Duzce Medical Journal

2026;28(1):71-76
https://doi.org/10.18678/dtfd.1810569

e-ISSN: 1307-671X
https://dergipark.org.tr/en/pub/dtfd

Research Article

Comparison of Cemented and Cementless Hemiarthroplasty Outcomes: A Retrospective Analysis of Mortality, Complications, and Subsidence

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Received: 11.11.2025
Revision: 14.04.2026
Accepted: 15.04.2026
Online: 25.04.2026

ABSTRACT

Aim: This study aimed to compare the clinical and radiological outcomes of cemented versus cementless femoral stems in patients undergoing hemiarthroplasty for femoral neck fractures.

Material and Methods: This study included patients who underwent hemiarthroplasty. Patients with pathological fractures, intertrochanteric fractures, secondary hemiarthroplasty after failed internal fixation, or total hip arthroplasty were excluded. Demographic, perioperative, and postoperative data were collected from hospital records. Radiographic evaluation included Dorr classification, leg length discrepancy, and femoral stem subsidence.

Results: A total of 364 patients were included. 212 (58.2%) patients underwent cemented and 152 (41.8%) cementless hemiarthroplasty. At final assessment, 131 (36.0%) patients were alive, 152 (41.8%) had died within one year, and 81 (22.3%) had died after one year. Cement use was not significantly associated with mortality (p=0.515), while 89 (42.0%) patients in the cemented group had died within the first year, this rate was 63 (41.4%) in the cementless group. Stem subsidence ≥5 mm was observed in 33 (15.6%) cemented patients and 19 (12.5%) cementless patients, without a statistically significant difference (p=0.410). Preoperative waiting time was significantly associated with one-year mortality (p<0.001).

Conclusion: Cemented and cementless hemiarthroplasty showed comparable outcomes with respect to mortality, implant-related complications, and stem subsidence in elderly patients with femoral neck fractures. Preoperative waiting time, rather than cement use, appeared to be the factor most strongly associated with early mortality. These findings highlight the importance of timely surgical management and careful patient selection based on bone quality.

Keywords: Femoral neck fractures, hemiarthroplasty, bone cements, mortality, prosthesis failure.

INTRODUCTION

Hip fractures predominantly occur in elderly individuals, particularly those aged ≥75 years, and are typically associated with low-energy trauma related to osteoporosis (1). Hemiarthroplasty is the most commonly preferred treatment method for displaced femoral neck fractures (2). The main reasons for this preference include allowing earlier mobilization compared to internal fixation methods, a lower need for revision surgery, and better functional outcomes (3). However, whether to use a cemented or cementless stem in hemiarthroplasty remains a subject of debate in the literature (4,5). While cementless stems may be advantageous in patients with better bone quality, several studies have suggested that cemented hemiarthroplasty provides better functional outcomes, greater pain relief, and fewer implant-related complications (6-8).

However, despite numerous comparative studies, the literature remains limited in providing a comprehensive evaluation of multiple clinically relevant outcomes within a single cohort. Most previous studies have focused on isolated parameters, such as mortality or functional outcomes, without integrating perioperative factors such as transfusion requirements and length of hospital stay. Therefore, the present study aimed to provide a more holistic assessment of the impact of cemented versus cementless hemiarthroplasty in routine clinical practice.

MATERIAL AND METHODS

After obtaining approval from the institutional ethics committee (Ümraniye Training and Research Hospital, approval no: 204, date: 10.07.2025), this study was designed as a retrospective analysis. Patients who underwent cemented or cementless hemiarthroplasty for isolated femoral neck fractures between 2018 and 2023 and had complete imaging and clinical records were included in the study. Patients with intertrochanteric fractures, those who underwent hemiarthroplasty as a secondary procedure following failed internal fixation (e.g., implant failure, cut-out, or nonunion), patients with pathological fractures, and those treated with total hip arthroplasty were excluded. Demographic data of all patients were recorded, along with the duration of surgery, presence of postoperative infection, preoperative and postoperative length of hospital stay, need for transfusion, reoperation status (and the reason if reoperation was performed), incision technique, presence of intraoperative fractures during stem insertion, comorbidities assessed using the Charlson comorbidity index (CCI) and postoperative complications during follow-up. Mortality data were obtained from the hospital electronic patient record system, which enabled assessment of vital status independent of clinical follow-up visits. Therefore, mortality outcomes, including 1-year mortality, were determined based on electronic records rather than solely on in-person follow-up.

