

Ambulation Outcomes After Hip Fracture

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Ability to achieve prefracture ambulation status after hip fracture and subsequent rehabilitation was studied in 70 inpatients in a geriatric rehabilitation center. The association of 11 factors with the ability to achieve prefracture ambulation status was measured by chi-square analysis. The 11 factors were age, sex, number of visits to physical therapy, presence of pain in the affected extremity, leg-length difference of 0.5 in or more, side of fracture, motivation, orientation, alertness, previous leg fracture, and surgical repair with a prosthetic replacement or fracture pinning. Forty percent of the entire group returned to their prefracture level of ambulation by the time of discharge from physical therapy. Of the 11 variables studied, only previous leg fracture and the number of visits to physical therapy showed a significant association with the patient's ability to reach prefracture ambulation status.

Key Words: *Aged, Hip fractures, Rehabilitation.*

The effective delivery of medical care is one of many reasons for the great expansion of our geriatric population. One of the results of this expansion is an increase in older patients with chronic conditions such as hip fractures.¹ Surgical and medical expertise in treating hip conditions is improving, but failure to recover functional skills is still encountered in an unacceptably high number of cases.¹ One of these skills is ambulation.

The challenge of hip-fracture rehabilitation is great. Hip fractures rank only 55th in frequency of discharge diagnoses from acute-care hospitals; however, they rank 10th in total patient days of hospital care. In one series, 70 percent of all patients over 65 admitted to an orthopedic service had hip fractures.²

The problem of hip fractures is more common in women than in men. One in 20 women reaching the age of 65 will fracture the proximal end of the femur, and 2 percent of the women and 0.6 percent of the men over age 85 will fracture a hip each year.³

Previous studies concerned with the outcome of hip-fracture treatment were based on reduction of the fracture, devices used for fixation or replacement, type of postoperative regimen, other diagnoses, degree of osteoporosis, and short- and long-term survival after hip

fracture.^{1,4-9} Other studies have emphasized the importance of reducing the mortality rate and returning the patient as quickly as possible to an ambulatory status.^{2,4,10-12} Few studies have examined the functional results after a rehabilitation program.^{10,12} No study was found that examined the variables of the number of visits to physical therapy, leg-length differences, motivation, orientation, alertness, or pain in the fractured leg.

The purposes of this descriptive study were as follows: 1) to determine what percentage of a group of geriatric patients sustaining hip fracture and undergoing rehabilitation were able to reach preinjury level of ambulation at time of discharge from physical therapy, 2) to determine the distribution of variables present at discharge in those reaching prefracture ambulation status and those not reaching preambulation status, and 3) to determine if an association existed between one or more of these variables and the ability of patients to reach their preoperative ambulatory status at discharge. The criterion for successfully reaching prefracture ambulation status was that at the time of discharge from physical therapy, the patient had to be walking at least at the same functional level as before the fracture. For instance, if the patient was walking with a standard cane before the fracture and at the time of discharge from physical therapy needed a quad-cane, the patient did not meet the criterion. Distance or velocity walked were not assessed for the study.

METHOD

Subjects

The study included 70 patients who were referred to Madonna Professional Care Center for rehabilitation between April 1, 1979 and April 1, 1980. The center is a 252-bed rehabilitation and long-term care facility specializing in geriatric rehabilitation of neurological and orthopedic patients. Levels of care include 33 hospital beds, 57 short-term restorative care beds and 162 long-term care beds. Subjects did not sign informed consent slips. The protocol for the study was approved by the center's Medical Care Evaluation Committee.

Patients in this study had been discharged from acute-care hospitals to the short-term restorative care areas of the rehabilitation center. These patients had sustained hip fractures that were surgically repaired either by pinning or prosthetic replacement. Patients who died, became seriously ill, refractured the hip, or transferred to another facility before beginning gait training were excluded from the study.

Procedure

Prefracture ambulation status was determined by the patient, family history, medical records, or social worker. One of six therapists treating the patient at the time of discharge from physical therapy determined postrehabilitation ambulation status. Generally, the same therapist assessed and treated the patient. No attempt was made to follow the patients after discharge.

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This article was submitted December 6, 1982; was with the author for revision 24 weeks; and was accepted October 5, 1983.

