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A Retrospective Evaluation of Risk Factors and Post-Operative Functional Outcome Assessment of Elderly Patients with Hip Fractures in a Tertiary Care Teaching Hospital of Eastern India

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A B S T R A C T

Aim: *The aim of the present study was to evaluate the post-operative functional recovery in elderly patients with hip fractures and also assessing the risks of not regaining to the pre-fracture mobility level.*

Methods: *This retrospective observational cohort study examined a sample of 250 consecutive patients aged 65 and above who were admitted to the hospital with hip fractures. The study received approval from the ethics committee at our institution. The study excluded patients who met the following criteria: having a contralateral hip fracture, experiencing a pathological fracture, being bedridden prior to the occurrence of the hip fracture, dying within six months after the operation, and being alive but lacking postoperative sixth-month follow-up data. The study incorporated the remaining 200 patients.*

Results: *120 (60%) of the patients were female and 80 (40%) were male, with a mean age of 76.4±8.2 years. There were 120 (60%) intertrochanteric fractures and 80 (40%) femoral neck fractures. 104 (52%) patients underwent proximal femoral nail (PFN), 80 (40%) patients underwent hemiarthroplasty, 8 (4%) patients underwent dynamic hip screw (DHS) and 7 (2.5%) patients underwent total hip arthroplasty. 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=0.002). 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: *During the postoperative phase, a considerable increase in the deterioration of activities of daily living and restriction of mobility was observed among patients who underwent surgical intervention for hip fractures. Individuals diagnosed with intertrochanteric fractures, who undergo surgical intervention utilizing proximal femoral nail (PFN) implants, and who also present comorbidities such as cardiovascular disease or dementia, exhibit a higher propensity for functional incapacity to restore to their pre-fracture state.*

Keywords: *hip fracture surgery, walking, post-hip fracture surgery, risk factors*

INTRODUCTION

The prevalence of hip fracture has been steadily increasing, making it a significant concern from both a social and medical standpoint. This is primarily due to the detrimental effects it has on health, as well as the substantial economic burden it places on the healthcare system.[1] In the context of a progressively ageing population, hip fracture emerges as the foremost consequential consequence of osteoporosis. Projections indicate a projected surge in global hip fracture occurrences, with estimates reaching 6.3 million cases by the year 2050.[2] Hip fractures in older adults are orthopaedic injuries that primarily result from low-energy falls and are associated with a significant mortality rate.[3] The primary objectives of post-fracture treatment are to restore the patient's mobility to pre-fracture levels. Due to this rationale, individuals frequently receive medical management through surgical procedures. The objective is for patients to achieve functional independence through the implementation of intensive rehabilitation protocols following surgical intervention. One of the most significant complications that can be observed following a fracture is the patient's inability to fully restore their mobility to pre-fracture levels.[4]

It is frequently observed that older patients who experience hip fractures tend to exhibit a higher incidence of preoperative complications, and the restoration of walking capacity following surgery may pose challenges in the postoperative period.[5-9] Fractures result in substantial limitations in the capacity to autonomously engage in fundamental daily tasks, including mobility (particularly ascending stairs), dressing, and bathing.[10] A significant proportion, ranging from 25% to 75%, of individuals who were capable of independent ambulation prior to sustaining a fracture experience a decline in their functional abilities within a year following the injury. This decline manifests as either a complete dependence on others for mobility or an inability to regain the same level of autonomy that was present prior to the fracture.[11] There is a documented association between hip fracture and increased rates of co-morbidity and mortality. The mortality rate for hip fractures within one year varies between 18% and 33%.[12]

The primary determinant of functional recuperation subsequent to surgical intervention for hip fractures is the reinstatement of ambulatory capacity to levels equivalent to those observed prior to the occurrence of the fracture. The restoration of ambulatory ability is a crucial requirement for elderly individuals residing in a community-based setting. Furthermore, it is worth noting that older individuals perceive functional capacity in their everyday activities as a significant determinant of their overall health status.[13] Hence, it is worth exploring the use of walking status as a metric for assessing physical recovery after undergoing hip fracture surgery.

