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FUNCTIONAL OUTCOME AND RADIOLOGICAL ASSESSMENT OF UNCEMENTED TOTAL HIP ARTHROPLASTY IN YOUNG POPULATION

Orthopaedics

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ABSTRACT

Background- Hip joint is most important joint of a body as it allows the person to undertake various postures. Total hip arthroplasty (THA) remains as treatment of choice in restoring function and activity in end stage hip arthritis. The modern implant design and improved surgical methods must result in improved long term survival of the adult joint reconstructions. Harris hip score is used most widely used scoring system for assessing functional outcome of hip arthroplasty. Hence this study was conducted to determine functional outcome, radiological assessment and the complications associated with uncemented THA in young Indian population.

METHODS-The study was conducted August 2019 to December 2021, sample size of 40 patients was taken. All pateints were either unilateral or bilateral arthritis of hip with less than or 40 years.Patients were evaluated preoperatively and post-operatively. After discharge patients were followed up at regular intervals. Modified Harris Hip score were calculated. Radiological evaluation was done with anteroposterior radiograph of pelvis with both hip.

Results -Total 40 patients were followed for 6 months.Mean pre-operative Harris Hip Score (HHS) was 35.31±8.79 increased to 92.09±6.84 at 6-months . Limb length discrepancy was observed in eight patients.The mean vertical offset (femoral length) and mean horizontal offset (femoral offset) were restored to normal side in all cases.The acetabular inclination ranged from 35-45 degree. Only 1 patient femoral stem was aligned in Valgus. None of the patients had any major complications.

CONCLUSION-Our study recommends that the current generation implants without cement can provide satisfactory clinical and radiographic outcomes after an intermediate duration of follow-up in young age group.

KEYWORDS

Young age group, Uncemented total hip arthroplasty, Functional outcome Harris hip score

INTRODUCTION:

Hip joint is most important joint of a body as it allows the person to undertake various postures[3]. Hip can be categorized as largest joint in a body. The components of hip include the acetabulum of pelvic bone and the ball of femoral head. Bony surfaces are secured with the articular cartilage, and smooth tissue which cushions end of bones, and aids the mobility in joint[12].

Earlier days, hip arthrodesis or resection arthroplasty were the preferred options but since last couple of decades total hip arthroplasty emerged as successful option with good functional results. With the advances in design and materials used for implants the success rate has increased in even high demand patients. Thus, Total hip arthroplasty (THA) remains as treatment of choice in restoring function and activity in end stage hip arthritis[1].

Few indications of THA that were seen in individuals in the study are-

- Osteoarthritis- Primary and Secondary
- Secondary osteoarthritis- Osteonecrosis, Post trauma
- Rheumatoid and Other terminal inflammatory arthopathies- Spondyloarthropathies (Ankylosing spondylitis)

Although THA was earlier considered only for elderly patients, good functional results have been reported by multiple studies in younger patients[1].

THA is the surgical procedure that has relieved the millions of individuals from devastating pain arising from hip joint, presently it is the commonest performed adult reconstructive hip procedure.

The modern implant design, and improved surgical methods must result in improved long term survival of the adult joint reconstructions.

The success of THA is essentially based on creation of stable, and artificial weight-bearing surfaces having low friction between the components which are securely fixed in the bone, careful selection, and assessment of patients, in addition to meticulous attention to operative technique and asepsis.

Total hip arthroplasty results in pain relief, functional recovery, and improved quality of life.

Uncemented THA was developed in the response to mark that the cement debris plays the essential role in promoting the bone lysis, and the loosening. Prosthetic devices were developed which achieve fixation without the cement, either by the "press-fit", or by the biologic in-growth. With press-fit technique the stabilization is attained by the interference fit of implant into femur with the biologic in-growth. Fixation happens by the bone ingrowth into porous surface[2].

Evaluation of long-term outcomes of the operative procedure is very important to determine durability of procedures like THR. Patient derivative outcome scales, have become progressively important to the surgeons, and the clinical researchers for measuring the improvement in the function after the surgery. It provides the means for the comparison of results of the different clinical interventions, which might lead to the changes in the operative technique, and design of implant over time. Harris hip score is used most widely scoring system for assessing functional outcome of hip arthroplasty[17].

