Risk Factors For Mortality From Infectious Diseases Among Elderly From Long-Term Care Facilities

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Citation

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Abstract

Background: The purpose of this study was to analyze risk factors for mortality in elderly residents who had acquired infections in long-term care facilities (LTCF) and were transferred to an acute care hospital.
Methods: A retrospective medical record review was conducted in Okinawa Chubu Hospital, a 550-bed community teaching hospital in Okinawa, Japan. Study population included elderly LTCF residents in central Okinawa with signs or symptoms suggestive of infectious diseases or referred with probable infections that were transferred to an acute care hospital from 1995 to 1999. The medical records were reviewed and data were analyzed by stepwise logistic regression.
Results: Two hundred patients (median age, 83 years) with diagnosis of infections were evaluated during the 5-year study period. Overall, 23 patients (11.5%) died. Independent predictors of mortality were lower respiratory tract infection, history of hip fracture, systolic blood pressure less than 100 mmHg, and serum creatinine greater than 1.5mg/dl.

Conclusions: Our findings could help physicians identify elderly LTCF residents with infectious diseases that pose high risk for mortality and provide prognostic information for patients and caregivers. Strict evaluation for infectious focus is important since lower respiratory tract infection has worse prognosis.

INTRODUCTION

Infectious diseases are important causes of hospitalization and mortality in residents of long-term care facilities [1,2,3]. Previous reports of elderly residents of LTCF focused on incidence and risk factors of general infectious diseases including minor febrile episodes [4,5,6]. Since most patients with those febrile episodes recover rapidly and many needed no specific treatment, special attention should be given to patients with severe diseases who require admissions to acute care hospitals and are therefore potentially high-risk groups for mortality. However, few studies investigating such a specific group of patients have been reported. There is also no report from an Asian country where elderly individuals make up a greater proportion of the population than North America.

The aims of this study were to (1) determine the in-hospital mortality rate of hospitalized patients 65 years of age or older who were transferred from long-term care facilities with the admission diagnosis of an infectious disease, and (2) to identify the independent risk factors for mortality.

MATERIAL AND METHODS

PARTICIPANTS

A computerized registration of initial diagnosis was used to identify all patients who had been transferred from long term care facilities for treatment of infectious diseases or presented with a chief complaint of fever or documentation of probable infections in reference letters to Okinawa Chubu Hospital, Okinawa, Japan, a 550-bed community teaching hospital. The division of general internal medicine reviewed the medical records of all identified patients for inclusion in this study. The principal outcome was in-hospital mortality attributed to infectious diseases. The institutional review board of Okinawa Chubu Hospital approved the study. Informed consent for utilizing the individual patient medical record in this study was obtained from the designated surrogate decision makers (i.e., health care agent or next of kin).

DATA COLLECTION

Detailed baseline demographic and clinical data were obtained at admission for each patient by physicians and nurses in the facilities. Potential risk factors for in-hospital mortality that were evaluated included age, gender, past

medical history [7], types of infection [8], dependency of basic Activities of Daily Living (ADL) [9], tube feeding [10], urinary catheterization [11], nasal colonization of methicillin-resistant staphylococcus aureus [12], and the presence of decubitus ulcer. Functional status was assessed using the ADL index of Katz and colleagues [13]. Dependency of basic ADL was defined for the purposes of this study as an ADL score of 4 or 5 (dependent in bathing, dressing, transferring, going to the toilet, continence, and/or feeding) [14,15,16]. Vital signs were measured and recorded as initial data during admission. Laboratory data, which were selected for the purpose of this study, were blood leukocyte count, hemoglobin, serum creatinine, albumin [17], and cholesterol levels at admission [18]. A confusion assessment diagnostic algorithm was used for all patients for the evaluation of delirium at admission [8].

DISEASE DEFINITION

Lower respiratory tract infection (LRI) was defined as fever (temperature >38°C), tachypnea (respiration rate more than 24 per minute), production of purulent sputum, oxygen saturation less than 90% on pulse oximetry, and radiological evidence of alveolar infiltrates. Urinary tract infection was defined as fever (temperature >38°C) with pyuria (more than 9 urine leukocytes per high power field) and bacteriuria (bacteria qualitative assessment). Biliary tract infection was defined as fever (temperature >38°C) with right upper quadrant tenderness, laboratory evidence of biliary enzyme elevations including serum total bilirubin more than 1.4mg/dl and imaging tests (computed tomography or echography) showing biliary system inflammation as judged by gall bladder wall thickening or dilated biliary ducts. Soft tissue infection consistent with cellulitis was defined as fever (temperature >38°C) with signs of inflammation of skin. Other causes of infectious diseases such as nonspecific upper respiratory tract infection, sinusitis, septic arthritis, infective endocarditis and perianal abscess were diagnosed based on the clinical judgment of the attending physicians [19].

