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Research Article

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Risk factors for nine-year mortality of elderly patients with cognitive impairment at admission

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Abstract

Background: Dementia can be a major cause of mortality and morbidity in geriatric patients. It is thus essential to assess their mental state at an early stage.

Aims: We appraised the impact on mortality and hospital outcomes using the revised simplified short-term memory recall test (STMT-R) with simultaneous collection of clinical data.

Methods: The subjects were 612 acute inpatients ≥65 years old encountered from December 2014 to September 2015. Following the collection of clinical data, the survival was subsequently measured for eight to nine years until December 2023. An STMT-R score of ≤4 was considered to indicate cognitive dysfunction. To explore the association between the risk factors and mortality in cognitive impairment subjects, the Kaplan-Meier method and Cox's proportional hazards regression models were used to examine mortality and survival rates.

Results: The mean age of the subjects was 82.1 (±7.94) years old, and 55.9% were female. The cognitive function was classified into three categories according to severity: Incomplete Testing Group (Incomplete), Cognitive dysfunction Group (Abnormal) and Non-Cognitive dysfunction Group (Normal). A total of 325 patients (51.5%) died during follow-up. The Kaplan-Meier and the log-rank tests showed a negative prognostic effect of cognitive impairment, malnutrition, pneumonia and cancer-bearing state ($p<0.01$). After adjusting for potential covariates, the Cox regression analysis showed that the mortality hazard is increased for "Incomplete" (hazard ratio 3.53; 95% confidence interval 2.39-5.21 $p<0.0001$) and "Abnormal" (hazard ratio 1.68; 95% confidence interval 1.21-2.32 $p<0.01$).

Conclusion: Malnutrition, hypoalbuminemia and a cancer-bearing state can significantly decrease the survival rate in patients with cognitive impairment at admission. Cognitive impairment also has an independent impact on survival rate in acutely ill geriatric patients.

Keywords: Cognitive impairment; Malnutrition; Revised Simplified Short-Term Memory Recall test (STMT-R); Mini-Mental State Examination (MMSE); Short-Form Mini-Nutritional Assessment (MNA-SF)

Introduction

Cognitive impairment is a geriatric syndrome along with delirium and all stages of dementia, but it is often difficult to detect in modern acute care [1,2]. Prompt recognition of cognitive dysfunction with sensitive screening is essential to improve emergency care and the prognosis in the elderly patients

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[1]. Cognitive impairment and dementia can also be important predictors of disability, dependence, and death among older adults [3,4]. Malnutrition is also associated with a multitude of geriatric syndromes, including cognitive dysfunction, suggesting a relationship between the nutrition status and cognitive function [4,5]. Several studies have shown that malnutrition is associated with cognitive decline in older adults [6]. Globally, the decline in the cognitive function associated with malnutrition is expected to further burden already-strained health care system due to the continued expansion of the aging population and the extension of life expectancy [4].

In Japan, the birth rate has fallen below the replacement level in recent decades; while the average life expectancy is getting longer, Japanese society is aging rapidly [7]. As a result, an increase in the dementia rate among the population is also expected. In fact, the current official data shows that there are 4.62 million dementia patients, representing about 15% of the elderly population in Japan [8,9]. Furthermore, in 2030, 8.3 million people, equivalent to about 23.2% of the elderly population in Japan, are expected to be dementia patients, bringing further burden to the Japanese healthcare system [9].

People with dementia are hospitalized frequently, but little is known about the health profile and prognosis of patients with dementia who access care in acute wards [10]. Multiple observational studies have shown that emergency physicians and nurses often do not recognize cognitive dysfunction [11]. More generally, physicians often fail to recognize cognitive impairment in elderly patients [1]. Indeed, it was reported that over 80% of emergency department (ED) patients with cognitive dysfunction lacked a diagnosis of dementia in the United States [12].

