ORIGINAL ARTICLE

LONGITUDINAL CHANGES IN ANXIETY AND DEPRESSIVE SYMPTOMS AMONG PRIMARY CAREGIVERS OF ELDERLY HIP FRACTURE PATIENTS DURING PROLONGED PREOPERATIVE HOSPITALIZATION

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Nazım ERKURT[1]
Murat ÇAKAR[1]
Tahsin Olgun BAYRAKTAR[1]
Doğa KORUN[1]
Ali KAFADAR[2]
Ali YÜCE[1]

[1] Prof. Dr. Cemil Tascioglu Ctiy Hospital, Orthopedic and Traumatology, İstanbul, Türkiye

[2] Ceylanpınar State Hospital, Orthopedic and Traumatology, Şanlıurfa, Türkiye

Correspondence

Nazım ERKURT
Phone : +905075494163
e-mail : nzmrkrt@gmail.com

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Abstract

Introduction: This study aimed to evaluate the temporal changes in anxiety and depressive symptoms among primary caregivers of elderly patients with hip fractures during a prolonged preoperative hospitalization period.

Materials and Method: This prospective observational study was conducted at a tertiary care hospital between January and February 2026 and included 81 primary caregivers of patients with intertrochanteric or femoral neck fractures and a preoperative hospital stay ≥7 days were included. State anxiety (STAI-State) and depressive symptoms (Beck Depression Inventory) were assessed at study enrollment (baseline), on the third day after enrollment, and on the day of surgery. Temporal changes were analyzed using repeated-measures analysis of variance (ANOVA)

Results: Mean time to surgery was 8.3±2.2 days. After adjustment, STAI-State scores showed a significant time effect (p=0.021), with a decrease between the third day after enrolment and the day of surgery. Depression scores also demonstrated a significant time effect (p=0.013), with lower scores on the day of surgery than at baseline. Caregiver age and educational level were not significantly associated with either psychological outcome.

Conclusion: Anxiety and depressive symptoms among caregivers of elderly patients with hip fractures change over the course of prolonged preoperative hospitalization. These findings suggest that repeated preoperative psychological assessments may help clinicians identify caregivers requiring additional psychological support and provide appropriate interventions.

Keywords: Hip Fractures; Depression; Preoperative Period; Anxiety; Caregivers.

INTRODUCTION

Hip fractures are clinical conditions associated with high morbidity and mortality, particularly in the elderly population, and frequently require urgent surgery (1) and 70–90% of patients who sustain a hip fracture survive for at least one year. Many of these survivors fail to regain their prefracture functional status. No work in this regard has been done in the developing world. Elderly patients with acute intertrochanteric fracture and fracture of the femoral neck were followed up prospectively for 12 months after surgery to record the mortality, morbidity, functional status and complications. Three hundred and forty-five patients (61% female. However, accompanying comorbidities, the need for medical stabilization, and organizational reasons may lead to delays in surgery, thereby prolonging the duration of preoperative hospital stay (2). A prolonged preoperative hospitalization process affects not only the patient but also the family members directly responsible for the patient's care. During this period, patients' relatives may experience a substantial psychological burden due to lack of information, uncertainty, financial concerns, and the caregiving responsibilities they will assume in the future (3).

Although various scales have been used in the literature to assess the psychological status of patients with hip fracture, the majority of these studies have been patient-oriented. However, relatively little attention has been paid to the psychological burden experienced by patients' relatives during the preoperative hospitalization period.

A substantial proportion of existing studies focus on the postoperative period and treat the preoperative period as a static process by evaluating it at a single time point (4,5). However, in cases where surgery is delayed and hospital stay is prolonged, anxiety and depressive symptoms, particularly among patients' relatives, may be expected to vary over time. Prolonged uncertainty during the preoperative period, limited participation in decision-making processes, and the perception of loss of control are key factors that may increase the psychological burden of patients' relatives. Despite this, studies evaluating the temporal change in anxiety and depression during prolonged preoperative hospitalization in the primary caregivers of patients hospitalized due to hip fracture are extremely limited (6). Understanding these temporal changes may help clinicians identify caregivers at increased psychological risk and provide timely psychological support during the preoperative period.

This study aims not to evaluate postoperative outcomes, but to describe the temporal change in psychological burden during the prolonged preoperative period in the primary caregivers of patients hospitalized due to hip fracture whose surgery was delayed for various reasons. Specifically, we aimed to determine whether symptoms of anxiety and depression changed during the extended preoperative hospital stay, and to identify the period when psychological burden developed among caregivers.

