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Original Research Article

The Assessment of the Contributing Factors Responsible for Incapacity of Older Individuals to Restore Their Pre-Fracture Mobility after Undergoing Hip Fracture Surgery

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Abstract

Aim: To identifying the risk variables that contribute to the incapacity of older individuals to restore their pre-fracture mobility after undergoing hip fracture surgery.

Materials and Methods: In this retrospective was conducted in the department of Orthopaedics, Jannayak Karpoori Thakur Medical College and Hospital, Madhepura, Bihar, India, 473 consecutive patients over the age of 65 who were admitted to the hospital with hip fractures during the study periods were examined. Patients who had a contralateral hip fracture (n:6), had a pathological fracture (n:9), were bedridden beforethe hip fracture occurred (n:7), died within six months afterthe operation (n:127), and were alive but were missing postoperative sixth-month follow-ups (n:23), were excluded from the study. The remaining 281 patients were included in the study.

Results: In patients whose mFIM scores were calculated, the numberof patients whose mFIM score was the same as before the fracture occurred at the postoperative sixth month was 185 (65.8%) patients. The number of patients whose mFIM score worsened in the sixth month postoperatively compared to the score before the hip fracture occurred was 96 (34.2%). In the analysis in which the relationship between the fracture type and pre-fracture mobility was evaluated, it was determined that intertrochanteric fractures were more common in people who did not have normal mobility and whomoved with the use of an aid, (p=0.003). In the analysis of the relationship between the fracture type and the postoperative sixth month mobility, it was found that the rate of moving with the use of an aid and immobile was higher in patients with intertrochanteric fractures than in patients with collum femoris fracture (p=0.001).

Conclusion: According to the results obtained in this study, the effects of keeping the patients under close follow-up in the postoperative period, ensuringthe participation of the patients in the rehabilitation programs to be applied and providing the necessary training to the relatives of the patients about the postoperative rehabilitation of the existing disease will have a positive effect on the results.

Keywords: Functional recovery, hip fracture, mobility, geriatrics, activities of daily living.

Introduction

Hip fractures are a significant health concern among the elderly, often resulting in substantial morbidity, reduced quality of life, and increased mortality. Despite advances in surgical techniques and postoperative care, a considerable proportion of elderly patients fail to regain their pre-fracture mobility, which is crucial for maintaining independence and overall well-being . Understanding the risk factors that contribute to this inability is essential for developing targeted interventions to improve outcomes. [1-3] Age is a well-documented risk factor, with advanced age associated with a higher likelihood of poor functional recovery. Older patients often have decreased physiological reserves and higher prevalence of comorbidities, which can complicate postoperative rehabilitation. Additionally, gender differences have been observed, with women typically experiencing poorer recovery outcomes than men, possibly due to differences in bone density and muscle mass. [4,5] Pre-existing

comorbidities significantly influence postoperative mobility outcomes. Conditions such as cardiovascular disease, diabetes, and chronic obstructive pulmonary disease (COPD) can impair recovery by exacerbating physical limitations and complicating rehabilitation efforts. Cognitive impairment is another critical factor, as patients with dementia or delirium are less likely to adhere to rehabilitation protocols and may have poorer outcomes. [6-8] Nutritional status and body mass index (BMI) are also important determinants of recovery. Malnutrition and underweight status can lead to muscle weakness and delayed healing, while obesity can impose additional stress on the musculoskeletal system and complicate surgical recovery. [9] The type of fracture and the surgical approach used can impact mobility recovery. Intertrochanteric fractures and certain surgical techniques have been associated with worse functional outcomes compared to femoral neck fractures and other surgical methods. Additionally, postoperative complications, such as infections and thromboembolic events, can further hinder recovery. [10-12] Rehabilitation practices play a crucial role in regaining mobility. Early and intensive rehabilitation is associated with better outcomes, emphasizing the need for structured and personalized rehabilitation programs. The involvement of multidisciplinary teams, including physiotherapists, occupational therapists, and nutritionists, can optimize recovery trajectories. Social factors, such as living arrangements and social support, also influence recovery. Patients living alone or lacking adequate social support may struggle with postoperative care and adherence to rehabilitation programs, leading to suboptimal recovery. [13] Understanding these multifaceted risk factors is vital for healthcare providers to implement comprehensive care plans that address both medical and social needs.

