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PŮVODNÍ PRÁCE

Evaluation of Depression and Cognitive Status in Geriatric Patients Undergoing Orthopedic Surgery

Hodnocení deprese a kognitivního stavu u geriatrických pacientů podstupujících ortopedickou chirurgii

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ABSTRACT

PURPOSE OF THE STUDY

Cognitive disorders are common in geriatric surgical patients We conducted a study to evaluate depression and cognitive behavior in geriatric patients undergoing orthopedic surgery.

MATERIAL AND METHODS

This descriptive cross-sectional study was conducted at a university hospital in Turkey, involving 262 elderly patients who underwent orthopedic surgeries. Data were collected using The Patient Information Form, Standardized Mini-Mental Test, and Geriatric Depression Scale.

RESULTS

The mean score of the Standardized Mini-Mental Test scale of the patients after surgery was 17.97±4.99, mean score of the Geriatric Depression Scale was 6.20±2.78. The study revealed that 85.1% (n=223) of the participants had cognitive impairment and 69.1% (n=181) depressive symptoms. Additionally, cognitive impairment and depressive symptoms increased as age, pain scores, and length of hospital stay increased. Our research also showed that individuals with a history of falls, visual/hearing impairment, malnutrition, use of assistive devices, dependence on others for daily activities, non-educated or single, individuals are more likely to experience geriatric depression and have a higher of cognitive impairment. Additionally, patients who have had hip arthroplasty, have low hemoglobin levels, or have high ASA scores are more prone to cognitive impairment. Cognitive impairment was more common in patients with higher depression scores.

CONCLUSIONS

Considering these findings, it is crucial to identify the cognitive disorders and depressive symptoms during their initial hospitalization to prevent or treat them in geriatric patients. Regular monitoring of geriatric patients in orthopedic clinics for symptoms of cognitive status and depression is recommended, and caregivers should be made aware of this issue.

Key words: geriatric patients, orthopedic procedures, cognitive status, depression.

INTRODUCTION

Most geriatric individuals seeking orthopedic care for falls, hip fractures, or prosthetic surgery are prevalent. Cognitive disorders are common in geriatric surgical patients (1). Cognitive impairments are a hallmark of early mental illness and can significantly impact an individual's daily functioning and long-term outcomes. Therefore, it is aimed to recognize the profound effects of cognitive disorders on individuals' lives and to increase the general well-being of patients by taking into account their emotional, social and psychological needs and physical health (2, 21). Delirium, sometimes called an "acute confusional state" is common and can occur after any surgical procedure, with an incidence of up to 60% after hip fracture (14, 27). Delirium is more common in conditions such as dementia, depression, serious illnesses, and visual and hearing impairment. It can also be triggered by inappropriate drug use, physical restrictions, pain, dehydration, poor nutritional status, infection, or electrolyte disturbances (17, 26). It is a severe condition associated with poor outcomes such as hospital-associated complications, increased hospital stays, high dependency, increased incidence of dementia, need for long-term care/support on discharge, short and long-term mortality, and high cost. Early assessment and intervention can prevent and treat cognitive disorders (5, 17, 21). Thus, emphasizing prevention proves more effective than seeking a cure, underscoring the importance of initiating interventions at an early stage. On the other hand, depression is common in the geriatric population and affects patient outcomes such as delirium. Clinical signs of depression, such as low motivation, perceived lack of recovery, sleep disturbances, and difficulty with physical rehabilitation, may slow postoperative recovery (5, 14). Therefore, in geriatric patients, the identification of cognitive disorders and depression should be prioritized to improve surgical intervention results (2, 5). In this context, identifying the factors that influence the early detection of cognitive impairments in geriatric patients in surgical clinics is important. We evaluated depression and cognitive status in geriatric patients post-orthopedic surgery.

