



COMPARATIVE STUDY OF CEMENTED VERSUS CEMENTLESS TOTAL HIP ARTHROPLASTY

Manmatha Nayak^{1*}, Somnath Baskey², Sarthak Sahoo³

^{1*} Assistant professor, Department of orthopaedics, Scb medical college, Cuttack, manmatha0002@gmail.com, Orchid ID: <https://orcid.org/0000-0003-1380-5601> –

² Assistant professor, Department of orthopaedics, Scb medical college, Cuttack, som1053@gmail.com

³ Assistant professor, Department of orthopaedics, Scb medical college, Cuttack, sdrsarthak@yahoo.com

***Corresponding Author:** Manmatha Nayak

*Assistant professor, Department of orthopaedics, Scb medical college, Cuttack, som1053@gmail.com

ABSTRACT

Total hip arthroplasty (THA) is an established therapeutic intervention for advanced degenerative and traumatic hip disorders. While both cemented and cementless fixation techniques are widely used, their comparative influence on therapeutic effectiveness, pharmacologic utilization, and population-level clinical outcomes in routine clinical practice remains incompletely characterized. To compare therapeutic and functional outcomes, postoperative pharmacologic requirements, and population-level clinical outcomes between cemented and cementless total hip arthroplasty. A retrospective comparative cohort study was conducted at SCB Medical College, Cuttack, a tertiary care hospital, from January 2023 to January 2025, involving 120 patients who underwent primary total hip arthroplasty. Patients were equally divided into cemented (n = 60) and cementless (n = 60) fixation groups. Data on demographic characteristics, postoperative pain scores, functional outcomes, medication utilization, complications, mortality, and length of hospital stay were extracted from medical records. Statistical analyses included descriptive statistics, independent *t*-tests, correlation analysis, and multivariate linear regression. Both fixation techniques resulted in significant improvement in postoperative pain relief and functional recovery, with comparable long-term outcomes. Cemented THA was associated with lower pain scores at discharge and shorter duration of postoperative analgesic use compared with cementless THA ($p < 0.001$). Length of hospital stay was significantly shorter in the cemented group. Correlation analysis demonstrated a moderate positive association between postoperative pain intensity and analgesic duration ($r = 0.46, p < 0.001$). Regression analysis identified cementless fixation, higher pain scores, and prolonged analgesic use as independent predictors of longer hospital stay. Cemented and cementless THA provide comparable long-term therapeutic benefits; however, cemented fixation is associated with reduced early postoperative pain, lower pharmacologic burden, and shorter hospitalization. These findings highlight the importance of integrating therapeutic and population-level considerations in fixation selection.

Keywords: Total hip arthroplasty; Cemented fixation; Cementless fixation; Pharmacologic utilization; Population health outcomes

INTRODUCTION

Total hip arthroplasty (THA) is an unambiguous treatment procedure of patients with progressive degenerative and traumatic hip diseases, which is directed to eliminate pain, rehabilitate mobility, and enhance the overall quality of life. Being one of the most common treatment modalities, THA is not only a surgery but a holistic method of treatment that determines the postoperative recovery patterns and a functional independence in the long term. Comparative analyses of cemented and cementless types of fixation have shown significant differences in functional results and rehabilitation patterns after surgery, which makes the fixation selection choice especially relevant to the clinical planning of therapies.¹ The fixation strategy is critical in the development of postoperative pain management, early mobility and functional rehabilitation. Comparative evidence shows that fixation technique can potentially impact patient-reported outcomes, recovery profiles in arthroplasty groups, which can have general therapeutic implications beyond the stability of implants.² The survival and fixation durability of the implants are still significant factors; nevertheless, the meta-analytic evidence suggests that cemented, cementless, and hybrid implants have different performance properties over the follow-up, which supports the necessity of therapeutic evaluation in context.³ Although much of the comparative literature is based on the research of knee arthroplasty, systematic reviews and randomized trials show that fixation choice influences perioperative recovery, risk of complications, and medium-term outcomes, which informs the practice of hip arthroplasty on the basis of shared biomechanical and rehabilitation principles.^{4,5} Long-term comparative cohorts also indicate that fixation technique can have long-term effects on functional sustainability and clinical stability during long follow-ups, which is why it is important to its applicability to therapeutic efficacy.⁶ Patient-reported outcomes, which have become a vital therapeutic outcome, differ depending on the method of fixation, and differences in perception of pain, activity levels, and satisfaction with arthroplasty are observed.⁷ Systematic reviews also report the heterogeneity in the outcomes between cemented and cementless fixation which demonstrates the multifactorial characteristics of therapeutic success.⁸ The meta-analyses and network analyses are more up-to-date, and again fixation strategy further relates to the risk of postoperative infection and complication profile, which directly impact pharmacologic management and recovery pathways.^{9,10} The growing number of THA surgeries among the elderly populations enhance the significance of the optimization of the therapeutic procedure of fixing. Older patients commonly have comorbidities that increase sensitivity to postmenopausal pain, drug exposure, and complications, hence placing fixation decision as a predictor of population-wide therapeutic results.