Materials and Methods

In this retrospective was conducted in the department of Orthopaedics, Jannayak Karpoori Thakur Medical College and Hospital, Madhepura, Bihar, India, 473 consecutive patients over the age of 65 who were admitted to the hospital with hip fractures during the study periods were examined. Patients who had a contralateral hip fracture (n:6), had a pathological fracture (n:9), were bedridden before the hip fracture occurred (n:7), died within six months after the operation (n:127), and were alive but were missing postoperative sixth-month follow-ups (n:23), were excluded from the study. The remaining 281 patients were included in the study. Hospital digital records were examined and patients' age, gender, body mass index (BMI), smoking, American Society of Anesthesiologists (ASA) score, comorbidities (cardiovascular, respiratory, renal, neurological diseases and malignancy), fracture type, type of implant used in surgery, waiting time until surgery, and Charlson comorbidity index score were recorded [12]. In order to determine the mobility levels of the patients before the hip fracture occurred, the information obtained and recorded from the patient or his/her relatives was reviewed. In order to determine their mobility levels in the sixth month postoperatively, a detailed examination of the patients who came for routine control was performed. Patients who could not come for the control were called by phone and their mobility levels were determined. Mobility levels were divided into 3 groups in accordance with the standard definitions available in the literature: 1) mobile without the use of an aid, 2) mobile with the use of an aid, and 3) immobile. Crutches, Canes and walkers were considered an aid.

The Motor Functional Independence Measure (mFIM), a subscale of the Functional Independence Measure (FIM), was used to evaluate the patients' activities of daily living (ADL) before the fracture occurred and in the sixth month postoperatively [13]. FIM is a scale of 18 parameters rated from 1 to 7 points. Of these 18 parameters, 8 parameters are used to evaluate ADL, 5 parameters are used to determine the mobility level, and 5 parameters are used to evaluate cognitive function. On the other hand, mFIM includes 13 parameters used to determine ADL and mobility level. Each of the 13 items in mFIM is rated from 1 to 7, as in FIM. Higher scores indicate better ADL. The minimum score is 13, the maximum score is 91 [13]. The patients included in the study were divided into two groups according to their mFIM scores: those whose mFIM score at 6 months postoperatively was the same as before the fracture occurred, and those whose mFIM score at 6 months postoperatively worsened than before the fracture occurred. Age, BMI, gender, smoking, ASA score, comorbidities, fracture type, type of implant used in the surgery, waiting time until surgery and Charlson comorbidity index score variables were analyzed between the groups.

Statistical Analysis

All statistical analyzes were performed using the SPSS statistical program (Version 25.0; SPSS Inc., Chicago, IL). While evaluating the study data, the data were summarized by using descriptive statistical methods (mean, standard deviation, frequency, minimum, maximum). Pearson Chi- square independence tests were used to test the independence between two categorical variables, and the Mann Whitney U Test was used for the two groups to compare the data that did not show normal distribution. The relationships between the classified variables forming the 2x2 crosstabs were investigated with Fisher's exact tests. The statistical significance level was accepted as $p < 0.05$.

Results

As a result of the evaluations, 281 patients were included in the study. Descriptive information about the patients is shown in Table 1. 173 (61.5%) of the patients were female and 108 (38.5%) were male, with a mean age of 79.9±9.1 years. There were 174 (62%) intertrochanteric fractures and 107 (38%) femoral neck fractures. 149 (53%) patients underwent proximal femoral nail (PFN), 116 (41.2%) patients underwent hemiarthroplasty, 9 (3.3%) patients underwent dynamic hip screw (DHS) and 7 (2.5%) patients underwent total hip arthroplasty. In the analysis performed to determine the level of mobility, it was found that 244 (87%) patients moved without the use of an aid and 37 (13%) patients moved with the use of an aid in the pre-fracture period. In the sixth month of postoperative follow-up, it was observed that 182 (64,8%) patients were ambulated without the use of an aid, 44 (15,7%)patients were ambulated with the use of an aid, and 55 (19,5%) patients were immobile.

In patients whose mFIM scores were calculated, the numberof patients whose mFIM score was the same as before the fracture occurred at the postoperative sixth month was 185 (65.8%) patients. The number of patients whose mFIM score worsened in the sixth month postoperatively compared to the score before the hip fracture occurred was 96 (34.2%).

