International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2022; 8(2): 01-06

www.orthopaper.com
Received: 01-03-2022
Accepted: 30-03-2022

Bekir Karagoz
Adiyaman University Training and Research Hospital, Department of Orthopaedics and Traumatology, Adıyaman, Turkey

Mustafa Erdem
Adiyaman University Training and Research Hospital, Department of Orthopaedics and Traumatology, Adıyaman, Turkey

Corresponding Author:
Bekir Karagoz
Adiyaman University Training and Research Hospital, Department of Orthopaedics and Traumatology, Adıyaman, Turkey

Risk factors affecting the inability to regain pre-fracture mobility after hip fracture surgery in elderly patients

Bekir Karagoz and Mustafa Erdem

DOI: https://doi.org/10.22271/ortho.2022.v8.i2a.3107

Abstract
Background: To evaluate the functional recovery at six months postoperatively in elderly patients with hip fractures and to determine the risks of not regaining to the pre-fracture mobility level.
Materials and Method: In this retrospective observational cohort study, 281 patients over the age of 65 who underwent surgery for hip fracture were included in the study. The patients were divided into two groups (mobil without an aid and mobil with an aid) according to their pre-fracture level of mobility, and three groups according to their postoperative 6th month mobility level (mobil without an aid, mobil with an aid and immobile). In addition, motor-Functional Independence Measure (mFIM) scores were calculated to evaluate activities of daily living (ADL). Risk factors for not regain pre-fracture mobility and worsening of ADL were identified.
Results: The rate of patients who could not regain their pre-fracture ADL after 6 months postoperatively was 34.1%. Patients with intertrochanteric fractures or those with an intraoperative proximal femoral nail (PFN) implanted were less likely to regain their pre-fracture mobility and ADL (p=0.006, p=0.005, respectively). The most important risk factors for not regain to pre-fracture mobility and worsening of ADL were advanced age, high ASA score, cardiovascular disease or malignancy among comorbidities, intertrochanteric fracture as fracture type, and PFN use as implant type.
Conclusion: Advanced age, high ASA score, cardiovascular disease or malignancy among comorbidities, intertrochanteric fracture as fracture type, and use of PFN as implant type were the main risk factors for not regaining to pre-fracture mobility and ADL.

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

Introduction
With the increase in the average age of the world population, hip fracture seen in the elderly occurs as a serious public health problem [1]. Hip fractures in the elderly are orthopedic injuries that mostly occur due to low-energy falls and have a high mortality [2]. Post-fracture treatment aims to ensure that the patient's mobility is the same as before the fracture. For this reason, patients are often treated with surgical intervention. It is aimed that patients can lead a functionally independent life with intensive rehabilitation studies after surgical treatment. One of the most important complications observed after a fracture is the inability of the patient to regain the mobility before the fracture [3]. Despite advances in technology and treatment techniques, this complication remains a serious problem. Because the patients' inability to regain their mobility before the fracture causes limitations in their daily activities, this situation increases the patients' dependence on their environment. In addition, the inability to regain mobility can cause serious medical problems, and the treatment of these problems can lead to serious economic losses [4].
The proportion of patients with limited mobility after hip fracture ranges from 20% to 50% [5, 6]. These high rates have caused scientists to be interested in this subject. It is possible to find many studies on this subject in the literature [2, 5-7]. However, although there are so many studies, discussions still continue. The most important of these discussions is about the risk factors that affect the inability to regain mobility. Many risk factors are blamed. The main risk factors studied are gender, race, hemoglobin level, comorbidities, functional status before fracture, and length of hospital stay [7, 8].

However, very few studies compare the relationship between fracture type and postoperative mobility [9-11].
Our aim in this study is to examine the effects of fracture type on restoring mobility in the postoperative period, which is not emphasized much in studies in the literature, and to determine the risk factors in patients who inability to regain mobility.

