

Living Alone as a Prognostic Factor of Elderly Pneumonia [Version 2, Approved]

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Abstract

Background: Pneumonia is a main cause of elderly death, and various kinds of prognostic factors have already been reported, but the involvement of elderly life style is still remained unclear. Purpose of the study is to analyze the prognostic factors of pneumonia in elderly patients, and to focus on the possible involvement of living alone.

Methods: The subjects were 272 hospitalized pneumonia patients more than 65 years old in Akiota Hospital from September 2011 to August 2015. 163 Community-acquired pneumonia cases and 109 nursing care and healthcare-associated pneumonia cases were included in the study. Multiple factors including severity of pneumonia, vital signs, and blood chemistry data were retrospectively compared by using multiple logistic regression analysis. Cases were followed until discharge or death. And they were divided into 2 groups, which were 30-day non-survivors group (those who died within 30 days from admission) or 30-day survivors group (remainder).

Results: 40 cases died within 30 days from onset of pneumonia. The clinical characteristics related to poor prognosis were as following; advanced age, past history of cerebral vascular disease and/or diabetes mellitus, decreased serum albumin level, and higher CURB-65 points. Furthermore, cases who were living alone without care givers had a higher mortality than cases living with others.

Conclusions: These findings suggest potential prognostic factors for elderly pneumonia, including living alone.

Keywords

Elderly; Pneumonia; Living Alone

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Abbreviations

CAP-Community-Acquired Pneumonia; NHCAP-Nursing Care And Health Care-Associated Pneumonia; CRP-C-Reactive Protein; PORT-Patient Outcome Research Team; PSI-Pneumonia Severity Index; CVD-Cerebral Vascular Disease; COPD-Chronic Obstructive Pulmonary Disease; DM-Diabetes Mellitus; 95 % CI-95 % Confidence Interval; GP-General Practitioner

Introduction

Acute pneumonia is a common disease and main cause of death in the elderly [1,2]. As previous papers already reported, classifications of the severity of pneumonia including CURB-65 [3] and pulmonary severity index (PSI) [4] are associated with pneumonia prognosis in all generations. Most of elderly patients already complicated other diseases at the onset of pneumonia [2], and that was the difference between elderly pneumonia cases and younger pneumonia cases. Since the prognosis of elderly pneumonia is affected by their concomitant diseases, elderly pneumonia might have different prognostic factors other than younger pneumonia. Therefore, we speculated that it would be appropriate to analyze prognostic factors for pneumonia other than the CURB-65 and PSI of PORT-study in elderly cases. Previously, we already reported that QTc prolongation in ECG was associated with a poor prognosis in elderly pneumonia cases [2]. Diversity of elderly patients' concomitant diseases and life style might affect their prognostic factor. Previously, Grant N et al [5] reported that social isolation affected stress-related cortisol responses, , exacerbated vascular inflammation, and metabolic disorder. And Tilvis RS et al [6] reported that loneliness increased mortality risk in elderly. Recently, as one of living arrangements, living alone was reported to be associated with increased risk of mortality [7], but influence of living alone upon elderly pneumonia prognosis is still remained uncertain.

The hypothesis of this study was that elderly living arrangements might be also associated with a poor prognosis in pneumonia patients, and the mortality rates of elderly pneumonia cases in our hospital were analyzed.

Methods

Study Design

The study was carried out in Akiota Hospital, which shared primary care- and critical care-medicine in north region of Hiroshima, Japan. The subjects were 272 hospitalized pneumonia patients (137 males, 135 females; 79.5 ± 8.7 years old) from September 2011 to August 2015. All consecutively hospitalized patients more than 65 years old were included in to the study, with 163 community-acquired pneumonia (CAP) patients and 109 nursing care and health care-associated pneumonia (NHCAP) patients. The Japan Respiratory Society Guidelines documented the category of NHCAP [8], which includes patients with any of the following: residence in a long-term nurs-