Cite as: Taşcı M, Uçar F, Çadırcıbaşı ER. Comparison of cemented and cementless hemiarthroplasty outcomes: a retrospective analysis of mortality, complications, and subsidence. Duzce Med J. 2026;28(1):71–6. doi:10.18678/dtfd.1810569.

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Although hemiarthroplasty is generally preferred in elderly patients, in selected cases, treatment decisions were based on clinical condition rather than chronological age alone. In some patients, discrepancies between recorded and biological age may have been present, and these individuals were managed according to their overall health status, comorbidities, and functional capacity.

Radiographic evaluations included assessment of the Dorr index, leg length discrepancy, and subsidence of the femoral stem during follow-up. As standardized leg length radiographs were not available for all patients, leg length was estimated using measurements between the lesser trochanters and between the inferior pubic rami on pelvic radiographs. Subsidence was calculated by measuring the positional change of the femoral stem within the femoral canal over time.

For patients with limited follow-up due to mortality, evaluations were based on the most recent radiograph available. The timing of mortality was recorded for each patient and categorized as death within the first year, death after one year, or survival at final follow-up. Any discrepancies in radiographic assessment were resolved in consultation with the senior author.

The decision to use cement was based on the preoperative radiographic Dorr index. Cement was applied in Group C patients, whereas it was not used in Group A patients. For Group B patients, the decision was made intraoperatively according to bone quality, and cement was applied in those considered to have poor bone stock.

The stems and cements used in patients were brands approved by the Ministry of Health and supplied to our hospital through a tender process. In cementless cases, proximally porous-coated conical stems were used, while in cemented cases, straight, non-coated, conical diaphyseal stems were preferred. For cementing, the second-generation cementation technique was applied.

Statistical Analysis

Data were analyzed using IBM SPSS software (ver. 22.0; IBM Corp., Armonk, NY, USA). The normality of continuous variables was assessed using the Kolmogorov-Smirnov test, and homogeneity of variances was evaluated using Levene's test. Continuous variables are presented as mean±standard deviation or median, interquartile range, and minimum-maximum values. Comparisons between two independent groups were performed using the Independent samples t-test or the Mann-Whitney U test. Categorical variables are expressed as frequencies and percentages, and were compared using the chi-square test or Fisher's exact test, where appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 364 patients were included in the study. Among them, 237 (65.1%) were male, and 127 (34.9%) were female. The mean age was 80.1±8.5 years. Cement was used in 212 (58.2%) patients, while 152 (41.8%) patients underwent cementless procedures. At follow-up, 131 (36.0%) patients were alive, 152 (41.8%) patients died within the first year, and 81 (22.3%) patients died after one year. A total of 27 (7.4%) patients required reoperation for various reasons. Based on the Dorr index, 91 (25.0%) patients were classified as type A, 178 (48.9%) as type B, and 95 (26.1%) as type C (Table 1). A posterolateral incision technique was used in 230 patients (63.2%), while 134 patients (36.8%) underwent surgery with a lateral incision. Outcomes were analyzed as patient-related (e.g., mortality, transfusion) and implant-related (e.g., stem subsidence and complications) parameters.

Table 1. Demographic and clinical characteristics of the patients.

Characteristics	**(n=364)**
Age (years), mean±SD	80.1±8.5 [55-104]
Gender, n (%)	
Male	237 (65.1)
Female	127 (34.9)
Cement, n (%)	
Cemented	212 (58.2)
Cementless	152 (41.8)
Dorr index, n (%)	
Type A	91 (25.0)
Type B	178 (48.9)
Type C	95 (26.1)
Mortality, n (%)	
Alive	131 (36.0)
≤1 year	152 (41.8)
>1 year	81 (22.3)

The median CCI was calculated as 6 (range, 2-17). There was no statistically significant correlation with preoperative waiting time (p=0.203), and no statistically significant difference was found in terms of mortality (p=0.198) or cement use (p=0.625) in CCI. However, when evaluating postoperative complication risk, patients with complications had significantly higher CCI scores (p=0.016). In addition, patients who required blood transfusion had significantly higher CCI values (p=0.007). Wound-related complications were observed in 19 (5.2%) patients, including 8 (3.8%) in the cemented group and 11 (7.2%) in the cementless group. Detailed distribution of postoperative complications—including deep vein thrombosis, dislocation, periprosthetic fracture, acetabular protrusion, and early mortality—is presented in Table 2. Overall, no complications were observed in 313 (86.0%) patients.

