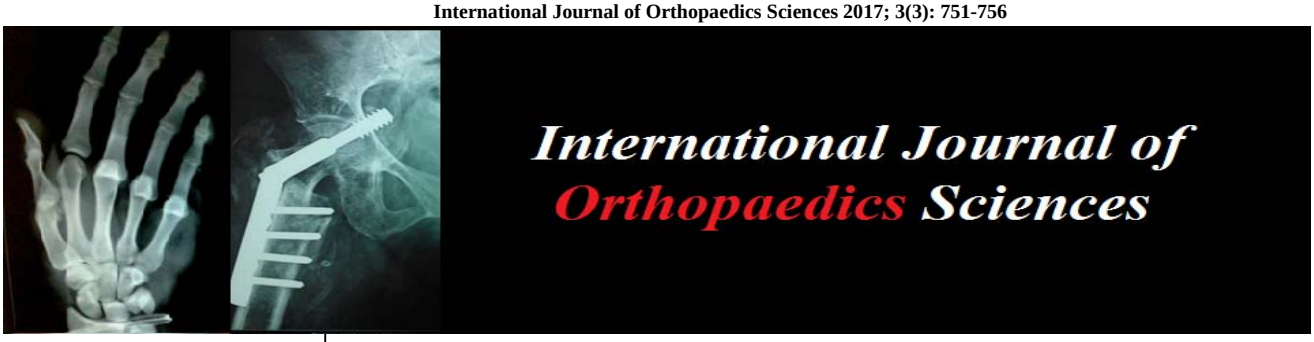

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A study of functional outcome in young arthritic hip undergoing uncemented total hip arthroplasty

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Abstract
There has been an increase demand of Total hip arthroplasty in young patients, however long-term results are expected to be inferior. To determine the efficacy of total hip replacements in population, the current authors reviewed the long-term results of patients who were 50 years and younger & who had cementless total hip arthroplasties at our institution, and reviewed the literature on total hip arthroplasty in younger patients.

Material and Methods: In our study we prospectively studied 35 young cementless total hip arthroplasties in 25 patients who were operated from June 2014 to May 2016. Majority of patients were in the age group of 41-50 years with Male to female ratio of 2:1. 23(92%) patients operated had moderate to highly physically active life style. The main indication was - avascular necrosis of hip (68%) followed by arthritis (16%). 10 patients (60%) were operated on both sides. Modified Gibson's approach was used in all cases. In all the patients, the type of femoral and acetabular prosthesis was uncemented, either Corail with Duraloc system or solution stems or pinnacle hip systems or ceramic on ceramic type. Of the 25 patients of cementless total hip arthroplasties performed in our study, 2 were of ceramic on ceramic variety, 1 patient was treated with solution femoral reconstruction system, and 3 patients were treated with pinnacle hip system, while the remaining majority of the patients, 19 were treated with Corail with Duraloc hip systems. Follow up ranged from 6 months to 24 months, average follow up of 12 months. 2 patients had dislocation of the cementless total hip arthroplasty components, 1 patient had DVT, 1 patient had sciatic nerve injury and 1 patient showed acute postoperative infection. Average acetabular cup size was 50mm while the most common femoral stem size was size 11. All patients (96%) had no pain on follow up except 2 patients had slight pain. All patients had no limp. 6 patients used cane for long walk distance, 5 patients were able to walk for 1 kilometer and rest were able to walk unlimited. Average flexion was 110°, abduction 40°, adduction 30°, external rotation 30°, internal rotation 20°. All 25 cases (100%) had no significant limb length discrepancy (>3.2cms) post-operatively. 96% excellent results was achieved according to modified Harris Hip Score. 1 patient had good outcome probably attributable to his systemic illness.

Conclusion: Cementless Total Hip Arthroplasty is a procedure which provides a nearly physiological joint and with experience, proper instrumentation, proper selection of implants, its placement in correct version and inclination, excellent results could be achieved with nil or minimal complication rate.