Materials and Methods

In this retrospective observational cohort study, which the ethics committee approved of our institution, 473 consecutive patients over the age of 65 who were admitted to the hospital with hip fractures between January 2017 and December 2020 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 [5]. 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 number of 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 month mobility	Mobil without an aid	182	64,8
	Mobil with an aid	44	15,7
	Immobile	55	19,5

SD: Standart Devision, BMI: Body Mass Index, ASA: American Society of Anesthesiologist's classification, mFIM: Motor Functional Independence Measure, PFN: Proximal Femur Nail, DHS: Dynamic Hip Screw

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(%)	
Intertrochanteric Fracture	143 (%58,6)	31 (%83,8)	0,003[a]
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(%)	
Intertrochanteric Fracture	106 (%58,2)	23 (%53,5)	45 (%81,8)	0,001[a]
Collum Femoris Fracture	76 (%41,8)	21 (%46,5)	10 (%18,2)	

a: Fisher's Exact Test, b: Chi-square Test of Independence
p-values <0.05 are shown in boldface

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	0,003[a]
	2	32 (%17,2)	4 (%4,2)	
	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)	0,005[a]
	DHS	7 (%3,8)	2 (%2,1)	
	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]

a:Fisher's Exact Test, b:Mann Whitney Test, c: Chi-square Test of Independence, SD: Standart Division, ADL: Activities of Daily Living, BMI: Body Mass Index, ASA: American Society of Anesthesiologist's classification, PFN: Proximal Femur Nail, DHS: Dynamic Hip Screw p-values <0.05 are shown in boldface

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 complications 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 elderly hip 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]. It has 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 reducelts 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 patientsounted among the rules of the study.

Conclusion

In the postoperative period, a high rate of worsening in activities of daily living and limitation of movemethe nt 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.

References

1. Abrahamsen B, van Staa T, Ariely R, Olson M, Cooper C. Excess mortality following hip fracture: a systematic epidemiological review. Osteoporos Int. 2009;20(10):1633-1650.
2. Mitchell R, Harvey L, Brodaty H, Draper B, Close J. Hip fracture and the influence of dementia on health outcomes and access to hospital-based rehabilitation for older individuals. Disabil Rehabil. 2016;38(23):2286-2295.
3. Pasco JA, Sanders KM, Hoekstra FM, Henry MJ, Nicholson GC, Kotowicz MA. The human cost of fracture. Osteoporos Int. 2005;16(12):2046-2052.
4. Haentjens P, Autier P, Barette M, Boonen S. The economic cost of hip fractures among elderly women. A one-year, prospective, observational cohort study with matched-pair analysis. Belgian Hip Fracture Study Group. J Bone Joint Surg Am. 2001;83(4):493-500.
5. Vochteloo AJ, Moerman S, Tuinebreijer WE, Maier AB, de Vries MR, Bloem RM, *et al*. More than half of hip fracture patients do not regain mobility in the first postoperative year. Geriatr Gerontol Int. 2013;13(2):334-341.
6. Dyer SM, Crotty M, Fairhall N, Magaziner J, Beaupre LA, Cameron ID, *et al*. Fracture Network (FFN) Rehabilitation Research Special Interest Group. A critical review of the long-term disability outcomes following hip fracture. BMC Geriatr. 2016;16(1):1-18.
7. Alegre-López J, Cordero-Guevara J, Alonso-Valdivielso JL, Fernández-Melón J. Factors associated with mortality and functional disability after hip fracture: an inception cohort study. Osteoporos Int. 2005;16(7):729-736.
8. Penrod JD, Litke A, Hawkes WG, Magaziner J, Doucette JT, Koval KJ, *et al*. The association of race, gender, and comorbidity with mortality and function after hip fracture. J Gerontol A Biol Sci Med Sci. 2008;63(8):867-872.
9. Ariza-Vega P, Jimenez-Moleon JJ, Kristensen MT. Non-weight-bearing status compromises the functional level up to 1 yr after hip fracture surgery. Am J Phys Med Rehabil. 2014;93:641-648.
10. Fukui N, Watanabe Y, Nakano T, Sawaguchi T, Matsushita T. Predictors for ambulatory ability and the

