

Assessment of Functional Outcome between Cemented and Uncemented Total Hip Replacement: A Comparative Study

P. Thiagarajan

ABSTRACT

Introduction: Total hip arthroplasty (THA) or total hip replacement is the most effective, economical surgical procedure for femoral neck fractures or hip joint diseases among elderly patients. The main purpose is to reduce pain as well as reduce joint function. Hence, the aim of the present study was to assess the functional outcome between cemented and uncemented total hip arthroplasty.

Material and Methods: The present study was an observational study which was hospital-based conducted among 140 cases divided into two groups with 70 cases in each group. All the patients of 50–80 years in which THR was indicated were taken in this study. Patients with neurovascular deficit and active infection were excluded from this study. In Group 1, cemented THR was done while in Group 2 uncemented THR was done. Pain was evaluated using Harris hip score.

Results: In cemented group, majority of the cases were avascular necrosis 24(34%) followed by fracture neck of femur 10 (14%), fracture-dislocation of hip 6 (8%) and in uncemented group, maximum cases were avascular necrosis 36 (51%) followed by fracture neck of femur 21 (30%) and fracture-dislocation of hip 14 (20%). mean difference among cemented group was 82.41 ± 7.2 at 6 weeks followed by 81.31 ± 7.5 in uncemented group and this difference was found to be statistically significant at p value 0.001.

Conclusion: Cemented implants showed better functional outcomes than uncemented in total hip arthroplasty at 6 weeks, 3 months and at 6 months.

Keywords: Total Hip Replacement, Cemented Hip Replacement, Uncemented Hip Replacement, Functional Outcome

INTRODUCTION

Total hip arthroplasty is one of the most successful and cost-effective of surgical procedures with the primary goals of pain relief and restoration of function. Since THRs were introduced, there has been steady improvement in the technology associated with it, leading to better functional outcome and implant survivorship. Cemented implants achieve stability from cement-bone mechanical interlock, once the polymethyl methacrylate has cured whereas cementless fixation relies on primary press-fit stability with long-term stability occurring secondary to endosteal microfractures at the time of preparation and subsequent bone on growth or ingrowth.¹

The modern artificial joint owes much to the work of Sir John Charnley at Wrightington Hospital. His work in the field of tribology, which is the science of interacting surfaces

in relative motion, resulted in a design that completely replaced the other designs by the 1970s. Sir Charnley's design consisted of three parts which is a metal (originally) femoral component, a teflon acetabular component which was replaced by high molecular weight polyethylene in 1962, both of which were fixed to the bone using and acrylic bone cement.²

The replacement joint, which was known as the Low Friction Arthroplasty, was lubricated with synovial fluid. The small femoral head was chosen for its decreased wear rate; however, this has relatively poor stability (the larger the head of a replacement the less likely it is to dislocate, but the more wear debris produced due to the increased surface area). For over two decades, the Charnley Low Friction Arthroplasty design was the most used system in the world, far surpassing the other available options (like McKee and Ring). Recently the use of a polished tapered cemented hip replacement (like Exeter) and uncemented hip replacements have become more popular.³

The hydroxyapatite coated femoral stems in humans were used by furlong and Osbone, who began clinical trials in 1985 and by Geesink, who reported on a series begun in 1986. In dogs, HA-coated hip implants show better bone on growth than plain titanium press-fit or porous-coated implants after two years. It has also been shown that HA coating can help to fill gaps and to improve ingrowth from osteoporotic bone and to achieve such ingrowth even under conditions of micro motion.⁴

The source of free calcium and phosphorus that is present even at the interface of highly crystalline, stable hydroxyapatite coatings appears to be the amorphous calcium phosphate phase which is found in all hydroxyapatite coatings. It is likely that some critical amount of degradation is essential to obtain rapid biological fixation, but premature dissolution of a coating or loss of mechanical bonding to a metal substrate must be avoided. Currently highly crystalline, pure, stable hydroxyapatite appears to contain adequate amorphous

Assistant Professor, Department of Orthopaedics, Sree Balaji Medical College & Hospital, Chennai, Tamil Nadu, India

Corresponding author: Dr. P. Thiagarajan, Assistant Professor, Department of Orthopaedics, Sree Balaji Medical College & Hospital, Chennai, Tamil Nadu, India

How to cite this article: P. Thiagarajan. Assessment of functional outcome between cemented and uncemented total hip replacement: a comparative study. International Journal of Contemporary Medical Research 2020;7(1):A16-A19.

