Functional Recovery After Hip Fracture in the Subacute Setting

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Abstract *Objective:* To measure functional recovery after hip fracture in the subacute setting. *Background:* There are over 340,000 hip fractures that occur in the United States annually. Three out of five hospitalizations attributable to injury among persons over 75 were for fractures. Greater than 50% were hip fractures. *Purpose:* The purpose of this study is to describe the functional recovery after hip fracture in the subacute setting utilizing performance-based measures (PBMs). *Method:* This is a prospective observational cohort. *Data analysis:* Descriptive statistics were used for baseline characteristics. Repeated measures analysis using a Bonferroni correction was utilized to compare admission and discharge PBM scores. *Results:* Eighty residents were enrolled in the study, of which seven were withdrawn because of medical complications and one subject died within 1 week of admission. Data were analyzed for 72 subjects. There were 59 women and 13 men ranging in age from 63–99. Mean age was 85.3. The patients' profiles were as follows: 53% lived alone, 63% were Medicare recipients, 50% used an assistive device before hip fracture, 46% sustained a femoral neck fracture, 57% underwent a bipolar hemiarthroplasty, 90% received

epidural anesthesia, and 90% had a weight-bearing status as weight-bearing was tolerated.

The PBM results are as follows:

Mean test score of the Tinetti gait and balance, timed up and go (TUG), and 6-min walk (6MW) test, mean (SD).

	6MW (Mean sd)	TUG (sec)	Tinetti Gait	Tinetti Balance	Total Tinetti Gait/Balance
Admission (10.2 days)	63.0 (88.6)	6.9.5 (43.9)	2.6 (2.3)	3.5 (3.0)	5.7 (4.9)
Discharge (32.5 days)	499.2 (247.4)	32.8 (18.7)	7.2 (2.3)	9.9 (2.6)	16.8 (4.6)
<i>p</i> value	0.001*	0.001*	0.001*	0.001*	0.001*

*Statistically significant at $p < 0.05$

Conclusion: There was a significant improvement between admission and discharge TUG test, Tinetti gait and balance test, and 6MW test scores in patients who underwent surgical repair of a hip fracture after a fall.

Key words performance-based measure · hip fractures · Tinetti gait and balance · timed up and go · 6MW test

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Introduction

Hip fractures are associated with a rising burden of morbidity and mortality in the United States. In 2000 the hip fracture rate per 100,000 was 525.7 for men and 1,198.00 for women over 65. More than 340,000 hospitalizations because of hip fracture have been reported (<http://www.cdc.gov>). For those individuals who have sustained a hip fracture, returning to their prefracture functional status is the primary goal.

It is estimated that up to 50% of patients who sustain a hip fracture lose their ability to function independently,

experience a reduction in mobility, and do not return to their previous level of premorbid function [5, 22, 26].

The shifting of the rehabilitation burden from the acute care facility to the skilled nursing facility (SNF) makes physical therapy management both daunting and challenging. The type of surgical intervention after hip fracture may vary, however, the postoperative goals are the same: (1) to restore function and (2) to rehabilitate the patient to their highest level of function [10, 14, 20].

It is crucial for members of the health care team to understand the trajectory of functional disability that occurs after hip fracture as the locus of rehabilitation shifts from the acute care setting to the subacute setting.

The purpose of this study is to describe functional recovery after hip fracture in the subacute setting, utilizing performance-based measures (PBMs) and specific functional milestones (FMs).

Materials and methods

Subjects and setting

This prospective study used an observational, longitudinal design. The study was conducted in a 409-bed SNF that provides short-term rehabilitation. Eligible subjects included patients requiring short-term rehabilitation after surgical repair of an intertrochanteric, subtrochanteric, or femoral neck fracture after a fall who were (1) 60 years of age or older, (2) living in the community, (3) ambulatory before hip fracture, and (4) able to follow one-step commands in English or Spanish. Exclusion criteria were as follows: (1) diagnosis of a pathologic hip fracture or a fracture from something other than a fall, (2) nonambulatory before hip fracture, (3) residing in a SNF before fracture, (4) under 60 years of age, (5) unable to follow one-step commands in English or Spanish, and (6) with a concomitant upper extremity fracture.

