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Research Article

Comparison of Functional Outcomes between Cemented and Uncemented Total Hip Arthroplasty in Elderly Patients

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ABSTRACT
Background: Total hip arthroplasty (THA) is a common intervention in elderly patients with hip pathology. The optimal fixation method—cemented or uncemented—remains debated, especially concerning functional outcomes and complication rates. **Aim:** To compare the functional outcomes of cemented versus uncemented total hip arthroplasty in elderly patients. **Methods:** This prospective observational study included 120 patients aged ≥60 years undergoing primary THA. Patients were divided into cemented (n=62) and uncemented (n=58) groups. Baseline demographics, diagnosis, and preoperative Harris Hip Scores (HHS) were recorded. Functional outcomes were assessed at 12 months postoperatively using HHS, Visual Analog Scale (VAS) for pain, walking distance, and walking aid usage. Postoperative complications and radiological outcomes including implant stability and subsidence were also evaluated. Statistical analysis involved t-tests and chi-square tests, with significance set at $p<0.05$. **Results:** Both groups were comparable at baseline. At 12 months, the cemented group had significantly higher mean HHS (86.5 ± 7.8 vs. 82.9 ± 8.5, $p=0.011$) and lower VAS pain scores (1.8 ± 1.1 vs. 2.3 ± 1.3, $p=0.035$). Walking distance and walking aid use favored cemented THA but were not statistically significant. Periprosthetic fractures were significantly less frequent in the cemented group (3.2% vs. 12.1%, $p=0.049$). Radiologically, implant stability was comparable, but subsidence was significantly less in cemented implants (0.8 ± 0.4 mm vs. 1.3 ± 0.7 mm, $p<0.001$). **Conclusion:** Cemented THA offers superior early functional outcomes and better implant stability with fewer periprosthetic fractures in elderly patients compared to uncemented THA. Cemented fixation should be preferred in this population to optimize postoperative recovery.

Keywords: Total Hip Arthroplasty, Cemented Fixation, Uncemented Fixation.

INTRODUCTION

Total hip arthroplasty (THA) is one of the most successful and commonly performed orthopedic procedures worldwide, providing substantial pain relief and functional improvement in patients with advanced hip pathology. Primarily indicated for conditions such as osteoarthritis, rheumatoid arthritis, avascular necrosis, and fractures of the femoral neck, THA has evolved significantly over the past decades in both surgical technique and implant design[1].

In elderly patients, THA is often the treatment of choice to restore mobility and improve quality of life. However, implant fixation techniques, specifically cemented versus uncemented prostheses, remain a topic of considerable debate. Cemented THA involves fixation of the implant to the bone using polymethyl methacrylate (PMMA) bone cement, which provides immediate stability. Uncemented THA relies on biological fixation, where the implant surface encourages bone ingrowth or ongrowth for long-term stability[2].

Cemented prostheses have been traditionally favored in elderly patients due to their immediate fixation, which can be advantageous in patients with poor bone quality typical of this age group. The immediate fixation reduces the risk of intraoperative fractures and allows early weight-bearing. However, concerns regarding cement-related complications such as bone cement implantation syndrome (BCIS), aseptic loosening, and potential difficulties during revision surgery persist [3].

Uncemented implants, on the other hand, are designed with porous or roughened surfaces to enhance osteointegration. They avoid complications related to cement but may require better bone quality for optimal fixation, which raises questions about their suitability in elderly patients, who often have osteoporotic bones. Additionally, the initial stability of

uncemented components may be less, potentially delaying full weight-bearing postoperatively [4].

Functional outcomes following THA are influenced by various factors, including surgical technique, implant type, patient bone quality, and rehabilitation. Comparison of cemented and uncemented THA in elderly patients is crucial to determine which approach yields better functional recovery, fewer complications, and greater implant longevity. Previous studies have reported mixed results, with some favoring cemented fixation for early postoperative outcomes and others advocating uncemented implants for long-term durability [5].

Aim

To compare the functional outcomes of cemented versus uncemented total hip arthroplasty in elderly patients.

Objectives

1. To evaluate and compare the postoperative functional scores between cemented and uncemented total hip arthroplasty in elderly patients.
2. To assess the incidence of complications related to each fixation technique during the follow-up period.
3. To analyze radiological outcomes including implant stability and signs of loosening in both groups.

MATERIAL AND METHODOLOGY

Source of Data

The source of data comprised elderly patients aged 60 years and above, who underwent total hip arthroplasty either by cemented or uncemented fixation at tertiary care teaching hospital.

Study Design

This study was designed as a prospective observational comparative study.

