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Caregiver burden and patient quality of life after hip fracture surgery: A comparison of proximal femoral nailing and bipolar hemiarthroplasty

Mustafa Kemal Yenidünya[1], İbrahim Faruk Adıgüzel[2], Muhammed Mustafa Özer[1], Sinan Yüksel[1], Mehmet Faruk Çatma[1]

[1]University of Health Sciences Türkiye, Ankara Etlik City Hospital, Department of Orthopaedics and Traumatology, Ankara, Türkiye

[2]Eskişehir Osmangazi University Faculty of Medicine, Department of Orthopaedics and Traumatology, Eskişehir, Türkiye

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Corresponding Author:
Mustafa Kemal Yenidünya MD, University of Health Sciences Türkiye, Ankara Etlik City Hospital, Department of Orthopaedics and Traumatology, Ankara, Türkiye
mkemalynd@gmail.com

ORCID:
orcid.org/0009-0001-7098-9024

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ABSTRACT

Aims: Hip fractures are frequently associated with loss of independence and increased caregiver burden during the postoperative period. This study aimed to compare patient quality of life and caregiver burden after bipolar hemiarthroplasty and proximal femoral nailing (PFN) in patients undergoing surgery for hip fractures, and to evaluate factors associated with caregiver stress during the postoperative period.

Methods: In this retrospective comparative study, caregivers of patients operated for femoral neck or intertrochanteric fractures between January 2023 and January 2025 were evaluated. A total of 132 patient-caregiver pairs were included: bipolar hemiarthroplasty (Group 1, n=64) and PFN (Group 2, n=68). Recorded caregiver variables included age, sex, relationship to the patient, daily caregiving time, positioning stress, and fear of damaging the implant. Patient outcomes included assisted/unassisted ambulation time, time to independence, EuroQol 5-dimension 5-level (EQ-5D-5L), and Zarit caregiver burden scale scores.

Results: Assisted and unassisted mobilization occurred earlier in Group 1 than in Group 2 ($p<0.001$ for both comparisons). Positioning stress was higher in Group 1, whereas fear of damaging the implant was higher in Group 2 ($p=0.020$ and $p=0.030$). Greater deterioration in EQ-5D-5L scores and higher Zarit burden scores between baseline and 3 months were observed in Group 2 ($p=0.020$ and $p=0.006$). Between 6 and 12 months, Group 2 showed significant improvement in quality of life and caregiver burden ($p=0.020$ and $p=0.001$, respectively). Between-group differences had largely diminished by one year.

Conclusions: Earlier mobilization and lower early caregiver burden were observed in the bipolar hemiarthroplasty group. However, caregivers in this group reported higher anxiety during transfers and repositioning. In the PFN group, early recovery was relatively slower and caregiver burden was more pronounced; nevertheless, significant improvement was observed during follow-up. These findings suggest that success after hip fracture treatment should be evaluated not only by surgical outcomes, but also by patient independence and caregiver burden.

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Introduction

Caregiver burden refers to the physical, psychological, social, and economic strain experienced by individuals who provide care for patients with functional dependency. This burden becomes particularly important in conditions that cause sudden functional decline and increased dependence on others, such as hip fractures in elderly patients. Hip fractures in older adults often result in prolonged functional limitations, increased need for daily assistance, and greater reliance on family members or caregivers. It has been reported that only approximately 40% of patients who undergo surgery are able to return to their pre-operative functional level (1). Additionally, it has been shown that approximately 75% of these patients lose the ability to independently perform activities of daily living (2). It has been reported that more than half of patients become dependent following hip fracture surgery, and their need for support from family members and caregivers increases significantly (3). This dependency not only negatively affects the patient psychologically and physically but also places a significant burden on caregivers. Indeed, it is reported that caregivers frequently experience a caregiving burden characterized by increased anxiety, depression, and musculoskeletal complaints (4). Although the caregiver's health status is directly related to the recovery process and functional gains of elderly patients who have suffered a hip fracture, these individuals are often not given sufficient consideration within the healthcare system (5,6). Although home care and home-based physical therapy services are available within the Turkish healthcare system, the daily care responsibilities after hip fracture surgery, including transfers, mobilization assistance, personal care, and follow-up support, are often largely assumed by family caregivers. Therefore, caregiver well-being remains an important component of postoperative recovery.