DOI: <http://dx.doi.org/10.21276/ijcmr.2020.7.1.50>



calcium phosphate to allow early biological fixation.⁵ Bioactive coatings are the substances that are added to the surface of an implant to promote and to enhance biological fixation. Bioactive coatings other than hydroxyapatite are fluorapatite was found to be bio-compatible and to bond readily to bone in several in animal studies and it is more thermo stable than hydroxyapatite.⁶

In response to the problem of loosening of the stem and cup based on the alleged failure of cement, press-fit, porous-coated, and hydroxyapatite-coated stems and cups have been investigated as ways to eliminate the use of cement and to use bone ingrowth or on growth as a means of achieving durable skeletal fixation. Many different techniques have evolved to improve cemented femoral fixation, including injection of low-viscosity cement, occlusion of the medullary canal, reduction of porosity, pressurization of the cement, and centralization of the stem.⁷ Hence, the aim of the present study was to assess the functional outcome between cemented and uncemented total hip arthroplasty.

MATERIAL AND METHODS

The present study was an observational study which was hospital-based conducted among 140 cases divided into two groups with 70 cases in each group. All the patients of 50–80 years in which THR was indicated were taken in this study. Patients with neurovascular deficit and active infection were excluded from this study. In Group 1, cemented THR was done while in Group 2 uncemented THR was done. All the surgeries were performed using posterolateral approach by a surgeon.

The complete blood count, ASO, CRP, RA Factor, throat swabs, urine analysis, chest x-ray and multi-channel ECG were done as a routine. Follow-up was done at 6 weeks, 3 months and 6 months in which complete functional examination was done. Pain was assessed using Harris Hip Score.⁸

Posterior approach

This approach was popularized by Moore and it is often called the southern approach. The patient is placed in the true lateral position with the affected limb uppermost. Make a 10 to 15 cm curved centered on the posterior aspect of the greater trochanter. The incision is begun 6 to 8 cm above and posterior to the posterior aspect of the greater trochanter. The part of the incision that runs from this point to the posterior aspect of the trochanter is in line with the fibres of the gluteus maximus.

Curve the incision across the buttock, cutting over the posterior aspect of the trochanter and continue down along the shaft of femur. Incise the fascia lata on the lateral aspect of the femur to uncover the vastus laterals. Lengthen the fascial aspect of the femur to uncover the vastus laterals. Split the fibers of the gluteus maximus by blunt dissection. Retract the fibers of the split gluteus maximus and the deep fascia of the thigh.

Underneath is the posterolateral aspect of the hip joint, still covered by the short external rotator muscles. Internally rotate the hip to put external rotator muscles on a stretch.

Detach the muscles close to their femoral insertion and reflect them backward. The posterior aspect of the hip joint capsule is now fully exposed. The hip joint capsule is incised with a longitudinal or T-shaped incision. Dislocation of hip is achieved by internal rotation. Now removal of the femoral head and neck is done, and exposure of the acetabulum is obtained.

Pain was evaluated using the Harris hip score, except in acute neck of femur fracture patients. This score takes into account pain, function, absence of deformity and range of motions. The general condition of the patient including his physical and mental status, general medical condition and ability to withstand surgery is considered. Physical status should include both upper and lower extremities including opposite hip, knees, feet and spine.

STATISTICAL ANALYSIS

The data was entered into the excel sheet and was analyzed with the help of descriptive statistics which was presented in the form of tables and graphs. Independent sample t-test was used to compare continuous variables between the groups and was expressed in the form of mean \pm standard deviation. Chi-square test was applied to analyse categorical variables. The level of significance was set at $p < 0.05$.