Hence this study was conducted to determine functional outcome, radiological assesment and the complications associated with uncemented THA in young population.

OBJECTIVE

- To asses functional outcome of uncemented total hip arthroplasty.
- To assess the radiograph post operatively and at final follow up.
- To assess the complications of uncemented total hip arthroplasty.

MATERIAL AND METHODS

The study was conducted in the department of orthopaedics surgery of SRMS-IMS, Bareilly from August 2019 to December 2021 for patients coming to IPD, in which sample size of 40 patients was taken. They underwent surgery after obtaining approval from hospital ethics committee.

Study Design: Prospective observational study design was adopted.

INCLUSION CRITERIA

1. Male and female patient with unilateral or bilateral hip arthritis with age less than or 40 yrs.
2. Skeletally mature patients who are medically fit for surgery and will give written consent for the surgery and study, were included in the study.

EXCLUSION CRITERIA
1. Skeletally immature patients.
2. Dysplastic hip conditions (congenital).
3. Active infection at operative or other site.
4. Septic arthritis.
5. Tubercular arthritis.
6. Neurological weakness of limb.

METHOD

Preoperative planning-

The detailed history of onset of pain, deformity and associated disease was recorded. All the patients were evaluated clinically on basis of modified Harris Hip Score. Clinical assessment in terms of range of motion, pain, restriction of distance walked and restriction of carrying out daily activities were recorded.

Associated medical problems: Hypertension, diabetes mellitus, coronary artery disease, past history of thrombo embolism, COPD, history of recent throat, urinary and other infections were evaluated.

Adequate compatible blood was reserved before surgery.

Pre-operative Radiographic Templating-
- Assess Vertical and Horizontal offset
- Assess femoral stem alignment
- Acetabular inclination

OPERATIVE METHOD

All the operations were done under spinal anaesthesia or epidural anesthesia, once the patient is found to be fit for anesthesia and surgery. All patients were treated by uncemented total hip arthroplasty using conventional technique.

The procedure was done either by postero approach or postero-lateral approach

Post-operative regimen

Ankle pump and quadriceps exercise was initiated immediately after effect of epidural anesthesia subsided.

Abduction Pillow was kept between two legs of patient immediately after operation.

Parenteral antibiotics for the period of 3 days were given to all the patient post operatively.

High sitting with partial weight bearing was initiated on POD 1.Patients were advised to avoid cross leg sit and squat.Patient were called for follow up on 6th week for reassessment. Both clinical as well as radiological assessment was performed and if fixation was found to be progressing then satisfactorily full weight bearing was started as tolerated. Patients were next called at 3 month follow up for a similar reassessment.

Follow Up
- Clinical assessment was done using modified harris hip score at preoperative and post operative follow up at 6 weeks, 3 month and 6 months. Radiographs were also analyzed at subsequent follow up.

Ethical clearance

The research procedure followed was in accordance with the approved ethical standards of SRMS-IMS, UP, India Ethics Committee (Human).

STATISTICAL ANALYSIS

Data was analyzed using Statistical Package for Social Sciences, version 23 (SPSS Inc., Chicago, IL). Results for continuous variables are shown as mean±standard deviation (SD), whereas results for categorical variables are shown as number (percentage). P values were calculated with Student t-test. Values of $p < 0.05$ were considered as significant.

OBSERVATIONS & RESULTS

The present study was aimed to determine functional outcome and radiological assessment of uncemented total hip arthroplasty in young population. A total of 40 patients were enrolled at Department of Orthopaedics, were included.

RESULTS-

Age

Mean age of the patients in our study was 28.55 years ranging from 20 years to 40 years. A majority of the patients aged between 31 and 40 years (55%) while 45% patients aged between 20 to 30 years.

Sex

In our study, male to female ratio was 4:1. 80% percent of the patients were males while remaining 20% were females.