In this context, the aim of the present study is to assess caregiver burden among individuals caring for patients who have undergone surgery for hip fractures and to analyze the factors affecting their quality of life. Additionally, the study aims to identify factors that increase the burden on caregivers and to identify potential areas for improvement to reduce this burden. In particular, the study aims to conduct a comparative analysis of the most challenging situations for caregivers following the application of proximal femoral nailing (PFN) and bipolar hemiarthroplasty treatment methods after a hip fracture.

Methods

Study design and setting

This retrospective comparative study was conducted at University of Health Sciences Türkiye, Ankara Etlik City Hospital. Eligible patients were identified through the hospital electronic database and archived medical records. Demographic and clinical data were obtained from medical files. Caregiver-related information and follow-up data were obtained from previously recorded follow-up forms and archived records; missing or updated data were completed during the postoperative period through telephone interviews with caregivers and face-to-face questioning during outpatient clinic visits. Among the 132 included patient-caregiver pairs, telephone interviews were required in 7 pairs (5.3%) to complete or verify missing or unclear follow-up data.

The study protocol was pre-approved by the Human Research Ethics Committee of the University of Health Sciences Türkiye, Ankara Etlik City Hospital (decision no.: AEŞH-BADEK1-2026-321, date: 08.04.2026). Written informed consent was obtained from each patient included in the study. The study protocol was conducted in accordance with the ethical principles of the 1975 Declaration of Helsinki (2013 revision).

Participants and selection criteria

Caregivers of patients who underwent surgery for an intertrochanteric femur fracture or a femoral neck fracture between January 2023 and January 2025 were retrospectively screened.

Inclusion criteria were as follows: being the primary caregiver of a patient with a hip fracture, regularly and consistently providing the majority of the patient's daily care, being 20 years of age or older, and reporting that they provided active care support for activities of daily living.

Exclusion criteria included the presence of a psychiatric disorder (major depression, schizophrenia, etc.) or cognitive impairment in the caregiver.

A total of 520 eligible patients were evaluated. However, due to the deaths of approximately 140 patients, the placement of 120 patients in nursing homes, the inability to obtain contact information for 82 patients, and the refusal of 46 caregivers to participate in the study, the study was completed with 132 patient-caregiver pairs. The distribution of excluded patients due to death, nursing home placement, unavailable contact information, or refusal to participate was relatively balanced between the bipolar hemiarthroplasty and PFN groups. Patients were divided into two groups: those who underwent bipolar hemiarthroplasty (Group 1, n=64) and those who underwent PFN (Group 2, n=68). In all patients in the bipolar hemiarthroplasty group, surgery was performed using the standard posterolateral approach.

Data collection and clinical variables

The following data regarding caregivers were recorded: age, sex, relationship to the patient, and the number of hours per day spent caring for the patient. Additionally, questions were asked to assess the level of stress they experienced when transferring the patient to bed or into a different position (positioning stress)

and their fear of damaging the implant while sitting the patient up or lifting the patient (fear of causing harm). Responses were recorded using a 5-point Likert-type scale scored from 0 (none) to 4 (very high).

Patient data included age, sex, pre-fracture walking ability, and treatment administered following a hip fracture. The patients' pre-fracture functional status and caregivers' pre-fracture conditions were designated as baseline. Baseline measurements were obtained from routinely completed preoperative and early admission assessment forms, follow-up records, and hospital medical records. These baseline data reflected the patients' pre-fracture functional status and caregivers' pre-fracture conditions as documented during the initial treatment period, rather than being based solely on delayed retrospective recall. Caregiver interviews were used only to complete or verify missing or unclear information when necessary. Additionally, within the scope of clinical data, the time to initiation of assisted mobilization (with a walker) (average days), the time to initiation of unassisted walking (average days), and the duration until the need for postoperative care support ended (average months) were recorded.