In the analysis in which the relationship between the fracture type and pre-fracture mobility was evaluated, it was determined that intertrochanteric fractures were more common in people who did not have normal mobility and who moved with the use of an aid, (p=0.003) (Table 2). In the analysis of the relationship between the fracture type and the postoperative sixth month mobility, it was found that the rate of moving with the use of an aid and immobile was higher in patients with intertrochanteric fractures than in patients with collum femoris fracture (p=0.001) (Table 2).

Table 3 summarizes the results of the variables for which comparisons were made between the groups in patients grouped according to the change in mFIM scores before fracture and at the sixth postoperative month. Accordingly,the mean age of patients with worsening ADL was significantly higher (p=<0.001). The rate of worsening of ADL was statistically higher in patients with cardiovascular disease and malignancy (p=<0.001). In the analysis performed according to ASA scores, ASA 3 and 4 scores are seen at a higher rate in patients with worsening ADL (p=0.003). It was determined that patients with worsening ADL had a significantly higher waiting time for surgery (p=<0.001). When compared according to fracture type, the rate of worsening in ADL was found to be significantly higher in patients with intertrochanteric fractures (p=0.006). In addition, in the comparison made between implant types that used surgery, it was found that the rate of worsening in patients using PFN was significantly higher than in patients using other types of implants (p=0.005).

Although there is no statistically significant relationship between the change in ADL and Charlson comorbidity Index scores, it is understood that the Charlson Comorbidity Index average of patients with worsening ADL is higher. Still, the difference is not statistically significant (p=0.418).

Table 1: Patient characteristics

Variables		Cohort	
		N:281	%
Age (years) (mean ±SD)		79,9±9,1	-
BMI (mean ±SD)		24,8±1,6	-
Gender	Woman	173	61,5
	Man	108	38,5
Smoking	Yes	232	82,5
	No	49	17,5
Comorbidities	Cardiovascular Diseases		
	Yes	185	65,8
	No	96	34,2
	Diabetes Mellitus		
	Yes	122	43,4
	No	159	56,6
	Respiratory Diseases		
	Yes	46	16,3
	No	235	83,7
	Renal Diseases		
	Yes	42	15
	No	239	85

	Neurological Diseases		
	Yes	13	4,6
	No	268	95,4
	Malignancy		
	Yes	39	13,9
	No	242	86,1
ASA Score	1	0	0
	2	36	12,8
	3	151	53,7
	4	94	33,5
Fracture Type	Intertrochanteric Fracture	174	62
	Collum Femoris Fracture	107	38
Implant Type	PFN	149	53
	DHS	9	3,3
	Hemiarthroplasty	116	41,2
	Total Arthroplasty	7	2,5
Waiting Time until Surgery (days) (mean ±SD)		3,4±2,6	-
Charlson Comorbidity Index (mean ±SD)		2,1±1,4	-
Pre-fracture mFIM score (mean ±SD)		83,8±20,3	-
Postoperative 6th month mFIM score (mean ±SD)		78,7±14,8	-
Pre-fracture mobility	Mobil without an aid	244	87
	Mobil with an aid	37	13
Postoperative 6th monthmobility	Mobil without an aid	182	64,8
	Mobil with an aid	44	15,7
	Immobile	55	19,5

Table 2: Comparison between fracture types and preoperative and postoperative 6th month mobility

	Pre-fracture mobility			**p value**
Fracture Type	Mobil without an aid n(%)	Mobil with an aid n(%)		0,003[a]
Intertrochanteric Fracture	143 (%58,6)	31 (%83,8)		
Collum Femoris Fracture	101 (%41,4)	6 (%16,2)		
	Postoperative 6th month mobility			**p value**
Fracture Type	Mobil with an aid n(%)	Mobil with an aid n(%)	Immobile n(%)	0,001[a]
Intertrochanteric Fracture	106 (%58,2)	23 (%53,5)	45 (%81,8)	
Collum Femoris Fracture	76 (%41,8)	21 (%46,5)	10 (%18,2)	

Table 3: Comparison between two patient groups (normalized and worsening ADL) relating to Age, BMI, comorbidities, smoking, ASA score,fracture type, implant type, waiting time until surgery and Charlson comorbidity index score.