Although there is considerable comparative literature, therapeutic and pharmacologic aspects of care are mostly underrepresented in the existing studies, even though the main focus of an investigation is on implant survival, mechanical fixation, and biomechanical performance. In spite of the fact that systematic reviews have assessed such functional outcomes and complication rates in particular subgroups, including the elderly with fractures, the therapeutic effectiveness has not yet been combined with the use of medication.¹¹ The risk of early mortality has been shown to vary between cemented and cementless THA in large-scale registry and cohort studies but often investigates these risks in terms of overall survival, without exploring the interaction between postoperative therapeutic burden or pharmacologic exposure.¹² Likewise, comparative analyses of hemiarthroplasty fixation methods focus on the results of the implantation, and little is extrapolated to most therapeutic routes applicable to primary THA groups.¹³ The latest randomized trials and systematic reviews further hone the knowledge on the results associated with fixation, but the majority of studies are process-focused, and provide minimal information on the actual practices of therapeutic patterns in clinical settings.^{14,15} As a result, a significant lack of institution-level retrospective studies that simultaneously investigate the effectiveness of therapeutic use, pharmacologic use, and population-involved clinical outcome after THA does exist.

The retrospective analysis of regularly treated THA patients allows evaluating the actual therapeutic trends that are not limited to controlled trial settings. These analyses can offer useful information on the effect of the fixation strategy on the postoperative analgesic demand, exposure to antibiotic, and the use of anticoagulants, which are the key aspects of clinical pharmacology and patient safety.

Comparative evidence shows that fixation option can impact infection-related complications and this will change antibiotic usage and therapeutic risk profiles, especially among elderly groups.¹⁶ Inpatient research also indicates that cemented and cementless fixing techniques are not equal regarding complication rates, resource-use, and healthcare expenses, which show their applicability to the population-level therapeutic planning.¹⁷ The long-term outcome studies support the view that fixation technique could affect the long-term treatment efficacy and implant retention, which has a direct effect on healthcare systems, which are dealing with the growing arthroplasty demand.^{18,19} Based on this, a retrospective comparative analysis of cemented and cementless THA presents the possibility to incorporate therapeutic, pharmacologic use, and population-based clinical measures into a single analytic system. This kind of evidence can promote informed selection of the choice of fixing, the postoperative drug plan, and the correspondence with the therapeutic pathway.

Research Objectives

1. To compare therapeutic and functional outcomes between cemented and cementless total hip arthroplasty.
2. To evaluate postoperative pharmacologic requirements associated with each fixation technique.
3. To assess population-level clinical outcomes, including complications, mortality, and length of hospital stay.

METHODOLOGY

Study Design

A retrospective comparative cohort study design was used to compare the effectiveness of therapeutic effects, pharmacologic application, and population level clinical outcomes between cemented and cementless total hip arthroplasty. This design allowed a systematic evaluation of actual clinical data on the basis of real-world clinical practice using orthopedic practice, and comparison of fixation strategies in the same institutional care structure.

Study Setting

The research was carried out from January 2023 to January 2025 at SCB Medical College, Cuttack, a tertiary care hospital with a dedicated orthopedic surgery department where primary orthopedic total hip arthroplasty surgeries are regularly conducted. The institution environment provided perioperative processes, postoperative workflows, and pharmacy procedures to be uniform, which reduced variation in regard to the quality of services provided and subsequent evaluation.

Study Population and Sample Size

A total of 120 patients who underwent primary total hip arthroplasty during the defined study period were included in the analysis. Patients were categorized into two groups based on fixation technique documented in operative records, comprising 60 patients who received cemented total hip arthroplasty and 60 patients who underwent cementless total hip arthroplasty, enabling balanced comparative evaluation.

Inclusion Criteria

Eligible participants included adult patients aged 18 years or older who underwent primary total hip arthroplasty for indications such as osteoarthritis, avascular necrosis of the femoral head, or femoral neck fracture, with availability of complete perioperative and postoperative medical records and a minimum follow-up duration of either six or twelve months sufficient for outcome assessment.

