Functional outcome of uncemented total hip replacement in AVN femoral head- A prospective study

Dr. Srikant Kulkarni, Dr. Rajkumar Bagewadi and Dr. Siddhant Sanjay Gandhi

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Abstract
Background & objectives: Total hip arthroplasty is the most commonly performed adult reconstructive hip procedure. It relieves pain and functional disability experienced by patients with moderate to severe arthritis of the hip, improving their quality of life. The success of Total Hip Replacement arthroplasty is its ability to relieve the pain associated with hip joint pathology, while maintaining the mobility and stability of the hip joint. The most common condition for which total hip arthroplasty is done is severe Arthritis of the hip, secondary to AVN of head of femur accounting for 70% of cases. The primary indication for this procedure is severe pain and the limitation in activities of daily living that it causes. To warrant doing total hip replacement, pain must be refractory to conservative measures such as oral analgesics weight reduction and use of cane.

The purpose of this study was to evaluate the clinical and radiological outcome of Total Hip Replacement using Modified Harris Hip score and radiological assessment.

Methods: The study was carried out on 20 hips of 17 patients of Total Hip Replacement performed in Dept of Orthopaedics from April 2012 to April 2014. All the admitted patients with diagnosis of AVN of femoral head were operated with uncemented THR. This was a prospective study. Information of patients was obtained pre-op, post-op and at each follow ups. Functional outcome was evaluated using Harris hip score. Patient follow up was for a minimum of 3 months to a maximum of 24 months.

Results: 20 hips of 17 patients were operated with uncemented THA for AVN of head of the femur. Patients were evaluated both functionally and radiologically. Functional evaluation with Harris hip score (modified) showed excellent results in 15 hips, good results in 4 hips, and fair result in 1 hip. Radiological evaluation at the latest follow-up showed no signs of loosening or implant failure.

Conclusion: We have evaluated THA using uncemented prosthesis. Our study suggests that current generation implants can provide satisfactory clinical and radiographical outcomes after a short duration of follow up. Though the study was not free of complications, the overall, functional and radiological outcome showed good results.

Keywords: uncemented total hip replacement; modified harris hip score; AVN

1. Introduction
Total hip replacement arthroplasty is a surgical procedure, which has relieved millions of people from incapacitating pain arising from the hip joint. At present it is the most commonly performed adult re-constructive hip procedure. The success of Total Hip Replacement arthroplasty is its ability to relieve the pain associated with hip joint pathology, while maintaining the mobility and stability of the hip joint.

With increase in longevity of life in past few decades, the incidence of chronic disabling conditions of the hip such as osteoarthritis, inflammatory arthritis and osteonecrosis are on the rise.

The primary indication for this procedure is severe pain and the limitation in activities of daily living that it causes. To warrant doing Total hip replacement, pain must be refractory to conservative measures such as oral nonsteroidal anti-inflammatory medication, weight reduction, activity restriction, and the use of supports such as a cane.

Conventional cemented THA dramatically improves the patients function and quality of life. With contemporary prosthesis and modern cementing techniques, the rate of femoral loosening appears to be substantially reduced. Regardless of cementing techniques, mechanical loosening
occurs more commonly in young, heavy, active men with
certain prosthetic designs. Noncemented devices were initially indicated only for use in
young patients with high physical demand where a revision
surgical procedure in future will be more likely. But now
various studies have proved the adequacy of non cemented
implants in middle and old age population also. Preliminary
data suggest that non cemented THA have a relatively low
revision rate and excellent prosthetic durability.

2. Objectives of the study
- To study the role of THR in patients with hip arthritis
  secondary to AVN of head of femur that cause the level
  of pain and disability, unresponsive to conservative
  measure and significantly impairing quality of life.
- To evaluate the results of THR clinically and assessing the
  functional outcomes of patients with reference to pain,
  walking ability and range of motion.
- Radiological evaluation and assessment of complications
  of this procedure.