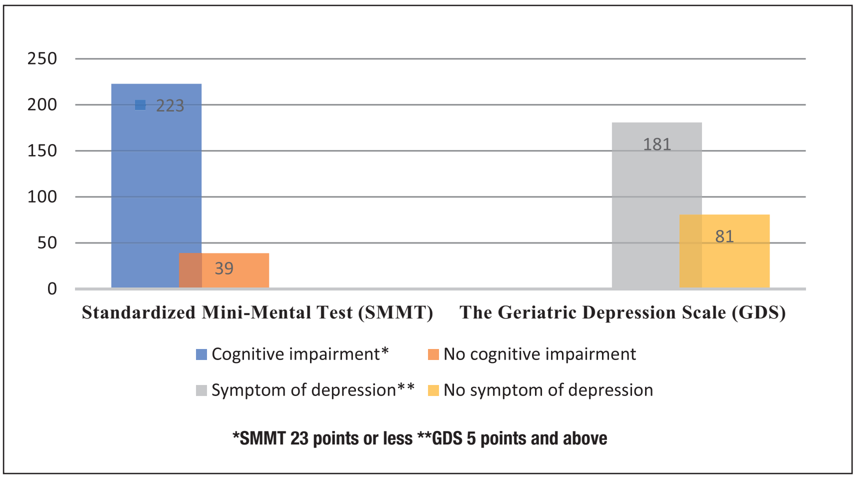

Fig. 1. Distribution of patients' cognitive impairment and symptom of geriatric depression (n=262)

MATERIAL AND METHODS

Design

This research is cross-sectional and descriptive.

Sample and settings

This research was conducted at the Orthopedics and Traumatology Service of a University Hospital in western Turkey from May 1, 2021, to May 15, 2022. The study population constituted all patients aged above 65 years who had surgeries and could communicate verbally. We excluded patients who were unable to communicate, had conditions (psychological problems, dementia, etc.) that would impair their ability to make decisions, or took sedatives, antipsychotics, or other medications that might impair their cognitive status.

In this study, the sample size was determined using the G* Power software (version 3.1). In line with the literature (11), a power analysis was performed at a confidence interval of 0.05 and 90% and discovered that the least sample size should be 230 people. In the case of data loss, the study was conducted with a sample size of 242 people.

Data collection tools

Data were collected using the Patient Information Form, Standardized Mini-Mental Test (SMMT), and Geriatric Depression Scale Short Form (GDS). The researchers developed a patient information form based on the literature, which consisted of two parts. The first part included questions related to the patient's sociodemographic details, such as their age, sex, educational level, place of residence, smoking habits, functional impairment, visual hearing impairment, ongoing use of drugs, and dependency on others. The second part focused on clinical characteristics (medical diagnosis, surgical intervention, length of hospital stay, type of anesthesia, ASA (American Society of Anesthesiologists) score, presence of complications, pain level, nutritional condition, laboratory results, intensive care unit stay, and comorbidities).

The standardized Mini-Mental Test (SMMT) was first developed by Folstein et al. (9) in 1975. Güngen et al.. conducted a Turkish validity and reliability study was conducted by Güngen et al. (10). This scale is an assessment instrument consisting of five parts that evaluate orientation, memory, attention, language, and visual-spatial skills. Each correct answer was one point, and the total score was 30. Scores of "23 and below" indicate cognitive impairment (9). In this study, Cronbach's alpha coefficient of the scale was 0.725. The Geriatric Depression Scale Short Form (GDS-15) was developed in 1991 as a simplified version of the GDS-30 (3). A Turkish validity and reliability study of GDS-15 was conducted by Durmaz et al. In their study, Cronbach's Alpha was 0.92 (7). In the scale scoring, no answers to positive and yes answers to negative questions were assigned 1 point each. Each question is scored out of 1 point according to its characteristics and the total score is calculated. A score of 0–4 indicates no depressive symptoms, and a score of 5 and above indicates depressive symptoms (8). In this study, the Cronbach's alpha coefficient was found to be 0.663.

Procedure

The researcher collected face-to-face data within the first 72 h after surgery. Each patient's data collection took approximately 15–20 min. Clinical information and laboratory findings, including hemoglobin and serum sodium levels, were obtained from patient and hospital databases.

Ethics

Ethics committee approval (decision dated 09.02.2021, numbered 2021/02–22) and institutional approval (decision dated 10.12.2020, numbered 2020/87) were obtained for this study. Written and verbal consent were obtained from all patients.

