

Risk factors for in-hospital death in elderly patients over 65 years of age with dementia

A retrospective cross-sectional study

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Abstract

As the population continues to age, dementia is becoming a huge social, economic, and healthcare burden. However, the risk factors for in-hospital death in elderly patients over 65 years of age with dementia are not well understood. Identifying factors that affect their prognosis could help clinicians with scientific decision-making.

To examine the risk factors for in-hospital death in elderly patients over 65 years of age with dementia in the Geriatric Department of West China Hospital.

In this retrospective, cross-sectional study, we analyzed inpatients aged ≥ 65 years with dementia between 2010 and 2016 using electronic medical records from the Information Center of West China Hospital. The risk factors for death were assessed using multivariable logistic regression.

Out of a total of 2986 inpatients with dementia, 3.4% died. Patient deaths were related to digestive diseases, respiratory diseases, circulatory diseases, urinary diseases, and chronic obstructive pulmonary disease, whereas patient survival was associated with osteoporosis and Parkinson disease. Patients with a mean length of hospital stay of ≥ 60 days had an increased risk of death (all $P < .05$). In the multiple logistic regression analysis, age ≥ 80 years, digestive diseases, respiratory diseases, urinary diseases, diabetes, chronic obstructive pulmonary disease, and ≥ 7 comorbidities were risk factors for death.

Mortality in hospitalized older patients with dementia is low, but some risk factors may be easily ignored. These findings could raise awareness among clinicians and caregivers about risk factors in hospitalized older patients, particularly hospitalized elderly patients with multiple comorbidities. Therefore, to reduce mortality, early prevention and management of potential risks are necessary.

Abbreviations: AD = Alzheimer disease, COPD = chronic obstructive pulmonary disease, EMRs = electronic medical records, LBD = Lewy body dementia, LTCFs = long-term care facilities, UI = urinary incontinence, VaD = vascular dementia.

Keywords: dementia, mortality, risk factors

1. Introduction

Dementia has become a global public health priority due to the aging population, and the prevalence of dementia is increasing dramatically worldwide.^[1] Alzheimer Disease International reports that “there are over 50 million people living with dementia globally, a figure set to increase to 152 million by 2050, and someone develops dementia every 3 seconds, and the current annual cost of dementia is estimated at US\$1 trillion, a figure

set to double by 2030.”^[2] Although dementia varies by etiology, type, and severity, it is a leading cause of disability and dependency in people >65 years,^[3,4] causing global social and economic burdens.

It has been reported that the number of patients with dementia in China accounts for approximately 25% of the entire population with dementia worldwide.^[4,5] As the population ages, there will be 22 million people with dementia by 2040, which would equal the number of elderly people in

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The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

The study adhered the Tenets of the Declaration of Helsinki and was approved by the ethics committee of West China Hospital of Sichuan University (ChiCTR-ECS-14004441).

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all developed countries combined.^[6] Moreover, the incidence of dementia increased in an age-specific manner in those aged ≥ 65 years.^[7,8] The number of dementia patients aged ≥ 65 is between 9 and 10 million in China^[3,9] and this figure is rising due to prolonged lifespan and improved diagnostic criteria,^[3] creating a substantial burden on and challenge to the sustainability of healthcare systems. Although relevant scholars and dementia organizations have implemented a series of measures and enabled people with dementia to obtain the maximum amount of treatment and healthcare, including improving long-term care and community and home care programs, it is clear that the efforts are insufficient and do not reach all dementia patients.^[10] Due to economic difficulties, social stigma, low awareness, and unclear early diagnostic criteria, receiving a timely diagnosis and continuous medical care has become a challenge for patients.^[6] As a result, many patients are diagnosed late in the disease, after irreversible crises and damage force patients to frequent hospitals, resulting in increasing medical costs, increasing burden on families, and consumption of social resources. Previous studies have shown that people with dementia are at a high risk of hospitalization and have high hospitalization rates.^[11–15]

Dementia is a disease with a poor prognosis.^[16] It has been reported that the risk of mortality in patients with dementia is 2 to 4 times higher than that in elderly patients without dementia.^[17,18] Many studies have also established that dementia increases the risk of death in elderly patients hospitalized for acute illnesses^[19–22] and infectious diseases^[23–25] and increase the length of hospital stays and costs.^[26,27] However, some studies attributed the increased risk of death in dementia patients to a greater comorbid burden or other risk factors during hospitalization, such as serious adverse events,^[20,28,29] several patient- and disease-specific factors,^[30,31] suboptimal care for acute illnesses,^[19,32] or other psychiatric diseases.^[16] Most studies reported an increased risk of mortality in patients with dementia, but data for hospitalized elderly patients are lacking. To our knowledge, the outcomes of hospitalized dementia patients depend on a variety of factors and affect their quality of life and well-being in the following years. Few studies have examined determinants of mortality risk in hospitalized patients with dementia. Additionally, the causes of death in dementia patients have not been established, particularly in those with rare dementia types. The risk factors for hospitalized patients with dementia may differ from those in an out-of-hospital setting.