Keywords: Total hip arthroplasty, modified harris hip score, Avascular necrosis of femoral head

1. Introduction
Total Hip Arthroplasty (THA), or the surgical replacement of the hip joint with an artificial prosthesis, is a reconstructive procedure that has improved the management of those diseases of the hip joint that have responded poorly to conventional medical therapy [1]. It is one of the most successful orthopedic procedures performed n*ow* a days. Providing a pain free, stable joint as treatment for various pathologies of the joints and solves one of the biggest and most challenging hurdles that surgeons around the world have tried to achieve. THA can dramatically improve the quality of life of the young patient with arthritis [2]. By far the most common type of arthritis is Osteoarthritis, a degenerative condition that is likely to affect us all too some degree as we get older. Yet other forms of arthritis are Rheumatoid Arthritis, Gout, Psoriatic Arthritis, Lupus, Reactive Arthritis, Septic Arthritis, Ankylosing Spondylitis, etc.

It is seen that non-infective arthritis of the hip joint predominantly affects a young to middle aged population [3]. Avascular necrosis (AVN) of the femoral head is one of the main causes of early end-stage degenerative arthritis of the hip in adolescents and young adults [4]. Young patients are expected to place increased demand on Total Hip Arthroplasty because they are more active and have a higher life expectancy cementless acetabular components have been shown to be successful in young patients [5]. The success of THA in older patients, in concert with improvements in techniques and biomaterials, has stimulated demand for this procedure in younger, more active patients hoping to regain full activity [6].

Long term follow-up studies in arthritic hip has shown the age of 50 years can be used as a benchmark to effectively differentiate a young hip from the older population that frequently need THA [7]. In 1961, ***Sir John Charnley,*** a British orthopedic surgeon, performed the first ever Total Hip Arthroplasty in ***Wrightington hospital***, ***Wigan*** which marked the beginning of a new era in Orthopedics. Sir John Charnley developed the fundamental principles of the artificial hip and is credited as "the father of THA". Total hip Arthroplasty development began with cementless THA. It was thus performed first using a cementless system, then followed by a hybrid system (cemented Thompson femoral prosthesis combined with an uncemented cup) by Charnley [8]. The results of Charnley's total hip arthroplasty are the benchmark for evaluating the performance of other arthroplasties. The laboratory and clinical contributions of Charnley have improved the quality of life for many patients [9]. Total Hip Replacement has been termed as "***Operation of Century***" as it has revolutionized the treatment of patients with advanced hip disorders [10]. The 1994 National Institutes of Health Consensus statement on total Hip Replacement concluded that "THR (total hip replacement) is an option for nearly all patients with diseases of the hip that causes chronic discomfort and significant functional impairment."[9]. Very few research work has been done in this Sub-Continent that can reflect the functional outcome of THA among this age group. With the gaining popularity of this surgery in India, it becomes a necessary to collect data and see for ourselves if we can reflect the same standard of result to our patients and if not, what might be the reasons and how so we can improve upon it.

We, in our institute began Total Hip Arthroplasty as a form of treatment for various hip pathologies. The experience gained over these years has helped us to slowly expand the indications by including more challenging and difficult cases like Rheumatoid Arthritis, Ankylosing Spondylitis, etc. The surgery has gained popularity gradually amongst the patient population reporting at our institute.

Materials and Methods

We prospectively studied 25 patients of either sex and varied age groups who were admitted in the Department of Orthopedics at K.B.Bhabha Municipal general hospital, Mumbai during June 2014 to May 2016. All patients under the age of 50 years who were operated for uncemented THR were included in our study while patients who didn't come for follow up were excluded. At the time of admission, detailed history was taken from all the patients followed by clinical examination. All pre-operative, intra operative and post-operative events were documented. Apart from this routine assessment, following specific evaluation was done- suffering from any incurable disease, whether life expectancy is reasonable, general condition of the patient to tolerate elective procedure, Peripheral vascular status for deep vein thrombosis to avoid complication, Long term ingestion of aspirin or any other anti-inflammatory drugs, or steroids, any pyogenic infections elsewhere in the body. X-rays of pelvis with both hips A. P. view and affected hip frog leg or lateral view were taken. Templating was done preoperatively to measure the expected size of prosthesis and limb length discrepancy. After data collection, data entry was done in Excel 2010. Data analysis was done with the help of PSPP software and Sigma Plot Ver.12. Quantitative data was presented with the help of Mean, Standard Deviation, Median and IQR, 'Pre' and 'Post' comparison among study groups is done with the help of Wilcoxon Signed Ranks Test as per results of Normality test**.** Qualitative data is presented with the help of Frequency and Percentage table.