Statistical analysis

IBM SPSS Statistics Package for Social Sciences 23 (IBM SPSS, Armonk, New, USA) was used for data analysis. Sociodemographic information was analyzed using numbers, percentages, and chi-square tests. An independent samples t-test, one-way ANOVA, and Pearson's correlation were also employed for the analysis. The statistical significance was set at $p < 0.05$ and was deemed acceptable for all tests.

RESULTS

The study included participants with an average age of 74.26±7.73 years. The mean ASA score was 2.71±0.51, and the average hospital stay was 2.57±2.27 day, while the mean operative time was 126.32±45.79 min. Postoperative pain was the highest, with a mean score of 8.07±1.7. The mean SMMT and GDS scores were 17.97±4.99 and 6.20±2.78, respectively. However, the study revealed that 85.1% (n=223) of the participants had cognitive impairment and 69.1% (n=181) had depressive symptoms (Fig. 1).

The findings suggest that as the patients age, their GDS scores increase (p=0.001, r_s=0.312), while SMMT decreases (p=0.001, r_s=-0.551). Longer hospitalization durations also correlated with higher GDS scores (p=0.006, r_s=0.031) and lower SMMT scores (p=0.006, r_s=-0.182). Postoperative time also affected the GDS and SMMT scores, with increasing postoperative hours resulting in higher GDS scores (p=0.029, r_s=0.135) and lower SMMT scores (p=0.002, r_s=-0.191). Furthermore, patients with higher ASA and pain scores had lower SMMT scores (p=0.001, r_s=-0.268), and increasing pain scores were associated with higher GDS scores (p=0.001<0.05, r_s=0.216). Higher pain levels also led to lower SMMT scores after the operation (p=0.010, r_s=-0.160), and lower hemoglobin levels correlated with lower SMMT scores (p=0.001, r_s=0.234). There was no significant relationship between smoking status, duration of surgery, serum sodium levels, or the participants' mean GDS and SMMT scores. Additionally, no significant correlation was observed between the mean GDS scores and duration of hospital stay, ASA score, or highest postoperative pain (p>0.05). The study found a negative correlation between mean GDS and SMMT scores (p=0.001, r_s=-0.475) (Table 1).

Patients who are not literate, single, with visual/hearing impairment, with a history of falling and malnutrition, dependency in ADL had higher average GDS scores and lower average SMMT scores (p=0.001). Participants without walking aids had a higher mean SMMT score than those with aids (p=0.009). Patients with underwent hip arthroplasty, and a high cognitive impairment was observed among these patients (p <0.05). (Table 2).

DISCUSSION

This study reveals a significant prevalence of cognitive impairment (85.1%) and geriatric depressive symptoms (69.1%). The average MMSE score of 17.97±4.99 (min–max=6–30) points. Additionally, 47.3% (n=124) were found to have a mean MMSE score below 18

Table 1. Relationship between sociodemographic and clinical characteristics of patients and scale scores (n = 262)

Variables	Mean± SD	Min– Max	GDS	SMMSE
Age	74.26±7.73	65–97	rs=0.312* **p= 0.001**	rs=-0.551* **p= 0.001**
Smoking (day/piece)	7.06±5.77	2–20	rs=0.149 p=0.407	rs=-0.073 p= 0.688
Duration of hospital stay (preoperative days)	2.57±2.27	1–20	rs=0.031 **p: 0.639**	rs=-0.182* **p= 0.006**
ASA score	2.71±0.51	2–4	rs=0.071 p=0.251	rs=-0.268* **p= 0.001**
Operation time (min)	126.32±45.79	25–360	rs=-0.056 p= 0.370	rs= 0.057 p= 0.357
Postoperative (hours)**	46.84±22.76	12–75	rs=0.135* **p= 0.029**	rs=-0.191* **p= 0.002**
Pain level (now)	4.40±2.57	1–10	rs=0.216* **p= 0.001**	rs=-0.143* **p= 0.021**
Pain level (highest pain after surgery)	8.07±1.7	3–10	rs=0.116 p= 0.061	rs=-0.160* **p=0.010**
Serum sodium(mg/dl)	139.87±3.41	127–149	rs=0.030 p=0.628	rs=0.038 p= 0.539
Hemoglobin	11.32±2.01	7–16.2	rs=-0.047 p=0.450	rs=0.234* **p= 0.001**
GDS	6.20±2.78	1–14	–	rs=-0.475 **p= 0.001**
SMMSE	17.97±4.99	6–30	rs=-0.475 **p= 0.001**	–