Therefore, knowledge of the related (risk) factors for death during hospitalization in these patients is important. This retrospective, cross-sectional study may improve awareness of which inpatients are at particular increased risk of mortality. We tested these hypotheses by characterizing hospitalized older patients with dementia and analyzing the risk factors for death in hospitalized individuals.

2. Methods

2.1. Study design and ethical considerations

The present retrospective, cross-sectional study was carried out in the West China Hospital, a nonprofit tertiary care academic and teaching hospital. The present study was approved by the ethics committee of West China Hospital of Sichuan University (ChiCTR-ECS-14004441).

2.2. Setting and participants

From November 2010 to December 2016, all patients aged ≥ 65 years who were diagnosed with dementia in the West China Hospital were sampled for the study. Then, the subjects were divided into death and survival groups according to hospitalization outcome. All types of dementia, such as Alzheimer disease (AD), Parkinson disease with dementia, vascular dementia

(VaD), and Lewy body dementia (LBD), were included. The patients were excluded if the administration records were unavailable or incomplete.

2.3. Data collection

The electronic medical records (EMRs) of the patients were retrieved from the Information Center of West China Hospital, and the information obtained was entered into a prepared spreadsheet. The retrieved information included age, sex, length of hospital stay, admission status, spousal status, prognosis, total hospital charges, surgery, primary medical conditions (diagnosis), medical insurance, and number of comorbidities. Our study was restricted to clinical data collected before 2016 because the EMR system was replaced at that time, and the new EMR system did not facilitate extraction.

2.4. Statistical analysis

All data from the EMRs were analyzed by SPSS (version 23.0, IBM Corp, Armonk, NY). Descriptive statistics are presented as means, medians, frequencies, or percentages.

To compare the outcomes and characteristics among hospitalized dementia patients, the chi-square test was used for comparison between groups. In the univariate analysis, we included sex, age, length of hospital stay, admission status, spousal status, outcome, surgery, primary medical diagnosis, medical insurance, and number of comorbidities. Main comorbidities included digestive diseases, respiratory diseases, circulatory diseases, hematological diseases, urinary diseases, nervous system diseases, osteoporosis, chronic obstructive pulmonary disease (COPD), Parkinson disease, infection, joint and spinal diseases, diabetes, coronary heart disease, asthma, hypertension, gallbladder disease, benign prostatic hyperplasia, cerebrovascular accident, and tumor. The results of logistic regression analysis were expressed as odds ratios (ORs) with 95% confidence intervals (95% CIs). The variables were entered at 0.05 and removed at 0.10 by the Enter method. A $P < .05$ was considered statistically significant.

3. Results

3.1. Demographics of participating patients

This study included a total of 2986 participants aged ≥ 65 years. No patients were excluded from the analysis. Among the 2986 patients, 1411 (47.3%) were aged 80 to 89 years, and the majority were men. In total, 2449 patients (82.0%) had spouses, 2615 patients (87.6) were in rehabilitation according to their admission status, and 1513 patients (50.7) had a length of hospital stay of 30 days. Most patients did not require surgery. In our study, the vast majority of patients (96.6%) survived. More than half of the patients had no medical insurance. Most of the patients had AD, while the other patients had Parkinson disease with dementia, LBD, or VaD. Most patients had >7 comorbidities (Table 1).

3.2. Outcome of dementia

Among all participants, 104 (3.4%) patients with dementia died. Patient deaths were related to digestive diseases, respiratory diseases, circulatory diseases, urinary diseases, and COPD, whereas patient survival was associated with osteoporosis and Parkinson disease. Patients with a mean length of hospital stay of ≥ 60 hospital days had an increased risk of death (all $P < .05$) (Table 2).

3.3. Factors associated with the death

Among the variables, multivariate logistic regression indicated that characteristics such as age 80 to 89 years (vs age 65–79

Table 1
Characteristics of the participants.