Preoperative traction and physiotherapy was given to decrease spasm, some cases required adductor tenotomy so as to facilitate intraoperative dislocation of femoral head. Lateral position on a straight table was used for the operative procedure and the patient was anchored firmly using side supports of the table. Modified Gibson (Modified by Marc and fletcher) approach was used. If desired, Steinmann pin was inserted into the Ilium superior to the acetabulum after exposure and a mark was made at fixed point on the greater trochanter for identification. The distance between these two points was measured to determine limb length after trial components had been inserted. All subsequent measurements with the limb in the identical position were made. Hip was then dislocated posteriorly by flexing, adducting and gently internally rotating the hip. A bone hook was placed beneath the femoral neck at the level of the Lesser Trochanter to gently lift the head out of the acetabulum. If the hip could not be easily dislocated, the femur was never forcibly internally rotated, since it could cause a spiral fracture of the shaft. Instead, it was ensured that the superior and inferior portions of the capsule had been released as far anteriorly as possible and Gluteus Maximus was released near its insertion on the femur. Any osteophytes along the posterior rim of the acetabulum and iliopsoas release was done at the lesser trochanter. If the hip still could not be dislocated without undue force, the femoral neck was divided with an oscillating saw at the appropriate level and subsequently the femoral head segment was removed with a corkscrew. In case of revision surgery, extended trochanteric osteotomy was done and cement was removed. The shaft was then fixed with Long stem with distal loading and Control cables. The acetabular cup was also gently removed using osteotome and hammer taking care not to perforate the floor or roof of acetabulum. The provisional femoral neck osteotomy was made 2 mm above lesser trochanter. Bony preparation of the acetabulum was done by cartilage removal and reaming of the acetabulum for both cementless and cemented acetabular components. The floor of the acetabulum within the cotyloid notch was palpated, occasionally, hypertrophic osteophytes completely covered the notch and prevent assessment of the location of the medial wall. These osteophytes were removed with osteotomes and rongeurs to locate the medial wall. Otherwise the acetabular component can be placed in an excessively lateralized position. The acetabulum was reamed with bone-conserving Mira-type reamers. The smallest size reamer was first used and it was directed medially down to, but not through the medial wall. The reamers were directed at an inclination of 45^{0} to the sagittal plane of the body with an anteversion of 15^{0} subsequently till hemispherical shape had

been produced. On the bleeding subchondral bone bed morselized cancellous bone obtained from femoral head was impacted with a small punch. During all the above procedure it was ensured that lateral position of the patient was maintained following which trial component were inserted. Then depending upon the type of implant selected, the component was either press-fitted into the prepared cavity or multiple cancellous screws were used to secure the fixation. Similarly trial reduction and final femoral stem component implantation was done. Prophylactic antibiotics (intravenous as well as oral) were continued for 5-14 days. Intravenous Teicoplanin (400mg) injection was given immediately prior to the operative procedure followed by 2 doses of the same antibiotic in the dosage of 200 mg each, on the night of the surgery and on the following day. X-ray was done usually on the third post-operative day (before weight bearing), Sutures were removed on 10^{th} - 14^{th} day after surgery. All patients received prophylaxis for deep vein thrombosis, pulmonary embolism with 3,500 I.U. of low molecular weight heparin for 5 days from the day of surgery. Depending upon the stability of the hip and reliance of the patient to follow our advice, some patients were immobilized in abduction pillow for period up to 3 weeks. Immediately post-operatively, the patients were encouraged to perform static quadriceps exercise. This was followed by non-weight bearing crutch walking of the patient with the help of a walker for a period of three weeks. The patients were advised to start partial weight bearing at three weeks beginning with a walking stick. Full weight bearing without any support was started at 6-8 weeks post-operatively in uncomplicated cases. Patients were instructed not to squat, sit cross-legged or to indulge in active sports. They were advised to use western style toilets. Patients were followed up monthly for the first 6 months followed by quarterly visits thereafter. The patients were assessed at each follow-up with proper clinical and roentogenic evaluation.

