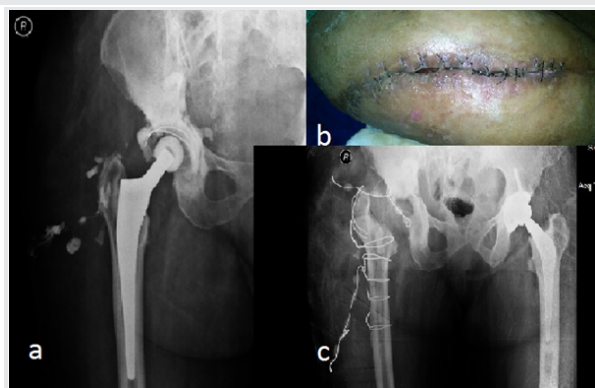


Figure 10: a) Patient developed severe infection post-surgery and sinogram shows the depth of the infection b) multiple debridements were done but skin dehiscence occurred and patient started showing signs of septicaemia c) finally the implant was removed by extended trochanteric osteotomy, girdle stone excision arthroplasty was done and antibiotic impregnated beads were inserted.

symptomatic aseptic cup (Fig 3&4) loosening in DeLee and Charnley zones 1. We planned for only cup exchange and the patient is doing well at seven years post second surgery. On application of standard normal test of proportions it was observed that the difference in incidence of symptomatic Aseptic loosening in a 5-10 year follow up is not statistically significant with respect to type of procedure. Two other patient of unknown bearing had radiological cup loosening at eight and 10 years but were asymptomatic and no intervention was required at the moment. Stem loosening was present was present in four patients, all of which were uncemented. Two patients, one in MoP group at 11 years (Fig 5, 6 &7) follow up, other at 12 year follow up had symptomatic femoral stem loosening in Gruen zones seven. Both the patient underwent revision surgery with long femoral stem. One patient in CoP group at nine years of follow up and one in MoPat eight years of follow up had radiological femoral stem loosening but asymptomatic, so no intervention was required at this moment. Polyethylene wear (asymmetric position of femoral head) was present in nine out of 84 patients (11.9%). Six out of nine (66.6%) patients were in MoP group and three out of these six (50%) were symptomatic. Two patient had cup exchange and one patient had infection and implant was removed. Rest three were in CoP group and were asymptomatic and no intervention was required. There was no evidence of heterotrophic ossification in our series.

Complications:

One patient had post traumatic dislocation at five year follow up and open reduction was done at that time. Patient is doing well currently at 11 years of follow up. One patient had periprosthetic fracture dislocation at one year follow up. He was treated with open reduction and encirclage stainless steel wires. Currently at seven years follow up he is painless and employed, fracture has united. Post operatively superficial infection was present in one patient and deep infection was present in three patients. All were treated with thorough debridement and antibiotic beads were inserted and the infection was subsided. In one patient infection did not subside and patient had to undergo implant removal and girdle stone resection was done (Fig 8, 9&10). There were no complaints of squeaking and no evidence of ceramic liner or head fracture.

Discussion:

It is well accepted that youth and high activity levels are among the factors that increase the risk of mechanical failure of total hip prostheses. However, there are few reports of long-term results in young patients.(23). The youngest patient in our series was at the age of 21 years when the patient presented with severe osteoarthritis of hip secondary to AVN femoral head. Busch et al (3) in a series of 57 hips younger than 30 years of age reported a mean HHS of 89. Adelani et al (24), a systematic review of THAs in in 30 years and younger reported in 12 studies a mean post-operative HHS of 84.5 at an average follow up 7.5 years. In our study we have 18 patients less than 30 years of age, the mean Harris hip score was 85.3 while in 29 patients in 40-50 years of age group it was 89.8. This is because younger patients are more physically active and any compromise in their activity will hinder their function. On the other hand older patients live a sedentary life style and are satisfied with whatever function they have. This can also be attributed to that more disabling conditions such as ankylosing spondylitis, rheumatoid arthritis present in a comparatively younger age group which overall can decrease the function in a patient. Saglam et al(25) reported an increase in mean preoperative HHS from 46.6 +/- 16.3 to postoperative 80.7 +/- 18.7. In a study by Yuasa, T. et al (26) the mean Harris hip score was 48.3 before surgery, and improved to 76.8 at the time of the final survey. They also mentioned that although its clinical outcomes were significantly different from those for OA, a satisfactory implant survival rate was achieved, at 92.9 % in RA patients. The main limitation of this study is small sample size of such disabling conditions and preoperative functional scores are not in hand to compare the results and evaluate the functional