From August 2002 to May 2004, there were 137 patients admitted who sustained a hip fracture. Eighty patients met the inclusion criteria and enrolled in the study. Of these 80 patients, eight were dropped from the study after enrollment because of the following reasons. Six patients were transferred back to the hospital for medical complications between 48 and 96 hours after admission to the nursing home and did not return to the nursing home; one resident sustained a fall in the nursing home and refractured her hip within 1 week of admission, and one resident died within 1 week of admission.

Data collection

Baseline demographic characteristics were collected from the patient, proxy, and medical record. Comorbidities were extracted from the medical record, and the Charlson comorbidity index (CCI) was calculated from this extraction. The CCI is a method of classifying disease severity using a weighted index [2].

Rehabilitation program

On admission to the SNF and weekly thereafter, the subjects' functional ability were tested utilizing the following PBMs: the timed up and go (TUG) test [27], functional reach (FR) test [3], Tinetti gait and balance assessment tool [28], and the 6-min walk (6MW) test [8].

Reliability and validity of these PBMs were previously reported [3, 8, 27, 28]. All patients received 30–45 min of daily physical and occupational therapy, consisting of therapeutic exercise, gait, balance, and ADL retraining.

Data analysis

A power study predetermined that a sample size of 80 would be required to yield a power of greater than 0.90. Utilizing the five PBMs, the alpha for each is 0.01. Statistical analysis was performed using the KWIKSTAT statistical software package. All continuous and categorical demographic data were recorded using standard methods. Nominal data on patient characteristics (e.g., comorbidity and ambulatory device) were recorded as either present or absent. Dichotomous data were coded "0" for absent and "1" present. Descriptive statistics were used for baseline characteristics and to identify specific levels of gait and balance, which were attained at various points in time during functional recovery.

Differences between the achievement of FM and preoperative functional status were explored using chi-square analysis. Linear regression was utilized to examine the relationship between explanatory variables and the PBM discharge scores.

The association between admission and discharge PBM scores were analyzed using Pearson's correlation coefficient and determined $r > 0.4$ to be clinically important. Covariate-adjusted correlation coefficients were used to determine the relationship between age, comorbidity, and functional recovery. Regression and ANOVA were used to build models relating the demographic and admission scores to the outcomes.

Results

Study sample and dropout

Eighty subjects were enrolled in this study. Eight were withdrawn including seven who were transferred back to the hospital within 72 hours of admission because of medical complications and one who died within a week of admission. A total of 72 subjects participated.

Baseline characteristics

There were 13 men and 59 women ranging in age from 63 to 99. Baseline clinical characteristics, personal factors, surgical factors, and discharge disposition are described in Table 1. Frequency distribution of comorbidities were as follows: 78% ($n=56$) with cardiac disease, 31% ($n=22$)

Table 1 Baseline characteristics

	Mean (SD)	Range
Personal factors		
Height (cm)	64 (4)	56–74
Weight (kg)	135 (30)	72–208
BMI	22.8 (3.8)	14–33
MMSE	22.6 (7.3)	0–30
CCI	1.2 (1.1)	0–4
Age	85.3 (7.3)	63–99
Comorbidities	6.5 (3)	1–12
	Number of Patients	Percent
Gender		
Male	13	18
Female	59	82
Prefracture ambulatory status		
Independent: no device	36	50
Independent: cane	23	32
Independent: walker	13	18
Prefracture living status		
Alone	38	53
Family	15	21
Assisted living	4	5
Home care <8 h	9	12.5
Home care 24 h	6	8
Prefracture ADL status		
Independent	75	75
Dependent	25	25
Elementary school	6	8
Junior high school	1	1
High school	30	42
College	13	18
Graduate degree	4	6
Marital status		
Single	7	10
Married	18	50
Widowed	36	50
Divorced	2	3
Surgical factors		
Side of fracture		
Right	38	53
Left	34	47
Type of fracture		
Femoral neck	33	46
Intertrochanteric	32	44
Subtrochanteric	7	10
Surgical procedure		
ORIF	28	39
Bipolar hemiarthroplasty	41	57
THA	3	4
Postoperative weight bearing		
Full weight bearing	65	90
Partial weight bearing	3	4
Toe-touch weight bearing	3	4
Nonweight bearing	1	1
Hospital complications		
Pressure ulcer	12	17
Cardiac (MI, CHF bradycardia)	6	8
Atrial fibrillation	4	5
Acute respiratory distress	3	4
Pneumonia	2	3
Pulmonary embolism	2	3
Deep vein thrombosis	3	4
Gastrointestinal bleed	1	1
Anemia	1	1
Bleed into hip	1	1