ing home setting or healthcare home; discharge from hospital within 90 days; elderly or physically disabled persons who need healthcare giver; and persons continuously receiving endovascular therapy in an ambulatory setting. Pneumonia was defined as the presence of symptoms of a lower respiratory tract infection with new infiltrate shadow on a chest X-ray and the absence of an alternative diagnosis. The attending physician decided content of the treatment. The research team carried followed recorded clinical data in all cases. At the time of diagnosis, severity of pneumonia, vital signs, and blood chemistry data were recorded, and they were retrospectively compared using multiple logistic regression analysis. Parameters included serum C-reactive protein (CRP), white blood cell count (WBC), and the serum albumin level. The severity of pneumonia was graded by the CURB-65 score (confusion, uremia, respiratory rate, low blood pressure, age 65 years or greater) [3]. PORT-study points were summed and also used as the PSI [4]. These data were compared by using multiple logistic regression analysis. Patients were followed-up until discharge from the hospital or death. The study was approved by the institutional review board of Shimane University School of Medicine and the local ethics committee of Akiota Hospital.

Endpoint of the Study

Cases were followed until discharge from the hospital or death. We divided the cases into 2-group. Those who died within 30 days from admission was (30-day non-survivors) group, and remainder was (30-day survivors) group.

Statistical Analysis

Statistical analysis was calculated using computer software (Excel Statistics 2012, SSRI Co., Ltd., Tokyo, Japan). All data are expressed as means \pm standard deviation (S.D.). The chi-square test, Fisher's exact test, and the Mann-Whitney U test were used to compare the difference between 2 groups (30-day survivors and 30-day non-survivors) group.). Using multiple logistic regression analysis, the patients' relative risks were calculated as previously reported [2]. Probability value of less than 0.05 was considered significant.

Result

A total of 232 patients (114 males, 118 females; 77.1 ± 7.6 years old) survived (30-day survivors), and 40 patients (23 males, 17 females; 83.4 ± 8.3 years old) died within 30 days (30-day non-survivors), for a mortality of 14.7 % (Table 1). Older age, severity of pneumonia score (CURB-65 and PSI) and lower serum albumin level were significantly different between the fatal outcome group and the survivors group. Mortality was higher in NHCAP cases than that of CAP cases (Table 2). And cases with non-survivors group had a higher rate of past history of cerebral vascular disease (CVD) and diabetes mellitus (DM). As the living arrangements, subjects with living alone showed higher mortality rate. With or without of health care-givers, social health service, and general practitioner (GP) contact did

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not affect the mortality. Next, multiple logistic regression analysis of differences in clinical characteristics of the pneumonia patients (30-day survivors group versus 30-day non-survivors group) was performed (Table 3). The odds ratios of older age, CURB-65, PSI, lower albumin level, living alone, and past history of CVD and DM were significantly higher in non-survivors group. The odds ratio of living alone in the non-survivors group was 3.492 (95 % confidence interval (CI) = 1.110-11.376).

Table 1: Univariate analysis of differences in clinical characteristics in elderly pneumonia [1].

Factors	30-day survivors		30-day non-survivors		p
	Mean ± S.D.	n	Mean ± S.D.	n	
Age (years old)	77.1 ± 7.6	232	83.4 ± 8.3	40	0.0039
CURB-65	2.1 ± 0.7	232	3.6 ± 0.7	40	< 0.0001
PSI	86.1 ± 24.0	232	117.1 ± 19.2	40	< 0.0001
WBC (/mm ³)	10,332.2 ± 4,518.3	232	10,256.3 ± 4,555.1	40	0.5131
CRP (mg/dL)	8.7 ± 6.5	232	9.2 ± 6.9	40	0.5897
Albumin (g/dL)	3.5 ± 0.5	232	2.8 ± 0.6	40	< 0.0001

Data represent the numbers of cases. All data is expressed as means ± standard deviation of the means. CRP: C-reactive protein, WBC: white blood cell count, PSI: pneumonia severity index. Counting points of CURB-65 and PORT-study as the severity of pneumonia are cited from reference-3 and -4.