The median time to surgery was 4 days (range, 1-18), the median postoperative hospital stay was 4 days (range, 1-150), and the mean operative time was 115.92±20.62 minutes. The mean operative time was 115.05±21.94 minutes in the cemented group and 117.17±18.66 minutes in the cementless group, with no significant difference between groups (p=0.501). The mean follow-up period was 29.7 weeks, with a median follow-up of 4 weeks (range, 1-350), indicating a skewed distribution primarily due to early mortality in a substantial proportion of patients. The relatively short follow-up period was attributed to early mortality among some patients, which reduced the overall follow-up duration.

When patients were grouped according to stem subsidence as of ≥5 mm versus <5 mm, a total of 52 (14.3%) patients exhibited subsidence of 5 mm or greater. Among these, 33 (15.6%) were in the cemented group, and 19 (12.5%) were in the cementless group. Although the difference was not statistically significant (p=0.410), subsidence ≥5 mm was

more frequently observed in patients who underwent cemented procedures (Table 3). When evaluating stem subsidence of ≥5 mm according to Dorr classification, there were 12 (13.2%) patients in type A, 26 (14.6%) patients in type B, and 14 (14.7%) patients in type C. No statistically significant differences were found among the groups (p=0.942).

Intraoperative iatrogenic fractures were observed in 33 (9.1%) patients, most commonly during stem insertion in the trochanteric region. These fractures were managed with cerclage or cable fixation. Based on stem fixation type, fractures were detected in 17 (8.0%) patients in the cemented group and 16 (10.5%) patients in the cementless group (p=0.411). According to the surgical approach, iatrogenic fractures occurred in 17 (7.4%) of 230 patients in the posterolateral group and 16 (11.9%) of 134 patients in the lateral group (p=0.145). With respect to femoral morphology, iatrogenic fractures were observed in 11 (12.1%) of 91 patients with Dorr type A, 15 (8.4%) of 178 patients with Dorr type B, and 7 (7.4%) of 95 patients with Dorr type C. No statistically significant differences were found between groups (p=0.490). Among patients with iatrogenic fractures, wound complications occurred in only 3 cases, while 1 patient developed deep vein thrombosis (DVT) and another had a dislocation.

No statistically significant associations were found between the need for reoperation and Dorr index (p=0.219), sex (p=0.650), or cement use (p=0.055). The mean age of patients who required reoperation was 77.5±8.7 years, compared to 80.3±8.4 years in those who did not undergo additional surgery (p=0.082). Among patients who developed postoperative infection, the requirement for blood transfusion was significantly higher (87.5% vs 40.6%, p<0.001).

During follow-up, heterotopic ossification was observed in 41 (11.3%) patients. This complication occurred in 26 (12.3%) patients in the cemented group and in 15 (9.9%) patients in the cementless group, with no statistically significant difference (p=0.476). Regarding the surgical approach, heterotopic ossification was observed in 21 (9.2%) patients operated via the posterolateral incision and in 20 (14.9%) patients operated via the lateral incision (p=0.092).

Although the relationship between cement use and mortality was not statistically significant (p=0.515), 89 (42.0%) patients who died within the first year and 51 (24.1%) who died after one year were in the cemented group (Table 3).

Table 2. Postoperative complications.

	Cemented (n=212)	Cementless (n=152)	p	Overall (n=364)
Wound complication	8 (3.8)	11 (7.2)		19 (5.2)
Deep vein thrombosis	5 (2.4)	5 (3.3)	0.191	10 (2.7)
Exitus	4 (1.9)	4 (2.6)		8 (2.2)
Dislocation	4 (1.9)	6 (3.9)		10 (2.7)
Asetabular protrusion	0 (0.0)	2 (1.3)		2 (0.5)
Periprosthetic fracture	2 (0.9)	0 (0.0)		2 (0.5)

Table 3. Perioperative and follow-up outcomes.