change in ADL after hip fracture in patients with different levels of mobility before injury: a 1-year prospective cohort study. J Orthop Trauma. 2012;26(3):163-171.
11. Haentjens P, Autier P, Barette M, Venken K, Vanderschueren D, Boonen S. Survival and functional outcome according to hip fracture type: a one-year prospective cohort study in elderly women with an intertrochanteric or femoral neck fracture. Bone. 2007;41(6):958-964.
12. Ludvigsson JF, Appelros P, Askling J, Byberg L, Carrero JJ, Ekström AM, *et al*. Adaptation of the Charlson Comorbidity Index for Register-Based Research in Sweden. Clin Epidemiol. 2021;13:21-41.
13. Wang CY, Graham JE, Karmarkar AM, Reistetter TA, Protas EJ, Ottenbacher KJ. FIM motor scores for classifying community discharge after inpatient rehabilitation for hip fracture. PMR. 2014;6(6):493-497.
14. Mariconda M, Costa GG, Cerbasi S, Recano P, Orabona G, Gambacorta M, *et al*. Factors Predicting Mobility and the Change in Activities of Daily Living After Hip Fracture: A 1-Year Prospective Cohort Study. J Orthop Trauma. 2016;30(2):71-77.
15. Heikkinen T, Jalovaara P. Four or twelve months' follow-up in the evaluation of functional outcome after hip fracture surgery? Scand J Surg. 2005;94:59-66.
16. Magaziner J, Simonsick EM, Kashner TM, Hebel JR, Kenzora JE. Predictors of functional recovery one year following hospital discharge for hip fracture: a prospective study. J Gerontol. 1990;45:101-107.
17. Biber R, Singler K, Curschmann-Horter M, Wicklein S, Sieber C, Bail HJ. Implementation of a co-managed Geriatric Fracture Center reduces hospital stay and time-to-operation in elderly femoral neck fracture patients. Arch Orthop Trauma Surg. 2013;133(11):1527-1531.
18. Friedman SM, Mendelson DA, Kates SL, McCann RM. Geriatric co-management of proximal femur fractures: total quality management and protocol-driven care result in better outcomes for a frail patient population. J Am Geriatr Soc. 2008;56(7):1349-1356.
19. Bertram M, Norman R, Kemp L, Vos T. Review of the long-term disability associated with hip fractures. Inj Prev. 2011;17(6):365-370.
20. Kristensen M. Factors affecting functional prognosis of patients with hip fracture. Eur J Phys Rehabil. 2011;47:257-264.
21. Pioli G, Frondini C, Lauretani F, Davoli ML, Pellicciotti F, Martini E, *et al*. Time to surgery and rehabilitation resources affect outcomes in orthogeriatric units. Arch Gerontol Geriatr. 2012;55(2):316-322.
22. Givens JL, Sanft TB, Marcantonio ER. Functional recovery after hip fracture: the combined effects of depressive symptoms, cognitive impairment, and delirium. J Am Geriatr Soc. 2008;56:1075-1079.
23. Cornwall R, Gilbert MS, Koval KJ, Strauss E, Siu AL. Functional outcomes and mortality vary among different types of hip fractures: a function of patient characteristics. Clin Orthop Relat Res. 2004;(425):64-71.
24. Yaradilmis YU, Okkaoglu MC, Ozdemir E, Ates A, Demirkale I, Altay M. The quality of life of the elderly is negatively affected by pertrochanteric femoral fractures despite successful surgical outcomes. Eur Res J. 2022;8(1):24-30.
25. Ravikumar KJ, Marsh G. Internal fixation versus hemiarthroplasty versus total hip arthroplasty for displaced subcapital fractures of femur- 13 year results of a prospective randomized study. Injury. 2000;31:793-797.