Table 2: Univariate analysis of differences in clinical characteristics in elderly pneumonia [2].

Factors	Categories	30-day	30-day	p
		survivors	non-survivors	
Gender	male	114	23	0.3928
	female	118	17	
CAP or NHCAP	CAP	148	18	0.0343
	NHCAP	84	22	
Past history of				
Heart failure	+	37	10	0.1758
	-	195	30	
COPD	+	54	8	0.8384
	-	178	32	
CVD	+	73	21	0.0102
	-	159	18	
DM	+	21	12	0.0008
	-	211	28	
Dementia	+	68	15	0.3527
	-	164	25	
Living alone	+	39	15	0.0046
	-	193	25	
Health care-givers	+	98	18	0.8628
	-	134	22	
Social health service	+	100	18	0.8646
	-	130	22	
GP contact	+	191	35	0.5075
	-	41	5	

Data represent the numbers of cases. CAP: community-acquired pneumonia; NHCAP: nursing care and health care-associated; COPD: chronic obstructive lung disease; CVD: cerebral vascular disease; DM: diabetes mellitus; GP: general practitioner

Table 3: Multiple logistic regression analysis of differences in clinical characteristics in elderly pneumonia.

Risk factors	Categories		Odds ratio		(95 % CI)	p
	≥	<	30-day survivors	30-day non-survivors		
Age (years old)	≥ 80	< 80	1	2.384	(1.219 - 4.894)	0.0061
CURB-65	≥ 3	< 3	1	12.126	(4.167 - 27.323)	< 0.0001
PSI	≥ 131	< 131	1	7.689	(3.321 - 14.758)	< 0.0001
Albumin (g/dL)	< 3.0	≥ 3.0	1	8.509	(2.536 - 32.354)	0.0043
NHCAP	+	-	1	3.896	(1.121-12.051)	0.0278
Past history of						
CVD	+	-	1	5.012	(1.872 - 15.541)	0.0110
DM	+	-	1	4.271	(1.428 - 13.927)	0.0093
Living alone	+	-	1	3.492	(1.100 - 11.376)	0.0428

Data represent the numbers of cases. NHCAP: nursing care and health care-associated; PSI: pneumonia severity index. Counting points of CURB-65 and PORT-study as the severity of pneumonia are cited from reference-3 and -4. CVD: cerebral vascular disease; DM: diabetes mellitus. 95 % CI: 95 % confidence interval

Then, these parameters with elderly living alone cases (n = 54) were compared, as subgroup analysis (Table 4). In poor prognosis group, severity of pneumonia (CURB-65 and PSI) was higher, and length from onset of pneumonia to admission was longer. The ratio of NHCAP and cases with care-givers were significantly higher in non-survivors group. Multiple logistic regression analysis of the clinical features of cases with living alone (survivor group versus non-survivors group) are shown in (Table 5). The odds ratios were significantly higher for severe pneumonia cases (CURB-65), NHCAP cases, cases without care-givers, and delayed admitted cases from the onset of pneumonia in 30-days non-survivors.

Table 4: Univariate analysis of differences in clinical characteristics in elderly pneumonia with living alone.

Factors	Categories	30-day	30-day	p
		survivors (n=39)	non-survivors (n=15)	
Age (years old)		79.9 ± 7.2	82.5 ± 7.9	0.0568
CURB-65		1.9 ± 0.7	3.5 ± 0.7	0.0018
	PSI	88.2 ± 22.3	113.1 ± 21.6	
Days from onset to admission		2.4 ± 1.5	4.3 ± 1.6	0.0453
Gender	male	16	8	0.5434
	female	23	7	
CAP or NHCAP	CAP	37	11	0.0439
	NHCAP	2	4	
Health care-givers	+	18	2	0.0307
	-	21	13	
Social health service	+	16	9	0.2386
	-	23	6	
GP contact	+	19	12	0.0638
	-	20	3	

All data is expressed as means ± standard deviation of the means. CAP: community-acquired pneumonia; NHCAP: nursing care and health care-associated; GP: general practitioner; PSI: pneumonia severity index, counting points of CURB-65 and PORT-study as the severity of pneumonia are cited from reference-3 and -4.