The aim of the present study was 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 METHODS

In this retrospective observational cohort study, which the ethics committee approved of our institution, 250 consecutive patients over the age of 65 who were admitted to the hospital with hip fractures were examined.

Patients who had a contralateral hip fracture, had a pathological fracture, were bedridden before the hip fracture occurred, died within six months after the operation, and were alive but were missing postoperative sixth-month follow-ups, were excluded from the study. The remaining 200 patients were included in the study.

Methodology

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.[14] 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.[15]

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.[16] 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 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

Table 1: Patient characteristics

Variables		**N** N%
Age (years) (mean±SD)		76.4±8.2
BMI (mean±SD)		25.5±1.5
Gender	Women	120 (60)
	Men	80 (40)
Smoking	Yes	168 (84)
	No	32 (16)
Comorbidities	Cardiovascular Diseases	
	Yes	130 (65)
	No	70 (35)
	Diabetes Mellitus	
	Yes	88 (44)
	No	112 (56)
	Respiratory Diseases	
	Yes	36 (18)
	No	164 (82)
	Renal Diseases	
	Yes	30 (15)
	No	170 (85)
	Neurological Diseases	
	Yes	10 (5)

	No	190 (95)
	Malignancy	
	Yes	30 (15)
	No	170 (85)
ASA Score	1	0
	2	24 (12)
	3	108 (54)
	4	68 (34)
Fracture Type	Intertrochanteric Fracture	120 (60)
	Collum Femoris Fracture	80 (40)
Implant Type	PFN	104 (52)
	DHS	8 (4)
	Hemiarthroplasty	80 (40)
	Total Arthroplasty	8 (4)
Waiting Time until Surgery (days) (mean±SD)		3.5±2.8
Charlson Comorbidity Index (mean±SD)		2.1±1.6
Pre-fracture mFIM score (mean±SD)		84.6±20.5
Postoperative 6th month mFIM score (mean±SD)		77.3±13.7
Pre-fracture mobility	Mobil without an aid	176 (88)
	Mobil with an aid	24 (12)
Postoperative 6th monthmobility	Mobil without an aid	130 (65)
	Mobil with an aid	30 (15)
	Immobile	40 (20)

120 (60%) of the patients were female and 80 (40%) were male, with a mean age of 76.4±8.2 years. There were 120 (60%) intertrochanteric fractures and 80 (40%) femoral neck fractures. 104 (52%) patients underwent proximal femoral nail (PFN), 80 (40%) patients underwent hemiarthroplasty, 8 (4%) 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 176 (88%) patients moved without the use of an aid and 24 (12%) 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 130 (65%) patients were ambulated without the use of an aid, 30 (15%) patients were ambulated with the use of an aid, and 40 (20%) patients were immobile.

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	100	20		0.002
Collum Femoris Fracture	76	4		
	Postoperative 6th month mobility			**p value**
Fracture Type	Mobil with an aid (N)	Mobil with an aid (N)	Immobile (N)	
Intertrochanteric Fracture	72	16	32	0.001
Collum Femoris Fracture	58	14	8	

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=0.002). 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 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:150)	Worsening ADL (n:50)	p value
Age (years) (mean±SD)		78.2±.3	82.8±6.4	<0,001
BMI (mean±SD)		25.5±1.6	2.8±1.49	0.725
Gender n(%)	Male	60 (40%)	20 (40%)	0.412
	Female	90 (60%)	30 (60%)	
Comorbidities n(%)	Cardiovascular Diseases			
	Yes	85 (56.66%)	45 (90%)	<0.001
	No	65 (43.34%)	5 (10%)	
	Diabetes Mellitus			
	Yes	66 (44%)	22 (44%)	.981
	No	84 (56%)	28 (56%)	
	Respiratory Diseases			
	Yes	28 (18.6%)	8 (16%)	0.840
	No	122 (81.34%)	42 (84%)	
	Renal Diseases			
	Yes	22 (14.66%)	8 (16%)	0.580
	No	128 (85.34%)	42 (84%)	
	Neurological Diseases			
	Yes	9 (%95,1)	2 (4%)	0.960
	No	176(%4,9)	48 (96%)	
	Malignancy			
	Yes	2 (1.34%)	8 (16%)	<0.001
	No	148 (98.66%)	42 (84%)	
ASA Score n(%)	1	0	0	0.003
	2	22 (14.66%)	2 (4%)	
	3	80 (53.34%)	28 (56%)	
	4	48 (32%)	20 (40%)	
Fracture Type n(%)	Intertrochanteric Fracture	84 (56%)	36 (72%)	0.006
	Collum Femoris Fracture	66 (44%)	15 (28%)	
Implant type n(%)	PFN	70 (46.66%)	34 (68%)	0.005
	DHS	7 (4.66%)	1 (2%)	
	Hemiarthroplasty	68 (45.34%)	12 (24%)	
	Total Arthroplasty	5 (3.33%)	3 (6%)	
Waiting Time until Surgery (days) (mean±SD)		3.18±2.54	3.30±2.44	0.550
Charlson Comorbidity Index (mean±SD)		2.04±1.50	2.20±1.48	0.414