RESULTS

In the present study, out of 140 cases, 70 were in Group 1 which was cemented and 70 in Group 2 which was uncemented. Graph 1 shows that out of 140 cases, 92 (65%) were males and 48 (34%) were females. The majority of the cases 58 (82%) and 56 (80%) were from the age group 50–60 years in cemented and uncemented groups. Very few 8 (11%) and 7 (10%) belonged to the age group 61–70 years in the cemented group followed by 71–80 years as presented in the Graph 2.

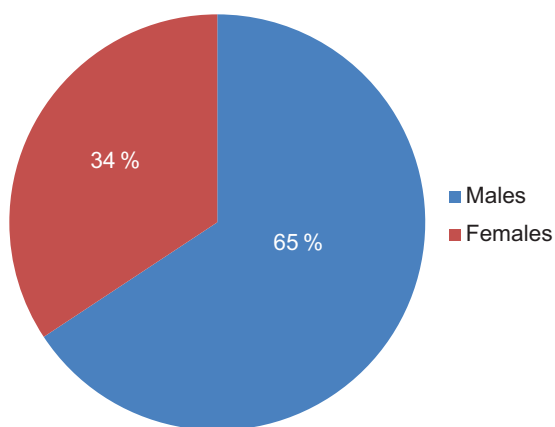
In cemented group, majority of the cases were avascular necrosis 24(34%) followed by fracture neck of femur 10 (14%), fracture-dislocation of hip 6 (8%) and displaced DHS 5(7%). Very few cases were having 2 (2%) periprosthetic fractures, 3 (4%) infected bipolar, 4 (5%) arthritis, non-union I/T femur 5(7%).

In uncemented group, maximum cases were avascular necrosis 36 (51%) followed by fracture neck of femur 21 (30%), fracture-dislocation of hip 14 (20%) and displaced DHS 9(12%). Very few cases were having 4(5%) periprosthetic fractures, 7(10%) infected bipolar, 8(11%) arthritis, non-union I/T femur 12 (17%).

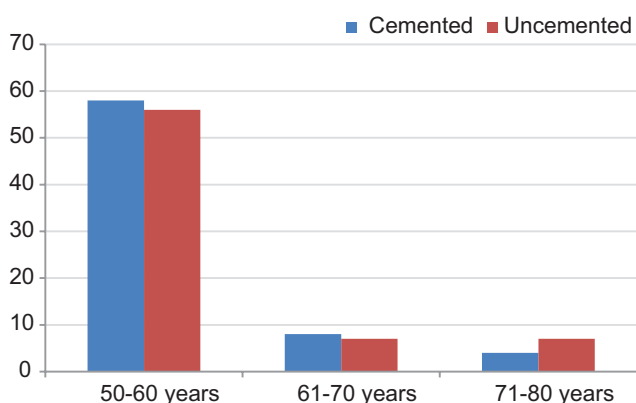
In the present study, table 1 shows that mean difference among cemented group was 82.41 ± 7.2 at 6 weeks followed

Follow-up months post-operatively	Cemented (n=70)	Uncemented (n=70)	p value
6 weeks	82.41 \pm 7.2	81.31 \pm 7.5	0.001
3 months	86.81 \pm 6.1	84.21 \pm 6.4	0.002
6 months	80.31 \pm 7.5	76.91 \pm 8.2	0.004