3. Methodology
This study was conducted in Department of Orthopaedics,
Sanjay Gandhi Institute of Trauma and Orthopaedics
Bangalore from 2012 April to April 2014. The patients
presenting to OPD and Emergency were screened for various
hip disorders and included in the study.
All confirmed cases of AVN of head of femur with arthritis of
hip were admitted at Sanjay Gandhi Hospital Bangalore.
All admitted patients were operated upon for Total Hip
Arthroplasty using uncemented acetabular cup and
uncemented femoral stem.

Inclusion criteria
All cases undergoing primary total hip replacement in our
institute which included,
- Both male and female sex
- Age group 18 – 65yrs
- Clinical signs and symptoms.
- Radiological findings.
- Patients who are fit for surgery.

Exclusion criteria
- Patients below the age of 18 years
- Patients who are unfit for surgery due to associated
  medical problems.
- Patients not willing for surgery.
- Active infection.

Detailed history, clinical examination, and radiological
examination were carried out in all patients.
All standard preoperative protocols were followed.

Operative steps
Procedure
Anaesthesia - Spinal/Epidural
Approach - Posterior approach (Moore’s / Southern approach)
Position – True lateral with affected limb uppermost.

Exposure
Posterior southern moore approach was used in all the
patients.
A 10 -15 cm curved incision, centered on the posterior aspect
of greater trochanter is taken. After dissecting the
subcutaneous tissue, fascia lata is incised in line with the skin
incision over the center of the greater trochanter. The gluteus
maximus fibres are split bluntly and Charnley’s retractor
applied.
Now the hip is internally rotated to put the short external
rotators were detached from their femoral attachment.
The capsule and the labrum are excised out to provide 360
degree exposure of bony margins of the rim of the
acetabulum. Excise fibrofatty tissue, ligamentum teres
remnant and any osteophytes to expose the medial wall of the
acetabulum. Progressive reaming is done at 1mm intervals, till
the bleeding subchondral bone is exposed and hemispherical
dome is achieved. Now the polyethylene liner is introduced
into the acetabular cup and impacted into the acetabular cup.
Now the femoral canal is entered at piriformis fossa with box
osteotome and bone is removed from the medial aspect of the
greater trochanter to form a groove. Insert the trial stem and
the head and do the trial reduction. The trial femoral
component is removed and thorough wash given with normal
saline. Then femoral stem of the corresponding size as
dictated by the trial stem is then inserted into the medullary
canal and hammered till tight fit is obtained.
Reduction is done. Stability of reduction is checked with hip
in 90 degree flexion, 5 degree extension, 30 degree of
abduction and adduction, 40 degree internal rotation and
external rotation.
Wound is then closed in layers with suction drain in situ.
Abduction pillow is given between the legs to prevent
adduction.

Fig 1: Incision

Fig 2: Proximal femur delivered after incising the capsule
Fig 3: Acetabular cavity after reaming implanted

Fig 4: Acetabular component

Fig 5: Femoral stem implanted

Fig 6: Closure with suction drain insitu

Post operative management
- Limb is kept in abduction with pillow between two lower limbs. Vitals are monitored carefully.
- Intravenous antibiotics are given for 4 days.
- On 1st post operative day, check X-rays are taken. Static quadriceps exercises, knee and ankle mobilisation done. Chest physiotherapy started. Patient is made to sit.
- On 2nd post operative day, drain is removed and dressing changed. Gait training started using walker with weight bearing to tolerance.
- DVT prophylaxis given for first 5 post operative days in the form of LMW heparin injection.
- Oral antibiotics started from 6th post operative day and continued for another 4 days.
- Suture removal done on 10th post op day and patient was discharged from hospital.

Radiological and clinical photographs (fig. no 7)
Clinical Photographs

Post-op

Abduction

Adduction

Internal rotation

External rotation

Straight Leg Raising

Flexion

Partial weight bearing

Adduction
Post operative Follow Up
The patients were followed up at 1 month, 3 months, 6 months, 1 year and at 17th month at the completion of my study. Patient follow up was for a minimum of 3 months to a maximum of 17 months.

Clinical assessment
During each visit, medical history was taken and physical examination was done. Deformity and ROM were measured with goniometer. The clinical and functional outcomes were evaluated by Modified Harris Hip Score.