Accordingly, the mean age of patients with worsening ADL was significantly higher. The rate of worsening of ADL was statistically higher in patients with cardiovascular disease and malignancy. In the analysis performed according to ASA scores, ASA 3 and 4 scores are seen at a higher rate in patients with worsening ADL. It was determined that patients with worsening ADL had a significantly higher waiting time for surgery. When compared according to fracture type, the rate of worsening in ADL was found to be significantly higher in patients with intertrochanteric fractures. 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. Although

there was 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.

DISCUSSION

The elderly population is experiencing a significant rise in hip fractures, which has emerged as a critical public health concern due to the global increase in average life expectancy.[17] Notwithstanding the progress made in technology and treatment methodologies, this complication continues to pose a significant challenge. The patients' lack of ability to regain mobility following a fracture result in constraints on their daily activities, thereby augmenting their reliance on their surroundings. Moreover, the lack of ability to restore mobility can give rise to significant medical complications, which in turn can result in substantial economic burdens associated with their treatment.[18]

Out of the total patient population, 120 individuals (60%) identified as female, while 80 individuals (40%) identified as male. The average age of the patients was calculated to be 76.4±8.2 years. A total of 200 fractures were observed, with 120 (60%) classified as intertrochanteric fractures and the remaining 80 (40%) categorised as femoral neck fractures. A total of 104 patients, accounting for 52% of the sample, received proximal femoral nail (PFN) treatment. Hemiarthroplasty was performed on 80 patients, representing 40% of the cohort. Dynamic hip screw (DHS) was utilised for 8 patients, constituting 4% of the population. Lastly, a total of 7 patients, equivalent to 2.5% of the group, underwent total hip arthroplasty. The analysis conducted to assess the degree of mobility revealed that 176 individuals, constituting 88% of the sample, were able to move without the assistance of any mobility aids. Conversely, 24 patients, accounting for 12% of the sample, relied on the use of aids for their mobility during the pre-fracture period. During the sixth month of postoperative follow-up, it was observed that a majority of patients, specifically 130 individuals (equivalent to 65% of the sample), were able to ambulate without the assistance of any aids. Additionally, 30 patients (15% of the sample) were observed to require the use of an aid for ambulation, while 40 patients (20% of the sample) remained immobile. According to a meta-analysis conducted by Bertram et al. (2019), the study revealed that 42% of elderly individuals who experienced hip fractures were unable to restore their mobility to pre-fracture levels, while 35% were unable to walk without assistance following the fracture.[19] The study conducted by Mariconda et al. (2020) revealed that a mere 57% of the patients were able to regain their pre-fracture functional state, while 13% experienced immobility within the initial year following the fracture. The duration required for patients to resume their regular daily activities following a fracture typically ranges from 4 to 11 months. However, in the majority of cases, this timeframe primarily encompasses the initial 6 months post-surgery.[20,21]

In the present analysis, an investigation was conducted to examine the association between fracture type and pre-fracture mobility. The findings revealed that individuals with intertrochanteric fractures were more prevalent among those who exhibited impaired mobility and relied on assistive devices for movement ($p=0.002$). The analysis of the association between fracture type and mobility at the sixth month postoperative period revealed that patients with intertrochanteric fractures had a higher incidence of using an aid for mobility or being immobile compared to patients with collum femoris fractures ($p=0.001$). Based on available literature, empirical evidence suggests that the initial four months following a fracture represent a particularly critical phase characterised by heightened healing activity. Subsequently, the recuperation of activities associated with daily living exhibits a notably sluggish trajectory commencing from the sixth month onward.[22,23]

