■ ORIGINAL CONTRIBUTION

Survival in End-Stage Dementia Following Acute Illness

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AN ESTIMATED 1.8 MILLION people in the United States are in the final stages of a dementing illness (eg, Alzheimer disease, vascular dementia)[1] and are unable to recognize family, dependent in activities of daily living, unable to communicate, and experience repeated infections and other complications. Despite the prevalence of advanced dementia, little is known about the prognosis of patients with this condition who develop a superimposed acute illness (eg, pneumonia). Preliminary data from nursing homes and hospice care suggest that survival for patients with end-stage dementia following febrile episodes is limited.[2-5] Furthermore, if prognosis is poor, palliation of symptoms and enhancement of comfort may be more important to the patient than the application of burdensome interventions directed at life prolongation or cure.

This study was designed to examine 6-month survival for patients with advanced dementia who were hospitalized for 2 common conditions (hip fracture and pneumonia) and to compare the care these patients received with that of cognitively intact adults with the same diagnoses. Hip fracture and pneumonia serve as useful models for this study because they are common conditions in elderly patients, are seen in both cognitively intact and advanced dementia patients, and are associated with considerable pain and other symptoms.

For editorial comment see p 87.

Context Little is known about the prognosis of acutely ill patients with end-stage dementia or about the type of care that these patients receive. If their prognosis is poor, then emphasis should be placed on palliative care for these patients rather than on curative interventions.

Objectives To examine survival for patients with end-stage dementia following hospitalization for hip fracture or pneumonia and to compare their care with that of cognitively intact older adults.

Design Prospective cohort study with 6 months of follow-up.

Setting and Patients Patients aged 70 years or older who were hospitalized with hip fracture (cognitively intact, n=59; with end-stage dementia, n=38) or pneumonia (cognitively intact, n=39; with end-stage dementia, n=80) in a large hospital in New York, NY, between September 1, 1996, and March 1, 1998.

Main Outcome Measures Mortality, treatments directed at symptoms, and application of distressing and painful procedures in cognitively intact patients vs those with end-stage dementia.

Results Six-month mortality for patients with end-stage dementia and pneumonia was 53% (95% confidence interval [CI], 41%-64%) compared with 13% (95% CI, 4%-27%) for cognitively intact patients (adjusted hazard ratio, 4.6; 95% CI, 1.8-11.8). Six-month mortality for patients with end-stage dementia and hip fracture was 55% (95% CI, 42%-75%) compared with 12% (95% CI, 5%-24%) for cognitively intact patients (adjusted hazard ratio, 5.8; 95% CI, 1.7-20.4). Patients with end-stage dementia received as many burdensome procedures as cognitively intact patients and only 8 (7%) of 118 patients with end-stage dementia had a documented decision made to forego a life-sustaining treatment other than cardiopulmonary resuscitation. Only 24% of patients with end-stage dementia and hip fracture received a standing order for analgesics.

Conclusions In this study, patients with advanced dementia and hip fracture or pneumonia had a very poor prognosis. Given the limited life expectancy of patients with end-stage dementia following these illnesses and the burdens associated with their treatment, increased attention should be focused on efforts to enhance comfort in this patient population.
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METHODS
Patient Population
Patients older than 70 years who were admitted to a large hospital in New York, NY, with diagnoses of hip fracture or pneumonia from September 1, 1996, to March 1, 1998, were identified by a trained research assistant who reviewed daily admission records. The study was approved by the Mount Sinai School of Medicine Institutional Review Board and all patients or their surrogates provided informed consent.

Patients with hip fracture were eligible if they had femoral neck or intertrochanteric fractures. Patients with pneumonia were eligible if they had new infiltrate on chest radiograph and

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the presence of at least 2 of the following: temperature greater than 38°C, new or increased sputum production, new or increased cough, new pleuritic chest pain, and new or increased pulmonary findings on physical examination; or 1 of the following changes in status: new or increased shortness of breath, respiratory rate greater than 25/min, and worsening mental or functional status.[6] Patients were excluded if they had multiple internal injuries, a previous fracture in the affected hip, or a known diagnosis of cancer that was not considered cured or in remission; or were non–English-speaking or identified more than 48 hours after admission. Patients with hip fracture or pneumonia were eligible for inclusion if they were cognitively intact or had end-stage dementia.

