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Examining the relationship between patients who have undergone brain surgery and their fear of falling and pain, cognitive status, functional mobility, anxiety, and depression

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Ethics Committee Approval
The study was approved by Dokuz Eylul University Ethics Committee for Non-Interventional Clinical Research (Date:19.07.2018, Decision Number: 4142-GOA, 2018/18-06).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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Abstract

Background/Aim: Patients who have undergone brain surgery are at risk of falling. Fear of falling causes an increase in the risk of falling and a decrease in movement and daily life activities. However, no previous research has investigated the fear of falling experienced by patients who have undergone brain surgery or the factors that affect it. This study aims to examine the relationship between fear of falling and pain, cognitive status, functional mobility, anxiety, depression, and socio-demographic and clinical characteristics in patients who have undergone brain surgery.

Methods: This cross-sectional study included 115 patients who had undergone brain surgery. The data were collected via a Patient Information Form, the Fear of Falling Scale, the Visual Analogue Scale, the Mini-Mental State Examination, the Itaki Fall Risk Scale, the Hospital Anxiety and Depression Scale, the Glasgow Coma Scale and the Timed Up and Go Test. IBM SPSS 22.0 software was used for descriptive statistics, correlation, and stepwise multiple linear regression analyses.

Results: Of the 115 patients, 73.1% were afraid of falling. Multiple linear regression analysis of the fear of falling in patients who had undergone brain surgery reveals that age (β=0.217, *P*=0.004), number of postoperative mobilizations (β=-0.141, *P*=0.031), a reported history of falling (β=0.155, *P*=0.032), the Timed Up and Go Test (β=0.372, *P*<0.001), and anxiety (β=0.358, *P*<0.001) were significant predictors of fear of falling. These variables explained 63% of the common variance.

Conclusion: Age, number of mobilizations, falling experience, functional mobility, and anxiety level can affect the fear of falling in patients after brain surgery. To mitigate this fear, it is important to plan care with reference to these variables from the time of the brain surgery until the patient is discharged. In addition, there is a need for further studies on falling and the fear of falling after brain surgery.

Keywords: fear of falling, brain surgery, pain, cognitive status, functional mobility, anxiety, depression

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Introduction

Fear of falling (FoF) is defined as anxiety related to falling that causes a person to avoid activities they can perform [1]. Studies have reported FoF in 56.5% to 71% of patients who have undergone surgery [1,2]. Falling and FoF are closely connected, and each is a risk factor for the other [1]. Research on the diseases that are most strongly associated with falling has indicated a direct relationship between falling and the lesion/pathology of the musculoskeletal system as well as an indirect connection with neurological and cardiac diseases [3]. Brain surgery patients often experience balance and gait problems, focal neurological disorders (e.g., hearing or visual impairment), epileptic seizures, motor strength and coordination deficiency, personality and emotional disorders, and changes in cognitive processes, which all pose a risk of falling [4–6]. Among patients who have undergone brain surgery, 82.9% have a high risk of falling [7]. Moreover, 40.6% to 74% of patients with cognitive changes exhibit FoF [8–11]. Studies have noted that an increase in cognitive impairment also heightens FoF [9–11].

The literature contains studies on FoF in patients with dementia, Alzheimer's, stroke, Parkinson's, and cognitive status changes [9,10]. However, no previous research has explored FoF in patients who have undergone brain surgery. Fear of falling in patients who have undergone major surgery, such as brain surgery, may result in limited activity levels, diminished balance, more frequent falls, less independence, an increase in hospital stay, the development of postoperative complications, heightened costs, restricted social participation, and deterioration in the quality of life [12–14]. This study examines the relationship between FoF and pain, cognitive status, functional mobility, anxiety, depression, and socio-demographic and clinical characteristics in patients who have undergone brain surgery.

Materials and methods

Study design

This research is of a cross-sectional type. The research was carried out in the neurosurgery clinic of a university hospital located in western Turkey between July 2018 and March 2020. In the clinic, the first mobilization of the patients after brain surgery was performed by a physiotherapist at the discretion of the surgeon. Subsequent mobilizations were facilitated by the physiotherapist, nurses, or caregivers. Patients were mobilized either on the first or second postoperative day, depending on the type of surgery and their general health status.