Consequently, there was a statistically significant difference in the average age of patients experiencing a decline in activities of daily living (ADL). Patients diagnosed with cardiovascular disease and malignancy exhibited a statistically significant increase in the rate of decline in activities of daily living (ADL). The analysis conducted based on ASA scores reveals a higher prevalence of ASA 3 and 4 scores among patients experiencing a decline in activities of daily living (ADL). A correlation was established between patients experiencing a decline in activities of daily living (ADL) and a notable increase in the duration of their surgical waiting period. A notable disparity in the rate of deterioration in activities of daily living (ADL) was observed between patients with intertrochanteric fractures and those with other

types of fractures, indicating a significantly higher rate of decline in ADL among the former group. Furthermore, the study conducted to compare different implant types that required surgical intervention revealed a notable disparity in the rate of deterioration between patients utilising the PFN implant and those utilising alternative implant types. While the statistical analysis did not reveal a significant correlation between the change in Activities of Daily Living (ADL) and Charlson Comorbidity Index scores, it is worth noting that the average Charlson Comorbidity Index score tends to be higher among patients experiencing a decline in ADL. However, the observed distinction does not exhibit statistical significance. Research has indicated that individuals who experience impaired performance in their daily activities prior to sustaining a fracture are more likely to exhibit immobility during the postoperative phase.[15,20] This study aimed to investigate the risk factors associated with the deterioration of activities of daily living in patients during the postoperative period. The analyses conducted revealed that advanced age, the presence of cardiovascular disease or malignancy, and a high ASA score were associated with a decline in daily living activities and restricted mobility during the postoperative period. Close monitoring and treatment of patients with risk factors such as cardiovascular disease or malignancy can be particularly crucial in achieving positive outcomes. Furthermore, conducting a thorough assessment of patients exhibiting these risk factors during the postoperative phase, and adopting a more cautious and attentive approach towards rehabilitation protocols, can contribute to mitigating the potential adverse outcomes that may arise. In the study of Ravikumar et al[24], 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.[25] The present study examined the impact of different fracture and implant types on individuals' ability to perform daily activities and their mobility during the postoperative phase. In the postoperative period, a higher prevalence of limitations in activities of daily living was observed among patients who underwent surgery for intertrochanteric fractures and utilized proximal femoral nail (PFN) fixation. Furthermore, it was noted that the incidence of immobility was greater in patients diagnosed with intertrochanteric fractures compared to those with collum femoris fractures. The surgical approach commonly employed for patients diagnosed with intertrochanteric fractures primarily involves osteosynthesis, with the preferred implant being the proximal femoral nail (PFN). In the early postoperative period, it is recommended to refrain from placing full weight on the fractured side in these patients. Nevertheless, it is important to note that there exist studies which posit that the distribution of hip fractures is not uniformly distributed. Furthermore, these studies suggest that the mobility levels prior to the occurrence of a fracture can impact the type of fracture sustained. Consequently, it is argued that comparing fracture type with postoperative mobility may not be appropriate.[20,25]

CONCLUSION

During the postoperative phase, a considerable incidence of deterioration in activities of daily living and restricted mobility was observed among patients who underwent surgical intervention for hip fractures. Individuals with intertrochanteric fractures who undergo surgery with proximal femoral nail (PFN) implants, as well as those with comorbidities such as cardiovascular disease or dementia, exhibit a higher likelihood of experiencing functional limitations preventing them from returning to their pre-fracture level of functioning. Based on the findings of this study, it can be inferred that closely monitoring patients during the postoperative period, facilitating their involvement in rehabilitation programmes, and educating their relatives about postoperative disease rehabilitation will yield favourable outcomes.

LIMITATION

Choice of implants and surgery were decided as per the fracture characteristics and solely at the discretion of the surgeons. Hence, varied selection of implants and procedures are reflected in the study.

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