MATERIALS AND METHOD

Consecutive patients admitted to our hospital's Emergency Department between January and February 2026 with a diagnosis of hip fracture (intertrochanteric or femoral neck fracture) and scheduled for surgical treatment were screened for eligibility. The study participants were the primary caregivers. Because primary caregivers were not always present at the time of admission, caregivers were enrolled when they assumed primary responsibility for the patient's care during hospitalization. Ethical approval was obtained from the Institutional Ethics Committee (Approval No. 2026-52, February 9, 2026), and the study was conducted in accordance with the Declaration of Helsinki. The study was planned as a prospective observational study.



Study Population and Eligibility Criteria

Patients hospitalized due to hip fracture, for whom surgical treatment was indicated, and whose preoperative hospital stay was at least 7 days were included in the study. The criterion of a 7-day preoperative hospitalization period was determined in order to allow the temporal change in anxiety and depression levels to be evaluated dynamically rather than through a single measurement.

A primary caregiver was defined as a family member who spent most of his or her time with the patient during the hospitalization period, took an active role in daily care processes, and maintained communication with the healthcare team. Individuals meeting this definition were included regardless of the degree of kinship of the caregiver (spouse, child, sibling, etc.).

The inclusion criteria were defined as the presence of a caregiver responsible for the primary care of a patient with hip fracture requiring surgery, and the caregiver's having sufficient cognitive ability to understand and respond to the psychometric scales used in the study and to complete the scales in full. Patients whose preoperative hospital stay was shorter than 7 days, caregivers with communication difficulties or cognitive impairment severe enough to prevent the administration of psychometric assessments, patients with accompanying spinal or other extremity fractures, and caregivers who did not wish to participate in the study were excluded.

Perioperative Management

At the time of admission to the emergency department, the necessity of surgical treatment was explained to the patient by the orthopedic team. Following ward admission, routine laboratory tests, electrocardiography, and chest radiography were performed, and the risks related to surgery and anesthesia were explained. Risks related to anesthesia were reviewed again on the final day before surgery, and the patient was taken to surgery after completing an 8-hour fasting period prior to the operation.

Data Collection

Age, sex, degree of relationship to the patient, and educational level of all primary caregivers included in the study were recorded. In addition, the reasons for the postponement of the patients' surgery and accompanying comorbid diseases were documented.

Psychometric Assessments

The psychological status of the caregivers was assessed at three different time points during the preoperative period: at study enrollment (baseline), on the third day after enrollment, and on the day of surgery. Baseline assessment was performed immediately after caregivers had assumed primary responsibility for the patient's care and had provided written informed consent to participate in the study. For the evaluation of state anxiety levels, the state anxiety subscale of the State–Trait Anxiety Inventory (STAI-State) was administered; for the evaluation of depressive symptoms, the Beck Depression Inventory (BDI) was used. The STAI-State consists of 20 items evaluating situational anxiety. Each item is scored on a 4-point Likert scale (1–4), yielding a total score ranging from 20 to 80, with higher scores indicating greater levels of state anxiety. The Turkish version has demonstrated good reliability, with Cronbach's alpha values ranging from approximately 0.83 to 0.87 (7). The Beck Depression Inventory consists of 21 items assessing depressive symptoms. Each item is scored from 0 to 3, resulting in a total score ranging from 0 to 63, with higher scores indicating more severe depressive symptoms. The Turkish version has demonstrated excellent internal consistency, with Cronbach's alpha values ranging from approximately 0.89 to 0.94 (8). In this study, only the STAI-State subscale was used, and the STAI-Trait subscale, which evaluates individual anxiety predisposition, was not administered. The

reason for this was that the primary focus of the study was to evaluate changes in state anxiety associated with hospitalization and delay in surgery, rather than personality characteristics. All psychometric scales were administered in accordance with standard application guidelines. In caregivers with a low literacy level or of advanced age, the questionnaires were completed using a structured face-to-face interview method in order to prevent data loss.

The third day after enrolment was considered a period during which the acute post-traumatic stress response had partially decreased, the patient had become medically stabilized, and the caregiver had begun to adapt to the hospital environment. Therefore, the third-day measurement was accepted as an appropriate intermediate time point for evaluating the psychological effects of prolonged preoperative hospitalization. The day of surgery, on the other hand, was considered a critical time period in which uncertainty was experienced most intensely and anticipation and anxiety related to surgery increased.

Sample Size Calculation

A priori sample size calculation was performed using G*Power software (version 3.1.9.7). Assuming a medium effect size (Cohen's f = 0.25), an alpha level of 0.05, a power of 80%, three repeated measurements, and a correlation among repeated measures of 0.5, the minimum required sample size was calculated as 30 participants. Considering a potential dropout rate of 10–20%, the final target sample size was set at approximately 38–40 caregivers.