**r_s = Pearson correlation analysis*
*** Postoperative evaluation times of patients*

Table 2. Comparison of sociodemographic and clinical characteristics of patients with scale scores (n=262)

		GDS	Statistic	SMMSE	Statistic
Variables	**N (%)**	**Mean± SD**		**Mean± SD**	
Gender					
Male	171 (65.3)	6.29±2.69	t=0.686	17.62±4.96	t=-1.556
Female	91 (34.7)	6.04±2.95	p=0.493	18.63±5.01	p=0.121
Educational level					
Not literate	77 (29.4)	7.31±2.83	t= 4.276	15.25±4.19	t= -6.066
Primary-high school	185 (70.6)	5.74±2.64	**p=0.001**	19.10±4.87	**p=0.001**
Marital status					
Married	142 (54.2)	5.63±2.57	t= -3.701	19.51±4.54	t=5.739
Single	120 (45.8)	6.88±2.88	**p=0.001**	16.15±4.19	**p=0.001**
Chronic disease					
Yes*	208 (79.4)	6.09±2.79	t= -1.254	18±4.96	t= 0.224
No	54 (20.6)	6.62±2.74	p=0.211	17.83±5.17	p=0.823
Visual defect					
Yes**	166 (63.4)	6.67±2.81	t= 3.661	17.29±5.17	t= -2.939
No	96 (36.6)	5.39±2.55	**p=0.001**	19.15±4.46	**p=0.004**
Hearing defect					
Yes***	73 (27.9)	7.23±2.91	t= 3.799	14.81±4.60	t=-6.909
No	189 (72.1)	5.80±2.63	**p=0.001**	19.19±4.60	**p=0.001**
Use of walking aids					
Yes	105 (40.1)	6.48±3	t =1.294	16.99±4.75	t =-2.622
No	157 (59.9)	6.01±2.62	p= 0.197	18.62±5.05	**p=0.009**
Fall history					
Yes	116 (55.7)	6.52±2.89	t= -2.106	17.25±5.08	t =2.657
No	146 (44.3)	5.80±2.59	**p=0.036**	18.88±4.75	**p=0.008**
Dependency in ADL					
Yes	165 (63.4)	6.48±2.84	t=-2.093	16.98±5	t= 4.484
No	96 (36.6)	5.73±2.64	**p=0.037**	19.75±4.44	**p=0.001**
Malnutrition					
Yes ****	98 (37.4)	6.80±2.83	t= 2.726	15.62±4.78	t =-6.296
No	164 (62.6)	5.84±2.70	**p=0.007**	19.37±4.59	**p=0.001**
Type of surgery					
Total hip arthroplasty	93 (35.5)	6.66±2.93	F=1.831	16.20±4.94	F=5.476
Total knee arthroplasty	77 (29.4)	5.74±2.74	p=0.123	19.51±4.51	**p=0.001**
Arthroplasty revision	30 (11.5)	5.53±2.72		18.83±3.95	
Open reduction internal fixation	38 (14.5)	6.60±2.47		17.95±4.73	
Other(shoulder arthroplasty, arthrodesis)	24 (9.1)	6.12±2.65		18.83±6.35	