Exclusion Criteria

Patients were excluded if they underwent revision total hip arthroplasty, presented with pathological fractures related to malignancy or metabolic bone disease, had incomplete or missing clinical or medication records, or underwent additional major orthopedic procedures during the same hospital admission that could confound outcome evaluation.

Data Collection

Data were retrospectively extracted from institutional medical records and electronic health information systems, including demographic variables, clinical and operative details, postoperative medication records, and follow-up outcomes. Information collected encompassed age, sex, comorbidities, indication for surgery, fixation method, analgesic prescriptions, duration of antibiotic prophylaxis, anticoagulant therapy, pain scores, functional outcomes, complications, mortality, and length of hospital stay, with all patient identifiers removed prior to analysis.

Outcome Measures

Therapeutic outcomes included postoperative pain intensity and functional recovery assessed using standardized scoring systems, while pharmacological outcomes comprised postoperative analgesic consumption, duration of antibiotic prophylaxis, and use of anticoagulant therapy. Population-level outcomes included incidence of postoperative complications, all-cause mortality during the follow-up period, and length of hospital stay measured in days, reflecting healthcare utilization and clinical burden.

Statistical Analysis

Statistical analysis was performed using standard statistical software. Categorical variables were summarized using frequencies and percentages, while continuous variables were expressed as mean $\pm$ standard deviation. Baseline characteristics were compared descriptively between groups. Independent *t*-tests were used to compare pharmacologic utilization and continuous outcome measures between cemented and cementless total hip arthroplasty groups. Correlation analysis was conducted across the entire study cohort to evaluate the relationship between postoperative pain scores and duration of analgesic use. Multivariate linear regression analysis was performed to identify predictors of length of hospital stay, including fixation technique, postoperative pain scores, and analgesic duration. A predefined significance level was applied, and results were interpreted within a therapeutic and population-health framework.

RESULTS

Baseline Characteristics

A total of 120 patients were included, with 60 patients each in the cemented and cementless total hip arthroplasty groups. Baseline demographic and clinical characteristics expressed as frequency and percentage are presented in Table 1. A higher proportion of patients aged 65 years or older was observed in the cemented group (70.0%) compared with the cementless group (43.3%). Sex distribution was comparable, with males accounting for 56.7% of the cemented group and 60.0% of the cementless group. Osteoarthritis represented the most common indication for surgery in both groups (53.3% vs 50.0%), followed by avascular necrosis and femoral neck fractures. The prevalence of at least one comorbidity was similar between groups (63.3% in cemented vs 58.3% in cementless), indicating overall baseline comparability (Table 1).

Table 1. Baseline demographic and clinical characteristics

Category	Variable	Cemented THA (n=60)	Cementless THA (n=60)
Age	≥ 65 years	42 (70.0%)	26 (43.3%)
Gender	Male	34 (56.7%)	36 (60.0%)
	Female	26 (43.3%)	24 (40.0%)
Disease/ Indication for surgery	Osteoarthritis	32 (53.3%)	30 (50.0%)
	Avascular necrosis	14 (23.3%)	18 (30.0%)
	Femoral neck fracture	14 (23.3%)	12 (20.0%)
Medical Conditions	≥ 1 comorbidity	38 (63.3%)	35 (58.3%)

Baseline demographic and clinical characteristics of the study population were compared between the cemented and cementless total hip arthroplasty groups. Variables including age distribution, gender, indication for surgery, and presence of medical comorbidities were analyzed to assess baseline comparability between the two cohorts. The proportional distribution of these baseline characteristics is illustrated in Figure 1.