Table 1 Continued

Hypotension	1	1
CVA	1	1
Urinary tract infection	6	8
Discharge disposition		
Home with home care	50	69
Nursing home	11	15
Assisted living with home care	11	15

ORIF = open reduction internal fixation, THA = total hip arthroplasty, CHF = congestive heart failure, MI = myocardial infarction

with visual impairment, 26% ($n=19$) with depression, 24% ($n=17$) with previous neurological event, 19% ($n=14$) with previous fracture, 15% ($n=11$) with pulmonary disease, and 13% ($n=9$) with osteoporosis.

Disposition postnursing home

The mean number of days subjects were discharged from the nursing home was 32 days or 4.5 weeks. Sixty-one (85%) of the 72 subjects returned home with home care services consisting of a home health aide to assist in basic activities of daily living and physical therapy services to improve mobility. Eleven subjects (15%) admitted for short-term rehabilitation did not return home and remained in the nursing home for long-term care.

Changes in functional status: device use

All 72 subjects had been ambulatory before their hip fracture. Thirty-six (50%) ambulated without an assistive device. Twenty-three (32%) ambulated with a cane and 13 (18%) ambulated using a walker. Of the 36 subjects who ambulated without an assistive device prefracture at discharge, only three (4%) were discharged without using an assistive device. Of the remaining 33 subjects, 9 (25%) were discharged using a cane, and 24 (67%) were discharged using a walker. Of the 23 subjects who ambulated with a cane before sustaining a hip fracture, 4 (17%) were discharged using a cane whereas 19 (83%) were discharged using a walker. Thirteen subjects ambulated with a walker before their hip fracture. Eleven subjects (85%) were discharged using a walker. Two (2%) of these patients were discharged on a cane.

Change in functional status: ADLs

Thirty seven (51%) were independent in instrumental ADLs before sustaining a hip fracture whereas 54 (75%) were independent in basic ADLs, (walking, toilet transfers, and upper and lower body dressing) before their hip fracture. At discharge, 37 (51%) were independent in toilet transfers, 51 (94%) were independent in upper body dressing, and 28 ($n=54\%$) were independent in lower body dressing.

Achievement of functional milestones

At the time of discharge, 29 (40%) of the 72 subjects were able to ambulate with a walker independently (WU). Thirty-four (47%) achieved transfer unassisted (TU). Twenty-six (36%) achieved cane-assisted ambulation (CA). Five (7%) achieved cane-unassisted ambulation (CU). Forty-four (61%) could climb stairs with assistance (STA) and one (1%) could climb stairs unassisted (STU).

There was a negative correlation between age and the number of weeks to achieve each of the FM; however, the cane-unassisted FM was the only milestone that reached significance ($p=0.03$).

The number of weeks to achieve WU, TU, CA, and STA were compared in femoral neck and intertrochanteric fractures. All FM were achieved 2 weeks sooner in those subjects who sustained a femoral neck fracture (WU [$p<0.001$] TU [$p<0.001$] CA [$p<0.001$], and STA [$p<0.001$]). The postoperative week of achievement of WU, TU, CA, CU, STA, and STU were examined. Forty percent ($n=32$) achieved WU. Fifty-one percent ($n=37$) achieved TU. Forty-two percent ($n=30$) achieved CA. Eleven percent ($n=8$) achieved CU. Seventy-two percent ($n=52$) achieved STA and only 1% ($n=1$) achieved STU.