This study was approved by the Ethics Board for Non-Interventional Clinical Research and the University Hospital in West Turkey (Dokuz Eylul University Ethics Committee, Approval Number: 2018/18-06, 19.07.2018). All patients were informed of the aims and methods of the study. Oral and written informed consents were obtained from the participants, and written consent was acquired from the institution where the research was conducted.

Participants

The sample comprised 115 patients who had undergone brain surgery and consented to participate in the study. The sampling criteria for the patients included being at least 18 years old, having undergone brain surgery, being mobilized at least once, participating in the study voluntarily, understanding and speaking Turkish, having person, place, and time orientation, and having no hearing or speech impairment. Patients were excluded if they had a Mini-Mental test score of 23 or less, had been diagnosed with a psychiatric disorder (e.g., anxiety, depression, schizophrenic), or were immobile and unable to be mobilized. The sample size was calculated using G*Power v3. A post-hoc test was conducted for the power analysis, where the effect size was taken as 0.05 (P=0.05), the sample size was 115, and the number of predictor variables was 10. The research power was calculated as 0.81.

Data collection

The data were collected from patients who were hospitalized after brain surgery. The first step of the process was to identify patients who had made their first mobilization in physical therapy, subsequently mobilized on their own or with support, and met the inclusion criteria for the research sample. Each participating patient engaged in a face-to-face interview at an appropriate time when the patient's condition was stable (e.g., no severe pain). Immediately after each interview, the patient completed a Timed Up and Go Test. The research data were collected by one of the researchers involved in the study.

Measures

The data were obtained via the Patient Information Form, the Visual Analogue Scale (VAS), the Fear of Falling Scale, the Itaki Fall Risk Scale (IFRS), the Hospital Anxiety and Depression Scale, the Mini-Mental State Examination (MMSE), and the Timed Up and Go Test (TUG). The Patient Information Form, which was created by the researchers in line with the related literature, included questions about socio-demographic and clinical characteristics [8,11,15].

The VAS was developed to measure pain severity. This scale can be used either horizontally or vertically (0: no pain, 10: most severe pain). The horizontal version was used in this study. The patients were asked to indicate their pain severity by marking the corresponding point on a horizontal line.

The Fear of Falling Scale consists of a single-item Likert-type question that prompts patients to indicate their fear of falling based on a four-point scale (1: not afraid, 2: slightly afraid, 3: moderately afraid, 4: very afraid). Many studies of surgical patients have utilized this scale [2,16].

The IFRS was developed by the Turkish Ministry of Health and is used in all hospitals. The scale collects information about patient demographics, the time of the evaluation, the reason for its completion, and the major and minor risk factors. The scale was created for patients aged 17 years or older and had a total of 19 items. The scale score is established by adding the scores of all items. A total score between 0 and 4 points indicates a low risk of falling, while a total score of 5 or above denotes a high risk of falling. The psychometric properties of the scale have been evaluated by Barış et al. [17].

The HADS was developed by Zigmond and Snaith in 1983 and adapted to Turkish by Aydemir [18]. The scale is not intended to make a diagnosis but only to determine the risk of anxiety and depression in people with physical conditions. The scale consists of 14 items: seven investigate the symptoms of depression (HADS-D), while seven concern the symptoms of

anxiety (HADS-A). The cut-off points of the Turkish form are 10 for the anxiety subscale and 7 for the depression subscale.

The MMSE was devised by Folstein et al. [19] in 1983. This test can be easily administered to measure the degree of cognitive impairment. It contains sub-sections or dimensions that evaluate orientation, registration, attention calculation, recall, language, and structuring. Although various cut-off points have been used, scores of 23 or less are generally accepted as indicative of cognitive impairment. The highest possible score is 30. Turkish validity and reliability studies of the MMSE have been conducted by Güngen et al. [20].