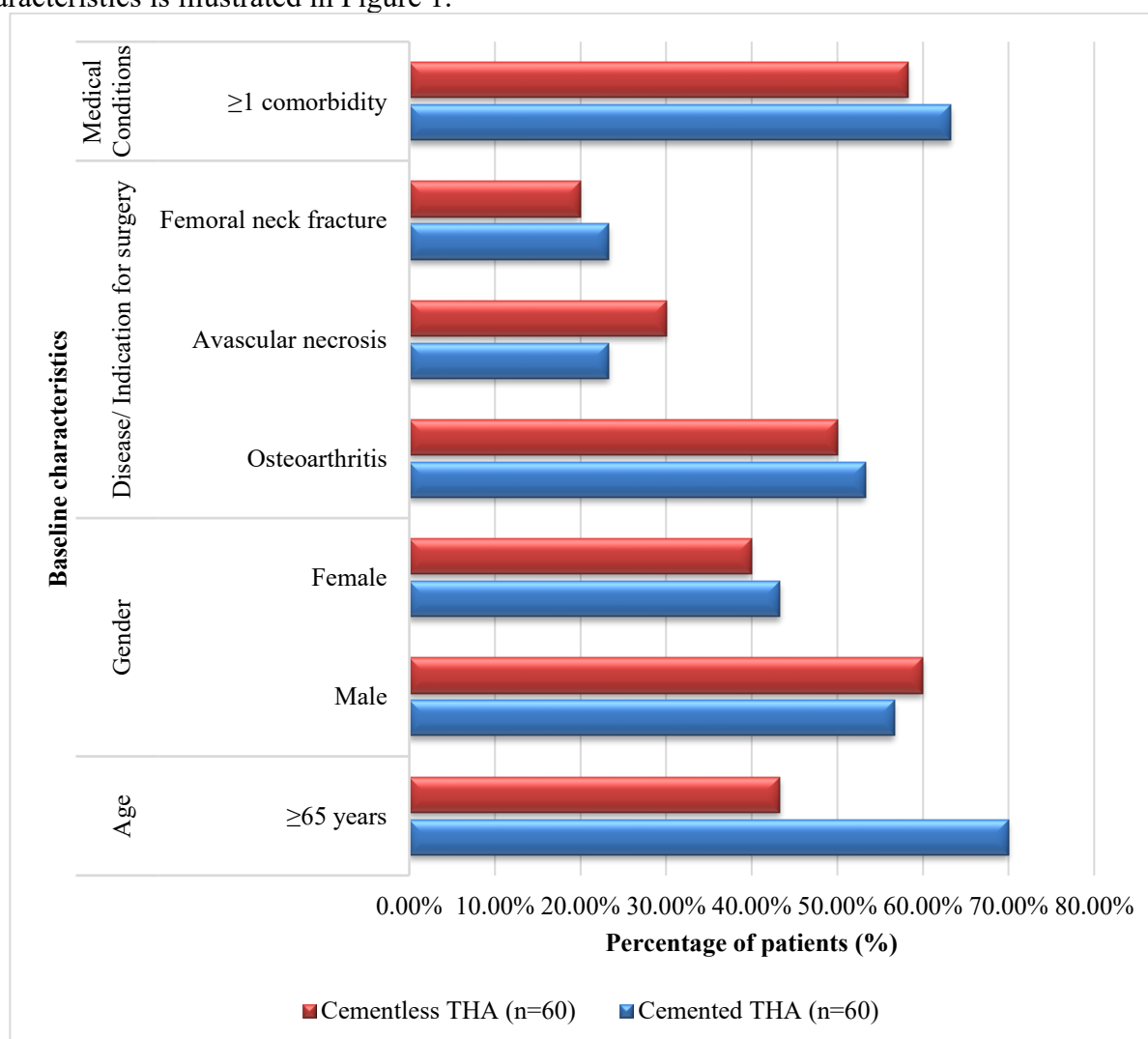


Figure 1. Baseline characteristics of the study population

As shown in Figure 1, a higher proportion of patients aged 65 years or older was observed in the cemented total hip arthroplasty group compared with the cementless group. Gender distribution was comparable between the two cohorts. Osteoarthritis represented the most common indication for surgery in both groups, followed by avascular necrosis and femoral neck fracture. The prevalence of at least one medical comorbidity was similar between groups, indicating overall baseline comparability of the study population.

Therapeutic and Functional Outcomes

Therapeutic and functional outcomes summarized as mean $\pm$ standard deviation are shown in Table 2. At discharge, mean pain scores were lower in the cemented group (3.2 ± 0.8) compared with the cementless group (3.8 ± 0.9). At final follow-up, pain scores improved substantially in both groups, with comparable values in the cemented (1.4 ± 0.6) and cementless (1.3 ± 0.5) cohorts. Functional outcome scores increased markedly from baseline to final follow-up in both groups, rising from 42.6 ± 6.5 to 82.3 ± 7.2 in the cemented group and from 44.1 ± 6.8 to 84.1 ± 6.9 in the cementless group, indicating similar long-term functional recovery (Table 2).