TABLE 1

Comparisons of Variables for Patients Who Reached Prefracture Ambulatory Status and Those Who Did Not

Reached Status	Variables																	
	Sex		Surgical Technique		Side of Fracture		Motivated		Oriented		Alert		Leg Pain		Leg-Length Difference		Previous Leg Fracture	
	(M)	(F)	(Pin)	(Prosthesis)	(R)	(L)	(Yes)	(No)	(Yes)	(No)	(Yes)	(No)	(Yes)	(No)	(Yes)	(No)	(Yes)	(No)
Did (n = 28)	9	19	15	13	15	13	17	11	19	9	26	2	15	13	6	22	13	15 ^a
Did not (n = 42)	6	36	23	19	20	22	29	13	29	13	38	4	23	19	18	24	7	35
TOTAL (N = 70)	15	55	38	32	35	35	46	24	48	22	64	6	38	32	24	46	20	50

^a $\chi^2 = 7.292$; $df = 1$; $p < .01$.

Before the study began, the six therapists defined the variables to be examined. For all the study patients, the variables were age, sex, number of visits to physical therapy, presence of pain in the affected extremity, leg-length difference of 0.5 in or more, side of fracture, motivation, orientation, alertness, previous leg fracture, and surgical repair with a prosthetic replacement or fracture pinning.

The presence of pain in the affected extremity was determined by the physical therapist treating the patient. Pain was rated as present if the patient complained of at least a moderate level of pain over the course of the rehabilitation period. Pain could be present with exercise, ambulation, or both activities. Moderate pain was defined as pain that interfered with activity, such as completion of hip abduction or flexion strengthening exercises, or pain on bearing weight on the affected leg that prevented progression to a more ambulatory state. Typical patient comments were "My hip hurts too much to lift that weight," or "I can't walk on my leg without the walker."

We measured leg lengths from the anterior superior iliac spine of the pelvis to the medial malleolus using a steel tape with the patient in the supine position.

The physical therapist treating the patient assessed motivation, orientation, and alertness after the patient had been given adequate time for adjusting to the move from the acute-care hospital to our center. Typically, this adjustment took two to three weeks. Patients were subjectively judged as motivated if they were cooperative, followed instructions to the best of their ability, attempted to reach goals, and actively participated in

TABLE 2

Chi-square Analysis of Visits to Physical Therapy for Patients Reaching Prefracture Ambulatory Status and Those Who Did Not

Physical Therapy Visits	Reached Prefracture		Ambulation Status
	Yes ^a	No	Total
39 or less	10	28	38
40 to 59	9	9	18
60 or more	9	5	14
TOTAL	28	42	70

^a $\chi^2 = 7.155$; $df = 2$; $p < .05$.

the rehabilitation process. Orientation was judged by response to questions about person, place, and time. Patients were judged to be alert if they responded appropriately to sensory stimuli of the environment and were not lethargic.

The typical treatment program for the affected leg consisted of active-assistive, active, and resistive exercises. When there was weakness or disuse of the other extremities, resistive exercises were given, as needed. The patient also received transfer training and ambulation training. Other modalities, such as heat or cold, were used for pain relief.

Data Analysis

Chi-square analysis was used to determine the association between ability of patients to reach prefracture ambulatory status and the 11 variables. Level of significance for acceptance of association was set at $p \leq .05$.

RESULTS

Twenty-eight of the 70 patients (40%) were able to walk as well after rehabilitation as before their fracture. Results of

chi-square analysis showed that only 2 of the 11 variables studied were significantly related to postrehabilitation ambulation status. A history of previous lower extremity fracture and the number of visits to physical therapy were associated with success in ambulation after rehabilitation. Table 1 compares 9 of the study variables of the patients reaching prefracture ambulation status with those not reaching that status. These 9 variables were sex, surgical technique, side of fracture, motivation, orientation, alertness, leg pain, leg-length difference, and history of previous leg fracture. A significantly greater number of patients in the successful ambulation group had previous leg fractures than in the group that was not successful ($p < .01$).

Number of visits to physical therapy for each of the two groups was collapsed into categories of 39 or fewer visits, 40 to 59 visits, and 60 or more visits. Chi-square analysis showed an association between number of visits and reaching prefracture ambulation status at the $p < .05$ level. The greater the number of visits the more likely the chance of successful ambulation (Tab. 2).

The degree of ambulation independence between the group reaching prefracture ambulatory status and the group who did not is compared in Table 3. Only 9 of 28 (32%) of the patients who were successful ambulators were walking independently or with a standard cane at time of discharge and 19 of 28 (68%) needed a walker or walkane for assistance. The majority of patients in the total group (44 out of 70) used a walker for ambulation. Three patients were still wheelchair-bound at discharge from physical therapy.

The average age of the 70 patients, 81.8 years, clearly showed hip fracture is a condition affecting primarily the elderly. The mean age for men was 78.9 years and for women 82.6 years, a difference of nearly 4 years. Age range for men was 47 years to 89 years and for women 65 years to 94 years. Men also averaged 10 more visits to physical therapy than women, 48.8 versus 38.8.