Cognitive Status

To identify cognitively intact patients, a research assistant with experience in geriatric assessment administered the telephone version of the Mini-Mental State Examination (MMSE) in person[7] to all potentially eligible patients. The telephone version of the MMSE was used because it requires only verbal responses and, thus, is easier to complete for frail, ill patients who may have difficulty writing or seeing the instrument. Patients whose score was at least 18 of 24 (consistent with normal cognitive function) were eligible for enrollment (cognitively intact group). Patients whose score was less than 18 but who had delirium as determined by the Confusion Assessment Method[8] were reassessed daily for 2 subsequent days using the telephone version of the MMSE. Patients whose score on the telephone MMSE was 18 or greater within this 2-day period were included in the cognitively intact group. Patients who had delirium and whose MMSE score was less than 18 were excluded, even if there was no reported history of dementia, to ensure that patients with undiagnosed cognitive impairment were not inadvertently included in the cognitively intact group. To identify patients with end-stage de-

mentia, we interviewed the next of kin of the remaining patients (ie, those whose score on the telephone MMSE was less than 18) and inquired about the patients' best functional and cognitive status for the month prior to admission. Patients whose functional/cognitive status was classified as stage 6 or 7 (severe to very severe dementia) on the Global Deterioration Scale[9] were enrolled in the end-stage dementia group. Persons who have a stage 6 or 7 classification on the Global Deterioration Scale are dependent in all activities of daily living (eg, bathing, dressing, transfer, continence, feeding), display sleep-wake cycle disturbances, and cannot remember the names of even close relatives or their spouse.

Patient Care and Survival

We collected information on the frequency of use of 9 common hospital procedures that previously have been found to be moderately to severely painful or uncomfortable: arterial blood gas measurement, central line placement, indwelling bladder catheter insertion, insertion of intravenous catheter after admission, use of mechanical restraints, use of nasogastric tube, daily phlebotomy during more than 50% of hospital stay, use of intravenous catheter for entire hospital stay, and mechanical ventilation other than for general anesthesia.[10] Hospital charts were reviewed daily by a research assistant for measures taken to assess and treat symptoms, discussions about goals of hospital and posthospital care, and decisions to withhold or withdraw life-sustaining treatments.

To evaluate reviewer bias and coding error, a second independent observer evaluated 25 randomly selected charts and was 100% concordant with the primary reviewer. Additional information about patient characteristics and demographics was obtained by directly interviewing patients in the cognitively intact group and by interviewing proxies of patients in the end-stage dementia group. Six-month survival data were obtained by first

crossmatching patients' medical records with the hospital database to identify in-hospital deaths within 6 months of the index admission (n=188), then performing a similar crossmatch for the 6-month to 1-year period following index admissions (ie, to document that patients had survived after 6 months) (n=179). Following these database searches, 124 patients' status remained unknown. We reviewed New York City death certificates for these 124 patients and identified 45 deaths. Finally, we made follow-up telephone calls to the patient, proxy, or nursing home to which the patient was discharged to determine the status of the remaining 79 patients.

Statistical Analyses

χ^2 Analyses and t tests were used to compare patient characteristics and other variables. The Cox proportional hazards regression model was used to examine survival. Variables were selected by reviewing the literature and identifying risk factors that have been shown to be associated with increased mortality in pneumonia and hip fracture. In addition to these variables, we included in the models a cognitive status variable (demented or nondemented) and age. Age was included because of the significant differences in mean ages between cognitively intact and end-stage dementia patients in both hip fracture and pneumonia groups. Variables entered into the pneumonia model were age, cognitive status (cognitively intact or with end-stage dementia), and a term that stratified patients into low and high risk for death based on pneumonia severity. The pneumonia risk term was derived by computing a severity score using a previously validated model that assesses pneumonia severity and risk of death based on demographic variables, coexisting conditions, and physical examination, radiological, and laboratory findings.[11] Scores were determined by summing the points assigned for the following applicable characteristics (points in parentheses) and the patient's age (age minus 10 for women): nursing