Table 2. Therapeutic and functional outcomes

Outcome	Cemented THA	Cementless THA
Pain score at discharge	3.2 ± 0.8	3.8 ± 0.9
Pain score at final follow-up	1.4 ± 0.6	1.3 ± 0.5
Functional score (baseline)	42.6 ± 6.5	44.1 ± 6.8
Functional score (final follow-up)	82.3 ± 7.2	84.1 ± 6.9

Comparison of Pharmacological Outcomes

Independent *t*-test analysis comparing postoperative pharmacologic utilization is presented in Table 3. The duration of analgesic use was significantly lower in the cemented group (4.1 ± 1.2 days) compared with the cementless group (5.3 ± 1.5 days; $p < 0.001$). No statistically significant differences were observed in the duration of antibiotic prophylaxis (2.3 ± 0.6 vs 2.2 ± 0.5 days; $p = 0.48$) or anticoagulant therapy (12.6 ± 3.1 vs 12.1 ± 2.9 days; $p = 0.36$) between groups (Table 3).

Table 3. Comparison of pharmacologic utilization

Parameter	Cemented THA (Mean ± SD)	Cementless THA (Mean ± SD)	<i>t</i> value	<i>p</i> value
Analgesic duration (days)	4.1 ± 1.2	5.3 ± 1.5	-4.78	<0.001
Antibiotic duration (days)	2.3 ± 0.6	2.2 ± 0.5	0.71	0.48
Anticoagulant duration (days)	12.6 ± 3.1	12.1 ± 2.9	0.92	0.36

Postoperative pharmacologic utilization was compared between the cemented and cementless total hip arthroplasty groups to evaluate differences in analgesic, antibiotic, and anticoagulant therapy requirements. Mean duration of postoperative medication use for each pharmacologic category is illustrated in Figure 2.

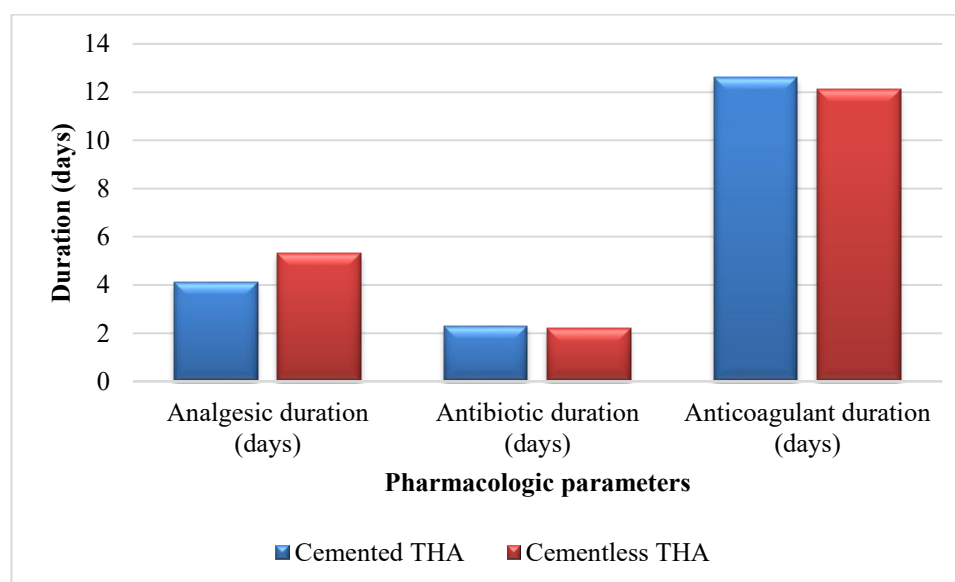


Figure 2. Comparison of postoperative pharmacologic utilization between cemented and cementless total hip arthroplasty

As shown in Figure 2, patients who underwent cemented total hip arthroplasty required a shorter duration of postoperative analgesic therapy compared with those who underwent cementless fixation. The duration of antibiotic prophylaxis and anticoagulant therapy was comparable between the two groups, indicating that fixation technique primarily influenced analgesic requirements rather than overall postoperative medication exposure.

Correlation Between Pain Score and Analgesic Duration

The correlation analysis was performed over the entire study cohort, which proved that there were moderate correlations in the strength of early postoperative pain and the period of analgesic application. Patients who complained of greater levels of pain at the discharging time took a longer period of postoperative analgesic treatment. This correlation was found to be statistically significant ($r = 0.46$, $p < 0.001$), and over the fixation technique, it was found that a higher pharmacologic burden was related to a higher level of postoperative pain.