Data collection and assessment tools

The EuroQol 5-dimension 5-level (EQ-5D-5L) questionnaire and the Zarit caregiver burden scale were used to assess functional outcomes. The EQ-5D-5L was selected because it is a standardized instrument with established validity and reliability for assessing health-related quality of life in orthopedic and geriatric populations. Outcomes following hip fracture surgery are not limited to technical or surgical success alone, but also require evaluation of multidimensional recovery parameters, including mobility, self-care capacity, ability to perform usual daily activities, pain level, and psychological well-being. The multidomain structure of the EQ-5D-5L allows a comprehensive assessment of postoperative functional recovery across these clinically relevant areas. In addition, its brief and easily administered format provides practical advantages for serial follow-up assessments in elderly patients. The EQ-5D-5L evaluates five core domains: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, with each dimension rated across five severity levels. Assessments were conducted to obtain baseline scores following fracture treatment. Subsequent follow-ups were performed at 3, 6, and 12 months postoperatively. Since an official EQ-5D-5L value set for Türkiye is not yet available, a provisional approach was adopted for calculating utility index scores based on similar publications (7,8). For this purpose, the coefficients from the Turkish EQ-5D-3L item set were used (9); EQ-5D-5L responses were converted to the 3-level system (3L) using the crosswalk method defined by Van Hout et al. (10), thereby yielding index scores. Higher index scores indicate better overall health status and quality of life. Since there is no official and independent EQ-5D-5L value set for Türkiye, index scores were calculated using an approximate method. In this method, the scores were assessed using coefficients adapted to the UK TTO-based value set, based on a linear transformation derived from Turkish participants. Therefore, the resulting coefficients partially reflect Turkish preferences (11). Taking this methodological limitation into account, the index scores were reported as approximate estimates. Once a valid and independent Türkiye-specific EQ-5D-5L value set becomes available, the obtained results are planned to be re-evaluated using that value set.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Mac, version 26.0 (IBM Corp., Armonk, NY, USA). The normality of the data was assessed using the Shapiro-Wilk test. Continuous variables were presented as mean ± standard deviation and compared using the independent samples t-test or the Mann-Whitney U test according to data distribution. Ordinal variables obtained from Likert-type scales were presented as median (interquartile range) and compared between groups using the Mann-Whitney U test. Categorical variables were analyzed using the chi-square test or Fisher's exact test. For longitudinal comparisons, changes from baseline to each follow-up time point were calculated for EQ-5D-5L and Zarit caregiver burden scale scores. Between-group comparisons of these change scores were performed using the independent samples t-test or Mann-Whitney U test according to data distribution. A p-value of <0.05 was considered statistically significant. In addition, multivariable linear regression analyses were performed to identify factors independently associated with 3-month EQ-5D-5L and Zarit caregiver burden scale scores. Treatment group was included as the main independent variable. Covariates were selected based on clinical relevance and their potential confounding effects and included age, sex, pre-fracture ambulatory status, and daily caregiving time. Separate regression models were constructed for 3-month EQ-5D-5L and 3-month Zarit caregiver burden scale scores. Regression assumptions were evaluated by examining linearity, residual distribution, homoscedasticity, and independence of residuals. Multicollinearity was assessed using variance inflation factor (VIF) and tolerance values. A VIF value <5 and a tolerance value >0.20 were considered to indicate the absence of relevant multicollinearity. Regression coefficients (B), 95% confidence intervals (CIs), and p-values were reported.

Results

The baseline demographic and clinical characteristics of caregivers and patients are summarized in Tables 1 and 2. No significant between-group differences were observed regarding caregiver age, sex, relationship to the patient, daily caregiving time, patient age, patient sex, or pre-fracture ambulatory status (all $p>0.05$). Caregiving responsibilities were largely undertaken

by family members, with sons and daughters constituting the majority of caregivers in both groups. In addition, most caregivers in both groups reported providing care for more than 12 hours per day. However, caregiver-reported positioning stress was significantly higher in Group 1 [median (interquartile range): 3 (3-4) vs. 2 (1-2); p=0.020], whereas fear of causing harm during transfers was significantly higher in Group 2 [2 (1-2) vs. 3 (3-4); p=0.030]. Furthermore, patients in Group 1 achieved assisted ambulation (8.0±2.2 vs. 11.5±3.5 days; p<0.001) and independent ambulation (22.1±3.4 vs. 36.6±3.3 days; p<0.001) significantly earlier than those in Group 2.

In the analysis of EQ-5D-5L score changes, Group 2 showed a significantly greater decline than Group 1 during the early postoperative period, particularly between baseline and the 3-month follow-up (p=0.020). Although the between-group difference in change scores decreased between the 3rd and 6th months, it was not statistically significant (p=0.080). However, a significant between-group difference in change scores was observed between the 6th and 12th months (p=0.020). The overall change from baseline to 1 year was numerically greater in Group 2. Details are presented in Figure 1.