Changes in admission and discharge performance-based measures

The study population improved significantly in physical functioning as demonstrated by the improvement from the admission to discharge scores on the 6MW test ($p<0.001$), TUG test ($p<0.001$) Tinetti gait ($p<0.001$), Tinetti balance ($p<0.001$), and total Tinetti score ($p<0.001$) (Table 2).

The association between the PBMs scores at discharge and time elapsed since fracture were measured. There was no association between hospital length of stay and any of the discharge PBM scores, nor any association between subacute length of stay and PBM scores.

The associations between admission and discharge PBM scores were explored. There was a fair to good correlation between admission and discharge 6MW test scores ($p=0.004$), admission and discharge TUG scores ($p<0.001$), admission and discharge Tinetti gait scores ($p<0.001$), admission and discharge Tinetti balance scores ($p<0.001$), and combined Tinetti gait and balance admission and discharge scores ($p<0.001$). The number of comorbidities was

not correlated with the discharge scores on the 6MW test ($p=0.9$), TUG test ($p=0.6$), Tinetti Gait score ($p=0.7$), and balance test score ($p=0.5$). When the severity of comorbidities was measured utilizing the CCI, a relationship between comorbidity scores and PBMs were found. There was a positive correlation between the CCI and the discharge TUG score ($r=0.27$) and a negative correlation between the CCI and the discharge 6MW test score ($r=-0.29$).

Age was negatively correlated with the discharge 6MW test score ($p=0.04$), Tinetti gait score ($p=0.01$), and Tinetti balance score ($p<0.03$). To calculate the odds ratio for the determination of the recovery of the ability to achieve the FM, the influence exerted by each PBM (predictor variable) was studied using bivariate analysis. Predictors with p values less than or equal to 0.05 were selected as significant and used to calculate odds ratio (Table 3). The stairs unassisted FM was only achieved by one subject, and the cane unassisted FM was achieved by five subjects, and therefore not utilized in the odds ratio calculation.

The significant predictors for the achievement of the WU FM were the ability to ambulate on admission, OR=5.6, $p=0.008$; the ability to ambulate greater than 50 ft on the admission 6MW test, OR=3.4, $p=0.03$; admission Tinetti gait score greater than or equal to 5, OR=4.9, $p=0.004$; admission Tinetti balance score greater than or equal to 5, OR=3.6, $p=0.02$. a combined admission Tinetti gait and balance score greater than or equal to 6/28, OR=3.9, $p=0.006$; and the ability to score less than 60 s on the first TUG test, OR 6.3, $p=0.001$.

The significant predictors for the achievement of the TU FM were the ability to ambulate on admission, OR=8.3, $p<.001$; the ability to ambulate greater than 50 ft on the admission 6MW, OR=12.6, $p<.001$; admission Tinetti gait score greater than or equal to 5, OR 18.4, $p<0.001$, admission Tinetti balance score greater than or equal to 5 OR 10.0, $p<0.001$; a combined admission Tinetti gait and balance score greater than or equal to 6/28, OR=4.5, $p=0.002$; and the ability to score less than 60 s on the first TUG test, OR 2.9, $p<.001$.

The significant predictors for the achievement of the CA FM were the ability to ambulate on admission, OR=3.4, $p=0.047$; the ability to ambulate greater than 50 ft on admission, OR=2.9, $p=0.05$; admission Tinetti gait score greater than or equal to 5, OR=4.7, $p=0.01$, admission Tinetti balance score greater than or equal to 5 OR=4.4, $p<0.006$; a combined admission Tinetti gait and balance score greater

Table 2 Comparison between admission and discharge PBM scores, mean (SD)

	6MW (ft)	TUG (sec)	Tinetti Gait	Tinetti Balance	Total Tinetti Gait/Balance
Admission	63.0 (88.6)	69.5 (43.9)	2.6 (2.3)	3.5 (3.0)	5.7 (4.9)
Discharge	499.2 (247.4)	32.8 (18.7)	7.2 (2.3)	9.9 (2.6)	16.8 (4.6)
p value	0.001*	0.001*	0.001*	0.001*	0.001*

6MW = 6-min walk, TUG = timed up and go

*Statistically significant at $p<0.05$

Table 3 Significant predictive factors for recovery of the ability to achieve FMs