Statistical analysis

Statistical analyses were performed using SPSS program version 27.0. Statistical analyses were planned to evaluate the changes over time in state anxiety and depressive symptom levels of patients' relatives during the preoperative period. Continuous variables were presented as mean ± standard deviation or median (minimum–maximum). The distributional characteristics of STAI-State and Beck Depression Inventory scores were evaluated using the Shapiro–Wilk test. While assessing the effect of the time factor (day of admission, third day of hospitalization, and day of surgery) on psychological scale scores, the age and educational level of the patients' relatives were considered as potential confounding variables. Therefore, repeated measures analysis of covariance (repeated measures ANCOVA) was applied to examine change over time, and age and educational level were included in the model as covariates. Since all caregivers were first-degree or close relatives of the patient, degree of kinship was not added to the model as a separate variable. The assumption of sphericity was evaluated using Mauchly's test, and the Greenhouse–Geisser correction was applied when this assumption was not met. When the effect of time was found to be statistically significant, pairwise comparisons between time points were performed using the Bonferroni correction. In cases where the assumptions of parametric analysis were clearly violated, supportive analyses were performed using the nonparametric Friedman test in order to evaluate the robustness of the results. In all statistical analyses, the level of significance was accepted as $p < 0.05$.

RESULTS

A total of 81 patients' relatives were included in the study. The demographic characteristics of the patients and their caregivers are presented in Tables 1 and 2, respectively. Forty-six of the patients' relatives were women (56.8%), and the mean age was found to be 75.53 ± 11.96 years (range:62-96). When fracture types were evaluated, 32 patients (39.5%) had femoral neck fractures, while the remaining patients had intertrochanteric femur fractures. The method of surgical treatment was determined according to fracture type; intramedullary nailing was performed in intertrochanteric fractures, whereas partial hip



Table 1. Demographic data and graphical data of the patient.

Age, mean ±SD [min-max]	75,54 ± 11,97 [62-96]
Gender, female, n(%)	46 (%56,8)
Time to surgery (day)±SD [min-max]	8,3 ± (2,2) [7-20]
Femoral neck fracture, n(%)	32(%39,5)
Reasons for surgical delay n (%)	
COPD	22 (%27,2)
Electrolyte imbalance	15(%18,5)
Uncontrolled diabetes	11(%13,6)
Urinary trackt infection	9(%11,1)
Arrhythmia	6(%7,4)
Pneumonia	5(%6,2)
Thyroid disorders	4(%4,9)
Antiplatelet therapy	4(%4,9)
Herpes infection	4(%4,9)
Other infections	1(%1,2)
Educational status n (%)	
Primary school	70 (%86,4)
High school	8 (%9,87)
University	2 (%2,46)
Master's degree	1 %1,23)

COPD; Chronic Obstructive Pulmonary Disease SD; Standart Deviation

Table 2. Demographic data of the patient's caregivers

Age mean ±SD[min-max]	46,79 ±13,72[21-71]
Gender, female n (%)	64 (%79)
Educational status n (%)	
Primary school	29 (%33,3)
High school	33 (%37,9)
University	16 (%18,4)
Master's degree	3 (%3,4)

SD; Standart Deviation

prosthesis was applied in patients with femoral neck fractures.

The mean duration from the patients' hospitalization to surgery was calculated as 8.3 ± 2.2 days. The reasons leading to delay in surgery are summarized in Table 1. Descriptive statistics for STAI-State and Beck Depression Inventory scores at baseline (enrollment), on the third day after enrollment, and on the day of surgery are presented in Table 3. The most frequent reasons for operative delay were chronic obstructive pulmonary disease (COPD) (27.2%), electrolyte disturbances (18.5%), and irregularly controlled diabetes mellitus (13.6%), respectively. Other reasons included urinary tract infection (11.1%), arrhythmia (7.4%), pneumonia (6.2%), thyroid diseases (4.9%), use of antiplatelet therapy (4.9%), herpes infection (4.9%), and other infections (1.2%).

Repeated-measures ANOVA demonstrated a significant effect of time on STAI-State scores (Greenhouse–Geisser corrected, $F(1,77)=4.09$, $p=0.021$, partial $\eta^2=0.04$). Bonferroni-adjusted pairwise comparisons revealed a significant decrease in STAI-State scores the third day after enrollment and the day of surgery (mean difference = 1.31, p = 0.029), whereas no significant differences were observed between baseline and the third day after enrollment (p = 1.000) or between baseline and the day of surgery (p = 0.065).

Similarly, Repeated-measures ANOVA demonstrated a significant effect of time on Beck Depression Inventory scores showed a significant time effect (Greenhouse–Geisser corrected, $F(1,77)=4.78$, $p=0.013$, partial $\eta^2=0.12$). Bonferroni-

Table 3. STAI and BDI depression inventory results.