Harris Hip Score

In our study, mean pre-operative Harris Hip Score (HHS) was 35.31±8.79, which increased postoperatively to 75.63±6.33 at 6-weeks, 84.94±5.98 at 3-months, and 92.09±6.84 at 6-months. We also observed that there was a significant improvement in HHS postoperatively at all times in comparison to pre-operative HHS ($P<0.001$) (Table 3 and Figure 3).

Table 3: Change in Harris Hip Score(mean)

	Harris Hip Score (mean)	P-value*
Pre-operative	35.31±8.79	<0.001
Post operative 6-weeks	75.63±6.33	
Post operative 3-months	84.94±5.98	
Post operative 6-months	92.09±6.84	

- Very highly significant (Pre-op vs. 6-weeks, Pre-op vs. 3-months, Pre-op vs. 6-months)
- Very highly significant (6-weeks vs. 3-months, Pre-op vs. 6-months)
- Very highly significant (3-months vs. 6-months)

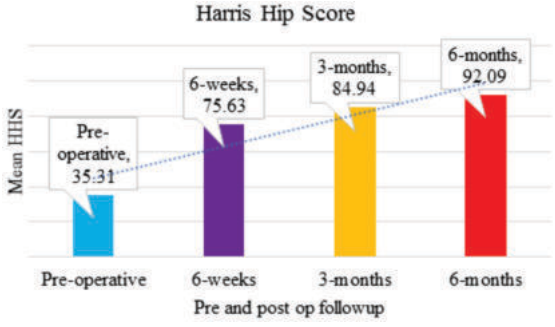


Figure 3: Change in Harris Hip Score(mean)

Grading Of Functional Outcome On Basis Of HHS

Our study observed the functional outcome post operatively at 6-weeks ,at 3-months and at 6-months.At 6 months 75% had excellent outcome. There was a significant improvement in functional outcome post-operatively when compared with pre-operative score. (Table 4).

Table 4: Grading Of Functional Outcome On Basis Of HHS (n=40)

	Pre-operative	Post operatively at 6 Month
Excellent (90-100)	0	30 (75%)
Good (80-90)	0	8 (20%)
Fair (70-80)	0	2 (5%)
Poor (<70)	40 (100%)	0
P value		<0.001

Post-operative Lower Limb Length Discrepancy (LLLD)

In our study, limb length discrepancy was observed in 8 patients. Three patient (7.5%) had shortening of 1cm and five patients (12.5%) had limb lengthening (four patients had 1cm and one patient had 1.5cm). Remaining thirty two patients reported no change in the limb length. (Table 5).

Radiological assessment of implant position in follow up

Vertical offset findings-

In present study the Average vertical offset (femoral length) preoperatively of normal side were 6 cm and at post op it was 6.5 cm

Horizontal offset

In the present study the average horizontal offset (femoral offset) preoperatively of normal side was 5 cm and restored at post-operative side average of 4.82cm

ACETABULAR INCLINATION

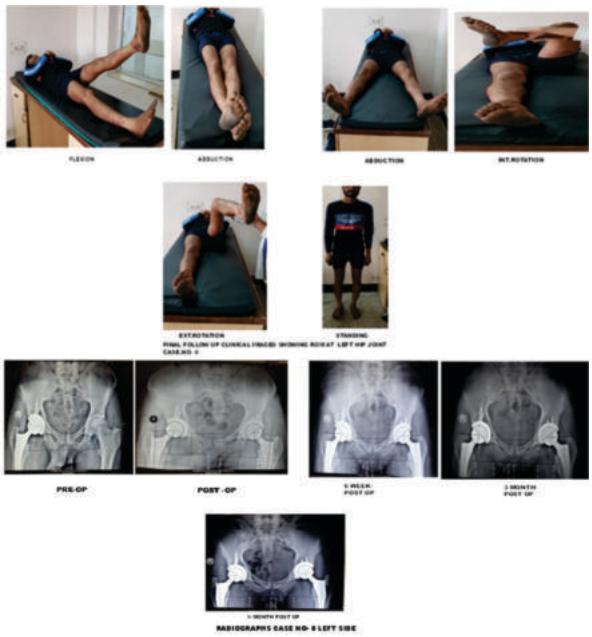
In present study the mean acetabular inclination postoperatively was 37.50±3.36 degrees and at six month follow up it was 37.50±3.36 as

there was no change in the inclination.