Variable	n (%)	Variable	n (%)
Age (yr)		Admission status	
65–79	1032 (34.6)	Long-term	346 (11.6)
80–89	1411 (47.3)	Acute	25 (0.8)
≥90	543 (18.2)	Rehabilitation	2615 (87.6)
Spouse status		Length of hospital stays	
Presence of a spouse	2449 (82.0)	Mean length of stay	726 (24.3)
Loss of a spouse	537 (18.0)	30	1513 (50.7)
Sex		30–59	355 (11.9)
Male	1826 (61.2)	60–89	322 (10.8)
Female	1160 (38.8)	≥90	70 (2.3)
Number of comorbidities		Dementia type	
1	49 (1.6)	Dementia (total)	2986
2	90 (3.0)	Alzheimer disease	2181 (73.0)
3	193 (6.5)	Parkinson disease	117 (3.9)
4	254 (8.5)	Vascular dementia	498 (16.7)
5	337 (11.3)	Other diseases with dementia	190 (6.4)
6	328 (11.0)	Surgery	
7	1735 (58.1)	No	2675 (89.6)
Medical insurance		Yes	311 (10.4)
None	1591 (53.3)	Death	
Partial	938 (31.4)	Yes	142 (4.8)
Complete	457 (15.3)	No	2844 (95.2)

Table 2
Prevalence of in-hospital death in elderly patients >65 yr of age with dementia.

Variables		Survival (n = 2844)	Death (n = 142)	χ ²	P value
Digestive diseases	Yes	362 (12.7)	29 (20.4)	7.036	.008
Respiratory diseases	Yes	809 (28.4)	83 (58.5)	11.262	<.01
Circulatory diseases	Yes	378 (13.3)	43 (30.3)	32.237	<.01
Urinary diseases	Yes	338 (11.9)	30 (21.1)	10.691	<.01
Osteoporosis	Yes	315 (11.1)	8 (5.6)	4.152	.04
COPD	Yes	674 (23.7)	51 (35.9)	10.979	<.01
Parkinson disease	Yes	116 (4.1)	1 (0.7)	4.091	.04
Length of hospital stay	Mean length of stay	688 (24.2)	38 (26.8)		
	30	1456 (51.2)	57 (40.1)		
	30–59	340 (12.0)	15 (10.6)	14.096	.007
	60–89	295 (10.4)	27 (19.0)		
	≥90	65 (2.3)	5 (3.5)		

COPD = chronic obstructive pulmonary disease.

years, OR = 3.618, 95% CI = 1.171–11.180), age ≥90 years (vs age 65–79 years, OR = 6.133, 95% CI = 1.704–22.078), AD (OR = 9.564, 95% CI = 1.221–74.908), digestive diseases (OR = 2.902, 95% CI = 1.716–7.163), respiratory diseases (OR = 2.835, 95% CI = 1.386–5.801), urinary diseases (OR = 2.456, 95% CI = 1.072–5.629), diabetes (OR = 2.675, 95% CI = 1.270–5.636), and COPD (OR = 2.101, 95% CI = 1.017–4.340) were significantly associated with the death. Patients with ≥7 comorbidities had a higher risk of death than those with 5 or 6 (OR = 0.138, 95% CI = 0.038–0.499; OR = 0.162, 95% CI = 0.051–0.509, respectively) (Tables 3 and 4).

4. Discussion

In-hospital outcomes in elderly patients with dementia have always been the focus of previous research. In our study, 3.4% of patients with dementia died and showed that the effect was minimal in elderly patients over 65 years of age.

Although previous studies have shown that dementia may increase the risk of death in older populations, our study showed that the effect was minimal in elderly patients over 65 years of age. Our results are consistent with other findings,

suggesting a minor role of dementia in mortality in hospitalized older patients.^[19,31] This may be related to improved medical care and the mortality risk of dementia being minimized after the use of life-support treatments. Furthermore, it may be associated with local medical techniques and technology and economic development. However, we also considered psychological factors that may have affected the results. A study reported that 5-year mortality in older patients with dementia was 63.5% in psychiatric care facilities.^[16] This may imply that mortality in older in-hospital patients with dementia may not be restricted to those in tertiary A hospitals but may also occur in those in special departments or community hospitals.

According to previous researches,^[30–35] the mortality of older patients with dementia mainly depends on the local hospital facilities, the level of medical treatment and their physical and mental health. This information should be considered by clinical decision makers and physicians when caring for older inpatient with dementia. However, the results also suggest that a low inpatient mortality rate was associated with active treatment. Due to the lack of advanced directives and filial piety culture in China, family members rarely talk about death, and the younger family members ignore the wishes of the elderly family members, so most undergo active treatment. Therefore, we need to establish

hospice or specialized care center for patients with dementia to give them the best quality of care.