	Baseline ± SD [min-max]	**3rd day ± SD [min-max]**	**Operation day ± SD [min-max]**	**F**	**Overall p****	**Partial η^2**
STAI	41,07 ± (5,12) [30-53]	40,87 ± (6,58) [28-56]	39,68± (6,77) [28-58]	4.09	0,021	0.04
BDI	19,34 ± (11,64) [1-47]	17,89 ± (10,14) [3-45]	16,77 ± (11) [2-54]	4.78	0,013	0.12

STAI; State-Trait Anxiety Inventory BDI; Beck Depression Inventory SD; Standart Deviation**Overall p values were obtained using Greenhouse–Geisser corrected repeated-measures ANOVA.

adjusted pairwise comparisons indicated a significant reduction in depression scores between baseline and the day of surgery (mean difference = 2.68, p = 0.031). No significant differences were observed between baseline and the third day after enrollment (p = 0.489) or between the third day after enrollment and the day of surgery (p = 0.147).

To evaluate the potential influence of caregiver characteristics, additional repeated-measures analyses including caregiver age and educational level were performed. Neither caregiver age nor educational level was significantly associated with STAI-State or Beck Depression Inventory scores. Furthermore, no significant interactions were observed between time and caregiver age or educational level for either psychological outcome.

DISCUSSION

The most important finding of our study was that anxiety scores in patients' relatives had decreased on the day of surgery; likewise, depression measures had decreased on the day of surgery compared with the third day after enrollment. Methodologically, our study contributes to an important gap in the literature by demonstrating that anxiety and depression in patients' relatives are not static throughout the preoperative period and may show a significant changes during the preoperative period, particularly between the third day after enrollment and the day of surgery.

It has been reported that anxiety levels may be high in patients and patients' relatives during the early period of hospitalization due to the acute effects of trauma and uncertainties related to surgery (9). In the pediatric surgery literature, anxiety in patients' relatives has been shown to increase particularly on the day of surgery; this has been associated with the hospital environment, medical interventions, and concerns about possible complications (10)emotional, and physiological responses of children undergoing surgery, as well as on parental state anxiety. Children (n = 90. Although studies addressing anxiety and depression levels in patients' relatives are limited in the orthopedic literature, these findings indicate that caregiver anxiety may interact with the surgical process. In our study, contrary to the literature reporting increased anxiety on the day of surgery, a decrease in anxiety levels was observed on the day of surgery among the relatives of elderly patients with hip fracture. We think that the completion of the diagnostic process, clarification of surgical planning, and the initiation of the management of comorbidities may have supported psychological adaptation by reducing the perception of uncertainty.

The temporal evaluation of anxiety levels in patients' relatives during the preoperative period suggests that this may be considered not only as a psychological outcome, but also as complementary information that could support clinical decision-making processes. The fact that the relationship between patient and caregiver anxiety before orthopedic surgery has previously been demonstrated (11) and findings indicating that the psychological well-being of caregivers may be associated with the patient's stress response and adaptation processes (12), strengthen the clinical context of this assessment. The systematic recognition of anxiety in patients' relatives before an upcoming surgical intervention, and its support through appropriate information, may contribute to the individualization of rehabilitation planning by increasing participation in the care process (13,14). Especially in the elderly and osteoporotic patient group, supporting the adaptation of patients' relatives to the process may play an indirect but clinically meaningful role in optimizing treatment compliance and postoperative recovery.

This study has a number of limitations. First, although the sample size exceeded the minimum number required by the a priori power analysis, the overall number of caregivers remained relatively small, which may limit the generalizability of the

findings to broader populations and different healthcare settings. Second, the degree of relationship of the patients' relatives to the patient (spouse, child, sibling, etc.) was not analyzed as a separate variable; this may not have fully reflected the heterogeneity of caregiving burden and emotional responses. Third, the absence of a control group consisting of caregivers of patients who underwent early surgery limits our ability to determine whether the observed temporal changes were specifically associated with prolonged preoperative hospitalization or reflected the natural psychological adaptation of caregivers over time. Fourth, the variation among individuals in the time elapsed until surgery limited the evaluation of the preoperative period as a homogeneous time interval. In addition, the single-center nature of the study is another factor that may restrict the generalizability of the findings obtained.

This study demonstrates that anxiety and depression are not static throughout the preoperative period in the relatives of elderly patients with hip fracture and may show significant changes as surgery approaches. The temporal variability in anxiety and depression levels suggests that the preoperative period cannot be represented by a single measurement. Future research could benefit from a larger and more diverse sample, consideration of additional factors, and longitudinal follow-up assessments to provide a more comprehensive understanding of caregiver mental health in this context

Conflict of interest: The authors have no conflict of interest to report.

Ethical approval: The study protocol complied with the Declaration of Helsinki, and written informed consent was obtained from each participants. Ethical approval was obtained from the institutional ethics committee (approval number 2026-52, February 9, 2026)

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