The Figure shows number and percentage of patients reaching prefracture ambulatory status in age groups of 5 years. Generally, the younger the patient, the greater the likelihood of reaching prefracture ambulatory status. The 80- to 84-year-old age group was an exception; over half (8 out of 15) were successful. Chi-square analysis showed no association between successful ambulation and age group. This finding was true even when groups were combined into three groups, younger than 75 years, 75 years to 84 years, and 85 years and older.

DISCUSSION

This study showed that 40 percent of the hip fracture group returned to their prefracture ambulation level after rehabilitation. These results compare favorably with those of others. Miller found that 51 percent of 360 patients with hip fractures returned to preinjury ambulatory status one year after fracture.¹² Niemann and Mankin found 41 percent of a group of institutionalized hip fracture patients who were ambulatory prefracture were able to walk again after one year.¹¹ No mention was made in those studies of level of ambulation achieved or the quantity or quality of rehabilitation.

Miller, in a related study, found 42 percent of 149 hip-fracture patients were able to walk independently after an average of 162 days after starting walker ambulation.² Naden and Denbesten found 64 percent of a group of surviving hip-fracture patients were walking one year after surgery.⁴

Three of the previous four studies did not compare prefracture level of ambulation for each patient with subsequent follow-up studies.^{2,4,11} Patients who were walking independently prefracture may have needed an assistive device postfracture but still would be successful in ambulation outcomes. Also, the previous studies followed patients up to one year postfracture. We were unable to follow patients that long in our study,

TABLE 3
Comparison of Ambulation Independence at Discharge for Patients Reaching Prefracture Ambulatory Status and Those Who Did Not

Reached Status	Type of Ambulation				
	Independent	Standard Cane	Walkane (Pyramid)	Walker	Wheelchair
Did (n = 28)	1	8	4	15	0
Did not (n = 42)	0	7	3	29	3
TOTAL (N = 70)	1	15	7	44	3

and we think a greater number would have reached their prefracture ambulation level if they had been followed for a longer period. Our subsequent studies will follow the patient for a year.

Age, especially advanced age, may be an important variable in reaching prefracture ambulation level, although this variable was not shown statistically in this study. Only 1 of 10 (10%) patients 90 years and older and 8 of 21 (38%) patients 85 years to 89 years old were successful in ambulation. Other studies have shown that relatively younger patients generally recover more completely after hip fracture.^{9,12,13} An exception to this in our study was the age range of 80 years to 84 years, where 8 of 15 (53%) reached prefracture ambulatory status (Figure).

The mean age of fracture in our study was 78.9 for men and 82.6 for women. Other studies have also found the mean age at fracture to be lower in men.^{3,8,9,13}

Women live longer than men and are, therefore, susceptible to falls and fractures for a longer time span than men.

Average age of the 70 patients was nearly 82 years. The average age in other studies of hip fracture patients has ranged from 70 years to 78 years.^{2,3,9,13} This finding may indicate the increasing number of older people in society who fracture a hip or it may show that younger patients are discharged directly to home after hospitalization for acute care rather than to a specialized geriatric rehabilitation center such as ours.

This study showed an association between the number of visits to physical therapy and reaching prefracture ambulatory status. Some patients left the rehabilitation program before their full ambulation potential may have been reached, even though they were progressing in exercise and ambulation programs. Reasons such as Medicare denials, transfers to other facilities, and fam-