Regression Analysis for Length of Hospital Stay

Multivariate linear regression analysis identified predictors of length of hospital stay, with results presented in Table 4. Cementless fixation was independently associated with prolonged hospitalization ($\beta = 0.94$, $p = 0.003$). Higher pain scores at discharge ($\beta = 0.58$, $p = 0.001$) and longer duration of analgesic use ($\beta = 0.41$, $p = 0.004$) also significantly predicted increased length of stay.

Table 4. Linear regression analysis predicting length of hospital stay

Predictor	β coefficient	Standard Error	p value
Cementless fixation	0.94	0.31	0.003
Pain score at discharge	0.58	0.17	0.001
Analgesic duration	0.41	0.14	0.004

DISCUSSION

The present retrospective comparative study evaluated therapeutic effectiveness, pharmacologic utilization, and population-level clinical outcomes following cemented and cementless total hip arthroplasty. This was supported by both the fixation methods which saw significant enhancement in pain relief and functional recovery and confirmed total hip arthroplasty as an effective therapeutic intervention regardless of the fixation mechanism. Nonetheless, it was found that there were early differences in the outcomes occurring after the surgery, especially in analgesic needs and hospital stay. The patients having cemented total hip arthroplasty reported lower pain scores at discharge, and a reduced period of postoperative analgesic medication than patients having cementless fixation. These results imply that cemented fixation can offer improved early mechanical stability that reflects in the provision of less postoperative pain and less pharmacologic load in the immediate postoperative recovery phase. Notably, the levels of pain in both final follow-up and functional outcome measures showed no significant difference in either groups, meaning that the long-term therapeutic efficacy was the same in both groups irrespective of the fixation method. Correlation analysis in the total group of the cohort proved that the degree of pain after surgery and the period of analgesic administration had significant positive correlations, which once again tell in favor of the priority of pain management in the definition of the pharmacologic burden. The regression study also established cementless fixation, increased pain scores, and longer analgesic consumption as the independent variables that predicted a long hospital stay. Taken together, these results indicate that postoperative pain is an essential mediator between the fixation strategy and the pharmacologic use and the healthcare resource consumption. The results of the research have a wide general consistency with the current comparative literature on assessing the fixation strategy in arthroplasty of the joints. Cemented and cementless studies on knee arthroplasty have similarly shown similarity in long-term outcome of functional results with variations mostly noted in the early recovery and complication rates.²⁰ Matched comparative trials over the long run have also shown that fixation strategy can affect early stability and rehabilitation courses without a significant decrease in long-term performance of implants.²¹ On the one hand, in relation to hip arthroplasty, systematic reviews of cemented and cementless through stems have shown no evidence of a superiority of one type of fixation over the other in relation to long-term functional or survival outcomes, which is why on the other hand, equal functional recovery was shown in the present study.^{22,23} The cementless hip stem design reviews have highlighted that the characteristics of implants and the type of patient selected to undergo the

procedure have an effect on the early outcomes, which could be the reason behind the differences in postoperative pain and analgesic needs.²⁴ As much of the comparative evidence is based on knee arthroplasty and revision hip operations, the current results are consistent with the rest of the arthroplasty literature that points to fixation strategy as more important than long-term functional success to early postoperative recovery and therapeutic burden. The noted correlation of fixation method and hospitalization is similar to the previous studies that associated the implant selection with the use of inpatient resources and the early postoperative recovery trends.²⁵

Clinically, the reduced first line analgesic needs in patients who have cemented total hips arthroplasty has significant clinical implications on the management of postoperative pain and the safety of medications especially in the elderly with many comorbidities. Less analgesic exposure could decrease the adverse events related to medication, earlier mobilize, and easier switch to rehabilitation. On a population-wide level, reduced healthcare use and efficiency of the system might be the consequences of shorter hospital stay related to cemented fixation. These results underlie the selective fixation of the individual in relation not only to the nature of the implant but also based on the expectations of the therapeutic burden, comorbidity profile, and the considerations of the available resources of the patient.

There are a number of limitations to be noted. The retrospective design restricts the possibility of causal inferences and is prone to the risk of selection bias because fixation choice might have been biased by the age of the patients, the quality of their bones, or the preferences of the surgeon. The research was carried out in one tertiary care facility and this could be limiting because it might not be generalizable to other units that have a different patient or perioperative guideline. Also, there was derivation of functional outcomes and pain scores based on standard clinical documentation, which can create inconsistency in the procedure. The long-term outcomes that were not measured were the ones outside the defined follow up.