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Table 5: Multiple logistic regression analysis of differences clinical characteristics in elderly pneumonia with living alone.

Risk factors	Categories		Odds ratio		(95% CI)	p
			30-day survivors	30-day non-survivors		
CURB-65	≥ 3	< 3	1	3.289	(0.843 - 12.839)	0.0867
PSI	≥ 131	< 131	1	2.444	(3.031-13.702)	0.1958
Days from onset to admission	≥ 3	< 3	1	4.3075	(0.173 - 2.595)	0.0204
CAP	+	-	1	0.326	(0.173 - 2.595)	0.1493
Health care-givers	-	+	1	2.078	(1.082 - 15.792)	0.0468

PSI: pneumonia severity index, counting points of CURB-65 and PORT-study as the severity of pneumonia are cited from reference-3 and -4. CAP: community-acquired pneumonia, 95% CI: 95% confidence interval

Discussion

In this study, the presence of living alone in pneumonia cases was correlated with poor prognosis. As far as we know, this is the first report showing that living alone might be a predictive factor of mortality in elderly pneumonia cases. Other than living alone, older age [9], lower serum albumin level [10], high point of CURB-65 score [3,11] or PSI score [4,12], past history of CVD [13] and DM [14] were also associated with higher mortality, and these findings were compatible with previous reports describing about prognostic factors of elderly pneumonia [15].

Accompanied with increased number of elderly people living alone, which is considered as one of social problems. Mouodi S et al reported that prevalence of many kinds of diseases was higher in elderly living alone [16]. Already increased mortality risk of ischemic heart disease [17], CVD [18], and respiratory disease [19] was reported.

Several mechanisms have been previously proposed to explain the relationship between living alone and development of diseases as following; proinflammatory and prothrombotic states [20], impaired medication adherence [17], health-compromising behaviors such as heavy smoking or drinking [21], psychological distress [22], and decline of quality of life [23].

Another reason that living alone was associated with increased mortality in our study was speculated that most cases had their GP contact as attending physician, but they did not have their health care-givers and delayed to be hospitalized from the onset of pneumonia. As the result, pneumonia cases with living alone showed poor prognosis.

On the other hand, all the cases with elderly living alone did not show poor prognosis, since population of living alone cases was unique group which has various background. For example, many of CAP cases did not showed poor prognosis in this study, but NHCAP cases showed poor prognosis. Therefore, their background including concomitant diseases should be taken into the account to evaluate the prognosis of pneumonia cases.

There are some limitations in this study. One limitation of this study was that results were based on retrospective analysis. However, the subjects included all the patients experienced during the period of the study. Therefore, we speculated that the possibility of having a bias might not be high. And another limitation was method of statistical analysis. There are two ways for multivariate analysis. One is logistic analysis and another is cox regression analysis. In general, cox regression analysis is used for analyzing both of mortality (survivor or non-survivor) and length of survival. But when analyzing only prognosis (survivor or non-survivor), not only cox regression analysis but also logistic analysis are used as we reported [2]. In the study, we compared only prognosis, therefore logistic analysis were suitable. And the other limitation was that NHCAP was not still popular concept. But recently, several papers about NHCAP [2,8] has been reported.

Recently, relationship among loneliness, social isolation, and elderly mortality was also discussed [24]. Although it was another important problem as living arrangements, we did not have enough data to discuss in this study and further studies would be necessary.

In clinical practice, physicians can consider that living alone, older age, lower albumin level, higher pneumonia severity score, past history of DM and/or CVD might be useful predictable factors to know the future risk of mortality and need for intense treatment in elderly pneumonia patients.

In summary, the present study suggests several potential prognostic factors in elderly patients with pneumonia, including living alone.

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