Changes in Zarit caregiver burden scale scores showed a similar pattern to the EQ-5D-5L findings. Group 2 had a significantly greater increase in caregiver burden during the first 3 months (p=0.006), whereas the between-group difference in change scores was not statistically significant between the 3rd and 6th months (p=0.200). Between the 6th and 12th months, caregiver burden decreased in both groups, with a significantly greater reduction in Group 2 (p=0.001). By 1 year, caregiver burden had improved in both groups, although the overall change from baseline was numerically greater in Group 2. Details are presented in Figure 2.

Multivariable linear regression analyses are summarized in Table 3. After adjustment for baseline covariates, treatment group remained independently associated with both 3-month EQ-5D-5L scores (B=-0.18, 95% CI: -0.30 to -0.06, p=0.010) and 3-month Zarit caregiver burden scale scores (B=8.72, 95% CI:

Table 1. Demographic and clinical characteristics of caregivers

Parameter		Group 1 (n=64)	Group 2 (n=68)	p-value
Age (years), mean ± SD		45.3±8.1	47.4±8.2	0.400
Sex, n (%)	Male	20 (31.3)	16 (23.5)	0.700
	Female	44 (68.7)	52 (76.5)	
Relationship to patient, n (%)	Spouse	8 (12.5)	8 (11.8)	0.900
	Son/daughter	44 (68.7)	52 (76.5)	
	Professional caregiver	8 (12.5)	4 (5.9)	
	Other	4 (6.3)	4 (5.9)	
Caregiving time (hours), n (%)	0-8	4 (6.3)	4 (5.9)	0.800
	8-12	12 (18.7)	8 (11.8)	
	>12	48 (75.0)	56 (82.3)	
Positioning stress, median (IQR)		3 (3-4)	2 (1-2)	**0.020**
Fear of causing harm, median (IQR)		2 (1-2)	3 (3-4)	**0.030**

Group 1: bipolar hemiarthroplasty, Group 2: proximal femoral nailing, SD: Standard deviation, IQR: Interquartile range. Between-group comparisons of continuous variables were performed using the independent samples t-test, while categorical variables were analyzed using Pearson's chi-square test or Fisher's exact test. Ordinal variables obtained from Likert-type scales were compared using the Mann-Whitney U test. A p-value of <0.05 was considered statistically significant

Table 2. Demographic and postoperative clinical characteristics of patients

Parameter		Group 1 (n=64)	Group 2 (n=68)	p-value
Age (years), mean ± SD		78.3±9.4	75.6±8.5	0.200
Sex, n (%)	Male	16	20	0.800
	Female	48	48	
Assisted ambulation (days), mean ± SD		8.0±2.2	11.5±3.5	**<0.001**
Independent ambulation (days), mean ± SD		22.1±3.4	36.6±3.3	**<0.001**
No assistance needed (months), mean ± SD		4.7±1.1	5.2±1.8	0.080
Pre-fracture ambulatory status, n (%)	With walker	8 (12.5)	8 (11.8)	0.900
	Without walker	56 (87.5)	60 (88.2)	

Group 1: bipolar hemiarthroplasty, Group 2: proximal femoral nailing, SD: Standard deviation. Continuous variables were compared using the independent samples t-test, while categorical variables were analyzed using Pearson's chi-square test. A p-value of <0.05 was considered statistically significant

3.41 to 14.03, p=0.030). No other covariate showed a significant independent association with either outcome (all p>0.05).

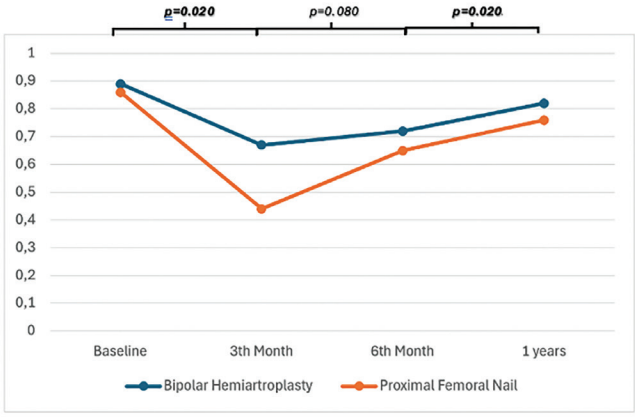


Figure 1. Changes in modified EQ-5D-5L index scores over time. Change scores were compared using the independent samples t-test. A p-value of <0.05 was considered statistically significant
EQ-5D-5L: EuroQol 5-dimension 5-level