Future studies ought to be on prospective, multicentric research incorporating standardized pain measures, deep pharmacologic exposure variables, and cost-effectiveness studies to further opiate the therapeutic and population-level effects of fixation techniques. Association of patient-reported outcome measures and long-term follow-up data would enhance the cognizance of the translation of early postoperative disparities into long-term quality-of-life improvements. This kind of evidence would be used to develop fixation-specific therapeutic pathways that are patient risk-profiles and health care system priorities.

CONCLUSION

This study indicated that cemented and cementless total hip arthroplasties have considerable therapeutic advantages, and substantial reduction in postoperative pain and functional recovery. There were no significant differences in the long-term functional outcomes and the pain scores at final follow-up among the fixation techniques, which supports the notion of total hip arthroplasty being an effective intervention in both versions of fixation. Nevertheless, it was found that there were significant variations in the initial post-operative results. At discharge, patients undergoing cemented total hip arthroplasty reported lower pain levels and postoperative analgesic therapy took a shorter period than patients undergoing cementless fixation. These results indicate that cemented fixation can provide benefits of early postoperative stability and pain management and, therefore, less acute pharmacologic load. Also, cemented fixation was linked to decreased hospital stay, which indicated the possible advantage in healthcare utilisation and recovery efficiency. Additionally, correlation and regression analysis demonstrated that postoperative pain was a major predetermining factor of pharmacologic needs and the length of hospitalisation. The increased intensity of pain was connected to the extended analgesic consumption, and the two factors independently led to the extended stay in the hospital. The results highlight the key place of managing pain in achieving optimal therapeutic results and minimizing costs to the healthcare sector on a population level. In general, the paper highlights the need to address the effectiveness of the therapeutic approach, the use of pharmacology, and the outcomes of the interventions at the population level in the choice of fixation methods in total hip arthroplasty. Individualizing fixation decision based on patient factors, such as older people, those

with medical comorbidities, etc., could lead to improved recovery in the initial stages, reduced drug exposure, and more effective healthcare resources utilization.

REFERENCE

1. Goyal D, Bansal M, Lamoria R. Comparative study of functional outcome of cemented and uncemented total hip replacement. *Journal of Orthopaedics, Traumatology and Rehabilitation*. 2018 Jan 1;10(1):23-8.
2. Murylev VY, Muzychenkov AV, Zhuchkov AG, Tsygin NA, Rigin NV, Elizarov PM, Kukovenko GA. Functional outcomes comparative analysis of cemented and uncemented total knee arthroplasty. *Journal of Orthopaedics*. 2020 Jul 1;20:268-74.
3. Phedy P, Ismail HD, Hoo C, Djaja YP. Total hip replacement: A meta-analysis to evaluate survival of cemented, cementless and hybrid implants. *World journal of orthopedics*. 2017 Feb 18;8(2):192.
4. Liu Y, Zeng Y, Wu Y, Li M, Xie H, Shen B. A comprehensive comparison between cementless and cemented fixation in the total knee arthroplasty: an updated systematic review and meta-analysis. *Journal of orthopaedic surgery and research*. 2021 Mar 5;16(1):176.
5. Nam D, Lawrie CM, Salih R, Nahhas CR, Barrack RL, Nunley RM. Cemented versus cementless total knee arthroplasty of the same modern design: a prospective, randomized trial. *JBJS*. 2019 Jul 3;101(13):1185-92.
6. Prudhon JL, Verdier R. Cemented or cementless total knee arthroplasty? Comparative results of 200 cases at a minimum follow-up of 11 years. *Sicot-j*. 2017 Dec 12;3:70.
7. Ko H, Pelt CE, Martin BI, Pellegrini Jr VD. Patient-reported outcomes following cemented versus cementless primary total knee arthroplasty: a comparative analysis based on propensity score matching. *BMC musculoskeletal disorders*. 2022 Oct 27;23(1):934.
8. Prasad AK, Tan JH, Bedair HS, Dawson-Bowling S, Hanna SA. Cemented vs. cementless fixation in primary total knee arthroplasty: a systematic review and meta-analysis. *EFORT open reviews*. 2020 Nov 13;5(11):793-8.
9. Liu Z, Wen L, Zhou L, Liu Z, Chen Y, Geng B, Xia Y. Comparison of cemented and cementless fixation in total knee arthroplasty: a meta-analysis and systematic review of RCTs. *Journal of Orthopaedic Surgery*. 2024 Nov 19;32(3):10225536241267270.
10. Onggo J, Phan K, Wilson C. Comparison of infection in cemented, cementless and hybrid primary total knee arthroplasty: a network meta-analysis and systematic review of randomized clinical trials. *ANZ Journal of Surgery*. 2020 Jul;90(7-8):1289-98.
11. Raja BS, Gowda AK, Singh S, Ansari S, Kalia RB, Paul S. Comparison of functional outcomes and complications of cemented vs uncemented total hip arthroplasty in the elderly neck of femur fracture patients: a systematic review and meta-analysis. *Journal of Clinical Orthopaedics and Trauma*. 2022 Jun 1;29:101876.
12. Garland A, Gordon M, Garellick G, Kärrholm J, Sköldenberg O, Hailer NP. Risk of early mortality after cemented compared with cementless total hip arthroplasty: a nationwide matched cohort study. *The Bone & Joint Journal*. 2017 Jan 1;99(1):37-43.
13. Veldman HD, Heyligers IC, Grimm B, Boymans TA. Cemented versus cementless hemiarthroplasty for a displaced fracture of the femoral neck: a systematic review and meta-analysis of current generation hip stems. *The bone & joint journal*. 2017 Apr 1;99(4):421-31.
14. Hannon CP, Salih R, Barrack RL, Nunley RM. Cementless versus cemented total knee arthroplasty: concise midterm results of a prospective randomized controlled trial. *JBJS*. 2023 Sep 20;105(18):1430-4.
15. Yoo JI, Cha YH, Kim KJ, Kim HY, Choy WS, Hwang SC. Comparison between cementless and cemented bipolar hemiarthroplasty for treatment of unstable intertrochanteric fractures: systematic review and meta-analysis. *Hip & pelvis*. 2018 Dec;30(4):241-53.
16. Yoon BH, Seo JG, Koo KH. Comparison of postoperative infection-related complications between cemented and cementless hemiarthroplasty in elderly patients: a meta-analysis. *Clinics in Orthopedic Surgery*. 2017 May 8;9(2):145.