The TUG was established by Podsiadlo et al. [21] in 1991. This test includes measurements of independent functional mobility, such as standing up from a chair, walking, turning, stopping, and sitting again. The individual is initially seated on a chair and then instructed to stand up, walk three meters, turn around, and sit on the chair again. Meanwhile, the elapsed time is recorded in seconds. The time to complete the test is related to the functional mobility level. For the TUG, scores above 13.5 signal a risk of falling.

Statistical analysis

Data analysis was performed with SPSS 22 statistical software. The correlation between FoF and socio-demographic and clinical features was assessed with a Pearson correlation analysis in which a *P*-value of less than 0.05 was considered significant. Multiple regression using a stepwise approach was conducted to determine which set of independent variables predicted the dependent variable (FoF). Before creating the regression model, standardized residual and multicollinearity were examined for the variables and independent variables, respectively.

Results

In the study sample, the 115 patients who had undergone brain surgery had an average age of 54.65 (14.07). Additionally, 52.2% were female, 82.6% were married, and 55.7% were primary and secondary school graduates. Sixty percent of the patients had a brain tumor, 17.4% had a pituitary tumor, and 22.6% experienced hemorrhage (intracranial, subarachnoid, or subdural). Furthermore, 24.4% had hypertension, 14.3% had diabetes mellitus, 5.2% had chronic heart failure, and 3.1% had another chronic disease. Fifteen percent were using oral diabetes medication, 25.6% were using antihypertensive drugs, 21.2% were using painkillers, and 4.1% were using another type of drug.

While 26.1% of participants reported a history of falling prior to their hospitalization, only 2.6% actually fell while in the hospital. However, 73.1% stated that they were afraid of falling. The average postoperative days of the patients was 4.66 (1.56). The average first mobilization day was 2.38 (1.14) days after the operation, and the average number of total mobilizations was 5.6 (3.9). After the postoperative process, the average scores of the patients were 2.72 (1.71) for the VAS, 14.30 (3.25) for the IFRS, 14.88 (0.31) for the GCS, 27.08 (2.43) for the MMSE, 14.66 (4.86) for the TUG (second time), 8.33 (3.72) (min=0, max=18) for the HADS-A, and 7.94 (3.63) for the HADS-D (Table 1).

Table 1: Socio-demographic and clinical features of participants

		n	%
Gender	Female	60	52.2
	Male	55	47.8
Marital status	Married	95	82.6
	Single	20	17.4
Educational status	Primary school and secondary school	64	55.7
	High school	46	40
	Undergraduate	5	4.3
Diagnosis	Tumor	69	60
	Pituitary tumor	20	17.4
	ICH*/SAH**/SDH***	26	22.6
Drugs used regularly	Yes	74	64.3
	No	41	35.7
Chronic disease	Yes	46	40
	No	69	60
Fall history	Yes	30	26.1
	No	85	73.9
Fall in hospital	Yes	3	2.6
	No	112	97.4
Fear of falling	Not afraid	31	27
	Slightly afraid	14	12.2
	Moderately afraid	44	38.3
	Very afraid	26	22.6
		mean (SD) (min-max)	
Age		54.65 (14.07) (18-83)	
Days after surgery		4.66 (1.56) (2-8)	
FoF		2.56 (1.11) (0-4)	
First mobilization (day)		2.38 (1.14) (1-5)	
Number of mobilizations		5.6 (3.9) (1-20)	
VAS		2.72 (1.71) (0-10)	
IFRS		14.30 (3.25) (0-22)	
GCS		14.88 (0.31) (14-15)	
MMSE		27.08 (2.43) (24-30)	
TUG (time)		14.66 (4.86) (8-28)	
HADS-A		8.33 (3.72) (0-18)	
HADS-D		7.94 (3.63) (0-14)	

ICH: Intracranial hemorrhage, SAH: Subarachnoid hemorrhage, SDH: Subdural hemorrhage, FoF: Fear of Falling Scale, VAS: Visual Analog Scale, IFRS: Itaki Fall Risk Scale, GCS: Glasgow Coma Scale, MMSE: Mini-Mental State Examination, TUG: Timed Up and Go Test, HADS-A: Hospital Anxiety and Depression Scale- Anxiety, HADS-D: Hospital Anxiety and Depression Scale- Depression