Study Location

The study was conducted in the Department of Orthopedics.

Study Duration

The study was carried out over a period of 12 months, from January 2022 to December 2022.

Sample Size

A total of 120 patients were included in the study, with 60 patients receiving cemented total hip arthroplasty and 60 receiving uncemented total hip arthroplasty.

Inclusion Criteria

- Patients aged 60 years and above.
- Patients diagnosed with hip joint pathology requiring total hip arthroplasty such as osteoarthritis, rheumatoid arthritis, avascular necrosis, or displaced femoral neck fractures.
- Patients willing to provide informed consent and comply with follow-up schedules.

Exclusion Criteria

- Patients with previous hip surgery on the affected side.
- Patients with pathological fractures secondary to tumors or infections.
- Patients with severe systemic illnesses contraindicating surgery.
- Patients with neurological or musculoskeletal conditions affecting lower limb function independently.

Procedure and Methodology

Patients who met inclusion criteria were allocated into two groups based on the type of implant fixation: cemented or uncemented. Preoperative evaluation included clinical assessment, routine laboratory tests, and radiological imaging (X-rays of pelvis and hip). Preoperative functional status was recorded using Harris Hip Score (HHS). All surgeries were performed by experienced orthopedic surgeons under standardized protocols. The choice of implant fixation was made based on surgeon preference, bone quality assessment, and patient factors. Cemented THA utilized PMMA bone cement for implant fixation, whereas uncemented THA used porous-coated implants designed for biological fixation. Postoperatively, patients followed a structured rehabilitation protocol emphasizing early mobilization and weight-bearing as tolerated. Clinical evaluations were conducted at 6 weeks, 3 months, 6 months, and 1 year post-surgery. Functional outcomes were assessed by Harris Hip Score and Visual Analog Scale (VAS) for pain. Radiological assessments were done to check implant position, loosening, subsidence, and periprosthetic fractures.

Sample Processing

All clinical data, functional scores, and radiological findings were collected systematically and recorded in structured data

sheets. Data quality was ensured by periodic audits and cross-checking.

Statistical Methods

Data were analyzed using statistical software SPSS version 27.0. Descriptive statistics were expressed as mean ± standard deviation for continuous variables and percentages for categorical variables. The Student's t-test was used to compare continuous variables between groups. Chi-square or Fisher's exact test was used for categorical data. A p-value of <0.05 was considered statistically significant.

Data Collection

Data were collected from patient records, direct clinical examination, and follow-up visits. A standardized proforma was used to gather demographic information, clinical history, intraoperative details, postoperative complications, and follow-up functional and radiological outcomes.

OBSERVATION AND RESULTS

Table 1: Demographic and Baseline Clinical Characteristics of Patients (N=120)

Parameter	Cemented Group (n=62)	Uncemented Group (n=58)	Test Statistic (t/χ^2)	95% CI for Difference / OR	P-value
Age (years), Mean (SD)	71.3 (6.7)	69.8 (7.2)	t = 1.28	-0.79 to 4.19	0.204
Gender (Male), n (%)	35 (56.5%)	33 (56.9%)	χ^2 = 0.002	OR = 0.98 (0.47–2.04)	0.967
BMI (kg/m²), Mean (SD)	24.9 (3.1)	25.5 (3.6)	t = -0.86	-1.82 to 0.74	0.392
Diagnosis (Osteoarthritis), n (%)	40 (64.5%)	38 (65.5%)	χ^2 = 0.02	OR = 0.95 (0.45–2.03)	0.889
Diagnosis (Fracture neck femur), n (%)	22 (35.5%)	20 (34.5%)	χ^2 = 0.02	OR = 1.05 (0.48–2.29)	0.889
Preoperative Harris Hip Score, Mean (SD)	38.7 (6.5)	39.2 (7.0)	t = -0.35	-2.44 to 1.44	0.727

Table 1 presents the demographic and baseline clinical characteristics of the 120 elderly patients who underwent either cemented (n=62) or uncemented (n=58) total hip arthroplasty. The mean age was slightly higher in the cemented group (71.3 ± 6.7 years) compared to the uncemented group (69.8 ± 7.2 years), though this difference was not statistically significant (t=1.28, p=0.204). Gender distribution was almost identical, with males constituting 56.5% and 56.9% of the cemented and uncemented groups, respectively (χ^2=0.002, p=0.967). Similarly, body mass index (BMI) was comparable between groups (24.9 ± 3.1 kg/m² vs. 25.5 ± 3.6 kg/m², t=-0.86, p=0.392). The primary diagnoses leading to surgery were osteoarthritis (64.5% vs. 65.5%) and fracture neck femur (35.5% vs. 34.5%), with no significant differences observed (p=0.889). Preoperative functional status, as measured by the Harris Hip Score (HHS), was also similar (38.7 ± 6.5 vs. 39.2 ± 7.0, t=-0.35, p=0.727), indicating well-matched baseline groups.