Results

In our study age distribution was 18 to 50 yrs. with mean age of 36 years; most of them were adults and 72% patients belonged to 31-50 years. 17 cases (68%) were males and 8 (32%) were females with male: female ratio of 2:1. Patients in our study belonged to varied groups of occupation right from being highly physically active to retired personnel and house-wives. Maximum were housewife and labourer constituting around 8 cases (32%) each. The indication for surgery included avascular necrosis of hip in 17(68%) cases mainly due to sickle cell disease, post-traumatic, steroid or alcohol intake and idiopathic variety. 4 cases (16%) were caused by arthritis of variety of reasons viz. rheumatoid arthritis, ankylosing spondylitis and remaining 4 cases (16%) of implant failure. 5 patients were operated on right side and 9 patients were operated on left side and 10 Patients were operated on both sides. 10 patients had bilateral hip involvement and 15 patients had unilateral hip involvement. Average follow up period was 12 months. Associated systemic disease in form of ankylosing spondylitis, alcoholism, diabetes mellitus, and hypertension in 1 (4%) case each. While rheumatoid arthritis was seen in 2, sickle cell disease in 4 and remaining 12(48%) of cases had no co-morbidities. All the patients in our series were operated using Modified Gibson's posterolateral approach. Spinal (24%, n=6) and Epidural + Spinal Anaesthesia (72%, n=18) was preferred but General Anaesthesia was given in one case as there was some definite indication for it, as determined by the anaesthetic team. Average blood transfusion done for each surgery was 1.7 units with requirement of 3 or more units in 4 cases. In all the patients in this study, the type of femoral and acetabular prosthesis was uncemented, either Corail with Duraloc system or solution stems or pinnacle hip systems or ceramic on ceramic type. Of the 25 patients cementless total hip arthroplasties performed in our study, 2 patients were of ceramic on ceramic variety, 1 patient was treated with solution femoral reconstruction system, and 3 patients were treated with pinnacle hip system, while the remaining majority of the patients 19 were treated with Corail with Duraloc hip systems.

Size of Prosthesis: Acetabular Component: 50mm was found to be the most common size used in patients in our study followed by size 52mm. Femoral Component: Size 11 was the most common size of femoral component used. There were no intraoperative significant events. Complications in our study were 2(8%) cases of dislocation, single case(4%) each case of deep vein thrombosis, post-operative infection and sciatic nerve injury. 80% (n=20) cases were without any complications. The patients were followed up till May 2016, the largest follow up being 24 months and shortest being 6 months. The average follow up period was 12 months. 15(60%) were follow up for 0-12 months while 10 patients were followed up for 13 to 24 months. 24 patients showed excellent results, and 1 patient showed good result with no case of fair and poor result. In this study, 2 patients were having slight pain, no patients had limp, 6 patients used cane for long walk distance, 5 patients were able to walk for 1 kilometer and rest were able to walk unlimited, 4 patients were using railing for climbing staircase, and all patients were able to sit comfortably, able to wear shoes and socks easily, and were able to use public transport. Range of motion score of all patients was 5 except 1 patient who had score 4. Preoperatively 10 cases had fixed flexion deformity, 12 cases had adduction deformity, and 5 cases had abduction deformity but there were no postoperative deformity. Average flexion was 110°, abduction 40°, adduction 30°, external rotation 30°, internal rotation 20°. All 25 cases (100%) had no significant limb length discrepancy (>3.2cms) post-operatively.

We assessed our patients based on modified Harris hip score, and compared individual components of modified Harris hip score pre-operative and post-operative.