The results suggest a statistically significant positive relationship between FoF and age (r=0.419, P<0.001), constant use of medicine (r=0.199, P=0.016), chronic disease (r=0.287, P=0.001), history of falling (r=0.464, P<0.001), postoperative IFRS score (r=0.307, P<0.001), VAS score (r=0.357, P<0.001), TUG time (r=0.666, P<0.001), HADS-A score (r=0.497, P<0.001), and HADS-D score (r=0.260, P=0.012). In addition, as Table 2 indicates, there was a statistically significant negative r correlation between FoF in patients who had undergone brain surgery and male gender (r=-0.189, P=0.046), educational status (r=-0.197, P=0.032), number of postoperative mobilizations (r=-0.410, P<0.001), GKS score (r=-0.238, P=0.014), and MMSE score (r=-0.344, P<0.001).

Table 2: Relationship between clinical characteristics and fear of falling

	r	*P*-value
Age	0.404	<0.001
Gender	-0.189	0.066
Marital status	0.076	0.408
Education status	-0.197	0.032
Diagnosis	-0.001	0.823
Drugs used regularly	0.199	0.016
Chronic disease	0.287	0.001
First mobilization (day)	0.049	0.868
Number of mobilizations	-0.410	<0.001
Prior falls history	0.464	<0.001
Itaki Fall Risk Scale	0.307	<0.001
Visual Analog Scale	0.357	<0.001
Glasgow Coma Scale	-0.238	0.014
Mini-Mental State Examination	-.0344	<0.001
Timed Up and Go Test	0.666	<0.001
Hospital Anxiety and Depression Scale- Anxiety	0.497	<0.001
Hospital Anxiety and Depression Scale- Depression	0.260	0.012

Multiple linear regression analyses were performed to determine the contribution of factors related to FoF in patients who had undergone brain surgery. As Table 3 illustrates, a model was created for the predictors of FoF. According to an examination of FoF in patients who had undergone brain surgery

based on the model, age (β=0.217, *P*=0.004), number of postoperative mobilizations (β=-0.141, *P*=0.031), history of falling (β=0.155, *P*=0.032), TUG time (β=0.372, *P*<0.001), and HADS-A score (β=0.358, *P*<0.001) were significant predictors of FoF. These variables explained 63% of the common variance.

Table 3: Multiple regression analysis for variables predicting fear of falling (n=115)

Independent variables	Model		
	β	t	*P*-value
Age	0.217	2.929	0.004*
Chronic disease	0.008	0.116	0.908
Number of mobilizations	-0.141	-2.184	0.031*
Visual analog scale	-0.003	-0.047	0.963
Prior falls history	0.155	2.173	0.032*
IFRS	0.041	0.632	0.528
MMSE	-0.062	-0.923	0.358
TUG (time)	0.372	4.813	<0.001**
HADS-A	0.358	4.231	<0.001**
HADS-D	-0.033	-0.452	0.653
Adjusted R2	0.637		
F	9.512		
***P*-value**	<0.001*		

* *P*<0.05, ** *P*<0.001, VAS: Visual Analog Scale, IFRS: Itaki Fall Risk Scale, GCS: Glasgow Coma Scale, MMSE: Mini-Mental State Examination, TUG: Timed Up and Go Test, HADS-A: Hospital Anxiety and Depression Scale- Anxiety, HADS-D: Hospital Anxiety and Depression Scale- Depression

Discussion

The research results reflect that age, history of falling, number of mobilizations, TUG time, and anxiety were significant predictors of FoF in patients who had undergone brain surgery. Evidently, FoF increased with age. In previous research, FoF also increased with age [22,23], and the prevalence of FoF in older adults varied from 26% to 64% [16]. In a study on factors relating to the movement level of postoperative patients, difficulties with movement increased in parallel with age [24]. The literature further identifies old age, diminished physical health, "insomnia, dizziness, weakness, problems in walking and vision" increased dependence in daily life activities, poor health perception, chronic diseases, and use of medicine as factors relating to FoF [15,16,25]. In line with this information — and considering the risk factors for FoF — older patients are seemingly at a higher risk. Therefore, it is likely that the postoperative patients in this study experienced a stronger FoF due to more serious problems associated with old age, such as additional comorbidities, hearing impairment, and inactivity, as well as memory, cognitive, and neurological impairments resulting from the brain surgery.