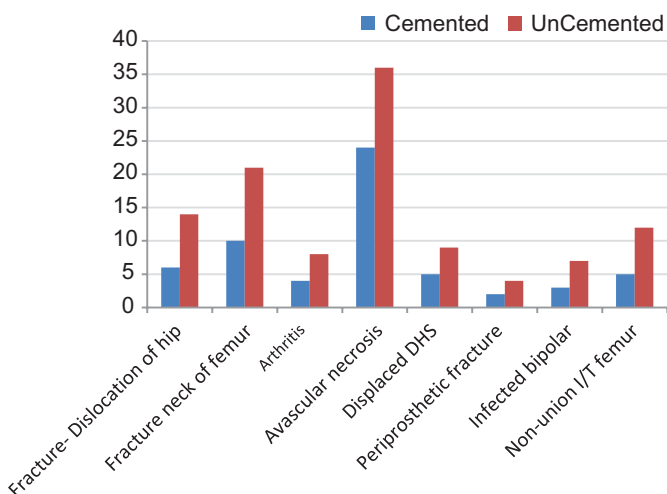
Table-1: Shows the distribution of data based on follow-up of months post-operatively among both the groups with the help of Harris hip score



Graph-1: Shows the distribution of data based on gender among the study subjects



Graph-2: Shows the distribution of data in both the groups based on age among the study subjects



Graph-3: Shows the distribution of data in cemented group and uncemented group based on diagnosis of case

by 81.31 ± 7.5 in uncemented group and this difference was found to be statistically significant at p value 0.001. At 3 months, mean difference in cemented group was found to be 86.81 ± 6.1 at 6 weeks and 84.21 ± 6.4 in uncemented group and this difference was also found to be statistically significant at p value 0.002. At 6 months, mean difference in cemented group was found to be 80.31 ± 7.5 and 76.91 ± 8.2 in uncemented group and this difference was found to be statistically significant at p value 0.004.

DISCUSSION

THR surgery is a wonderful surgery for patients with hip joint destruction and has made lot of progress. Newer designs have come, each claiming its superiority over other. Cost has also increased with these advancements. But still, the basic question remains unanswered, cemented or uncemented. This question becomes even more important in elder age group patients and developing nations like India where cost-effectiveness is still a major concern.

There has been a worldwide trend toward the uncemented THR over the past 10 years. Uncemented THR was introduced to cope up with the complications of cemented THR, especially in younger patients. However, now invariably most of the institutes are performing uncemented THR >95% out of THRs.

In a study done by Makela et al compared survival of cemented and uncemented hip replacement prosthesis in patients older than 55 years and came up with a conclusion that cemented implants have better survival. The author compared data from four nations. Also another study conducted by Hailer et al analyzed Swedish Hip Arthroplasty Register and stated significant difference in 10-year survival of cemented and uncemented THR with cemented being better as uncemented implants had more revisions due to aseptic loosening of cup.^{9,10}

In a study performed by Zimmerma et al reported that totally non-cemented prosthesis was more costly, there were no statistically significant differences in clinical or functional outcomes between the non-cemented and the cemented prostheses up to 12 months post-surgery.¹¹

In a study done by Maggs and Wilsonin et al stated that cemented THR has abundant evidence of excellent outcomes. Stem can be placed according to surgeon's will following patients' anatomy. It can be used in patients with femoral deformity, osteoporotic bone, or following radiotherapy, and in young or old alike. Short-term clinical outcomes in terms of pain relief and early mobilization are good.¹²

In a study conducted by Divyanshu Goyal reported there was no significant difference between cemented and cementless group at 2 years' follow-up. Cemented femoral component provides an immediate postoperative advantage in terms of better integration between bone, cement and the prosthesis, which permits dramatic early relief of pain and early weight-bearing.¹³

It is almost certain that better short-term clinical outcomes mainly improved pain score can be obtained from cemented fixation. Also, cemented implants are cheaper than the uncemented implants. Hence, cemented THR is more cost effective especially for poor patients. Cost is still a major problem in developing countries especially for patients older than 50–55 years as they can be treated with cemented THR prosthesis. The most common complications known till now includes aseptic loosening, periprosthetic osteolysis appears late, therefore 2 years' follow-up is very short and further studies with a longer period of follow-up are required.