Table 1: Distribution as per Pre-Operative & Post-Operative

Component Pre-operative Post-operative	Mean	Standard deviation	Median	IQR	Wilcoxon Signed Ranks Test	
Pain	29.20 43.68	2.77 1.11	30.00 44.00	0.00 0.00	-4.838	**Diff is Significant**
Limp	6.44 11.00	1.53 0.00	5.00 11.00	3.00 0.00	-4.507	
Support	5.24 10.20	1.33 1.63	5.00 11.00	2.00 0.00	-4.442	
Walking distance	5.48 10.40	1.66 1.22	5.00 11.00	1.50 0.00	-4.500	
Stairs use	1.52 3.76	0.77 0.66	2.00 4.00	1.00 0.00	-4.478	
Sitting	1.68 5.00	1.52 0.00	3.00 5.00	3.00 0.00	-4.512	
Foot wear	1.92 4.00	0.40 0.00	2.00 4.00	0.00 0.00	-4.914	
Public transport	0.40 1.00	0.50 0.00	0.00 1.00	1.00 0.00	-3.873	
Range of motion	1.80 4.96	0.41 0.20	2.00 5.00	0.00 0.00	-4.622	
Deformity absence	0.00 4.00	0.00 0.00	0.00 4.00	0.00 0.00	-5.000	
Modified harris hip score	53.68 98.00	6.54 2.92	55.00 100.00	5.50 4.00	-4.378	

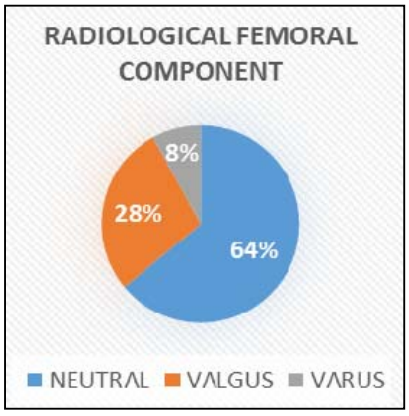
Note- normality test(shapiro-wilk) failed($p < 0.05$), thus Wilcoxon signed rank test applied

Radiological assessment of parameter was done at final follow up and there was no case of cup migration and wear of socket, while cup position in form of inclination and version was normal. No screw was broken and even no osteolysis was found around screw. In case of femoral component stem was intact in all cases with no subsidence, radiolucency, resorption of medial side of neck (calcar) or ectopic calcification.

96% excellent results were achieved according to modified Harris Hip Score. 1 patient had good outcome probably attributable to his systemic illness.

Table 2: Distribution as per Radiological Femoral Component Position

Radiological Femoral Component Position	No. of patients	Percent
NEUTRAL	16	64.00%
VALGUS	7	28.00%
VARUS	2	8.00%
Total	25	100.00%



A case of left uncemented total hip arthroplasty in a case of avascular necrosis of left femoral head in case of 5 yrs. back operated left posterior acetabular plating without neurovascular deficit.

Fig 1: case of pre-operative and post-operative post traumatic hip AVN

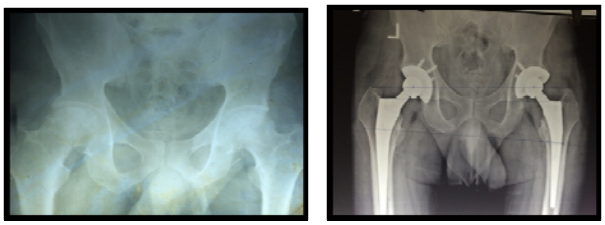


Fig 2: bilateral case of hip AVN pre-operative and 6 week pos-operative

Discussion and Analysis

Total hip replacement is being performed on younger patients at increasing rate. In the UK national joint registry, patients under the age of 55 years account for 12% of the arthroplasty burden [11]. Good surgical technique And choice of implant are crucial for patients undergoing Total Hip Arthroplasty (THA) because of their high physical demands and the need for long-term survival of the implant. However short term results have been excellent as seen in our study also.