	Cemented (n=212)	Cementless (n=152)	p	Overall (n=364)
Time to surgery (days)	4 (3-6) [1-18]	4 (3-5) [1-18]	0.946	4 (3-5) [1-18]
Postoperative hospital stay (days)	4 (3-5) [1-60]	4 (3-5) [2-150]	0.837	4 (3-5) [1-150]
Operative time (min)	115.05±21.94 [60-180]	117.17±18.66 [80-240]	0.501	115.92±20.62 [60-240]
Follow-up period (weeks)	4 (4-24) [1-350]	6 (4-46) [1-300]	0.394	4 (4-32) [1-350]
Stem subsidence (≥5 mm), n (%)	33 (15.6)	19 (12.5)	0.410	52 (14.3)
Iatrogenic fractures, n (%)	17 (8.0)	16 (10.5)	0.411	33 (9.1)
Heterotopic ossification, n (%)	26 (12.3)	15 (9.9)	0.476	41 (11.3)
Mortality, n (%)				
Alive	72 (34.0)	59 (38.8)	0.515	131 (36.0)
≤1 year	89 (42.0)	63 (41.4)		152 (41.8)
>1 year	51 (24.1)	30 (19.7)		81 (22.3)

*: the mean follow-up period was 29.7 weeks, shortened by early mortality, continuous variables are presented as mean±standard deviation or median (interquartile range) [minimum-maximum].

Among patients who died within the first year, 68 (44.7%) had cardiovascular disease (CVD), and 48 (31.6%) had both CVD and accompanying neurological conditions.

Regarding the relationship between mortality and age, the mean age of patients who died within the first year was 82.1±8.7 years, while it was 80.1±6.9 years for those who died after one year, and 77.3±8.5 years for those still alive at final follow-up (p<0.001). While there was no significant difference between patients who died within one year and after one year (p=0.544), the differences in mean age between patients who remained alive and those who died within the first year (p<0.001), and those who died after one year (p=0.006) were statistically significant. There was a statistically significant association between preoperative waiting time and mortality within the first year (p<0.001). The preoperative waiting time was significantly

longer in patients who died within the first year compared to the patients who survived (p<0.001) and who died after one year (p=0.022). Similarly, patients who received blood transfusion had a significantly longer preoperative waiting time than those who did not (p=0.005).

DISCUSSION

Hemiarthroplasty remains the most commonly preferred treatment option for femoral neck fractures in elderly patients. However, the question of whether cemented or cementless femoral stems offer greater advantages continues to be a subject of debate. In this retrospective study, cemented and cementless hemiarthroplasty demonstrated comparable outcomes in terms of implant-related complications and stem subsidence. No significant association was found between cement use and postoperative complications, reoperation rates, or mortality. In contrast, preoperative waiting time emerged as a more influential factor associated with mortality, with longer waiting times significantly increasing the risk of death within the first year. These findings suggest that perioperative timing and patient-related factors may play a more critical role than implant fixation method in determining clinical outcomes. Hemiarthroplasty remains the most commonly preferred treatment option for femoral neck fractures in elderly patients. However, the question of whether cemented or cementless femoral stems offer greater advantages continues to be a subject of debate.

In this study, no significant association was observed between the use of cement and the development of postoperative infections. In contrast, Elmenshawy et al. (9) reported lower infection rates in the cementless group, attributing this to a significantly shorter operative time in those patients. However, in our study, operative times were similar between the cemented and cementless groups, and infection rates were not influenced by cement use. Although cement setting time may prolong operative time, this difference did not reach statistical significance in our study.

Mortality rates following hemiarthroplasty have been extensively examined in previous studies, and our results did not show a direct association between cement use and overall mortality. Nevertheless, both early (within the first year) and late (beyond one year) mortality were higher in the cemented group. Similarly, other studies have also failed to demonstrate a statistically significant relationship between cement use and mortality (9-11).

It is known that cement can increase intramedullary pressure, potentially leading to fat embolism or fatal cardiac events, particularly in patients with high comorbidity burdens. While this risk may contribute to early postoperative mortality, studies have shown no significant long-term difference between cemented and cementless techniques, which is consistent with our findings.