17. Gwam CU, George NE, Etcheson JI, Rosas S, Plate JF, Delanois RE. Cementless versus cemented fixation in total knee arthroplasty: usage, costs, and complications during the inpatient period. *The journal of knee surgery*. 2019 Nov;32(11):1081-7.
18. Chen C, Shi Y, Wu Z, Gao Z, Chen Y, Guo C, Bao X. Long-term effects of cemented and cementless fixations of total knee arthroplasty: a meta-analysis and systematic review of randomized controlled trials. *Journal of orthopaedic surgery and research*. 2021 Oct 12;16(1):590.
19. Clar C, Leitner L, Koutp A, Hauer G, Rasic L, Leithner A, Sadoghi P. The worldwide survival rate of total hip arthroplasties is improving: a systematic comparative analysis using worldwide hip arthroplasty registers. *EFORT Open Reviews*. 2024 Aug 1;9(8):745-50.
20. Pacoret V, Kalk E, Labattut L, Girardot G, Baulot E, Martz P. Survival rate of cemented versus cementless tibial component in primary total knee arthroplasty over 5 years of follow-up: comparative study of 109 prostheses. *SICOT-J*. 2020 Sep 8;6:36.
21. Giovanoulis V, Kenanidis E, Aïm F, Gamie Z, Marmor S, Potoupnis M, Lustig S, Tsiridis E. Collared versus collarless hydroxyapatite-coated stems for primary cementless total hip arthroplasty; a systematic review of comparative studies. Is there any difference in survival, functional, and radiographic outcomes?. *SICOT-J*. 2024 Feb 15;10:8.
22. Elbardesy H, Anazor F, Mirza M, Aly M, Maatough A. Cemented versus uncemented stems for revision total hip replacement: A systematic review and meta-analysis. *World Journal of Orthopedics*. 2023 Aug 18;14(8):630.
23. Chen C, Li R. Cementless versus cemented total knee arthroplasty in young patients: a meta-analysis of randomized controlled trials. *Journal of orthopaedic surgery and research*. 2019 Aug 19;14(1):262.
24. Prudhon JL, Verdier R, Caton JH. Primary cementless total knee arthroplasty with or without stem extension: a matched comparative study of ninety eight standard stems versus ninety eight long stems after more than ten years of follow-up. *International Orthopaedics*. 2019 Aug 6;43(8):1849-57.
25. Van Praet F, Mulier M. To cement or not to cement acetabular cups in total hip arthroplasty: a systematic review and re-evaluation. *SICOT-J*. 2019 Oct 1;5:35.