Table 1: preoperative diagnosis and other demographic data of patients included in our study

| NUMBER OF PATIENTS | 74 |
|--------------------|---------------------------------|
| Mean Age | 38.27 (maximum:49; minimum :21) |
| Male: Female | 59:15 |
| Side: | NUMBER OF PATIENTS |
| Left | 26 |
| Right | 30 |
| Bilateral | 18 |

Table 2: Mean Harris Hip score in different age group.

| Diagnosis | |
|------------------------------------|---------------|
| Avascular necrosis of femoral head | 58 |
| Ankylosing-spondylitis | 1/9/1900 0:00 |
| Sequelae Of Perthes Disease | 2 |
| Post traumatic osteoarthritis | 9 |
| Rheumatoid-Arthritis | 2 |
| Others | 4 |

Table 3: Mean Harris hip score in different bearings in a 5-10 year follow up

| AGE LIMIT(YEARS) | NUMBER OF PATIENTS | HARRIS HIP SCORE MEAN ± Sd |
|------------------|--------------------|----------------------------|
| 20-30 | 16 | 85.6 ± 7.2 |
| 30-40 | 28 | 87.0 ± 7.9 |
| 40-50 | 29 | 89.9 ± 9.9 |

Table 4: Mean Harris Hip Score in different bearings in 10-20 year follow up. We do not have cases of ceramic on ceramic in 10- 20 year follow up group

| 10-20 YEARS | MEAN HARRIS HIP SCORE |
|-------------|-----------------------|
| | 7 |
| | 3 |

outcome in such cases. The ideal bearing surface for total hip arthroplasty still is being sought. Ceramic-on-ceramic bearings have continued to evolve and have enjoyed success throughout in the recent years.(27-30) Rajae, S. S. et al (5, 31) recently concluded that Use of hard-on-hard (MoM, CoC) surfaces has decreased significantly in this population, whereas CoP and MoP surfaces have become increasingly common. In the present study we found an increase in functional score as we move from MoP to CoP and then recently used CoC. Although the no of CoC cases may be small to conclude the outcome but still the results are significant in a 5-10 year follow up. The reported survival rates in the published literature range from 49% to 95% (3, 14, 23, 32). In all studies aseptic loosening was the main

reason for revision. A large multicenter study by Girard et al(33) with 896 patients evaluated factors influencing the revision rate of THAs performed in patients younger than 30 years (30). Four factors independently influenced the rate of revision; the use of hard-on-soft bearings (Odds Ratio 3.42), younger ages at the time of primary THA (Odds Ratio 1.14), more than two previous surgeries (Odds Ratio 5.41) and at least one dislocation after the primary THA (Odds ratio 3.98).(32). Many studies suggest that the survival rate for hybrid THA in osteoarthritis patients younger than 55 is marginally superior to that for cemented THA alone or cementless THA alone.(9, 34, 35)We have an overall implant survival rate of 94% with results slightly better in Hybrid THAs. Although the sample size in Hybrid THAs is too small to conclude the results and needs further studies with large sample size. The present study has many limitation. First of all it's a retrospective study with limited sample size of conditions other than AVN. Implant size can have a definite impact on the outcome, which has not been taken into consideration. Although the bearing surfaces have been studied well in this series but Ceramic on ceramic needs further long term follow up with large sample size to see the squeaking, head and liner fracture

Conclusion:

The present study shows excellent outcome of THAs in patients younger than 50 years, clinically better as the age advances but that might be because of the confounding effects produced by the systemic conditions in young patients. CoC bearing proved better in a short term follow up 5-10 years clinically, CoP bearing proved better than MoP clinically in a long term follow up. The debate of hybrid versus uncemented needs further studies with large sample size.

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