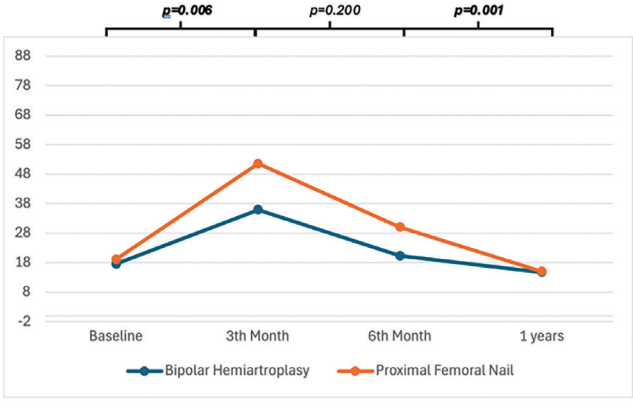


Figure 2. Changes in Zarit caregiver burden scale scores over time. Change scores were compared using the Mann-Whitney U test. P-value of <0.05 was considered statistically significant

Discussion

Three main findings emerged: mobilization was achieved earlier and early caregiver burden was lower after bipolar hemiarthroplasty; the nature of caregiver stress differed between procedures; and between-group differences had narrowed substantially by one year. Most patients were able to walk without a walker before the fracture, indicating that the care requirement arose primarily from the acute fracture and its treatment rather than from pre-existing dependence.

Care was predominantly informal, with family members, most often sons or daughters, undertaking the majority of caregiving responsibilities, whereas spouses and professional caregivers were less frequently involved. Caregiving was also time-intensive, and patients required assistance for several months before regaining independence. Although not designed to compare caregiver subgroups, the study allows some comment. Adult children may be physically better able to assist with transfers but may experience greater occupational difficulties due to caregiving responsibilities. Spouses may be more available but, being elderly themselves, may face greater physical challenges when performing lifting and transfer activities. Professional caregivers could reduce the physical burden but were rarely used, possibly due to economic considerations. The relationship to the patient may therefore influence which component of caregiver burden predominates rather than its overall magnitude. Furthermore, the similar distribution of caregiver-patient relationships between groups makes this variable an unlikely primary explanation for the observed differences.

The two procedures imposed qualitatively different types of caregiver stress. After bipolar hemiarthroplasty through a posterolateral approach, the risk of dislocation during hip flexion with adduction and internal rotation requires particular caution when turning, sitting up, or repositioning the patient (12). Accordingly, positioning stress was significantly higher in

Table 3. Multivariable linear regression analysis for 3-month EQ-5D-5L and Zarit caregiver burden scale scores

Outcome variable	Predictor	B	95% CI	p-value
3-month EQ-5D-5L score	Treatment group	-0.18	-0.30 to -0.06	**0.010**
	Age	-0.02	-0.08 to 0.04	0.400
	Sex	0.03	-0.07 to 0.13	0.500
	Pre-fracture ambulatory status	0.05	-0.08 to 0.18	0.400
	Caregiving time (hours)	-0.03	-0.06 to 0.04	0.300
3-month Zarit caregiver burden scale score	Treatment group	8.72	3.41 to 14.03	**0.030**
	Age	0.11	-0.18 to 0.40	0.400
	Sex	-1.64	-6.80 to 3.52	0.400
	Pre-fracture ambulatory status	2.15	-4.26 to 8.56	0.500
	Caregiving time (hours)	2.40	-1.35 to 6.15	0.200

B: Unstandardized regression coefficient, CI: Confidence interval, EQ-5D-5L: EuroQol 5-dimension 5-level. Treatment group represents the surgical treatment method: Bipolar hemiarthroplasty versus proximal femoral nailing. The statistical significance of individual regression coefficients was assessed using the t-test. A p-value of <0.05 was considered statistically significant

Group 1. After PFN, concern about loss of reduction or mechanical failure before union in osteoporotic bone is more relevant during transfers and sit-to-stand manoeuvres, and fear of harming the patient was correspondingly higher in Group 2. The surgical technique thus influences not only the magnitude but also the nature of caregiver burden.

