

Intertrochanteric Versus Femoral Neck Hip Fractures: Differential Characteristics, Treatment, and Sequelae

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Background. More than 220,000 persons 65 years and older fracture a hip every year in the United States. Although hip fractures have been considered as a single, homogeneous condition, there are two major anatomic types of proximal femoral fractures: intertrochanteric and femoral neck. The present study's objective was to determine if the two types of hip fracture have different patient characteristics and sequelae.

Methods. A prospective study of 923 elderly patients admitted to seven Baltimore hospitals for a hip fracture between 1984 and 1986.

Results. Patients with intertrochanteric fractures were slightly older, sicker on hospital admission, had longer hospital stays, and were less likely at 2 months postfracture to have recovered activities of daily living than femoral neck fracture patients. Intertrochanteric fracture patients also had higher mortality rates at 2 and 6 months after fracturing. Long-term recovery (1 year) did not differ between fracture type.

Conclusions. It appears that intertrochanteric fracture patients have intrinsic factors (older age, poor health) impacting upon their risk of fracture and ability to recover. Differences in patient characteristics and sequelae do exist between femoral neck and intertrochanteric hip fracture patients that impact upon recovery.

MORE than 220,000 persons 65 years and older fracture their hip every year in the United States (1,2). It has been estimated that there may be 350,000 hip fractures annually by the year 2020 and between 530,000 to 840,000 annually by the year 2040 (3). Proximal femoral hip fractures among elderly persons are associated with more deaths, disability, and medical costs than all other osteoporotic fractures combined (1,4,5). Costs are estimated to be between \$31 and \$62 billion each year in acute hospitalization and long-term care (3,6). Many researchers have considered hip fracture as a single, homogeneous condition; however, there are two major anatomic types of hip fracture, fractures of the femoral neck and fractures through the intertrochanteric region.

A few studies have indicated that femoral neck and intertrochanteric fractures may have different risk factors and consequences (7–13). A retrospective review of hospital discharge data indicated a linear increase in the ratio of trochanteric fractures to femoral neck fractures with age (11). Likewise, the proportion of hip fractures occurring in the trochanteric region rose steeply with age among white women in a 5% sample of the U.S. Medicare population (12). One prospective study found that appendicular bone mineral density was strongly related to risk of intertrochanteric but not femoral neck fractures (9). Additionally, intertrochanteric fracture patients were shown to have lower trabecular bone density than femoral neck fracture patients (10). Women with intertrochanteric fractures had lower vitamin D levels, poorer health and ambulation, and a higher mortality rate than women with femoral neck fractures (8). In contrast, a 20-week prospective study of 216 patients during

1983 and 1984 found no significant differences between women with these types of fractures in use of medications and functional or mental status on admission to acute care facilities following fracture (7).

The present study's objectives were to determine if intertrochanteric and femoral neck hip fracture patients 65 years of age and older differ in prefracture characteristics and postfracture mortality and functional outcomes. A comparison of this type has not been reported in the literature.

MATERIALS AND METHODS

Study patients were derived from a prospective study of hip fracture mortality, recovery, and long-term care utilization in Baltimore, MD (5). Subjects were all patients 65 years of age and older, with a new fracture of the hip, admitted to one of seven Baltimore area hospitals from the community between October 1, 1984, and September 30, 1986. Hip fracture patients who were admitted to these seven hospitals from a nursing home or another institution were excluded from this study because of differences in rate of fracture, health, cognition, and physical activity level. Within 1 week following hospital admission, the patient was administered a questionnaire designed to assess prefracture functional and health status, affective and cognitive status, and demographic characteristics. Information not available directly from patients due to health problems while they were hospitalized was obtained from a proxy who knew the patient. Proxies were family members or friends who knew the patient well and were best able to report on the patient's health. An analysis of the correspondence between

patient and proxy reports appears elsewhere (14). Abstraction of the patient's medical chart provided information on comorbidities, complications, surgical procedure, hospital length of stay, and discharge status.

Nine hundred eighty-two patients were eligible for the study and a medical chart abstract was completed. This study was restricted to the 923 subjects with a femoral neck or intertrochanteric hip fracture for whom a medical abstract was completed. Of these patients, 737 agreed to participate in the study and the proxy was interviewed during the patient's hospital stay. Proxy report of patients' functional and health status was ascertained by telephone at 2, 6, and 12 months following hospital discharge. Consent to participate was given without knowledge of fracture type and there was no differential lack of participation between fracture types. Description of the study population appears elsewhere (4,5).