Table 2: Postoperative Functional Scores at 12 Months Follow-up (N=120)

Parameter	Cemented Group (n=62)	Uncemented Group (n=58)	Test Statistic (t)	95% CI for Difference	P-value
Harris Hip Score (HHS), Mean (SD)	86.5 (7.8)	82.9 (8.5)	t = 2.59	1.02 to 6.38	0.011*
Visual Analog Scale (VAS) Pain, Mean (SD)	1.8 (1.1)	2.3 (1.3)	t = -2.13	-0.91 to -0.06	0.035*

Walking Distance (meters), Mean (SD)	435 (72)	410 (80)	t = 1.63	-7.3 to 57.3	0.106
Use of Walking Aid (Yes), n (%)	10 (16.1%)	16 (27.6%)	χ^2 = 2.56	OR = 0.52 (0.22–1.21)	0.109

*Statistically significant at $p < 0.05$

Table 2 compares the postoperative functional outcomes at 12 months. The cemented group demonstrated significantly higher mean Harris Hip Scores (86.5 ± 7.8) than the uncemented group (82.9 ± 8.5), with a mean difference between 1.02 and 6.38 (t=2.59, p=0.011). Pain levels assessed by the Visual Analog Scale (VAS) were significantly lower in the cemented group (1.8 ± 1.1) compared to the uncemented group (2.3 ± 1.3) (t=-2.13, p=0.035). Although the cemented group walked a longer mean distance (435 ± 72 meters) than the uncemented group (410 ± 80 meters), this difference was not statistically significant (t=1.63, p=0.106). The need for walking aids was less frequent in the cemented group (16.1% vs. 27.6%), but this difference did not reach statistical significance (χ^2=2.56, p=0.109).

Table 3: Incidence of Postoperative Complications (N=120)

Complication	Cemented Group (n=62)	Uncemented Group (n=58)	χ^2 Value	95% CI for OR	P-value
Infection	3 (4.8%)	4 (6.9%)	0.28	OR = 0.68 (0.14–3.21)	0.598
Dislocation	5 (8.1%)	9 (15.5%)	1.88	OR = 0.48 (0.15–1.55)	0.170
Periprosthetic fracture	2 (3.2%)	7 (12.1%)	3.88	OR = 0.23 (0.04–1.19)	0.049*
Aseptic Loosening	4 (6.5%)	6 (10.3%)	0.63	OR = 0.61 (0.17–2.17)	0.426
Thromboembolic Events	1 (1.6%)	2 (3.4%)	0.49	OR = 0.46 (0.04–5.01)	0.483

*Statistically significant at $p < 0.05$

Table 3 outlines the incidence of postoperative complications. Rates of infection were low and comparable between groups (4.8% cemented vs. 6.9% uncemented, p=0.598). Dislocation occurred in 8.1% of the cemented group and 15.5% of the uncemented group, without a statistically significant difference (p=0.170). Notably, periprosthetic fractures were significantly less common in the cemented group (3.2%) compared to the uncemented group (12.1%) (χ^2=3.88, p=0.049), suggesting a protective effect of cement fixation. Rates of aseptic loosening and thromboembolic events were low and statistically similar in both groups (p>0.4).

Table 4: Radiological Outcomes at 12 Months Follow-up (N=120)

Parameter	Cemented Group (n=62)	Uncemented Group (n=58)	Test Statistic (χ^2/t)	95% CI for Difference / OR	P-value
Implant Stability (Stable), n (%)	59 (95.2%)	54 (93.1%)	χ^2 = 0.23	OR = 1.48 (0.32–6.77)	0.632
Signs of Loosening, n (%)	3 (4.8%)	4 (6.9%)	χ^2 = 0.28	OR = 0.68 (0.14–3.21)	0.598
Radiolucent Lines Present, n (%)	5 (8.1%)	10 (17.2%)	χ^2 = 2.61	OR = 0.43 (0.14–1.28)	0.106

Subsidence (mm), Mean (SD)	0.8 (0.4)	1.3 (0.7)	t = -5.01	-0.71 to -0.32	<0.001*

*Statistically significant at $p < 0.05$

Table 4 presents radiological outcomes at 12 months. Implant stability was excellent and comparable, with 95.2% stability in the cemented group and 93.1% in the uncemented group ($\chi^2=0.23$, $p=0.632$). Signs of loosening were rare and statistically similar (4.8% vs. 6.9%, $p=0.598$). Radiolucent lines, suggestive of potential early loosening, were more frequent in the uncemented group (17.2%) compared to the cemented group (8.1%), but this did not reach statistical significance ($p=0.106$). Importantly, mean subsidence was significantly lower in the cemented group (0.8 ± 0.4 mm) compared to the uncemented group (1.3 ± 0.7 mm), with a mean difference between -0.71 and -0.32 ($t=-5.01$, $p<0.001$), indicating better early fixation with cemented implants.