These differences are consistent with the respective rehabilitation protocols. In the PFN group, partial weight-bearing was initiated at the end of the first postoperative month, and full weight-bearing was permitted at approximately six weeks based on radiological and clinical evaluation (13,14). In contrast, bipolar hemiarthroplasty permits weight-bearing from the first postoperative day because prosthetic stability does not depend on fracture union (13,15).

The slower early recovery in the PFN group was reflected in both patient- and caregiver-reported outcomes. During the early postoperative period, the decline in EQ-5D-5L scores and the increase in Zarit caregiver burden scores were significantly greater in Group 2, whereas assisted and independent ambulation were achieved significantly earlier in Group 1. Importantly, treatment group remained independently associated with both 3-month EQ-5D-5L and Zarit scores after adjustment for baseline covariates, with no other covariate showing a significant independent association (Table 3). Earlier mobilization and immediate postoperative stability may therefore reduce caregiver dependence during the period in which burden is greatest.

Between the sixth and twelfth months, however, significantly greater improvements in both quality of life and caregiver burden were observed in Group 2, which may reflect progressive fracture healing, withdrawal of weight-bearing restrictions, and restored independence. Union in most trochanteric fractures within six months has been reported previously (16). In the hemiarthroplasty group, by contrast, cautious behaviour regarding extreme positions and rotational movements may have persisted, plausibly because dislocation after a posterolateral approach may occur up to one year postoperatively (17). Caregiver burden thus peaked at around the third month and declined thereafter, with the initially less favourable PFN group approaching Group 1 by one year, although the overall change from baseline remained greater in Group 2.

These findings should also be interpreted in the context of post-discharge care in Türkiye. Structured orthogeriatric units and routine home visits, which form part of hip fracture pathways in several countries, are not yet routinely integrated into care pathways in Türkiye, so rehabilitation and daily care after discharge fall largely on family caregivers. Home health-care and home physiotherapy services are available within the national health system but are not automatically initiated at discharge. Systematic referral to these services, together with brief predischarge caregiver training addressing the procedure-specific concerns identified here, may help reduce burden during the first three postoperative months.

Study Limitations

This study has several limitations. First, the retrospective design may have introduced information bias; although baseline data came mainly from routinely completed assessment forms and medical records, the small proportion of follow-up data collected by telephone is subject to recall bias. Second, the single-centre design and the substantial number of eligible patients excluded because of mortality, nursing-home placement, unavailable contact details, or refusal may have favoured patients in better general condition, introducing selection bias, limiting generalizability, and reducing statistical power in subgroup analyses. Third, because the two procedures are indicated for different fracture patterns, treatment-indication bias cannot be excluded; the findings should be interpreted in relation to earlier mobilization and weight-bearing permission rather than as evidence of the superiority of either technique. Fourth, burden was assessed only in the primary caregiver identified at follow-up; caregivers who shared responsibilities or gave up caregiving as burden increased may not have been captured, so the highest burden levels may have been underestimated. Comorbidities of patients and caregivers were also not analysed as confounders. Finally, because an official Turkish value set is not yet available, EQ-5D-5L utility scores were calculated using a provisional index based on Turkish EQ-5D-3L coefficients. Larger multicentre prospective studies are needed, ideally recording caregiver transitions and the reasons for discontinuation of caregiving.

Conclusion

Postoperative caregiver burden after hip fracture surgery is closely related to the patient's early functional independence and mobilization status. Therefore, treatment success should not be evaluated solely by surgical outcomes, but also by patient independence and caregiver burden. Early caregiver education and structured support may help reduce the burden during the critical early recovery period.

Ethics

Ethics Committee Approval: The study protocol was pre-approved by the Human Research Ethics Committee of the University of Health Sciences Türkiye, Ankara Etlik City Hospital (decision no.: AEŞH-BADEK1-2026-321, date: 08.04.2026).

Informed Consent: Written informed consent was obtained from each patient included in the study.