Factor	Odds ratio	<i>p</i> Value
Significant predictive factors for recovery of the ability to walk unassisted at discharge		
Ability to ambulate >50 ft on admission	3.4	0.03
Admission Tinetti gait score >5	4.9	0.004
Admission Tinetti balance score >5	3.6	0.02
Admission Tinetti gait and balance score >6/28	3.9	0.006
Admission TUG test score <60 s	6.3	0.001
Able to walk on admission	5.6	0.008
Significant predictive factors for recovery of the ability to transfer unassisted at discharge		
Ability to ambulate 50 ft on admission	12.6	<0.001
Admission Tinetti gait score >5	18.4	<0.001
Admission Tinetti balance score >5	10.0	<0.001
Admission Tinetti gait and balance score >6	6.7	<0.001
Admission TUG test score <60 s	2.9	<0.001
Able to walk on admission	8.3	<0.001
Significant predictive factors for recovery of the ability to perform cane assisted FM discharge		
Ability to ambulate >50 ft on admission	2.9	0.05
Admission Tinetti gait score >5	4.7	0.01
Admission Tinetti Balance score >5	4.4	0.006
Admission Tinetti gait and balance score >6	3.0	0.03
Admission TUG test score <60 s	2.9	0.03
Able to walk on admission	3.4	0.05
Significant predictive factors for recovery of the ability to perform stairs assisted FM at discharge		
Admission Tinetti gait score >3	4.3	0.02
Admission Tinetti balance score >5	5.2	0.03
Admission Tinetti gait and balance score >6	3.2	0.04

than or equal to 6/28, OR=3.3, $p=0.02$; the ability to score less than 60 s on the first TUG, OR 2.9, $p=0.03$.

The significant predictors for the achievement of the STA was an admission Tinetti gait score greater than 3, OR=4.3, $p=0.02$; Tinetti Balance score greater than or equal to 5, OR=5.2, $p=0.03$, and combined admission Tinetti gait and balance score greater than or equal to 6/28, OR=6.4, $p=0.002$.

Discussion

Standards of care for patients with hip fracture have dramatically changed; patients no longer remain hospitalized for 21 days and discharged directly home as they had been two decades ago [12]. According to the National Center for Health Statistics at the Center for Disease Control, the average hospital length of stay after hip fracture in 2003 was approximately 6.5 days. Over 80% of patients are discharged to subacute facilities, either rehabilitation centers or nursing homes that provide short-term rehabilitation [9, 25]. We were able to identify five factors that influenced functional recovery after hip fracture in the subacute setting: age, type of fracture, prefracture ADL, walking ability, and cognitive function. The younger patient who sustained a femoral neck fracture, who was independent in basic ADLs and ambulated without a device, and who had normal cognitive function achieved the FM sooner and scored higher on the PBM than patients who were older, had lower cognitive function, required assistance with ADL prefracture, walked with a device, and sustained an intertrochanteric fracture.

We found that the number of comorbidities did not influence functional recovery in the time frame for achievement of FM, or influence the score of any of the PBMs or subacute length of stay. In our study, the mean number of comorbidities was 6.5 with a range of 1–12. This is more than three times the number of comorbidities reported by Koval et al. [15], and Jette et al. [12], but consistent with Mossey et al. [26] who reported a mean of 6.3 comorbidities.

When we categorized the comorbidities according to severity utilizing the CCI. A relationship between comorbidity scores and functional recovery was found. The mean CCI was 1.2, indicating that our subjects were relatively healthy. Our CCI was similar to the mean CCI score reported by Johnson and Binder in similar cohorts of patients [1, 13]. Those with higher scores (greater disease severity) ambulated a significantly less distance and performed worse on the TUG test.

It was demonstrated that older patients scored significantly lower on the PBMs, took longer to achieve the FMs, and had a lower percentage of achievement of the FMs than their younger counterparts. Although older patients took longer to achieve the FM and scored significantly lower than younger patients, when admission and discharge PBM scores of older patients were compared there was a significant improvement.