DISCUSSION

Demographic and Baseline Clinical Characteristics (Table 1)

In the present study comparing cemented and uncemented total hip arthroplasty (THA) in elderly patients, both groups were well matched in terms of baseline demographic and clinical variables. The mean age of patients was around 70 years in both groups, consistent with studies by Kang H et al.(2021)[6] and Polat A et al.(2015)[7], which also focused on elderly cohorts typically aged 65 years and above. Gender distribution and BMI were comparable, indicating homogeneity between groups. Osteoarthritis and femoral neck fractures represented the primary indications for THA, paralleling the clinical profiles reported in studies by Yoon RS et al.(2015)[8] and Rollo G et al.(2019)[9]. Preoperative Harris Hip Scores were also similar, ensuring that postoperative functional outcomes could be reliably compared.

Postoperative Functional Outcomes (Table 2)

At 12 months, the cemented group showed significantly higher Harris Hip Scores (mean 86.5) compared to the uncemented group (mean 82.9), reflecting better overall hip function. This finding aligns with the meta-analysis by Avilucea FR et al.(2016)[10], which reported superior short- to mid-term functional outcomes in cemented THA in elderly patients. The lower pain scores on the VAS in the cemented group further support this, consistent with findings from a randomized trial by Guo C et al.(2018)[11]. While walking distance and walking aid usage favored cemented THA, these differences were not statistically significant, similar to observations by Polat A et al.(2015)[7]. These functional benefits of cemented implants may be attributed to the immediate fixation and stability they provide, facilitating early rehabilitation.

Postoperative Complications (Table 3)

The incidence of infections and dislocations was comparable between groups, consistent with other reports such as those by Meena RC,et al.(2015)[12]. Notably, periprosthetic fractures were significantly less frequent in the cemented group (3.2% vs. 12.1%), corroborating the established notion that cemented stems reduce the risk of intraoperative and postoperative fractures, especially in osteoporotic bone Meccariello L et al.(2021)[13]. Aseptic loosening rates were low and did not differ significantly, which is in agreement with long-term studies indicating comparable implant survivorship between the two fixation methods in the elderly Hashmi P et al.(2014)[5]. Thromboembolic events were rare and similar across groups, reflecting effective perioperative prophylaxis protocols.

Radiological Outcomes (Table 4)

Radiological assessment revealed high implant stability rates in both groups, with no significant differences in loosening or presence of radiolucent lines. However, subsidence was significantly greater in the uncemented group (1.3 mm vs. 0.8 mm), indicating a relative advantage of cemented fixation in early implant stability. This finding is supported by biomechanical studies and clinical series by Behlmer RJ et al.(2021)[14], which documented initial subsidence as a concern in uncemented stems, potentially delaying functional recovery. Although radiolucent lines were more frequent in uncemented implants, the difference did not reach statistical significance, paralleling findings from Natarajan GB et al.(2014)[2].

CONCLUSION

This study demonstrates that cemented total hip arthroplasty in elderly patients provides superior functional outcomes at one year postoperatively compared to uncemented arthroplasty, as evidenced by higher Harris Hip Scores and lower pain levels. Cemented implants also showed better early implant stability with significantly less subsidence. The incidence of periprosthetic fractures was significantly lower in the cemented group, highlighting its advantage in osteoporotic bone. However, complication rates such as infection, dislocation, and aseptic loosening were comparable between the two groups. These findings support the preferential use of cemented fixation in elderly patients undergoing total hip replacement to optimize functional recovery and reduce fracture risk.

LIMITATIONS OF THE STUDY

- The study was conducted at a single tertiary care center, which may limit the generalizability of the results.
- The sample size, though adequate for detecting functional differences, may be insufficient to detect less frequent complications or long-term implant survivorship.
- The follow-up duration of 12 months may not fully capture long-term outcomes such as implant longevity and late complications.
- The choice of cemented versus uncemented fixation was based partially on surgeon preference, which could introduce selection bias.
- Rehabilitation protocols were standardized but patient adherence was not objectively monitored, potentially affecting functional outcomes.

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