In the present study, follow-up till 6 months was done in

comparison between cemented and uncemented total hip arthroplasty and was found that cemented was better than uncemented at 6 weeks, 3 months and 6 months. This difference was also found to be statistically significant and the results of the present study was found to be in concordance with the studies done by Chen Yang et al and Corten K et al where rate of revision and HHS among patients who underwent cemented THA were better than those of patients who underwent uncemented THA.^{14, 15} The limitations were more follow-up time period for both the groups with the larger sample size.

CONCLUSION

In this study, cemented group showed better functional outcome than uncemented in total hip arthroplasty and this difference was found to be statistically significant.

REFERENCES

1. Charles MN, Bourne RB, Davey JR, Greenwald AS, Morrey BF, Rorabeck CH. Soft-tissue balancing of the hip. *J Bone Joint Surg* 2004; 86:1078-88.
2. Abdulkarim A, Ellanti P, Motterlini N, Fahey T, O'Byrne JM. Cemented versus uncemented fixation in total hip replacement: A systematic review and meta-analysis of randomized controlled trials. *Orthop Rev (Pavia)* 2013;5:e8.
3. Coventry MB. The treatment of fracture-dislocation of the hip by total hip arthroplasty. *J Bone Joint Surg Am* 1974; 56:1128-34.
4. Jasty M. Prosthetic Loosening in Total Hip Replacements. In: Bono J.V., McCarthy J.C., Thornhill T.S., Bierbaum B.E., Turner R.H. (eds) *Revision Total Hip Arthroplasty*. Springer, New York 1999: 3-10.
5. Banaszkiwicz PA. Improved Cementing Techniques and Femoral Component Loosening in Young Patients with Hip Arthroplasty: A 12-Year Radiographic Review. In: Banaszkiwicz P., Kader D. (eds) *Classic Papers in Orthopaedics*. Springer, London. *Class Pap Orthop* 2013:31-4.
6. Morscher EW. Cementless total hip arthroplasty. *Clin Orthop Relat Res* 1983:76-91.
7. Cheng SL, Davey JR, Inman RD, Binnington AG, Smith TJ. The effect of the medial collar in total hip arthroplasty with porous-coated components inserted without cement. An in vivo canine study. *J Bone Joint Surg Am* 1995; 77:118-23.
8. Charnley J. Arthroplasty of the hip. A new operation. *Lancet* 1961; 1:1129-32.
9. Davies JP, Harris WH. In vitro and in vivo studies of pressurization of femoral cement in total hip arthroplasty. *J Arthroplasty* 1993; 8:585-91.
10. Mäkelä KT, Matilainen M, Pulkkinen P, Fenstad AM, Havelin L, Engesaeter L, et al. Failure rate of cemented and uncemented total hip replacements: Register study of combined nordic database of four nations. *BMJ* 2014; 348:f7592.
11. Hailer NP, Garellick G, Kärrholm J. Uncemented and cemented primary total hip arthroplasty in the Swedish Hip Arthroplasty Register. *Acta Orthop* 2010; 81:34-41.
12. Zimmerma S, Hawkes WG, Hudson JI, Magaziner J, Hebel JR, Towheed T, et al. Outcomes of surgical

management of total HIP replacement in patients aged 65 years and older: Cemented versus cementless femoral components and lateral or anterolateral versus posterior anatomical approach. *J Orthop Res* 2002; 20:182-91.

13. Maggs J, Wilson M. The relative merits of cemented and uncemented prostheses in total hip arthroplasty. *Indian J Orthop* 2017; 51:377-85.
14. Divyanshu Goyal, Mahesh Bansal, Ravindra Lamoria. Comparative Study of Functional Outcome of Cemented and Uncemented Total Hip Replacement. *J Orthop Traumatol Rehabil* 2018; 10:23-8.
15. Chen Yang, Xiulan Han et al. Cemented versus uncemented femoral component total hip arthroplasty in elderly patients with primary osteoporosis: retrospective analysis with 5-year follow-up. *Journal of International Medical Research* 2019; 47:1610-1619.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 10-12-2019; **Accepted:** 01-01-2020; **Published:** 28-01-2020