STATISTICAL ANALYSIS

Each patient‘s characteristic was evaluated for an association with mortality on the basis of separate univariate logistic regression models. We performed a stepwise multivariable logistic regression analysis to identify variables independently associated with mortality. The a-level for inclusion of individual variables was 0.05; however, because many correlated variables were being considered, model building ceased if the residual chi-square statistic was insignificant at the 0.10 levels. The residual chi-square statistic tested the association of the dependent variable with all the variables not in the model at a given step, with adjustment for the number of variables in the model at that step. The strength of the association of each variable with mortality was summarized by calculating an odds ratio and corresponding 95% confidence intervals (CI) that were derived from the coefficients estimated in the logistic regression models. Continuous variables that were positively skewed were analyzed on the log-2 scale. The odds ratios were reported as a doubling in the value of the variable. Statistical analysis was performed by using SPSS software, version 10 (SPSS Inc. Chicago, Illinois).

RESULTS

During the 5-year period of the study from 1995 to 1999, 200 patients meeting the criteria of infections acquired in LTCF were included. There were two such patients per 100 total hospital admissions in that period. Twenty-three (11.5%) patients died eventually during hospitalization. Table 1 presents the clinical characteristics of all patients. The median age was 83 years (range, 65 to 103 years). One hundred five (52.5%) were female and 95 (47.5%) were male. The median duration of hospitalization was 12.5 days (range, 1 to 84 days). Since recovered patients was discharged back to their original LTCFs in the study area and LTCFs did not care for dying patients, all mortality patients in the short term period were identified. LRI was the most common infectious disease diagnosis at admission (61%, 95% CI 54.2-67.8), followed by urinary tract infection (24.5%, 95% CI 21.5-27.5), biliary tract infection (4.0%, 95% CI 2.6-5.4) and soft tissue infection (2.5%, 95 %CI 1.4-3.6). Other infectious causes included upper respiratory tract infection (11 patients), septic arthritis (2), infective endocarditis (2), and perianal abscess (1).

Figure 1

Table 1: Patient Characteristics

characteristics	all patients (n=200)	death (n=23)	survival (n=177)	P Value
Demographic				
median age (range), y	83(65-102)	85(67-97)	83(65-102)	0.4047
female, n (%)	105(52.5)	7(30.4)	98(55.4)	0.0243
Past medical history, n				
hypertension	68	8	60	0.9329
diabetes	10	1	9	0.9999
heart disease	65	8	57	0.8038
pulmonary disease	131	16	115	0.6879
malignant disease	17	3	14	0.4319
dementia	127	14	113	0.7806
hip fracture	30	8	22	0.0047
Type of infection, n				
lower respratory tract infection	122	20	102	0.0077
urinary tract infection	49	2	47	0.0449
biliary tract infection	8	0	8	0.3693
soft tissue infection	5	0	5	0.5393
others	14	1	13	0.5035
Baseline status, n				
dependency of basic ADL	178	20	158	0.724
tube feeding	57	10	47	0.0943
urinary catheterization	14	0	14	0.3773
MRSA colonization	51	10	41	0.0652
decubitus ulcer	23	4	19	0.3119
Vital signs at admission, mean±SE				
systolic blood pressure, mmHg	118 ± 1.7	108 ± 5.3	119 ± 1.8	0.0389
heart rate, per minute	103 ± 5.2	96 ± 2.6	104 ± 5.9	0.6566
respiratory rate, per minute	26 ± 0.6	27 ± 1.4	25.7 ± 0.6	0.4694
temperature,0	38.0 ± 0.18	37.2 ± 0.24	38.1 ± 0.20	0.1198
Laboratory data, mean ±SE				
blood leukocyte, /mm3	12721 ± 715	11000 ± 1364	12956 ± 791	0.3761
hemoglobin, g/dl	11.7 ± 0.15	10.3 ± 0.43	11.8 ± 0.15	0.0005
serum creatinine, mg/dl	0.99 ± 0.063	1.54 ± 0.463	0.92 ± 0.034	0.0015
serum albumin, g/dl	3.1 ± 0.07	3.2 ± 0.60	3.0 ± 0.04	0.38
serum cholesterol, mg/dl	144 ± 2.9	120 ± 7.2	147 ± 3.0	0.0037
Delirium at admission, n	11	1	10	0.9999

ADL indicates activity of daily living; MRSA, methicillin-resistant staphylococcus aureus; SE, standard error.