Femoral Stem Alignment-
In our study only 1 (2.5%) patient had Valgus postoperatively and at the end of follow up while rest 97.5% were having neutral femoral stem alignment.

COMPLICATIONS-
In present study only two patient (5%) showed complication of anterior thigh pain.

The patient with complain of anterior thigh pain was managed conservatively with NSAIDs and physiotherapy.



DISCUSSION
Total hip arthroplasty continues to evolve. This surgical procedure that was once for the elderly patients is now being performed in all age groups, also patients with high activity level. As the number of younger patients requiring hip arthroplasty continues to rise, this effective surgical procedure needs to meet challenges of the future. Some of the challenges are to design a prosthesis that has ample longevity in all patient groups, also the young and the active; can be implanted with relative ease; minimizes bone loss; and has a predictable outcome with little complications.[46]

We evaluated functional and radiological outcomes of Uncemented THA in 40 hips operated at our center by Harris Hip Score.

AGE AND SEX DISTRIBUTION
Mean age of the patients in our study was 28.55 years ranging from 20 years to 40 years. A majority of the patients aged between 31 and 40 years (55%) while 45% patients aged between 20 to 30 years. In our study, male to female ratio was 4:1. 80% percent of the patients were males while remaining 20% were females .Our findings were in accordance with **G. Mahiques-Segura et al**[49] that reported a male predominance in his study; **Wade R and Shah KA**[1] who reported mean age of patients at the time of surgery was 27.5 years (from 21–38 years) basically younger patients. Out of the studied patients, 68.0% were male and 32.0% were female.. **Bansal A et al**[47] reported that 77.4% were male and 22.6% were female. Mean age was 38 years (from 28 to 68 year). 88.0% of their cases were below 50 years and 62.0% were below 40 years of age.

Most of the patients are in younger age group because Osteonecrosis is more common in young age and early diagnosis and management availability.

Osteonecrosis is more in males, due to post traumatic complication and alcohol intake because alcohol intake is much more common in male patient. So, in this study male are more than females.

HARRIS HIP SCORE
In our study**,** mean pre-operative Harris Hip Score (HHS) was 35.31±8.79, which was increased to 75.63±6.33 at 6-weeks, 84.94±5.98 at 3-months, and 92.09±6.84 at 6-months and it shows that Harris score improves significantly in comparison to the preoperative score ($p<0.01$). Our findings were comparable with **Hearn S L at al**[53] that Harris hip score was 91.6. and in **Kim Y H et al**[50] study the mean Harris hip score increased from 40 ± 13.1 points preoperatively to 95 ± 2.9 points at 1 year after surgery,another study by **Fye M A et al**[55] the mean Harris Hip Score was improved from 31 (preoperatively) to 96 (2 years). The study by **Wade R and shah KA**[1] who reported mean Harris Hip score improved from 36 (pre-operative) to 92 (5years follow-up). Similarly, according to **Chiu K. H. et al**[56] average preoperative score for all patients (both those with and those without ON) was 36.3, and that at the last follow-up examination was 82.8. According to **Kulkarni S et al**[51] mean total preoperative score was 37.20 (19- 70). At latest follow up the total mean score was 90.44 (72- 97). **Bansal A et al**[47] observed mean pre-op Harris Hip Score of 49 improved to 95.07 postoperatively at final follow up.

In present study the Preop harris hip score -mean of 35.31 shows that the patients report only when the disease is advanced i.e. pain is severe and functions are affected.

In the follow up at 6 month, harris hip score were significantly high thus inference can be drawn, in patients with advanced stage of arthritis of hip joint, Un-cemented THA provides significant pain relief, functional recovery, and improved quality of life.