**HT (n=172), DM (n=100), coronary artery disease (n=31), HL (n=27), cronic obstructive pulmoner disease (n=27), benign prostatic hyperplasia (n=15), chronic kidney disease (n=15), hypothyroidism (n=14), asthma (n=9), Parkinson's (n=3),epilepsy (n=1)*
***%24.8 (n=65.) uses glasses. *** %1.9 (n=5) uses hearing aids.*
*****It was taken according to the results of the nutritional assessment scale used in the clinic (patients with a Nutritional Risk Assessment Score of 3 and above)*
ADL: activities of daily living

points. This suggests that almost half of the patient group had severe cognitive impairment such as dementia, making the management of the postoperative process difficult. This underscores the association between aging the likelihood of experiencing cognitive impairment and geriatric depression. Age was found to be a risk factor for both conditions. Several studies have shown that the prevalence of delirium and depression increases with age (11, 17, 20). In a study of patients undergoing cardiac surgery, the incidence of delirium was 21.4% in patients aged >65 years and 33.5% in patients >80-year-old (13). These findings suggest that the physiology of aging may be related to these results. With age, the number of neurons, brain weight, cerebral blood flow, and oxygenation decrease, whereas senile plaques and neurofibrils increase. These irreversible physiological changes can result in altered consciousness, decreased reflex responses, and impaired sensory perception-motor functions (16, 26). In a study, the majority of the patients had a history of falls, and those with a history of falls had higher depressive symptoms and cognitive impairment. Worldwide, the risk of falls in individuals aged over 65 years is between 30–62% worldwide. The most frequent injury caused by falls in geriatric patients requiring surgical treatment is hip fracture (26). A literature review revealed that orthopedic surgery is a risk factor for cognitive disorders, especially since the incidence of delirium after hip surgery is higher than that after other operations (23, 26). In this study, most patients had hip fractures and one-third (35.5%) had undergone hip arthroplasty. The patients in this group were found to have a high cognitive impairment. In another study, the incidence of delirium after hip fracture surgery in geriatric patients ranged from 13–56% (18). We cannot say that the rates we obtained in the study are related to the surgical process. Because we did not do a preoperative evaluation. This may be due to severe pain, anesthesia, fluid imbalance, nutritional deficiency, or comorbidities in patients undergoing hip fracture surgery.

Our study did not find any significant differences between sexes and cognitive impairment or had depressive symptoms. Patients with higher levels of education find nursing education more comprehensible. However, for patients who are not educated, only verbal education could be provided. We discovered that non-educated patients (29.4%) had a higher depressive symptoms and cognitive impairment than those with a primary or high school education.

Orthopaedic surgeries involve high levels of pain and anxiety (12). In addition, physiological changes due to surgical intervention increase the perception of pain, causing the body to be in a state of constant alarm, inability to rest, insomnia, and cognitive status (12, 18). It is crucial to manage pain effectively to recognize and prevent changes in cognitive functions, as highlighted in the guideline (19, 21). This study found that cognitive impairment and depressive symptoms increased with pain levels. Pain is a leading cause of depression in the elderly, along with disabilities, death of relatives, surgical trauma, and hospitalization (25). Other studies conducted on orthopedic surgery patients showed that, while their functional status improved, severe pain, fear of falling, and anxiety about walking could trigger depressive symptoms (6, 17, 19, 20). Elderly patients may remain dependent for a long time after orthopedic problems and interventions (15). According to our research 63.4% of the participants required assistance in performing everyday tasks. We found that those who depended on others for daily living activities were more likely to experience depression and cognitive impairment. Patients who cannot perform these tasks independently often feel stressed and suffer from loss of self-esteem.

Our research showed that depressive symptoms and cognitive impairment tends to increase with longer hospital stays. Effective management of pre and post-operative conditions can positively affect surgical outcomes, as noted by Wainwright et al. (24). Additionally, our findings revealed that individuals with low hemoglobin levels were at a higher risk of cognitive impairment. Similar results were reported in the meta-analysis by Yang et al. (27). A patient's nutritional status can affect cognitive function (4). The study revealed that 37.42% of participants had nutritional deficiencies, leading to an increased depressive symptoms and cognitive impairment. Nutritional deficiency is prevalent among patients undergoing surgical intervention, particularly among the elderly population. Detecting and optimizing this condition is crucial for preventing the deterioration of cell and organ function, postoperative complications, delayed recovery, and prolonged hospitalization (22). Our study indicated that the nutritional status of patients, low hemoglobin levels, duration of hospital stay, and dependency status were interrelated. Although the correlation values are low, the relationship between age, time before surgery, pain and hemoglobin level and cognitive status is also clinically significant (19, 24, 26, 27). However, we found no significant relationship between chronic diseases and cognitive status or had depressive symptoms. One study have shown that geriatric patients diagnosed with diabetes mellitus are prone to postoperative delirium (4).