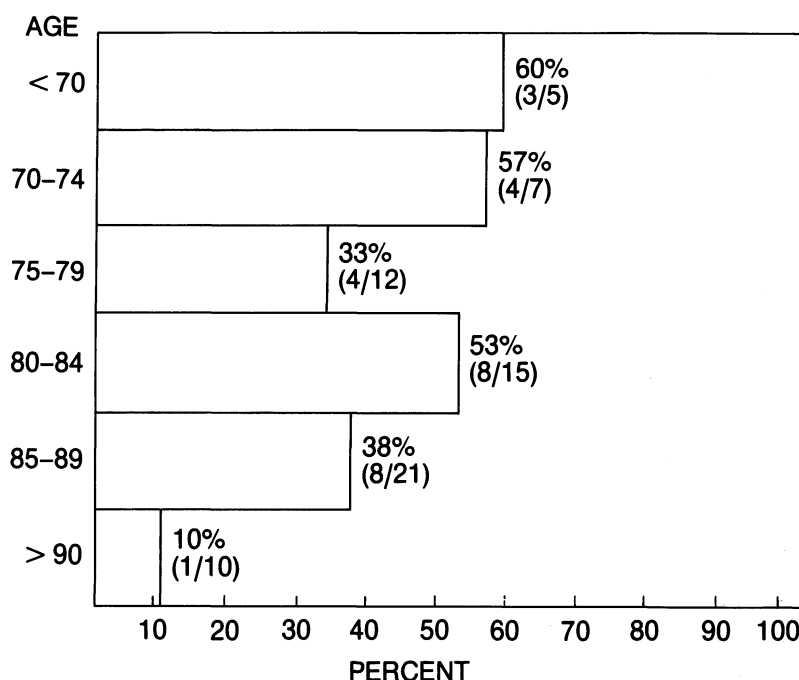


Figure. Number and percentage of patients reaching prefracture ambulatory status by age group. N = 70.

ily and financial considerations may have affected the group not reaching prefracture ambulatory status. Even in a specialized rehabilitation center such as ours, numerous uncontrollable factors alter or curtail treatment programs and affect rehabilitation outcomes.

There was no difference in frequency of side of fracture in this study, 35 for each side. Alffram found greater numbers of left hip fractures and believed it may have been the result of lower mineral or ash content in the left leg.¹³ Hielema recommended use of a cane in the right hand to decrease weight-bearing stresses on the left hip in the frail elderly who may have lower bone density in the left leg.¹⁴

A history of a previous lower extremity fracture was significant in reaching prefracture ambulation status in our 70 patients. This finding was not verified in any other studies examined.^{2, 10-12} Perhaps having a previous leg fracture gave those patients an advantage in re-learning ambulation skills. A more likely reason is that elderly patients who had already fractured a leg were walking at a lower functional level and could reach prefracture ambulatory status more easily. Several in the group of 70 were using assistive ambulatory devices, including walkers, before their fracture.

Therapists who are referred hip-fracture patients could anticipate that those with previous leg fractures should reach at least the same ambulatory status as before their most recent fracture. This information might be useful in making decisions about future living arrangements or need for personal assistance in ambulation or transfers.¹²

Motivation, orientation, alertness, or presence of pain in the fractured leg were not significantly different in comparing the two groups. One might predict that one or more of these variables would be important in successful ambulation after hip fracture. Inherent difficulties in defining and measuring these subjective variables may have influenced these results.

CONCLUSION

We studied 70 inpatients with hip fractures at a specialized geriatric rehabilitation center. Forty percent of the group returned to their prefracture ambulation independence level at time of discharge from physical therapy.

Using chi-square analysis, we analyzed 11 variables for the 28 patients

who reached prefracture ambulatory status and the 42 patients who did not. Only the variables of a history of previous leg fracture and of the number of visits to physical therapy were associated with reaching prefracture ambulatory status. Because some patients may have been discharged before their potential was reached, we believe that continuing exercise and ambulation training should be encouraged as long as the patient progresses. Based on this study and the literature, clinicians can expect 40 to 50 percent of their hip-fracture patients in this age range to regain prefracture ambulation status.

Acknowledgment. I give special thanks to Emilie Ellingson for statistical assistance.

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Commentary

Mr. Barnes has chosen to study an important condition that is likely to become more prevalent as the proportion of older individuals in America increases. Hip fracture ranks only 55th in frequency of discharge diagnoses from acute-care hospitals but may account for up to 25 percent of admissions to skilled nursing facilities.¹ Rehabilitative efforts are aimed at reambulation and achievement of independence in activities of daily living while not jeopardizing chances for bony healing. Operative techniques for internal fracture fixation were developed specifically to allow rapid mobilization in these patients for whom the consequences of bedrest would otherwise be devastating.²⁻⁴

My Commentary will discuss the following issues: 1) my question regarding the treatment program used with the individuals in the study; 2) several methodological issues related to variable measurement, classification of outcome, selection, and the choice of level of sig-

nificance for acceptance of association; and 3) my agreement with Mr. Barnes in not concluding that reaching prefracture ambulatory level was a result of a greater number of visits to physical therapy.

A distinct impression is obtained that the physical therapy program used in the study included resisted hip flexion on the affected side (eg, patient comments such as, "My hip hurts too much to lift that weight"). I believe that resisted knee extension and flexion on the affected side are probably an important component of rehabilitation when weakness is present. Resistive exercises that place a strain on plates, screws, or pins used in internal fixation involving the hip joint, however, are contraindicated until bony union is established; this process usually requires four to six months.⁵⁻⁷ Consequently, in most cases, motion at the hip joint should be limited to active exercise. As an exception, patients with firmly cemented femoral-