The literature on hip fracture is replete with descriptions of relevant functional outcome data following hip fracture in the acute care setting [7] and return to community at 3, 6, and 12 months postoperatively [12, 16, 20, 24], including survival statistics at 2 and 5 years postoperatively [21–24, 26]. However, there is little documented evidence regarding functional recovery after

hip fracture in the subacute setting utilizing objective measures of physical performance such as the 6MW test, TUG test, and Tinetti gait and balance test. The postoperative day of achievement of specific FM were reported in the acute care setting [6]. Nowhere in the literature have the same FMs been reported. We chose to report the postoperative week of achievement as it was our standard of care for over a decade.

We were able to describe functional recovery after hip fracture in the subacute setting in two ways. First, by the postoperative week of achievement of six FMs, WU, TU, CA, CU, STA, and STU, and second by utilizing PBMs. Table 4 represents the TUG and 6MW from postoperative week 1 to 12.

In 2001 a national consensus conference on improving the continuum of care for patients with hip fracture was held in Washington DC. It was recommended that guidelines for patients discharged from an acute care setting to a subacute rehabilitation unit or to a SNF to home should be based on the attainment of specific FM given the financial drivers to achieve the shortest length of stay possible [25]. It was recognized that the evidence for these guidelines was lacking.

This study prospectively collected data to track the functional recovery of patients who sustained a hip fracture utilizing specific FM and PBMs in a cohort of patients who were discharged from the hospital to a long-term care facility that provides short-term rehabilitation. The FM chosen were those that were previously reported in acute care after total hip arthroplasty (THA) and were necessary to perform basic ADL [18]. It was recognized that there is an immediate decline in physical function after hip fracture and it was reported that up to 50% of patients do not achieve their prefracture level of function at 1 year postfracture [4, 23]. These results were comparable to those of Laskin et al. [19] who reported that majority of the 236 patients who underwent repair of an intertrochanteric fracture did not achieve their prefracture level of function. It was documented that admission to nursing homes after hip fracture ranges from 15–50%. Similar to the findings reported by Jette et al. [12], 15% of our subjects who were admitted for short-term rehabilitation

did not return home and remained in the nursing home for long-term care.

Discharge disposition after an acute care hospital stay is in part driven by medical insurance, regardless of level of function achieved at hospital discharge. After an acute care hospital stay, patients may be discharged directly home to receive home physical therapy, or outpatient physical therapy, or may be transferred to an acute rehabilitation center or a subacute facility that provides short-term rehabilitation. The PBMs chosen for this study may be utilized in any setting and do not require special equipment other than a stopwatch [11].

The average patient profile for this study was a female who is a Medicare recipient, living alone, underwent a bipolar hemiarthroplasty after a femoral neck fracture, did not have any weight-bearing restrictions, and was able to ambulate during the physical therapy evaluation on admission to the nursing home. On admission, the distance walked during the 6MW test and the time it took to perform the TUG test at 2 weeks postoperatively using a walker was 146 ft and 67 sec, respectively. At 4 weeks postoperatively the scores were 264 ft and 53 sec, respectively.

In the subacute setting, it is necessary to complete the physical therapy initial evaluation within 24 h of admission, which includes documenting short- and long-term goals. Both short and long-term goals must be functional in nature and objective. Typically short-term goals are weekly or biweekly, and long-term goals may be 8–12 weeks. It is often difficult to accurately predict a long-term goal such as the number of feet the patient will be able to walk during the 6MW test at discharge or number of seconds the patient will take to complete the TUG test after a 30-min initial evaluation when the patient may or may not be able to ambulate. It is mandated by Medicare that short- and long-term goals, including time frames for achievement of goals, and a plan of care be established upon completion of the initial evaluation. The results of this study give therapists targets to aim for when writing short- and long-term goals.

The baseline demographics of this study's patient population are similar to those in previous studies reporting on functional recovery after hip fracture [4, 17, 22, 26].