The statistical analysis addressed two issues: (i) identification of prefracture (including characteristics of the fall) and in-hospital patient characteristics which differed between the two fracture types; and (ii) examination of survival and recovery patterns (activities of daily living performance equal or better than prefracture status) according to fracture type. To address the first issue, chi-square and *t* tests were used to evaluate the two fracture types for differences in patient characteristics. To address the second issue, logistic regressions were estimated for survival status (dead or alive), hospital length of stay (1–14 days vs ≥ 15 days), discharge placement (nursing home vs home), and recovery status (yes or no) at 2, 6, and 12 months with fracture type, with all prefracture characteristics which differed by fracture type ($p < .05$) as independent variables. Recovery in functional status was computed by comparing the level of dependence (dependent vs independent) at each follow-up visit to prefracture status. If level of dependence was lower than prefracture status, then the patient was considered as not recovered. Each follow-up period was examined separately because patient status changed over time that might be associated with fracture type.

RESULTS

Prefracture and Medical Characteristics

Table 1 presents demographic information for patients with the two types of hip fracture. In the Baltimore cohort, 496 (53.7%) patients suffered an intertrochanteric hip fracture and 427 (46.3%) patients fractured the femoral neck of the proximal femur between 1984 and 1986. No difference in gender distribution existed between intertrochanteric and femoral neck fracture patients; therefore, analyses were done with sexes combined.

Patients fracturing the intertrochanteric region of the femur were slightly older (an average of 1.8 years) than femoral neck fracture patients ($p = .002$, Table 1). Intertrochanteric and femoral neck hip fracture patients did not differ significantly on any other demographic or social characteristics compared.

The subpopulations of hip fracture patients did differ on medical and prefracture health characteristics (Table 2). Significantly more intertrochanteric fracture patients had four or more comorbid conditions than femoral neck fracture patients ($p = .001$). The proportion of subjects with specific comorbid conditions (arthritis, hypertension) did not differ between the fracture groups. Self-rated health was similar

between fracture types. The number of medications taken did not differ between the two subpopulations and the groups did not differ in cognitive or affective status during hospitalization.

Physical functioning (independent vs dependent in lower extremity activities of daily living) of both intertrochanteric and femoral neck fracture patients was similar before fracture (Table 2). Toileting and transferring were the only lower extremity activities of daily living that were significantly different between fracture types; fewer femoral neck fracture patients were independent in these two activities ($p = .008$ and $.022$, respectively). Another difference between fracture types in prefracture characteristics was the use of estrogen replacement therapy. A greater proportion of femoral neck fracture patients had taken estrogen therapy prior to fracture than intertrochanteric fracture patients ($p = .024$).

Circumstances of occurrence of the fracture differed between fracture types with regard to the proportion of patients who fell and those who had consumed alcoholic beverages within 24 hours prior to the fracture (Table 3). Although nearly all patients had a fall preceding the fracture, a greater proportion of intertrochanteric fracture patients fell than femoral neck fracture patients (98.1% vs 93.3%, $p = .001$).

Intertrochanteric fracture patients (8.4%) were more likely to have consumed alcoholic beverages just prior to the fracture than femoral neck fracture patients (4.4%, $p = .032$). On the

Table 1. Demographic and Social Characteristics of Community-Dwelling Elderly Patients With Intertrochanteric and Femoral Neck Hip Fractures

Characteristics	Intertrochanteric		Femoral Neck	
	<i>N</i>	Percent	<i>N</i>	Percent
Number of patients	496	53.7	427	46.3
Female		78.8		81.5
Age				
65–74		20.6		29.5
75–84		44.8		44.5
85+		34.7		26.0
Mean (<i>SD</i>)		81.0 (7.4)		79.2* (7.2)
White		94.6		93.7
Married		24.5		24.7
Living alone		40.8		43.0
Smoking status	360		333	
Never smoked		58.1		58.3
Currently smoke		14.4		12.9
Alcohol intake	366		339	
Daily		11.2		10.3
At least once a month		16.7		17.7
Few days a year		72.2		72.0
Size of social network				
4+ members	368	80.4	317	78.6
Social groups prefracture				
Belong to 1 or more	361	36.3	314	35.7
Social meetings prefracture				
Attend 1 or more	369	36.3	315	38.1

* $p < .05$.