Digestive diseases immediately increase the risk of malnutrition in elderly patients; subsequently, frailty, poor functional outcomes and mortality may occur.^[33,34] A survey reported that the incidence of malnutrition in hospitalized elderly inpatients was as high as 69.68%.^[35] Therefore, this population should be targeted for clinical interventions to improve prognosis.

Pulmonary function and respiratory diseases are also advanced risk factors in dementia patients.^[36,37] Previous studies showed a dose–response association between decreasing lung function and an increasing risk of dementia-related death,^[36] and deaths from respiratory diseases were particularly increased among persons with dementia.^[38,39] In this study, COPD was a risk factor for death in dementia patients, but other studies reported that dementia increased the risk of respiratory failure and hospital mortality in patients with COPD.^[40,41] Different types of dementia may have different outcomes. A study reported that individuals with LBD had a higher risk of respiratory death than those with AD,^[39] but the causal direction of the association between poor pulmonary function and dementia remains unclear and requires further examination.^[37]

Cardiovascular diseases are the main or contributory causes to dementia. Cardiovascular comorbidities are more prevalent in patients with VaD and mixed AD and VaD than in those with LBD.^[42] A cohort study showed that cardiovascular disease was the most frequent underlying cause of death in patients with dementia,^[39] and cardiovascular mortality was higher in individuals with VaD than in those with AD. However, in this study,

mortality was 9 times higher in AD patients than in non-AD patients. Garcia-Ptacek et al^[39] also reported that individuals with VaD and other types of dementia were significantly less likely to die than those with AD.^[39] Dementias cause cognitive and functional impairment and convey decreased life expectancy.^[43] In this study, AD patients accounted for the majority of dementia patients, which may bias our results.

Among urinary diseases, urinary incontinence (UI) has been identified as a significant predictor of mortality in older adult patients, especially residents of long-term care facilities.^[44–46] This may be related to the severity of UI.^[47] UI is a major risk factor for geriatric syndromes and is directly associated with mortality, frailty, and a rapid rate of progression of dementia.^[48] Although the pathophysiological mechanism of UI in dementia is not well understood, it is presumed to be related to detrusor overactivity, prefrontal cortex dysfunction, comorbidities and prescribed medications. Moreover, cognitive and physical functional impairment in patients with dementia can also increase the UI risk.^[49] Therefore, effective interventions should aim to improve UI symptoms. In addition, mortality in older adult patients with dementia was also associated with falls and urinary tract infections.^[50]

Patients aged 80 years and older in our study had an increased risk for mortality.

This was consistent with previous studies.^[16,18,51] With aging, geriatric patients, especially those with very old age, are more vulnerable to physical decline, comorbidities, and potential adverse drug reactions than younger patients.^[52] The length of hospital stay was generally associated with the prognosis of patients with dementia. In general, prolonged hospital stays are associated with a worse prognosis. In our study, a mean length of hospital stay of ≥60 days was a risk factor for death. This may be related to the admission status. Generally, in patients with a prolonged length of hospital stay, death is due to acute or severe physical conditions that are not survivable. Some patients are at the end of life, but they or their families want to continue maintenance therapy. However, patients with a hospital length of stay of ≥60 hospital days who died were in an irreversible state.

According to our data, patients with osteoporosis or Parkinson disease seemed to be less likely to die than those with other comorbidities. Findings from the present study suggested that the prevalence of death in in-hospital patients with osteoporosis or Parkinson disease was lower than anticipated.^[153,54] One potential explanation for the discrepancy between the present study and that of previous prospective studies relates to the severity of disease symptoms, especially when Parkinson disease does not reach the end of life and does not develop serious complications; the symptoms of osteoporosis and Parkinson

Table 3

Description of logistic variable regression assignment.

Variables	Value
Gender	Female = 0, male = 1
Age (yr)	65–79 = 0, 80–89 = 1, 90 y and over = 2
Spouse status	Loss of a spouse = 0, presence of a spouse = 1
Occupation	Retired cadres = 0, technician = 1, workers = 2, farmers = 3, Civil servants and managers = 4, others = 5
Payment type	Not at his own expense = 1, partially at his own expense = 2, Totally at his own expense = 0
Admission grades	Long-term = 0, acute = 1, rehabilitation = 2
Surgery	No = 0, yes = 1
Length of hospital stays	≥90 = 0, mean length of stay = 1, 30 = 2, 30–59 = 3, 60–89 = 4
Dementia type	No = 0, yes = 1
Number of comorbidity	7 = 0, 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = 5, 6 = 6
Death	No = 0, yes = 1

Table 4

The results of the logistic regression analysis.