Variables		**Normalized ADL (n:185)**	**Worsening ADL (n:96)**	**p value**
Age (years) (mean ±SD)		**77,9±9,5**	**83,7±6,9**	**<0,001[b]**
BMI (mean ±SD)		**24,5±1,7**	**25,6±1,42**	**0,785[b]**
Gender n(%)	Male	68 (%36,7)	40 (%41,6)	0,440[a]
	Female	117 (%63,3)	56 (%58,4)	
Comorbidities n(%)	Cardiovascular Diseases			
	Yes	101 (%54,6)	84 (%87,5)	<0,001[a]
	No	84 (%45,4)	12 (%12,5)	
	Diabetes Mellitus			
	Var	80 (%43,2)	42 (%43,8)	0,999[a]
	Yok	105 (%56,8)	54 (%56,2)	
	Respiratory Diseases			
	Yes	31 (%16,8)	15 (%15,6)	0,866[a]
	No	154 (%83,2)	81 (%84,4)	
	Renal Diseases			
	Yes	26 (%14)	16 (%16,7)	0,598[a]

	No	159 %86)	80 (%83,3)	
	Neurological Diseases			
	Yes	9 (%95,1)	4 (%4,1)	0,999[a]
	No	176(%4,9)	92 (%95,9)	
	Malignancy			
	Yes	18 (%9,7)	21 (%21,9)	<0,001[a]
	No	167 (%90,3)	75 (%78,1)	
Smoking n(%)	Yes	35 (%19)	14 (%14,6)	0,328[a]
	No	150 (%81)	82 (%85,4)	
ASA Score n(%)	1	0	0	
	2	32 (%17,2)	4 (%4,2)	0,003[a]
	3	96 (%51,9)	55 (%57,3)	
	4	57 (%30,9)	37 (%38,5)	
Fracture Type n(%)	Intertrochanteric Fracture	104 (%56,2)	70 (%72,9)	0,006[a]
	Collum Femoris Fracture	81 (%43,8)	26 (%27,1)	
Implant type n(%)	PFN	84 (%45,4)	65 (%67,7)	
	DHS	7 (%3,8)	2 (%2,1)	0,005[a]
	Hemiarthroplasty	89 (%48,1)	27 (%28,1)	
	Total Arthroplasty	5 (%2,7)	2 (%2,1)	
Waiting Time until Surgery (days) (mean ±SD)		3,21±2,69	3,30±2,46	0,589[b]
Charlson Comorbidity Index (mean ±SD)		2,04±1,50	2,20±1,48	0,418[b]

Discussion

In this study, the relationship between the type of fracture and postoperative mobility in elderly patients who underwent surgery for hip fracture, and the risk factors present in patients who could not regain sufficient mobility in the postoperative period were investigated. The study's most important finding is that in patients with intertrochanteric fractures, more ADL deterioration and mobility regression were detected in the postoperative period. In addition, the effective risk factors in the inability to regain the pre-fracture level of motion determined in the study; are advanced age, high ASA score, cardiovascular disease or malignancy among comorbidities, intertrochanteric fracture as fracture type and PFN use as implant type in surgery.

Studies have shown that hip fracture significantly affects patients' quality of life. [9-11,14-16] Another complication seen after hip fracture, which seriously affects patients' quality of life and is as important as mortality, is mobility limitation in the postoperative period compared to the period before the fracture. Especially in recent years, despite the developments in materials and techniques used in hip fracture surgery and efforts to improve patient care, worsening in daily life activities and inability to regain pre-fracture mobility continue to be seen as a serious complication after hip fracture in the elderly. [17, 18]

There are many studies evaluating mobility after fracture. [6,7] Current studies show that 20-50% of patients do not regain their pre-fracture mobility after hip fracture. [5, 6] In a meta- analysis by Bertram *et al*. [19], it was found that 42% of elderlyhip fracture patients could not regain pre-fracture mobility, and 35% could not walk unaided after the fracture. In the study of Mariconda *et al*. [14], it was observed that only 57% of the patients returned to their pre-fracture functional state and 13% became immobile in the first year after fracture. Although the time to regain normal activities of daily living after fracture varies between 4-11 months, this period is the first 6 months after surgery in the vast majority of patients. [16] According to literature data, it has been shown that the most intense period of post-fracture healing is in the first 4 months, and the recovery of activities of daily living is very slow starting from the 6th month. [10,15] In our study, in which 281 patients were evaluated, the number of patients whose activities of daily living deteriorated after fracture was found to be 96 (34.2%). This result is consistent with the available literature data. Apart from this, the number of patients who were immobilized after surgery was found to be 55 (19.5%). This result is slightly higher than the literature data. The patients included in the study mainly consisted of those with intertrochanteric fractures. The rate of immobility in the postoperative period was statistically higher in patients with intertrochanteric fractures. We attribute the reason for the higher rate of immobile patients in our study compared to the literature.