Radiological assessment
A radiograph was taken at the end of procedure and during follow up visits. The standard radiograph included X ray both hips with sufficient length of femur. The radiological assessment included positioning and alignment of the acetabular and femoral components and complications such as periprosthetic fractures, loosening, osteolysis, dislocation, subsidence and heterotrophic ossification.

1. Cup inclination was determined on the anteroposterior pelvic radiograph with a horizontal reference line drawn through the base of both teardrops.

This radiograph was compared with the one made at the time of the last follow-up evaluation to determine fixation, total wear, the annual wear rate, and the presence, extent, and location of osteolysis.

Loosening of femoral component was diagnosed if there was progressive varus shift or progressive axial subsidence of more than 5mm.

The prevalence, location, and extent of osteolytic lesions, progressive radiolucent lines, and calcar resorption were determined on anteroposterior radiographs made at the time of the last follow-up.

Method of statistical analysis
The following methods of statistical analysis have been used in this study. The results were averaged (mean+SD) for each parameter for continuous data and numbers and percentage for categorical data presented in fig. and table proportions were compared using chi square test of significance.

Table 1: Chi-Square Test (r, x, c tables)

<table>
<thead>
<tr>
<th>Rows</th>
<th>Columns</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>a</td>
<td>t1</td>
</tr>
<tr>
<td>2</td>
<td>b</td>
<td>t2</td>
</tr>
</tbody>
</table>

DF=(r-1)*(c-1), where r=rows and c=columns
DF= Degrees of Freedom (Number of observations that are free to vary after certain restriction, have been placed on the data).

2. Paired ‘t’ test
A paired ‘t’ test was performed to determine whether there were difference between the before and after treatment measurements on the parameter.

\[ t = \frac{\bar{x}_1 - \bar{x}_2}{s} \]

Where \( \bar{x}_1 \) and \( \bar{x}_2 \) are the mean difference in each set of paired observation, \( s \) is the SD of the difference and \( n \) is the number of observation.

In all the above tests the “p” value of less than 0.05 was accepted as indicating statistical significance.

The Excel and Graph pad software packages were used for data entry and analysis.

5. Observations and results
The study was conducted in Department of Orthopaedics, Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore. 20 hips were operated upon 17 patients for arthritis secondary to AVN of head of femur.

Age distribution
This study was conducted on patients with age ranging from 19 to 58 years with a mean age of 39.96 years at the time of surgery. Majority of patients were in the age group below 50 years.

Table 2: Showing age distribution of all patients

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30 yrs</td>
<td>5</td>
<td>25%</td>
</tr>
<tr>
<td>30-50 yrs</td>
<td>12</td>
<td>60%</td>
</tr>
<tr>
<td>&gt;50 yrs</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3: Showing Mean age and Standard deviation of age

<table>
<thead>
<tr>
<th>N</th>
<th>Mean Age</th>
<th>S D</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>39.96</td>
<td>10.91</td>
<td>19</td>
<td>58</td>
</tr>
</tbody>
</table>
Gender Distribution
In this study, 17 (68%) were males and 8 (32%) were females.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>13</td>
<td>65%</td>
</tr>
<tr>
<td>Female</td>
<td>7</td>
<td>35%</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100%</td>
</tr>
</tbody>
</table>

Modified Harris hip score

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre-op (Mean)</th>
<th>Post-op (Mean)</th>
<th>Difference</th>
<th>95% confidence interval</th>
<th>'T' value</th>
<th>'P' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>15.60</td>
<td>42.16</td>
<td>26.56</td>
<td>29.3-23.7</td>
<td>19.33</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Function</td>
<td>16.48</td>
<td>39.64</td>
<td>23.16</td>
<td>26.0-20.2</td>
<td>16.43</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Absence of deformity</td>
<td>2.88</td>
<td>4.00</td>
<td>1.12</td>
<td>1.87-0.36</td>
<td>3.05</td>
<td>0.005</td>
</tr>
<tr>
<td>ROM score</td>
<td>2.24</td>
<td>4.64</td>
<td>2.40</td>
<td>2.71-2.08</td>
<td>15.71</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total score</td>
<td>37.20</td>
<td>90.44</td>
<td>53.24</td>
<td>57.8-48.6</td>
<td>24.033</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

For the total score and each of the parameters, higher score implies lesser disability.
The mean total pre operative score was 37.20 (19- 70). At latest follow-up the total mean score was 90.44 (72- 97).