Of the 25 patients, 2 patients had slight occasional pain at the final follow-up. Of these two patients, one patient was a case of ankylosing spondylitis and pain may be due to stiffness of spine and pain in second case could be attributed to other factors of this patient. We also found that 6 patients used cane for long distance walking at the final follow-up. Of these two patients were of old age, one patient was of ankylosing

spondylitis, one patient was case of osteoarthritis of knee joint, one patient used cane due to calf pain as patient 1 month back admitted for deep vein thrombosis and one patient had sciatic nerve injury. 5 patients were able to walk for up to 1 kilometer, one patient had osteoarthritis of knee joint, One patient was case of bilateral AVN of femoral head, one side operated for uncemented THR and other side for core decompression and in other three cases it could be attributed to other factors of the patient. In this study, 4 patients used railing for climbing staircase, one patient was a case of bilateral AVN of femoral head with right side operated for uncemented THR and left side not operated, one patient had osteoarthritis of knee joint and in two cases it could be attributed to other factors of this patient. This shows that results were excellent in short term and co-mobidities affected the outcome post-operatively.

We also analyzed our results with other studies, Kolisek *et al* [12] in his study of 854 patients (936 cases), with mean age of 56 yrs. Showed 3 cases of revision surgeries for stem failure while none other complication was reported. Main indication for surgery in his study was avascular necrosis 152(16%), rheumatoid arthritis in 54(6%) and osteoarthritis in 730 (78%). Mean Harris hip score was 91 compared to 98 in our study.

Similarly mean Harris score in study by Jeffery *et al* [13] (10 yrs. follow up) of 138 patients(145 cases) was 88 with excellent result in 87%, fair (7%) and poor 6% compared to excellent 96% and good in 4 % of our cases however our study was of 2 yrs. follow up. Harris hip score in studies by Liang T *et al* [5] (10 yrs. follow up) was 94.5, Alexander *et al* [14] was 90 and by Torre *et al* [15] (10 yr. follow up) was 83.2.

Analysis of complication in our study, acute post-operative infection seen in 1 patient (it may be because of patient was a known case of sickle cell disease), DVT was seen in 1 patient because this patient had not started partial weight bearing after 3 weeks. Postoperative Dislocation in 2 patients, both of them did not follow post-operative hip precautions, and 1 patient had sciatic nerve injury. While there was none radiological complication in our 2 yrs. follow up period. In a study by Jin ho cho *et al* [16] (7 yrs. study) of 86 hips showed one case of acetabular osteolysis which required revision. Bidar *et al* [17] (10 yr follow up of 111 cases) showed retro-acetabular osteolysis in 12 cases and 1 case of peri-prosthetic fracture. Tiang j Liang T *et al* [5] (10yr follow up study of 77 cases) showed heterotopic calcification in 12 cases, osteolysis in 8 and 1 patient each of aseptic loosening and migration.

There were no femoral component loosening or osteolysis in all above study including ours. However in a study by Jeffery *et al* [18] (22-26 yr. follow up) showed one case of femoral component loosening and 4 case of osteolysis in femoral component.

Conclusion

The present study was aimed at evaluating the results of cementless total hip arthroplasty in Indian population under the age of 50 years, performed at our institute involving a strict preoperative, intraoperative and postoperative protocol. From this study, we have concluded that operative treatment for various hip disorders in the form of cementless total hip arthroplasty has helped in alleviation of intractable pain, resumption of ambulation and return to functional activity. The longevity of the cementless arthroplasty systems, their usefulness in overcoming the pitfalls of cemented total hip arthroplasties like the short duration of implant life, osteolysis and bone loss, subsequently needing revision surgeries at a later date, which are complicating and do not always yield satisfactory results, the excellent short and medium term outcome of cementless total hip arthroplasty in young active as well as older individuals, have decreased the chances of failures. In Indian population, avascular necrosis of hip is the main indication for this surgery. The surgery has been performed in younger patients with avascular necrosis of hip secondary to sickle cell disease, rheumatoid arthritis, pregnancy, alcoholism, post traumatic arthritis of the hip with good short term results.

This surgery has gradually gained good popularity since its inception amongst the patient population reporting at our institute. Cementless Total Hip Arthroplasty is a procedure which provides a nearly physiological joint and with experience, proper instrumentation, proper selection of implants, its placement in correct version and inclination, excellent results could be achieved with nil or minimal complication rate.

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