Table 4 Six-min walk test and TUG test scores by postoperative week

Postoperative Week	6MW Test				TUG Test			
	N	Mean (ft)	SD	Range	N	Mean (sec)	SD	Range
1	14	67.2	87.1	4–300	1	111		
2	41	146.7	176.6	2–272	25	67.8	49.9	9–231
3	60	221.3	178.5	2–700	46	56.6	42.2	9–233
4	61	264.6	178.5	10–815	55	53.5	33.4	13–188
5	58	330.3	253.6	6–1500	55	43.9	27.0	8–125
6	43	290.6	174.4	20–800	43	45.3	24.1	14–110
7	29	287.7	168.3	40–538	32	40.8	19.6	12–85
8	20	306.4	179.7	58–600	22	39.6	20.0	10–91
12	7	286.3	118.6	115–400	7	42.5	20.2	20–83

The subjects who were at a higher level of function pre-operatively (those ambulating with no device or a cane) significantly improved in terms of PBM scores, but declined in function from their premorbid ambulation status.

At discharge, only three subjects who ambulated without a device before sustaining a hip fracture returned to their premorbid ambulation status. These three were the only subjects able to perform the FR test as described by Duncan. All other subjects who were discharged ambulating with a device were unable to stand without a device and perform the FR test as described, therefore the FR test was eliminated from our analysis.

Subjects who were able to ambulate on admission were 5.6 times more likely to achieve WU FM than those subjects who were only able to stand without taking steps. For analysis, we grouped ambulation status into four categories, the ability and inability to ambulate (take steps) on admission, and the ability and inability to ambulate > 50 ft during the 6MW test. The Tinetti gait and balance scores were analyzed independently and in combination. The significant predictors of achieving WU, TU, and CA FM were the ability to ambulate, the ability to ambulate greater than 50 ft during the 6MW test, a Tinetti gait score greater than or equal to 5, Tinetti balance score greater than or equal to 5, a combined Tinetti gait and balance score greater than or equal to 6, and a TUG test score of <60 sec on initial admission assessment. The significant predictors of achieving the STA FM were a Tinetti gait score of greater than or equal to 3, Tinetti balance score greater than or equal to 5, and a combined Tinetti gait and balance score greater than or equal to 6. It was demonstrated that the PBMs utilized for this patient population were sensitive to change over time.

The mean admission Tinetti gait score was 2.6 compared to a discharge score of 7.2. Although there were significant improvements in the scores, we chose not to compare the weekly scores because there was such a small incremental change. Similarly, using the Tinetti admission balance score, the mean was 3.5 whereas the discharge score only increased to 9.9. The mean Tinetti gait and balance score at discharge was less than 19/28, indicating a high fall risk, and the mean TUG test was greater than 32 s, indicating dependence in ADLs and increased fall risk. All subjects who were discharged home ($n=61$) were referred for physical therapy services through various home health care agencies.

We have successfully demonstrated what the expected rate of recovery is utilizing specific FM and PBMs in the subacute setting.

Limitations

This study represented a specific patient population who were transferred to a nursing home for short-term rehabilitation after an acute care hospitalization for surgical intervention after a hip fracture. There are multiple factors driving the decision to discharge patients to a nursing home for short-term rehabilitation after hip fracture. This study represents patients discharged to a nursing home for short-

term rehabilitation and may not be representative of the general subacute hip fracture population, discharged to rehabilitation centers or to home after hospitalization.

There could have been recall bias pertaining to patients' recollection of their prefracture functional status. The reliance on family and proxy responses when the patient was unable to respond could pose concern to the accuracy of their responses.

We chose not to analyze the change in PBM scores because it was felt that patients who had high scores on admission had less room to improve than those who had lower scores on admission. At discharge all subjects who required an assistive device to ambulate were able to perform the FR test using one upper extremity for support but unable to perform the FR without upper extremity support as described by Duncan.

We were unable to control for the hour that subjects arrived in our facility on the day of admission. Therefore, unlike the weekly assessments, admission assessments were not performed at the same time for each resident.

Conclusion

This is the first study that measures functional recovery after hip fracture in a subacute setting utilizing PBMs and specific FMs. Objective measures of physical performance utilizing the TUG, Tinetti gait and balance, and the 6MW test scores significantly improved from admission to discharge in patients admitted to a long-term care facility for short-term rehabilitation after surgical repair of a hip fracture because of a mechanical fall.

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