GRADING OF FUNCTIONAL OUTCOME ON BASIS OF HHS
Our study observed the functional outcome post operatively at 6-weeks ,at 3-months and at 6-months.At 6 months 75% had excellent outcome. There was a significant improvement in functional outcome post-operatively when compared with pre-operative score. ($p<0.01$). **Chiu K. H. et al**[56]reportedexcellent or good (hip score between 80 and 100) in 28 hips (77.8%) for the osteonecrosis (ON) group and in 32 hips (88.9%) for the non-ON group. Similar findings were reported by **Patil P et al**[2] . Pre operatively 91.67% had a poor score. The results showed a significant improvement, wherein 72.22% had an excellent score and 13.88% showed good and fair results each. **Yaratapalli SR et al**[14] reported that 89.0% excellent / good results and 11.0% fair / poor results.

Hence inference can be drawn that, on basis of HHS the functional outcome of the Uncemented THA at 6 months can be graded as excellent to good, thus a procedure of choice in patients with advanced hip arthritis ,with debilitating pain affecting the quality of life.

POST-OPERATIVE LOWER LIMB LENGTH DISCREPANCY (LLLD)
In our study, limb length discrepancy was observed in 8 patients. Three patient (7.5%) had shortening of 1cm and five patients (12.5%) had limb lengthening (four patients had 1cm and one patient had 1.5cm). Remaining thirty two patients reported no change in the limb length. **Bansal A et al**[47] reported that more than 1 cm limb length discrepancy was seen in 25 (16.7%) patients with overall mean discrepancy of 0.24 cm (range 0 to 3cm). **Patil P et al**[2] reported the postoperative Limb Length Discrepancy: 2 patients (5.55%) had 1cm limb lengthening and 1 patient (2.77%) with 1.5cm lengthening. **Bourne RB et al**[59] and **Herzwvrm PJ et al**[60] reported the limb length discrepancy in 8.0% and 17.2% patients respectively.

Studies show most patients tolerate LLLD of up to 10mm while lengthening by more than 10 mm has been associated with limping, pelvic obliquity, requiring shoe raise (on opposite side) and feeling of disappointment.[61]

The discrepancy of limb length was managed by providing compensatory shoe raise on affected or unaffected side. Thus, inference can be drawn that patients undergoing the procedure can have limb length discrepancy, which can be kept to minimum with appropriate measures.

VERTICAL OFF SET (VO) AND HORIZONTAL OFFSET (HO) FINDINGS-
In present study the mean vertical offset (femoral length) preoperatively of normal side were 6±0.50 cm and at post operatively it was 6.±0.50 cm. similarly the average horizontal (femoral offset) preoperatively of normal side was 5 cm and at post op it was 4.82cm. **Jean Yves and Adrien et al**[62] found mean Preop femoral offset of 4.24

cm and mean post op were 4.08 cm.

Similarly, **N.D CLEMENT and R.S. PATRICK et al**[63] found mean femoral offset preoperative for normal side 4.5cm and mean vertical offset 6.5 cm. The mean femoral offset post-operative of 5cm and vertical offset post-operative 6.5cm. **Kevin A. Cassidy and Manish et al**[64] reported average femoral offset preoperative was 42.1mm compared to contralateral side 41.2 mm.

In our study, operated hip offsets were significantly restored in comparison to opposite hip, resulting in excellent to good functional outcome and activity.

ACETABULAR INCLINATION

In present study the mean acetabular inclination postoperatively was 37.50±3.36 degrees and at six month follow up it was 37.50±3.36 as there was no change in the inclination, the association was found insignificant (p>0.05). According to **Wade R and Shah KA**[1]the angle of inclination for acetabular component was between 40 and 50° in 95% of patients. The mean acetabular inclination was 44.2° (range 38–53). **Kulkarni S et al**[51] in their study found that in 90.0% patients' post-operative acetabular cup angle was in range of 45-50 degree. 5.0% patients with cup angle more than 50 degree had good to excellent outcome scores. 5.0% patient with cup angle less than 40 degree had good outcome score. **Patil P et al**[2] found postoperative Acetabular Cup Angle: In 47.22% of the patients the acetabular cup angle was 40°. The average acetabular angle was 45.08°±5.118.