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Footnotes

Authorship Contributions

Surgical and Medical Practices: M.K.Y., İ.F.A., M.M.Ö., S.Y., M.F.Ç., Concept: M.K.Y., M.F.Ç., Design: M.K.Y., M.F.Ç., Data Collection or Processing: İ.F.A., M.M.Ö., S.Y., Analysis or Interpretation: M.K.Y., İ.F.A., S.Y., Literature Search: İ.F.A., Writing: M.K.Y., M.M.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

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References

1. Scaf-Klomp W, van Sonderen E, Sanderman R, Ormel J, Kempen GI. Recovery of physical function after limb injuries in independent older people living at home. *Age and Ageing*. 2001;30(3):213-219.
2. Williams MA, Oberst MT, Bjorklund BC. Early outcomes after hip fracture among women discharged home and to nursing homes. *Res Nurs Health*. 1994;17(3):175-183.
3. Logue RM. Maintaining family connectedness in long-term care: an advanced practice approach to family-centered nursing homes. *J Gerontol Nurs*. 2003;29(6):24-31.
4. Ariza-Vega P, Castillo-Pérez H, Ortiz-Piña M, Ziden L, Palomino-Vidal J, Ashe MC. The journey of recovery: caregivers' perspectives from a hip fracture telerehabilitation clinical trial. *Phys Ther.* 2021;101(1):pzaa220.
5. Shyu YL, Chen MC, Wu CC, Cheng HS. Family caregivers' needs predict functional recovery of older care recipients after hip fracture. *J Adv Nurs*. 2010;66(11):2450-2459.
6. Saletti-Cuesta L, Tutton E, Langstaff D, Willett K. Understanding informal carers' experiences of caring for older people with a hip fracture: a systematic review of qualitative studies. *Disabil Rehabil*. 2018;40(7):740-750.
7. EuroQol. Funded projects-table for download [Internet]. [cited 2025 Sep 05]. Available from: https://euroqol.org/researchat-euroqol/our-research-portfolio/funded-projectsdownload/
8. Çeltik M, Orhan Ö, Öztürk Emiral G, Yücel K, Hürol Türkoğlu H, Ulucaköy C, et al. Health-related quality of life in patients undergoing surgery for upper extremity bone tumors: a cross-sectional study. *Jt Dis Relat Surg*. 2026;37(2):501-509.
9. Chuang LH, Malhan S, Oksuz E, Kind P. PMC54 estimating social preferences for EQ-5D in Turkey: a novel method based on a valuation exchange-rate mechanism. *Value Health*. 2009;12(7):A397.
10. Van Hout B, Janssen MF, Feng YS, Kohlmann T, Busschbach J, Golicki D, et al. Interim scoring for the EQ-5D-5L: mapping the EQ-5D-5L to EQ-5D-3L value sets. *Value Health*. 2012;15(5):708-715.
11. Ramos-Goñi JM, Pinto-Prades JL, Oppe M, Cabasés JM, Serrano-Aguilar P, Rivero-Arias O. Valuation and modeling of EQ-5D-5L health states using a hybrid approach. *Med Care*. 2017;55(7):e51-e58.
12. Sierra RJ, Schleck CD, Cabanela ME. Dislocation of bipolar hemiarthroplasty: rate, contributing factors, and outcome. *Clin Orthop Relat Res*. 2006;442:230-238.
13. Ekinci Y, Gürbüz K, Batın S, Kahraman M, Doğar F, Kaya Erten Z. A multicenter intertrochanteric fracture study in the elderly: hemiarthroplasty versus proximal femoral nailing. *Jt Dis Relat Surg*. 2020;31(2):209-217.
14. Kumar GN, Sharma G, Khatri K, Farooque K, Lakhotia D, Sharma V, et al. Treatment of unstable intertrochanteric fractures with proximal femoral nail antirotation II: our experience in Indian patients. *Open Orthop J*. 2015;9:456-459.
15. Sinno K, Sakr M, Girard J, Khatib H. The effectiveness of primary bipolar arthroplasty in treatment of unstable intertrochanteric fractures in elderly patients. *N Am J Med Sci*. 2010;2(12):561-568.
16. Ahrengart L, Törnkvist H, Fornander P, Thorngren KG, Pasanen L, Wahlström P, et al. A randomized study of the compression hip screw and Gamma nail in 426 fractures. *Clin Orthop Relat Res*. 2002;(401):209-222.
17. Ko YS, Park JW, Kim J, Yoo JI, Kim JT, Kim KC, et al. Posterior approach and inferior capsulotomy in bipolar hemiarthroplasty for femoral neck fractures: comparison with superior capsulotomy. *Clin Orthop Surg*. 2024;16(3):374-381.