Table 2. Prefracture Health Status and Surgical Characteristics of Intertrochanteric and Femoral Neck Hip Fracture Patients, Age 65 and Older

Characteristics	Intertrochanteric		Femoral Neck	
	N	Percent	N	Percent
Number of comorbid conditions on admission†	496		426	
1-3		17.1		23.9*
4+		82.3		76.1
Specific comorbidities	496		427	
Arthritis		31.2		32.1
Hypertension		41.7		40.3
Heart trouble		48.4		50.1
Diabetes		12.3		12.6
Stroke		9.3		7.7
Self-reported health	372		346	
Excellent/good		58.3		57.5
Fair/poor		41.7		42.5
Medications taking on admission	496		427	
0		27.4		27.2
1-2		28.0		29.3
3-4		25.8		24.6
5+		18.8		19.0
Depressed in hospital	207	36.2	215	32.1
Mentally incompetent, in hospital	216	14.8	221	14.5
Activities of daily living (% independent)	374		349	
Walking		87.1		82.2
Getting places		45.2		48.7
Shopping		42.5		44.7
Toileting		93.2		87.4†
Transferring		94.1		88.5†
Bathing		72.3		70.5
Dressing		86.9		83.4
Housework		34.6		41.1
Estrogen replacement therapy	266	6.0	269	11.5†

*† $p < .05$.

*Retrospective data are limited to a total of four comorbidities per patient because Medicare codes only five diagnoses, including the hip fracture diagnosis.

other hand, no differences were found between fracture subpopulations and prefracture type of activity, footwear, taking prescription medications, and feeling dizzy or unsteady (Table 3).

Sequelae

In general, intertrochanteric and femoral neck fracture patients were treated differently and had different functional outcomes. Most intertrochanteric fractures (91%) were repaired by internal fixation whereas femoral neck fractures were repaired either by internal fixation (30%) or arthroplasty (66%) ($p = .0001$). Intertrochanteric fracture patients had longer hospital stays (19.7 days) than femoral neck fracture patients (17.5 days) ($p = .003$, Table 4). Discharge placement differed; a higher proportion of intertrochanteric patients (45.6%) was discharged to a nursing home than femoral neck fracture patients (35.9%) ($p = .011$).

Table 3. Circumstances of the Fracture for Intertrochanteric and Femoral Neck Hip Fracture Patients, Age 65 and Older

Fracture Circumstances	Intertrochanteric		Femoral Neck	
	N	Percent	N	Percent
Fall	371	98.1	344	93.3*
Location of fracture	373		333	
Bathroom		5.9		4.5
Bedroom		16.4		19.5
Outdoors		16.9		15.0
Activity before fracture	351		323	
Walking		43.0		44.0
Climbing stairs		5.7		7.4
Footwear	342		314	
Flat shoes		52.9		53.2
Socks/slippers		33.0		31.8
Drinking alcohol within 24 hours before fracture	368	8.4	338	4.4*
Taking prescription medication before fracture	360	50.6	327	53.2
Dizzy before fracture	361	42.9	342	43.0
Unsteady walking before fracture	368	64.4	347	59.1

* $p < .05$.

Table 4. Surgical Management, Hospital Discharge Characteristics and Mortality of Intertrochanteric and Femoral Neck Hip Fracture Patients, Age 65 and Older

Characteristics	Intertrochanteric		Femoral Neck	
	N	Percent	N	Percent
Surgical procedure	493		425	
Internal fixation		90.7		29.6
Arthroplasty (any)		2.8		65.9
Hemiarthroplasty		2.6		62.8*
Total arthroplasty		0.2		3.1
No surgery		5.7		3.8
Hospital length of stay	489		423	
1-14 days		35.6		45.4
15+ days		64.4		54.6
Mean (SD)		19.7 (11.9)		17.5* (9.9)
Discharged to institution	355	45.6	304	35.9*
Mortality	383		349	
Hospital		2.6		1.8
At 2 months		6.3		3.7
At 6 months		13.8		11.2
At 1 year		17.5		17.2

* $p < .05$.