Outcome Analysis

<table>
<thead>
<tr>
<th>Grade</th>
<th>Pre op</th>
<th>At latest follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>Fair</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Good</td>
<td>None</td>
<td>4</td>
</tr>
<tr>
<td>Excellent</td>
<td>None</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Radiographic results
Results of the radiographic evaluation on all hips were as follows;

- 1 patient with cup angle more than 50 degree had good to excellent outcome scores. 1 patient with cup angle less than 40 degree had good outcome score.

Femoral Stem Placement
The femoral stem was in neutral position in 18 patients and in 2 patients, it was in 5 degree varus.
Table 11: Showing Femoral Stem Placement

<table>
<thead>
<tr>
<th>Femoral stem position</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central/normal</td>
<td>18</td>
<td>90%</td>
</tr>
<tr>
<td>Varus</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100%</td>
</tr>
</tbody>
</table>

Out of 2 patients with stem in varus, 1 had excellent outcome score and 1 had good score.
Stress shielding was noted in 2 patients.

Complications
Anterior thigh pain
In our study, 2 (10%) patients complained of anterior thigh pain which disappeared by 6 month postoperatively.

Dislocation of hip
We had 1 case of posterior dislocation in our study. Closed reduction was done in operation theatre and was immobilised in fixed traction for 2 weeks. The patient was subsequently discharged and no further episode of dislocation was noted.

Nerve injuries
We had 1 case of foot drop in immediate post-operative period which recovered completely at 1 year.

Infection
We had 1 case of deep infection in the early post operative period. Thorough debridement was done and was treated by administration of Pipercillin + Tazobactum antibiotic for 2 weeks and oral antibiotics were given for another 2 weeks,

Periprosthetic fracture
We had 1 case of intraoperative periprosthetic fracture involving greater trochanter (Vancouver type A) and was fixed by S-S wire. The fracture healed subsequently.

6. Discussion
Total hip arthroplasty is a well-documented surgical procedure that relieves pain and functional disability experienced by patients with moderate to severe arthritis of hip, thus improving quality of life.
The study was carried out on 20 hips in 17 patients who underwent uncemented THR. In our study, patients age group ranged from 19-58 years, out of which 5(25%) were below 30 years, 12 (60%) between 30-50 years and 3 (15%) were above 50 yrs. The mean age was 39.96 years. 13 (65%) were above 50 yrs, 12 (60%) between 30-50 years and 3 (15%) were below 30 yrs.

All surgeries were performed in conventional operation theatre through Moore’s approach. Uncemented straight stem-HA coated was used in 12 hips and uncemented press fit femoral stem-plasma coated was used in 8 hips. The stem size ranged from 9-14 and most commonly used was 13. The head size ranged from 22-32 and most commonly used was 32. The cup (shell) size ranged from 42-58 and most commonly used was of 54. The corresponding polyethylene liner was used. The follow up ranged from a minimum of 3 months to maximum of 24 months (mean 10.13 months) at regular intervals - 1mth, 3mths, 6mths, 12mths, and a maximum of 24 month. All patients were evaluated by the modified Harris hip score.

Mean Harris hip score improved from 37.20 to 88.04 immediate postoperatively and 90.44 at latest follow-up, as compared to Xim\(^{44}\) et al study (from 55.3 to 91), McLaughlin\(^{44}\) et al (from 48 to 88), Katz\(^{44}\) et al (from 42 to 84), and Moft\(^{71}\) et al (from 43 to 92).

7. Conclusion
We have evaluated Total hip arthroplasty for AVN femoral head using uncemented prosthesis. Our study suggests that current generation implants can provide satisfactory clinical and radiographical outcomes after a short duration of follow up. Though the study was not free of complications, the overall, functional and radiological outcome showed good results.

8. References