A study evaluating femoral stem subsidence was identified, in which patients were classified based on whether they had subsidence of ≥5 mm or <5 mm; cemented stems were reported in only three patients, but mean values were not provided (12). In our study, when comparing stem subsidence of 5 mm or greater between cemented and cementless groups, our findings—similar to the referenced study—showed that subsidence ≥5 mm was more commonly observed in cemented cases. Although subsidence ≥5 mm was numerically more frequent in the cemented group, this difference was not statistically significant, suggesting that fixation method alone may not be the primary determinant of stem migration. When evaluated according to femoral morphology, a trend toward higher subsidence rates was observed in Dorr type C femurs, which may reflect reduced cortical support and poorer bone quality in this subgroup.

In our study, surgical technique and implant selection were relatively standardized, and all patients were allowed early postoperative weight-bearing, reducing the likelihood that differences in loading or operative variability influenced the results. Therefore, the observed pattern of collapse is more likely to be attributed to underlying bone characteristics rather than cement usage.

These findings suggest that femoral morphology and bone quality should be carefully considered when evaluating the risk of stem subsidence, although further studies with larger sample sizes are needed to confirm this association.

Iatrogenic femoral fractures are a known risk during hemiarthroplasty. In our study, no significant association was found between the occurrence of intraoperative fractures and either the use of cement or the surgical approach. Although iatrogenic fractures were numerically more frequent in the cementless group (16 patients, 10.5%) compared to the cemented group (17 patients, 8.0%), this difference was not statistically significant. Similarly, fractures occurred more frequently in the lateral approach (16 patients, 11.9%) compared to the posterolateral approach (17 patients, 7.4%), without statistical significance.

When evaluated according to femoral morphology, iatrogenic fractures were observed across all Dorr types, with slightly higher rates in Dorr type A (11 patients, 12.1%) compared to type B (15 patients, 8.4%) and type C (7 patients, 7.4%), again without a statistically significant difference.

In a meta-analysis by Nantha Kumar et al. (13), periprosthetic fractures were more common in the cementless group, although the difference was not statistically significant. Consistent with these findings, our results suggest that iatrogenic femoral fractures may be more closely related to intraoperative technical factors—particularly during broaching or stem insertion—rather than implant fixation method or femoral morphology alone.

Consistent with the findings of Ng et al. (5), our study also found no significant relationship between cement use and the need for blood transfusion. These findings suggest that intraoperative broaching procedures resulted in comparable levels of blood loss between the two groups.

Nevertheless, an extended time to surgery was found to be a significant predictor of early mortality, particularly within the first year following the procedure. Similarly, Pangaud et al. (14) reported that prolonged preoperative delay was linked to higher mortality rates, and that performing surgery within the first 24 hours was most effective in reducing two-year mortality. In our study, the median preoperative waiting time was longer than 24 hours, primarily due to the consultations required for preoperative anesthesia preparation and the need to wait for the availability of postoperative intensive care unit beds. We observed that earlier surgical intervention is critically important for patient survival, and therefore, hospital administrations could be encouraged to establish dedicated postoperative monitoring areas outside of the intensive care unit to facilitate earlier operations.

We also observed a statistically significant association between patient age at the time of surgery and the timing of mortality. However, we were unable to define a specific age cut-off at which mortality risk significantly increased. Further studies with larger sample sizes are needed to clarify this threshold.

The Dorr classification is used to evaluate the cortical thickness of the proximal femur and guide the choice of femoral stem fixation. In type A femurs, where the cortex is thick, cementless prostheses are typically preferred, whereas in type C femurs, with thin cortices, cemented stems are commonly used. For type B femurs, the decision to use cement can be made intraoperatively based on observed bone quality and patient comorbidities (15). In the study by Choi et al. (12), the authors reported using the Dorr classification to guide cement use but did not assess how this approach influenced clinical outcomes. In our study, no statistically significant differences in subsidence were observed between the Dorr types. Nonetheless, in our clinical practice, we also use the Dorr classification as a basis for cement selection, taking into consideration the patient's mobilization potential and comorbidities. In particular, the outcomes of cementless femoral stems in Dorr type C patients remain uncertain.

Postoperative follow-up revealed several complications, including DVT, dislocation, serous wound drainage, acetabular protrusion, and periprosthetic fractures. The rate of DVT was similar in both the cemented and cementless groups (5 patients, 2.4% vs. 5 patients, 3.3%). However, both periprosthetic fractures occurred in cemented patients, whereas both cases of acetabular protrusion were observed in the cementless group. Although not statistically significant, dislocations were more frequent in the cementless group (6 patients, 3.9% vs. 4 patients, 1.9%). Furthermore, most dislocations were associated with the posterolateral approach (7 patients, 3.0% compared to 3 patients, 2.2% in the lateral approach).