Mortality over the 1-year follow-up period was similar for patients with both types of fracture (17%) (Table 4). Mortality rates were higher among intertrochanteric fracture patients during hospitalization and at 2 and 6 months after fracture. The hip fracture subpopulations also had different functional recoveries over this year (Table 5). At 2 months postfracture, femoral neck fracture patients were more functional than intertrochanteric fracture patients. Significantly fewer intertrochanteric fracture

Table 5. Functional Recovery Postdischarge for Elderly Intertrochanteric and Femoral Neck Hip Fracture Patients

Functional Recovery	Intertrochanteric		Femoral Neck	
	N	Percent	N	Percent
Two months postfracture	383		354	
Walking		40.2		51.7*
Getting places		48.0		49.7
Shopping		44.4		50.8
Toileting		71.8		81.4*
Transferring		64.0		76.3*
Bathing		52.5		60.4*
Dressing		63.4		71.5*
Housework		49.6		51.1
Six months postfracture	383		354	
Walking		62.7		72.6*
Getting places		62.9		68.4
Shopping		58.0		65.0
Toileting		82.5		87.0
Transferring		78.3		82.5
Bathing		69.2		74.9
Dressing		76.2		79.4
Housework		62.9		63.0
Twelve months postfracture	383		354	
Walking		68.9		74.6
Getting places		73.6		72.0
Shopping		64.2		66.7
Toileting		83.8		88.1
Transferring		80.9		86.4
Bathing		73.1		74.9
Dressing		77.3		81.1
Housework		65.8		66.4

* $p < .05$.

patients had recovered prefracture functioning in walking ($p = .002$), toileting ($p = .002$), transferring ($p = .0001$), bathing ($p = .029$), and dressing ($p = .020$) by 2 months postfracture, compared to femoral neck fracture patients. At 6 months postfracture, intertrochanteric fracture patients had recovered equally well to prefracture levels of functioning as femoral neck fracture patients, except for walking ability, where fewer intertrochanteric fracture patients recovered (63% vs 73%, $p = .004$). By 1 year postfracture, both fracture groups had recovered equally well in all daily activities.

Regression models were constructed to determine the effect of fracture type on sequelae such as discharge status, mortality, and functional recovery adjusted for significant prefracture characteristics. The fracture type effect was adjusted for age, comorbid conditions, estrogen use, fall, alcohol use prefracture, and toileting and transferring prefracture. Interaction terms were added to the regression model between each covariate and fracture type; none were significant. Logistic regression models were constructed adjusting for and not adjusting for surgical procedure type (internal fixation, arthroplasty) as well as a model including only fracture patients with internal fixation repair. Procedure type was not a significant predictor of sequelae for any outcome examined. The multivariate results confirmed the bivariate analyses indicating that fracture type was a significant predictor of hospital length of stay ($OR = 1.74$; 1.04–2.92) and functional recovery at 2 months postfracture after control-

ling for age, comorbidity, fracture occurrence, and prefracture toileting and transferring. Intertrochanteric fracture patients were less likely to recover their prefracture level of walking ($OR = 1.48$; 1.02–2.16), transferring ($OR = 1.61$; 1.07–2.41), and toileting ($OR = 1.57$; 1.01–2.45) by 2 months after fracture than femoral neck fracture patients. At 6 months postfracture, intertrochanteric patients were less likely to recover their prefracture level of walking than femoral neck patients. There was no difference between fracture types in any other functional recovery parameter at 6 months or 12 months postfracture. Results from adjustment for surgical procedure or analyzing only patients with internal fixation did not differ significantly from the regression model without surgical procedure type.

Surgical Management of Femoral Neck Hip Fractures

Because there was a difference in surgical management (internal fixation vs arthroplasty) of femoral neck hip fracture patients, it was determined whether sequelae differed by surgical procedure for femoral neck hip fracture patients. Intertrochanteric fracture patients were largely managed with internal fixation (91%); therefore, there was no variation in surgical procedure type to determine its influence on the recovery process. For femoral neck fracture patients, there were too few patients treated with total arthroplasty ($N = 13$) to differentiate the effect of total arthroplasty on recovery. Hemiarthroplasty and total arthroplasty were treated as a single surgical procedure type for these analyses. Omitting patients with total arthroplasty from the analysis provided similar results.