Variables	B	SE	Wald	df	P value	OR (95% CI)
Age (yr)			7.774	2	.021	
Age (1 vs 0)	1.286	0.576	4.992	1	.025	3.618 (1.171–11.180)
Age (2 vs 0)	1.814	0.654	7.703	1	.006	6.133 (1.704–22.078)
AD	2.258	1.050	4.623	1	.032	9.564 (1.221–74.908)
Digestive diseases	1.065	0.461	5.343	1	.021	2.902 (1.176–7.163)
Respiratory diseases	1.042	0.365	8.140	1	.004	2.835 (1.386–5.801)
COPD	0.742	0.370	4.021	1	.045	2.101 (1.017–4.340)
Urinary diseases	0.899	0.423	4.511	1	.034	2.456 (1.072–5.629)
Diabetes mellitus	0.984	0.380	6.696	1	.010	2.675 (1.270–5.636)
Number of comorbidities			16.806	6	.010	
Comorbidities (5 vs 7)	–1.981	0.656	9.123	1	.003	0.138 (0.038–0.499)
Comorbidity (6 vs 7)	–1.822	0.585	9.699	1	.002	0.162 (0.051–0.509)
Constant	–6.206	1.177	27.789	1	.000	0.002

$\chi^2 = 99.809, P = .000, R^2 = 0.339.$

AD = Alzheimer disease, CI = confidence interval, COPD = chronic obstructive pulmonary disease, OR = odds ratio.

disease not only progress slowly but also receive superior medical treatment. This may be the reason for the small sample size of patients who died and may have exaggerated our results. These findings also reinforce the viewpoint that there is likely a profound neuropathology associated with osteoporosis and Parkinson disease. In this study, we only found such differences. And we will add the control group to further explore related influencing factors.

Consistent with previous studies, diabetes was associated with a high risk of death in patients with dementia.^[55,56] Both AD and diabetes are chronic diseases that may share common pathologic features,^[57] and there is increasing evidence of brain glucose dysregulation in AD. This may also be related to a faster annual rate of cognitive decline in AD patients,^[58] and diabetes seems to promote specific neuropathologic processes that contribute to dementia^[59] And the present study showed that dementia and comorbid diabetes were associated with reduced survival time in individuals with dementia.

Seven or more comorbidities (vs 5 or 6) were significantly associated with the risk of death. And that appears to be the critical number at which mortality is significantly increased, as the number of comorbidities in dementia patients increases, so does the risk of death in the paper. Due to aging, patients with dementia usually have more comorbidities than younger people.^[52] Multiple overlapping diseases, various synergistic risk factors, and inappropriate medication use all significantly affect the survival of patients with dementia.

5. Limitations

There are several limitations in this study. First, this was a retrospective cross-sectional study. Therefore, several factors, such as diagnosis bias and the heterogeneity of study subjects, could limit the applicability of the results to other areas and populations, but the EMRs of the inpatients in the West China Hospital were complete and detailed. Second, our data were from EMRs, new EMR system did not facilitate extraction, and the single-center nature of the study may affect the generalizability of the results. However, the study revealed the prevalence of in-hospital death in elderly patients over 65 years of age with dementia. Third, people with mild dementia might be admitted to community hospitals or special care departments; thus, some samples may have been excluded because they could not be linked with hospital data. However, the bias may not affect the result because there were no large differences between excluded samples and included samples in the method section. Finally, the study lacks a comparative group, older adults without dementia; we will supplement the content in the following study to further explore the difference between patients with dementia and those without dementia. In this study, our main objective is to examine the risk factors for in-hospital death in elderly patients over 65 years of age with dementia.

6. Conclusion

Our results revealed the mortality rate and some risk factors for in-hospital death in elderly patients over 65 years of age with dementia. Mortality in hospitalized older patients with dementia is low, but medical staff may still ignore some risk factors, such as the effect of geriatric syndromes on the outcome of dementia, and thus mortality is not minimized. Therefore, prospective, large-scale cohort studies are needed in the future. The results of the present study should raise awareness among clinicians and caregivers about the risk factors in hospitalized older patients, particularly hospitalized elderly patients with multiple comorbidities. Therefore, to reduce mortality, early prevention and management of potential risks are necessary.

Author contributions

MZ and LC wrote the manuscript, acquired data, analyzed the results, and interpreted the data. XH acquired data and contributed to the design of the work. QC acquired data, critically revised the manuscript, and interpreted the data. All authors read and approved the final manuscript.

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