Many risk factors have been identified for inability thethe inability-fracture functional status after hip fracture. [14,20] There is no clear consensus on the identified risk factors. These risk factors can be counted as age, ASA status, comorbidities, poor cognitive status and high dependency level before fracture. [6,8,19] Studies claim that high age and poor cognitive status are the most important risk factors. [5,20] In studies on comorbidities, as the

number of comorbidities, especially dementia and cardiovascular diseases, increases, it has been determined that the functional status after fracture is at risk of severe worsening. [7-9,20-22] As with comorbidities, a high ASA score has been an important risk factor for the inability to regain pre-fracture mobility in the postoperative period. [14] Another risk factor on which many studies have been conducted is the limitation in the activities of daily living that existed before the fracture in patients. [5,8,20,21,23] Ithas been found that patients with retarded activities of daily living in the pre-fracture period become immobile at a higher rate in the postoperative period. [5,14] In this study, risk factors in patients with worsening in activities of daily living during the postoperative period were investigated. As a result of the analyses performed, it was observed that high age, having cardiovascular disease or malignancy, and a high ASA score caused worsening in daily living activities of daily living and limited mobility in the postoperative period. Among these r It is especially important to have cardiovascular disease or malignancy among these risk factors close follow-up and treatment of patients can be effective effectively reduces that these risk factors can cause. In addition, more careful evaluation of patients with these risk factors in the postoperative period and being more sensitive and careful in rehabilitation practices can reduce the bad results that may occur.

Another risk factor, which is thought to be related to the limitation of mobility after fracture and for which discussions continue in the literature, is the type of fracture and the surgical procedure applied. [5,7,11,20,24] In addition to publications reporting worse functional outcomes in intertrochanteric fractures than in femoral neck fractures, there are also publications with no significant difference. [5, 20] However, there are also studies claiming that the distribution of hip fractures is not homogeneous and that even the mobility before the fracture affects the type of fracture, and therefore, there are studies that argue that the fracture type cannot be compared with the postoperative mobility. [14,23] In the study of Ravikumar *et al*. [25], in which they examined the relationship between implant types used in surgery and postoperative mobility, similar results were obtained in patients who underwent PFN and DHS in regaining mobility in the postoperative period. In another study comparing PFN and arthroplasty, no significant difference was found in restoring mobility. [14] Our study investigated the effects of fracture and implant types on activities of daily living and mobility in the postoperative period. In patients with intertrochanteric fractures and who used PFN during surgery, more limitations in activities of daily living were detected in the postoperative period. In addition, it was observed that the immobile rate in patients with intertrochanteric fractures was higher than in patients with collum femoris fractures. The surgical method applied in patients with intertrochanteric fractures is mostly for osteosynthesis and the type of implant used is PFN. In these patients, giving full weight to the fractured side is avoided in the early postoperative period. The advanced age of the patients, osteoporotic changes in the bones, and cognitive retardation often force the surgeon to do this. In addition, patients undergoing arthroplasty are usually given almost full weight on the fractured side in the early postoperative period, and thus they can regain their daily life activities in a shorter time. We think that not initiating early movement causes the exacerbation of the diseases present in the future in patients and, as a result, the regression in daily life activities and the continuation of the limitation of mobility.

This study has some limitations. First of all, our study was designed retrospectively. Learning the latest status of some patients over the phone during postoperative follow-ups is another limitation due to the risk of bias in the results. Finally, the fact that patients different surgeons operate patients counted among the rules of the study.

Conclusion

In the postoperative period, a high rate of worsening in activities of daily living and limitation of movement not were detected in patients who were operated on for hip fractures. Patients who have intertrochanteric fractures, who use PFN as an implant type during surgery, and those with cardiovascular disease or dementia are more likely to be unable to return functionally to the pre-fracture stage. According to the results obtained in this study, the effects of keeping the patients under close follow-up in the postoperative period, ensuring the participation of the patients in the rehabilitation programs to be applied and providing the necessary training to the relatives of the patients about the postoperative rehabilitation of the existing disease will have a positive effect on the results.

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