In present study the acetabular inclination ranged from 35-45 degree and had excellent to good functional outcome with reduced risk of dislocation.

FEMORAL STEM ALIGNMENT

In our study only 1 (2.5%) patient had Valgus postoperatively and at the end of follow up while rest 97.5% were having neutral femoral stem alignment.Our findings were similar with **Chiu K. H. et al**[56], they found that stem alignments did not change with time; **Wade R and Shah KA**[1] who found that on radiological assessment for alignment of femoral stem, 46 (82.14%) hips were in neutral position, eight (14.28%) hips were in valgus and two (3.57%) were in varus. **Kulkarni S et al**[51] reported that the femoral stem was in neutral position in 90.0% patients and in 10.0% patients, it was in 5-degree varus. Out of 10.0% patients with stem in varus, 5.0% had excellent outcome score and 5.0% had good score. **Yaratapalli SR et al**[14] had a Central Femoral stem position in 69.0%, a Valgus position in 23.0% and a Varus position in 8.0%.

Various studies[69] have shown that femoral component's varus alignment increases the femoral offset and increasing tension on neck of femoral component thus increased risk of fractures. Therefore, femoral component should be placed in valgus or neutral position.

However in present study no significant association was found between alignment of femoral component and functional outcome.

COMPLICATIONS

In present study only two patient (5%) showed complication of anterior thigh pain. The patient with complain of anterior thigh pain was managed conservatively with NSAIDs and physiotherapy.

In present study no association was observed in between pain in the thigh and position of the stem which shows similar results as seen in a study by **Dr. Prabhulingreddy Patil, Dr. Eswara Reddy G et al**[2] and **Matthew J. Kraay, Victor M. Goldberg, et al.**[70]

Chiu K. H. et al[56]reported no infection; **Bansal et al**[47] observed complication only in 4 (2.67 %) patients, with dislocation in one and superficial infection in 3 patients after the operation. **Kim Y H et al**[50]reported dislocation occurred in 10 hips (0.9%) between 10 and 15 days, 3 hips (0.3%) had a recurrent dislocation. **Patil P et al**[2] in their study reported that the commonest complication noted was anterior thigh pain (13.89%). Nerve injury were seen in 2 individual patients. Only patient with dislocation showed fair result functionally. According to **Wade R and Shah KA**[1]10.0% complained of anterior thigh pain which subsided over period of three months with conservative treatment. 3 patients had superficial wound complications which were managed with secondary suturing. 3 patients had limb lengthening more than 2 cm.

The lower incidence of complications like infection and dislocation in our series is due to fact that we followed the protocol strictly for asepsis and component position.

LIMITATIONS OF THE STUDY

- Smaller sample size
- The cohort of patients has different diagnosis which may affect outcome and act as confounding factor.
- Six month follow-up is a relatively short follow-up.

STRENGTHS OF THE STUDY

- The data was analysed based on the consent proforma
- Although there are limitations to this study, study is important in the fact that it is prospective study and also reports outcome of uncemented THA in young patients.

RECOMMENDATIONS OF THE STUDY

- Further long term follow up is required for evaluating the long, term complication which is one of the draw back of the study.
- Our study recommends that the current generation implants without cement can provide satisfactory clinical and radiographic outcomes after an intermediate duration of follow-up in young population.

CONCLUSION

THA continues to be an excellent procedure to achieve painless, mobile, stable hip in cases with advanced hip problems. Proper clinical evaluation, appropriate measures to correct deformity, adherence to protocols and proper rehabilitation is essential to achieve excellent functional outcome. Uncemented THA can be used in young patients with excellent to good functional outcome at midterm follow-up. Though the study was not free of complications, the overall functional and radiological outcome showed good results. To establish confirmatory results, Longer follow-up and multicentric studies with larger sample size are necessary.

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