home resident (10); coexisting illness (neoplastic disease [30], liver disease [20], congestive heart failure [10], cerebrovascular disease [10], renal disease [10]); physical examination findings (altered mental status [20], respiratory rate $\geq$30/min [20], systolic blood pressure <90 mm Hg [20], temperature <35°C or $\geq$40°C [15], pulse $\geq$125/min [10]); and laboratory and radiographic findings (arterial pH <7.35 [30], serum urea nitrogen level $\geq$10.7 mmol/L [20], sodium level <130 mmol/L [20], glucose level $\geq$13.9 mmol/L [250 mg/dL] [10], hematocrit <0.30 [10], partial pressure of oxygen <60 mm Hg [10], and pleural effusion [10]). Patients with scores greater than 90 were considered to be at increased risk for death and a dichotomous variable (severity score >90) was entered into the pneumonia hazard model.

For the hip fracture model, in addition to age and cognitive status, we included variables that have been found in other studies[12-15] to be associated with increased mortality following hip fracture. The variables included comorbid illness (Charlson comorbidity index), nursing home residence prior to hospitalization, and ambulatory status.

RESULTS

Five hundred seven patients were initially identified from admission records and 235 met entry criteria (126/306 with pneumonia and 109/201 with hip fracture). Reasons for excluding 291 patients are as follows (numbers listed as pneumonia/hip fracture): incorrect admitting diagnosis (75/11), did not speak English (38/20), length of stay >48 hours before interview (5/4), could not communicate (1/2), delirium (6/10), and mild-to-moderate dementia (55/45). Of the 235 eligible patients, 216 patients or their proxies agreed to participate (119 [94%] of 126 with pneumonia and 97 [89%] of 109 with hip fracture).

Patient characteristics are shown in TABLE 1. Median age was 84 years (range, 71-100 years) for hip fracture patients and 86 years (range, 71-102

Table 1. Patient Characteristics (N = 216)*

	Patients With Hip Fracture			Patients With Pneumonia		
Characteristics	Cognitively Intact (n = 59)	With End-Stage Dementia (n = 38)	P Value	Cognitively Intact (n = 39)	With End-Stage Dementia (n = 80)	P Value
Age, median (range), y	82 (71-100)	88 (71-98)	.001	83 (71-98)	87 (72-102)	.003
Women	51 (86)	28 (74)	.18	25 (64)	48 (60)	.67
Ethnicity						
White	54 (92)	31 (82)	.21	28 (72)	45 (56)	.12
African American	5 (9)	3 (8)		8 (21)	16 (20)	
Latino	0	3 (8)		3 (8)	18 (23)	
Asian	0	1 (3)		0	1 (1)	
Residence						
Home	56 (95)	7 (18)	<.001	37 (95)	30 (38)	<.001
Nursing home	3 (5)	31 (82)		2 (5)	50 (63)	
Advance directive	35 (60)	15 (40)	.045	20 (51)	24 (30)	.02
Fracture repair						
Pin/plate	34 (58)	24 (65)	.38†			
Hemiarthroplasty	25 (42)	11 (27)				
Nonoperative management	0 (0)	3 (8.1)				
Length of hospital stay, median (range), d	8.0 (1-22)	6.0 (2-72)	.35	5 (2-32)	7 (2-39)	.09
Discharge site						
Home	21 (36)	5 (13)	<.001‡	37 (95)	19 (24)	<.001‡
Subacute rehabilitation facility	33 (56)	0		0	0	
Nursing home	3 (5)	30 (79)		2 (5)	46 (58)	
Hospice care	0	1 (3)		0	1 (1)	
Died in hospital	2 (3)	2 (5)		0	14 (18)	

*Data are number (percentage) except age and length of hospital stay.
†P value for pin/plate vs hemiarthroplasty.
‡P value for home vs other facility.

years) for pneumonia patients. Most patients were women (81% of hip fracture and 61% of pneumonia patients). End-stage dementia patients with hip fracture or pneumonia were 6 and 4 years older, respectively, than cognitively intact patients. Dementia patients were more likely to reside in nursing homes (82% vs 5% with hip fracture and 63% vs 5% with pneumonia).