Femoral neck hip fracture patients treated by internal fixation with screws and plates did not differ in age, gender, race, marital status, or prefracture comorbid condition from femoral neck fracture patients treated with arthroplasty (Table 6). With regard to sequelae, surgical procedure type was associated with hospital length of stay among femoral neck hip fracture patients. Femoral neck hip fracture patients treated with arthroplasty had significantly longer hospital stays than patients treated with screws and plates (Table 6). Surgical procedure type was not associated with discharge placement or mortality. A higher proportion of femoral neck hip fracture patients treated with arthroplasty had recovered their prefracture level of lower extremity functioning by 2 months postfracture than patients whose fractures were treated with screws and plates, but the differences were not statistically significant for any daily activity evaluated (Table 6). Recovery in daily activities did not differ between surgical procedure types for any activity of daily living at 6 months or 1 year. Logistic regression estimates for surgical procedure type predicting sequelae (length of stay, mortality, functional recovery) also were not statistically significant.

DISCUSSION

The present study demonstrated that prefracture characteristics and sequelae differ between intertrochanteric fracture and femoral neck fracture patients. These results have implications for prevention, clinical management, and reimbursement policies. Intertrochanteric fracture patients were older and in poorer health prefracture. Moreover, intertrochanteric fracture patients were more likely to have experienced a fall and consumed alcoholic beverages prior to their fracture. They were more likely to have longer hospital stays, be discharged to a nursing home, and not recover to their prefracture level of functioning at 2

Table 6. Prefracture Characteristics and Sequelae of Femoral Neck Hip Fracture Patients Treated With Internal Fixation Versus Arthroplasty

Prefracture Characteristics	Internal Fixation		Arthroplasty	
	N	Percent	N	Percent
Number of patients	126	31.0	280	69.0
Female		82.0		83.3
Age				
65-74		37.3		25.7
75-84		34.9		49.3
85+		27.8		25.0
Mean (SD)		78.5 (7.8)		79.4 (6.9)
White		93.6		93.2
Married		22.2		24.4
Number of comorbid conditions				
0-4		35.7		36.9
5+		64.3		63.1
Hospital length of stay	125		278	
1-14 days		52.8		41.7
15+ days		47.2		58.3
Mean (SD)		15.8 (8.8)		18.3 (10.5)*
Discharged to institution	106	34.9	205	36.6
Mortality	117		221	
At 2 months		3.4		3.6
At 6 months		13.7		9.0
At 1 year		17.9		15.4
Recovery in activities of daily living two months postfracture	117		221	
Walking		46.2		54.3
Getting places		43.6		52.0
Shopping		43.6		52.9
Toileting		81.2		82.4
Transferring		72.6		78.7
Bathing		55.6		62.4
Dressing		70.9		72.0
Housework		47.9		50.7

* $p < .05$.

months postfracture. Other investigators have found a similar association between age and trochanteric fractures in Maryland hospital discharge data (11) and the U.S. Medicare population (12). Femoral neck fracture patients were more likely to have used estrogen replacement therapy prefracture and to recover more quickly than intertrochanteric fracture patients. Femoral neck hip fracture patients also had lower mortality rates up to 6 months postfracture. The greater proportion of female femoral neck fracture patients on estrogen therapy may be due to their more frequent medical care utilization. These women visited a physician more frequently prefracture and therefore would be more likely to be treated for menopausal symptoms and osteoporosis than intertrochanteric fracture patients.

It appears that patients living in the community who are likely to fracture in the intertrochanteric region have intrinsic factors such as poor health and old age impacting upon their risk of fracturing and upon their ability to recover from the frac-

ture. Femoral neck fracture patients living in the community, on the other hand, appear to be healthy elders who are younger and better able to withstand a fall and its consequences. Their greater use of estrogen therapy and more frequent medical care may be indicative of their better health, especially bone health. These findings are consistent with the observation of Lawton and colleagues (8) that femoral neck fracture patients come from a "fitter" population with fewer concurrent medical conditions and younger ages. In a review of the literature, Mautalen and colleagues concluded that women with trochanteric fractures were older and had more severe bone loss, although fall biomechanics were not found to be different in the two types of hip fracture (13). Additionally, Seeley and colleagues (9) found bone density to be strongly related to intertrochanteric fractures and not femoral neck fractures, which indicates that intertrochanteric fracture patients may have more severe osteoporosis and be more likely to fracture this region rather than the femoral neck region. Chevalley and colleagues (15) did not find a significant difference in femoral neck bone density between trochanteric and cervical hip fractures in a small group of women. Additional study of the relationship between bone density status and fracture type is warranted.