In their study, Elmenshawy et al. (9) also examined postoperative complications and found no statistically significant difference between cemented and cementless groups regarding pulmonary embolism and dislocation. Additionally, they reported that heterotopic ossification was significantly more frequent in the cemented group. While our findings did not reach statistical significance, similarly, the rate of heterotopic ossification was higher in the cemented group (26 patients, 12.3% vs. 15 patients, 9.9%).

Independent of cement use, our study demonstrated that prolonged preoperative waiting time was associated with higher mortality and increased need for blood transfusion. Furthermore, infection was more common among patients who received transfusions. These findings highlight the importance of performing surgery as early as possible to reduce both mortality and postoperative infection risk.

We acknowledge several limitations of our study. The relatively small sample size and retrospective design are the primary limitations. Although the same type of femoral stem was used in all patients, the brand of the stem and cement varied due to institutional procurement policies in our public hospital. Although the implant brands may vary, proximally porous-coated stems were used in cementless procedures, whereas polished, non-coated stems were preferred in cemented cases. This variation may have affected standardization; however, our findings indicate that these differences did not lead to significant clinical outcome discrepancies. Additionally, although the Dorr classification was used to guide the choice of cemented versus cementless fixation, this assessment is inherently subject to interobserver variability and surgeon-dependent interpretation of bone quality. This is particularly relevant for Dorr type B femurs, where intraoperative decision-making may vary between surgeons. Therefore, potential classification bias in this subgroup should be considered when interpreting our findings.

Another important limitation of this study is the non-randomized selection of cemented versus cementless stems, which was largely influenced by femoral morphology and bone quality. This introduces a potential risk of confounding by indication, as patients with different baseline characteristics may have been preferentially assigned to a specific fixation method. In addition, no multivariable adjustment was performed, limiting the ability to control for potential confounders and to establish causal relationships between variables such as mortality and complications.

Furthermore, functional outcome measures were not available, which restricts the evaluation of clinical performance beyond complication and mortality rates. The heterogeneity in follow-up duration across patients may also have affected the consistency of outcome assessment. Cement implantation syndrome was not specifically evaluated in this study, representing another limitation in the interpretation of perioperative risk. Finally, the assessment of stem subsidence was based on standard radiographic measurements, which may be subject to measurement variability and potential bias.

Additionally, due to the advanced age and mortality of the patient group, long-term outcomes could not be obtained for all cases. Moreover, early mortality among patients accounted for the relatively short follow-up period observed in our study. We recognize that different results may emerge with longer-term follow-up.

CONCLUSION

Hemiarthroplasty remains a highly effective treatment method for femoral neck fractures in elderly patients due to its low complication rates and facilitation of early mobilization. When cement use is tailored to bone quality, comparable outcomes can be achieved, emphasizing the importance of proper patient selection. In this age group, we believe that the most critical factor influencing mortality is the duration of preoperative waiting.

DECLARATIONS

Acknowledgements: The authors do not wish to acknowledge any individual or institution. The study was presented as an oral presentation at the 34th National Turkish Orthopaedics and Traumatology Congress (November 4-9, 2025; Antalya, Türkiye).

Author Contributions: Conceptualization, M.T.; Methodology, M.T. and F.U.; Formal Analysis, M.T.; Investigation, M.T. and E.R.Ç.; Data Curation, F.U. and E.R.Ç.; Writing–Original Draft, M.T., F.U., E.R.Ç.; Writing–Review & Editing, M.T. All authors have read and approved the final version of the manuscript.

Conflict of Interest: The authors declare no conflict of interest.

Supporting Institutions: This research received no external funding.

Ethical Approval: This study was approved by the Scientific Research Ethics Committee of Ümraniye Training and Research Hospital (Approval no: 204, Date: 10.07.2025).

Plagiarism Statement: This article has been evaluated for plagiarism, and no instances of plagiarism were detected.

Use of Artificial Intelligence (AI) Tools: During the preparation of this work, the authors used ChatGPT (OpenAI, version 5.1) to improve language and readability. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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