Mortality

The FIGURE shows Kaplan-Meier survival curves for pneumonia and hip fracture patients. TABLE 2 shows the results of the proportional hazards model. At 6 months, 42 (53%; 95% confidence interval [CI], 41%-64%) of 80 pneumonia patients with end-stage dementia had died compared with 5 (13%; 95% CI, 4%-27%) of 39 cognitively intact patients (adjusted hazard ratio, 4.6; 95% CI, 1.8-11.8). Twenty-one (55%;

95% CI, 42%-75%) of 38 hip fracture patients with end-stage dementia died within 6 months of hospitalization compared with 7 (12%; 95% CI, 5%-24%) of 59 cognitively intact hip fracture patients (adjusted hazard ratio, 5.8; 95% CI, 1.7-20.4). Thirty-four (54%) of 63 end-stage dementia patients who died were readmitted to the study hospital within 6 months of their index hospitalization compared with 7 (58%) of 12 cognitively intact patients who died. Additional factors associated with decreased survival among hip fracture patients included a high Charlson comorbidity index score and being unable to walk or transfer without total assistance. Pneumonia patients with a high pneumonia severity score were also at increased risk for death. All patients with pneumonia received intravenous antibiotics; patients with end-stage dementia were significantly more likely to re-

Figure. Kaplan-Meier Survival Curves for Patients With Hip Fracture and Pneumonia
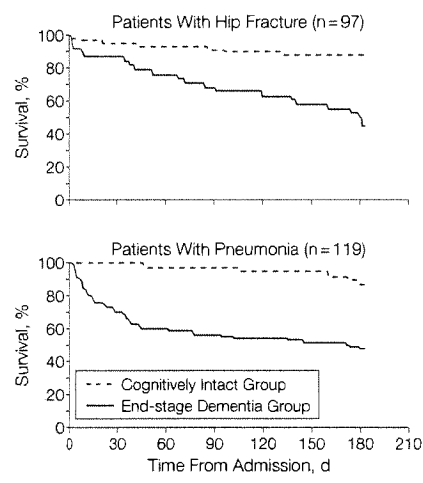
Table 2. Cox Proportional Hazards Model for Hip Fracture and Pneumonia for 6 Months After Admission

Risk Factor	Hazard Ratio (95% Confidence Interval)
Patients With Pneumonia (n = 119)	
Dementia	4.6 (1.8-11.8)
Higher pneumonia severity score*	3.1 (1.1-8.9)
Older age	1.1 (0.98-1.1)
Patients With Hip Fracture (n = 97)	
Dementia	5.8 (1.7-20.4)
Higher Charlson comorbidity score	1.4 (1.1-1.8)
Unable to walk/transfer	3.4 (1.3-8.9)
Nursing home residence	1.5 (0.5-4.5)
Older age	1.0 (0.99-1.1)

*Patients were assigned a pneumonia severity score using a prediction rule developed by Fine et al.[11]

ceive a third-generation cephalosporin or antipseudomonal penicillin (43% vs 13%; $P = .009$). A decision was made to withdraw antibiotics in 2 end-stage dementia patients with pneumonia.