It is noteworthy that the apparent benefits of better health among femoral neck fracture patients were apparent in the first 2 months following the fracture. After that time, recovery appeared similar by fracture type. Several deficits in activities of daily living were seen at 2 months postfracture for intertrochanteric patients. However, by 6 months these patients were similar in activities of daily living. Even though recovery equalized between fracture type, the slower course for intertrochanteric patients could lead to lengthier and more costly rehabilitation and home care for these patients in the short-term recovery period. This relationship between fracture type and recovery was not influenced by differences in surgical procedure.

Longer hospital stays and greater risk of institutionalization after acute care discharge for intertrochanteric fracture patients creates greater cost of care for these patients. Hospital reimbursement policies which currently allow for a single diagnosis-related group should allow for the differences in health and likely outcome of the different hip fracture types, rather than treating all hip fractures as a homogeneous group. Our findings suggest that at least two reimbursement groupings are needed for these patients.

Surgical procedure type (internal fixation versus arthroplasty) did not influence recovery or mortality in this cohort of femoral neck hip fracture patients. Patients receiving arthroplasty were similar in prefracture characteristics to patients treated by internal fixation. Although sequelae between those treated with screws and plates did not differ significantly from those treated by arthroplasty, there was a tendency toward speedier recovery with arthroplasty. However, the number of patients was too small to know if this was real. Hospital length of stay was longer for arthroplasty patients, perhaps due to a lengthier healing process than internal fixation. Although based on small numbers of subjects, it is important to note that with longer hospital stays and a more costly surgical procedure, arthroplasty patients demonstrated only a possibility of better short-term functional recovery, with no difference or improvement in overall mortality or long-term functional recovery compared to internal fixation for femoral neck hip fractures.

The present study is informative but has several limitations. The fracture cohort was enrolled nearly 12 years ago and there have been changes in length of stay and posthospitalization care that may reflect changes in treatment pattern for hip fracture patients. However, the underlying etiology and patient characteristics remain relevant to current treatment and care of the different fracture types. Numerous factors and three time periods were analyzed in this study to determine if fracture types were similar. Type I error may be a factor in our results, but we consider this analysis as exploratory and hypothesis generating. Actual *p* values and logistic regression results have been provided for the reader to judge the multiple comparison effect. The functional recovery data were obtained from proxies rather than from observations of patients. Although limited to some extent, prior analyses indicate that for the more observable and objective questions, proxies do provide ratings similar to those provided by patients (14). Also, by relying on proxies at baseline and follow-up, the impact of bias resulting from different data sources was minimized. Patients, although representing all admissions from the community to the seven Baltimore area hospitals treating over half of all hip fracture patients in the metropolitan area, were nevertheless from a limited geographic region (Baltimore area only). Generalizability was also limited to community-dwelling elderly persons. Nursing home patients will have different lifestyle characteristics and it is unknown whether fracture type differs in distribution among these patients. Surgical timing will impact length of stay and may vary according to fracture type. Although exact surgical time was not collected in this study, most patients underwent surgery within 12 hours of their fracture. Only a few patients were delayed, usually due to weekend admission. Also, physical and occupational therapy will influence recovery. This study could not assess the impact of rehabilitation between fracture types because these data were not collected. There were too few patients receiving total hip arthroplasty to enable differentiation between the effects of total versus partial arthroplasty. With the increasing utilization of total arthroplasty for hip fracture repair in recent years, future studies will be better suited to address this issue.

In summary, study data indicate that elderly hip fracture patients are not a homogeneous group. Intertrochanteric fractures may be more likely to occur as a result of older age and poorer health among community-dwelling elderly persons, which may also exacerbate difficulties in recovering quickly and increase mortality. Femoral neck fractures are more likely to occur in healthier elderly persons who, upon falling, break their hip at the weakest point. Treatment and preventive strategies should take into account this variation in prefracture health and subsequent outcomes.

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