In this study, FoF increased with anxiety in patients who had undergone brain surgery. This finding is consistent with earlier reports of higher anxiety in people with FoF [2,22]. Similarly, Polat et al. [23] have observed a negative effect of FoF on mood. The literature also highlights that neuroticism, which encompasses anxiety, worry, fear, and indecisiveness, is a risk factor for FoF [25]. Brain surgery is usually performed to treat diseases such as brain tumors, brain hemorrhages, or aneurysms, which significantly affect an individual's life and cause a high degree of stress. Previous research has revealed that 50% of patients experienced anxiety after brain surgery [5]. Furthermore, emotional, cognitive, sensory, and motor issues caused problems with mobility, and anxiety led to diminished physical functions in patients with brain tumors [12]. Anxiety can reduce patients' confidence in their physical health and cause them to develop more intense FoF [26]. During the perioperative process, anxiety in patients affects their coping, attention, concentration, learning ability, cooperation, and postoperative recovery process [5]. These findings imply that anxiety reduces patients' confidence in their health status and worsens their FoF by compromising their ability to cope with the process.

In the present study, FoF decreased as the number of mobilizations increased. Furthermore, FoF increased as the duration of the TUG increased. The results also reveal stronger FoF in patients who reported a history of falling. Another study with a different surgical sample group has found that patients experienced severe FoF during their first mobilization [2]. The literature identifies impaired physical performance as both a cause and a result of FoF [13,22]. In the present study, the average duration of the TUG was 16 s. Individuals with FoF often exhibit a more cautious gait (fearful gait) [12,14]. Since FoF negatively impacts an individual's confidence in performing daily life activities, it leads to a less active lifestyle, additional health problems (e.g. muscle weakness), and negative effects on subunits of life quality (e.g., mobility and energy) [23].

In previous research, difficulty with walking corresponded to stronger FoF [15], and individuals with FoF required more help with walking [22]. After brain surgery, many patients develop movement disorders and coordination problems. Patients with cognitive changes may experience mobility problems, such as a slow walking speed [4], and approximately 40% of falls occur when walking forward [27]. Research on another surgical group has found that improved physical activity in elderly patients was associated with faster walking, a shorter TUG time, and less FoF [28]. Meanwhile, in patients who had undergone spinal surgery, a longer TUG duration was related to greater dependence, more fragility, and negative postoperative outcomes [29]. The literature specifies a history of falling as a risk factor for falling [1,13] and a cause of more intense FoF [15]. Accordingly, patients who had problems with their movement while experiencing confusion and falling exhibited stronger FoF.

Limitations

The first limitation of this study was its exclusion of patients who had an MMSE score of less than 23 and who were not oriented to person, place, and time (i.e., confused). Confused patients are at a high risk of falling but may have less FoF. Further research could study both confused and unconfused groups of patients, including those who have undergone brain surgery. Another limitation was that the study included only postoperative brain surgery patients. Future studies could examine FoF in patients with diseases such as traumatic brain injuries, frontal, occipital, or other lobe injuries, or ruptured aneurysms, which can require follow-up without surgery.

Conclusions

The results of this study indicate that FoF increased with the duration of the TUG, the anxiety level, and age in patients with a history of falling who had undergone brain surgery. Furthermore, FoF decreased as the number of mobilizations increased. Health professionals are advised to adopt an individual approach that accounts for these variables when evaluating patients for FoF. Such factors are relevant to the mobilization process of patients and the development of strategies for fall prevention. Health professionals might be able to effectively mitigate FoF by allowing patients to express their feelings of anxiety after surgery as well as by evaluating their

psychosocial conditions and coping mechanisms. In addition, the provision of structured education about the surgery process and the post-surgery period prior to the surgery may be able to alleviate anxiety in patients. Since research on FoF in neurosurgery patients is limited, there is a need for further studies on this issue.

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