Patient Care and Procedure Use

The frequency of use of 9 common procedures that have been shown to be moderately to severely painful or uncomfortable is shown in TABLE 3. There were no significant differences in the number of burdensome procedures received by end-stage dementia and cognitively intact patients, and end-stage dementia patients were significantly more likely to be restrained. Addition-

ally, hip fracture patients with end-stage dementia received a mean of 1.7 mg/d of morphine sulfate equivalents compared with 4.1 mg/d for cognitively intact patients ($P<.001$) and no end-stage dementia patients received premedication prior to being turned, transferred, or repositioned. Furthermore, only 9 (24%) of 38 hip fracture patients with end-stage dementia—who often are unable to communicate the presence of pain or need for analgesia—received a standing order for analgesics (including acetaminophen or nonsteroidal anti-inflammatory drugs).

Finally, no documentation was found of any discussions about goals of care, including decisions to withhold or withdraw life-sustaining treatment (including antibiotics) for 106 (90%) of 118 end-stage dementia patients. Two patients with end-stage dementia (1 with hip fracture and 1 with pneumonia) were discharged to a nursing home with hospice at the initiative of a hospital social worker. Decisions were made to forgo life-prolonging therapies other than cardiopulmonary resuscitation for 8 end-stage dementia patients (7%) compared with 1 cognitively intact patient (1%). The decision to withhold these life-prolonging therapies was made when patients either were comatose or were hypotensive in the setting of multisystem organ failure and death appeared imminent.

COMMENT

This study found high 6-month mortality for patients with end-stage dementia following hospitalization for pneumonia (53%) or hip fracture (55%) compared with cognitively intact patients with the same conditions. Despite this high mortality, we observed almost no differences in the care that end-stage dementia patients received compared with cognitively intact adults and no evidence that palliative care was undertaken either in conjunction with or instead of life-prolonging measures for dementia patients. For example, treatment plans in end-stage dementia patients did not address the high symptom burdens associated with these 2 con-

ditions (eg, we found no evidence of morphine use to treat dyspnea or efforts to premedicate patients prior to painful interventions such as transferring from bed to chair). Also, there did not appear to be consideration of limiting burdensome interventions (eg, arterial blood gas measurement, phlebotomy, urinary catheter insertion) in patients with end-stage dementia. No palliative care plans (eg, opting to focus measures on enhancing and promoting comfort rather than life prolongation or cure) were identified; few discussions with families about the goals of hospital care, implementing a palliative care plan, or discharging a patient to hospice were noted; and few decisions to forgo life-sustaining therapy were made. These data suggest that advanced dementia is not viewed as a terminal diagnosis by physicians or families, perhaps because physicians and families may not be aware of the poor short-term prognosis for these patients.

Previous studies examining prognosis in dementing illnesses have been confined to patients with mild-to-moderate dementia[16-21] and those in nursing homes and hospice care.[2-5] This study is the first to examine survival following hospitalization for 2 common illnesses in this population. Our data suggest that pneumonia severe enough to warrant hospitalization in end-stage dementia is associated with a limited 6-month prognosis, even following treatment with antibiotics and other life-prolonging therapies and controlling for pneumonia severity.

Survival data following hip fracture for patients with advanced cognitive impairment are even more limited than those available for pneumonia because most hip fracture studies either have excluded nursing home residents or have not specifically reported mortality for advanced dementia patients.[12,22,23] Our study suggests that hip fracture is a catastrophic event for patients with advanced dementia and is associated with a low initial in-hospital mortality (5%) but a high 6-month mortality (55%). Whether hip fracture directly increases the risk of death or is a marker for increased

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frailty and higher probability of developing a fatal medical complication has yet to be determined.