Our research also suggests that patients' comorbidities are well-managed during surgery. Studies on the effects of general and spinal anesthesia on postoperative cognitive disorders have yielded varied conclusions. Our analysis indicates that patient comorbidities were effectively controlled throughout the surgical procedure. Various studies on the impact of general and spinal anesthesia on postoperative delirium have shown varying outcomes. Some studies (11, 22) found no statistically significant effect of anesthesia type on the rate of postoperative delirium, while others reported considerably higher rates in patients who received general anesthesia (1). Our study revealed no significant difference in the occurrence of cognitive impairment among elderly patients who undergoing general or spinal anesthesia. However, further research with a larger sample size is required to confirm this hypothesis.

Cognitive impairment was more prevalent in patients with higher ASA of Anesthesiologists scores. Several studies analyzing postoperative complications in geriatric patients with ASA of Anesthesiologists scores of 3 or 4 found that delirium was the most common complication (4, 26). The ASA score is a scoring system used to determine surgical risks. A high ASA score indicates that patients have comorbid diseases that increase the risk of surgical intervention (22). The ASA of Anesthesiologists score was used to evaluate surgical risk. A high score indicated that patients may have other illnesses that could make surgery more dangerous (1, 11, 26). It is thought that as patients' comorbidities increase, it becomes more challenging to manage the perioperative process, therefore, affecting cognitive functions.

Geriatric patients with visual and hearing problems are at a higher postoperative cognitive impairment (1, 26). Our study supports this finding, establishing that patients with visual and hearing impairments exhibited higher cognitive impairment compared to those without such impairments. Additionally, we identified that disabilities and dependence on daily activities affected the cognitive status of geriatric patients.

Our study did not find any significant differences between sexes and cognitive impairment or had depressive symptoms. Patients with higher levels of education find nursing education more comprehensible. However, for patients who are not educated, only verbal education could be provided. We discovered that non-educated patients had a higher likelihood of geriatric depression and cognitive disorders than those with a primary or high school education.

Limitations

The study was conducted at a single center with a limited number of patients during a specific period. Therefore, further studies need to be conducted at various centers with larger sample sizes to form a more general opinion. In addition, the fact that the patients were not examined before surgery was an important limitation for us. Cognitive impairments and depressive symptoms could also be present preoperatively in the geriatric population.

CONCLUSIONS

This study revealed that many elderly patients undergoing orthopedic surgery experience cognitive impairment and depressive symptoms. Furthermore, the risk of cognitive decline and depression increased with age, higher pain scores, and longer hospital stays. Our research also showed that individuals with a history of falls, who rely on others for daily activities, non-educated or single, have a greater likelihood of experiencing geriatric depression and cognitive impairment. Additionally, patients who have undergone hip arthroplasty, have low hemoglobin levels, or have high ASA scores are more susceptible to cognitive impairment. Individuals with visual and hearing impairments, nutritional deficiencies, and those who use assistive devices are also at higher depressive symptoms and cognitive impairment. More so, patients who had depressive symptoms are at an increased cognitive impairment. Considering these findings, it is crucial to identify the risks of delirium and depression in geriatric patients during their initial hospitalization to prevent or treat them. A comparison should be made between preoperative and postoperative cognitive status and depressive symptoms, and the effects of the surgical process should be revealed. Regular monitoring of geriatric patients in orthopedic clinics for cognitive status and depressive symptoms is recommended, and caregivers should be made aware of this issue. Additionaly, it may be necessary to plan a more comprehensive rehabilitation process for the patients. Structured discharge planning, especially involving caregivers, may be recommended.

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Ethical approval

Ethics committee permission (decision dated 09.02.2021 and numbered 2021/02-22) and institutional permission (decision dated 10.12.2020 and numbered 2020/87) were obtained for the study.

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