Twenty (87%) of twenty-three patients with fatal outcome had LRI as the cause of infectious diseases diagnosis at admission. Three patients without LRI who died during hospitalization had infectious diseases from urinary tract infection (2 patients) and infective endocarditis (1).

Factors significantly associated with mortality ($P < 0.05$) according to univariate analysis included male gender, past history of hip fracture, infectious causes other than urinary tract infection, lower systolic blood pressure at admission, lower blood hemoglobin, elevated serum creatinine, and low serum cholesterol (Table 1). Age, delirium at admission and presence of dementia were not significantly different between the non-surviving and surviving patients.

According to stepwise multivariable logistic regression analysis using these seven potential variables, in-hospital mortality was independently associated with admission diagnosis of LRI, history of hip fracture, admission systolic blood pressure less than 100 mmHg, and admission serum creatinine greater than 1.5mg/dl (Table 2).

Figure 2

Table 2: Factors associated with Mortality in Multivariate analysis

Variables, n	In-hospital death (n=23)	Discharge survival (n=177)	Multivariate analysis	
			Odds ratio (95% CI)	p Value
lower respiratory tract infection	20	103	7.58 (1.87-30.71)	0.0045
hip fracture	8	22	4.55 (1.57-13.19)	0.0053
SBP<100mmHg	9	31	4.11 (1.44-11.75)	0.0084
serum creatinine>1.5mg/dl	6	17	3.67 (1.12-12.0)	0.0312

SBP indicates systolic blood pressure.

DISCUSSION

In our series, in-hospital mortality was noted in approximately one tenth of patients who were admitted to acute care hospital for management of LTCF-acquired infectious diseases. Mortality was independently associated with diagnosis of LRI, history of hip fracture, hypotension and renal dysfunction at admission. Our rate of mortality (11.5%) was similar to that of another study (16%), in which the mortality from all infectious diseases including minor febrile episodes was analyzed in LTCF [20]. Our findings of a modestly lower rate of mortality was unexpected because our study patients, who were admitted and cared for in an acute care hospital, were supposed to represent the higher risk groups for mortality. However, reports of results similar to our findings were also observed from another study.

In our study, in-hospital mortality was independently associated with diagnosis of LRI, history of hip fracture, hypotension and renal dysfunction at admission. Similarly, a recent study in elderly residents of LTCF reported that pneumonia is a leading cause of death among infectious diseases [11]. Other studies have shown that hypotension and renal failure at admission can predict in-hospital mortality from community-acquired pneumonia in elderly patients in general [21]. Furthermore, history of hip fracture has been previously shown to predict higher mortality in 6 months to 3 years after date of fracture itself [22, 21, 23]. These results seem generalizable to other healthcare systems outside of Japan because almost all developed countries now face similar trends for aged society as Japan.

Fever a is common reason for acute care hospitalization in elderly residents of LTCF. Frequently, the infectious source is obscure at initial presentation in many LTCF patients; which may be due, in part, to empiric use of antibiotics for broad coverage of respiratory and urinary tract infections. Our findings showed the importance of investigating the specific infectious focus in terms of prognostic prediction since LRI suggested worse prognosis but urinary tract infection better.

The main limitation of our study is that the analysis focused on hospitalized patients which could have referral bias, although mortality rate was not much different between our study and other studies involving residents who had acquired infectious diseases in LTCF. Another limitation is its limited sample size, which may have contributed to the lack of statistical power to show other potentially significant variables for predictors of mortality. For example, Grant and

colleagues had indicated that male gender, low blood hemoglobin, and low serum cholesterol were predictors for overall mortality in elderly [18,24] and Walter and colleagues had recently reported six independent risk factors for one year mortality in elderly acute hospitalized inpatients: congestive heart failure, cancer, chronic renal failure, low serum albumin and dependent ADL [24].

CONCLUSIONS

Infectious diseases, which were acquired in LTCF and treated in acute care hospital, may cause in-hospital deaths in approximately one tenth of cases. Risk factors for mortality included diagnosis of LRI, history of hip fracture, hypotension and renal dysfunction at admission. Clinicians should be aware of these clinical variables because it could aid them in providing prognostic information for patients and caregivers, and also in making ethical decision such as introducing palliative care. The evaluation of fever for infectious focus is especially warranted [25]. The results of this study should be validated in other settings, especially outside of Japan.

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