There are several limitations to this study that should be noted. First, this study was undertaken at 1 hospital and the results may not be generalizable to other institutions in other settings. Second, it is possible that surrogates of end-stage dementia patients opted for a palliative approach for their relatives the next time they became ill, which may have resulted in an overall higher mortality rate than if they had received life-prolonging therapy. Fifty-four percent of the end-stage dementia patients who died were readmitted to our acute care hospital within 6 months of their index hospitalization compared with 58% of cognitively intact patients who died, suggesting no difference in whether cognitively intact or end-stage dementia patients were to be rehospitalized when acutely ill. Third, this study was undertaken in New York State, where a health care proxy or clear and convincing evidence of a patient's wishes is required to withhold or withdraw life-sustaining therapy. Sixty percent of hip fracture patients with end-stage dementia and 70% of pneumonia patients with end-stage dementia did not have an advance directive. There were, however, no significant differences in decisions to withhold or withdraw care between patients with and without an advance directive, and advance directives were not significantly associated with survival in univariate analyses for either hip fracture or pneumonia. Again, these data suggest that advanced dementia with superimposed pneumonia or hip fracture may not be viewed as a terminal diagnosis by physicians or families. Fourth, we relied on medical record review to determine whether conversations about the goals of care occurred between families of end-stage dementia patients and physicians. It is possible that such discussions occurred and that physicians failed to document these conversations when families opted for standard medical

Table 3. Prevalence of Painful/Uncomfortable Procedures

	No. (%) of Patients Receiving Procedure			
	With Hip Fracture		With Pneumonia	
Procedures	Cognitively Intact (n = 59)	With End-Stage Dementia (n = 38)	Cognitively Intact (n = 39)	With End-Stage Dementia (n = 80)
Arterial blood gas measurement	15 (25)	12 (32)	6 (15)	9 (11)
Central line placement	2 (3)	1 (3)	2 (5)	4 (5)
Indwelling bladder catheter insertion*	33 (56)	23 (61)	4 (10)	46 (58)†
Intravenous catheter insertion (after admission)	44 (75)	31 (82)	32 (82)	65 (81)
Mechanical restraint use	1 (2)	12 (32)†	1 (3)	12 (15)‡
Nasogastric tube placement	1 (2)	1 (3)	0	4 (5)
Daily phlebotomy during ≥50% of hospital stay	33 (56)	27 (71)	19 (49)	36 (45)
Intravenous catheter present for entire hospital stay	24 (41)	25 (66)	25 (64)	44 (55)
Mechanical ventilation (not including that associated with general anesthesia)	1 (2)	0	0	2 (3)

*Inserted at time of admission in pneumonia patients and 24 or more hours after surgery in hip fracture patients.
†$P < .001$.
‡$P = .04$.

therapies. Finally, this study excluded end-stage dementia patients with pneumonia or hip fracture for whom a decision was made not to admit to the hospital and excluded patients with cancer. Thus, our survival rates for end-stage dementia patients may be higher than might be expected if all end-stage dementia patients were included.

In summary, we found that end-stage dementia patients who received routine hospital care for pneumonia or hip fracture had a 4-fold increase in 6-month mortality compared with elderly cognitively intact adults with the same diagnoses (53% vs 13% for pneumonia patients and 55% vs 12% for hip fracture patients) and had survival rates similar to patients hospitalized with chronic end-stage liver disease, multiorgan system failure with sepsis, and some metastatic cancers.[24,25] This study cannot determine whether acute hospital care prolongs survival in end-stage dementia patients with pneumonia or hip fracture, and further studies are needed to help clinicians identify those patients whose survival might be prolonged. Given the burdens of treatment associated with pneumonia and hip frac-

ture that we have identified in this study—burdens that probably are greater in individuals with dementia because they cannot understand the reasons for tests or treatments, prepare for them emotionally, refuse them if desired, or request analgesia—and the high mortality observed following these illnesses, we believe that increased attention needs to be directed to relieving pain and other distressing symptoms and minimizing burdensome interventions in hospitalized end-stage dementia patients. Furthermore, given the high probability of death following pneumonia or hip fracture in the setting of end-stage dementia, we encourage physicians to initiate discussions with patients' surrogates about achievable goals for medical care and establish treatment plans consistent with these goals to minimize preventable pain and discomfort for these patients.

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> We must trust to nothing but facts: These are presented to us by Nature, and cannot deceive. We ought, in every instance, to submit our reasoning to the test of experiment, and never to search for truth but by the natural road of experiment and observation.
> —Antoine Lavoisier (1743-1794)