Notably, the prevalence of malnutrition among hospitalized older adults and its consequences are well established [13]. Cognitive decline is cited as a frequent and common finding among hospitalized patients who are malnourished [14]. Several studies have found that more than 80% of newly admitted geriatric patients present with malnutrition or are at risk of malnutrition [15,16]. Both before and after hospitalization, many conditions such as underlying diseases, co-morbidities, inflammatory conditions, and infections increase patient's energy consumption while reducing their normal intake [16]. Therefore, all patients should undergo an assessment of their nutritional status at all stages of hospitalization [16].

The prompt recognition of cognitive dysfunction is also essential for high-quality geriatric emergency care in order to prevent unnecessary errors and complications [1]. Therefore, the use of a simple and sensitive cognitive screening system early in a hospital admission might help ensure appropriate care for cases of cognitive decline, thereby shortening the duration of hospitalization, reducing medical expenses and decreasing mortality [17].

Multiple screening tests for the cognitive function have been proposed [17]. The Mini-Mental State Examination (MMSE) was developed in 1975 and has since become a widely used and accepted method for recognizing cognitive impairment [17]. However, the test itself takes roughly 6 minutes on average (3.5-14 minutes) [12], which can constitute a substantial burden for clinicians examining acutely ill geriatric patients [17]. Therefore, we adopted the Simplified Short-Term Memory Recall Test (STMT) [18] at our hospital, and for several years, we have been investigating the detection of cognitive impairment in our ED patients using this approach. In addition, given the difficulty for some groups of elderly patients to answer the STMT, we developed a slightly revised and modified version, called the STMT-R [17].

Evaluations of the nutritional status of the elderly, especially for patients with dementia, can be done in a variety of ways, depending on malnutrition indicators, anthropometric measurements, and oral intake assessments [19]. The Mini Nutrition Assessment (MNA) is the best validated and most widely utilized screening test for malnutrition among elderly populations because it was developed to assess the risk of malnutrition in the elderly and to identify those who are malnourished [20]. We adopted the MNA-Short Form (MNA-SF), which is a revised version of the MNA, at our hospital, and similarly to our efforts with the STMT/STMT-R, for several years. This evaluation consists of six items, including anthropometric, nutritional, and clinical evaluations as well as the self-perception of health [20]. The MNA-SF is used by trained health professionals and nutritionists for both screening and evaluating the nutritional status. The MNA-SF has been used to classify subjects as "Well-nourished" (score 12-14), "At risk for malnutrition" (score 8-11), or "Malnourished" (score 0-7) [21].

To improve the treatment and prognosis of patients with dementia, it may be useful to simultaneously evaluate the nutritional and mental status of elderly patients early in hospitalization. Therefore, we investigated the clinical outcomes of elderly patients admitted to the emergency ward using the STMT-R, MNA-SF, and serum albumin levels. We evaluated the impact of both cognitive impairment and the nutritional status on mortality and length of hospital stay in elderly patients with acutely ill geriatric patients.

Subjects and Methods

Study design

We conducted a prospective cohort study in the ED and acute care ward of Yamamoto Memorial Hospital.

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Participants

Yamamoto Memorial Hospital is an emergency medical institution with a rehabilitation wing located in Imari City, which has a population of about 60,000. We conducted a survey of non-critically ill patients ≥65 years old admitted to the emergency department and acute-care ward between December 1, 2014, and September 30, 2015. Eligible patients were approached during a period of symptom stabilization (when conversation was possible) within a week (two days on average) after admission. Screening for cognitive impairment, dementia, and delirium is conducted routinely during hospital admissions [17]. However, to enroll patients in our study, we sought verbal consent from participants or their families in order to ensure the appropriateness of conducting the assessment for research [17]. The findings of all assessments and consent attainment_were documented in the medical notes so that they could be freely accessed by clinical teams [17].

Screening assessments and the diagnoses

The diagnosis of cognitive dysfunction by STMT-R (Table 1)

In our previous study, using the STMT-R, which is highly correlated with the MMSE, patients with a score of ≤4 were classified as cognitively impaired ("Abnormal"), and those with a score of ≥5 were classified as non-cognitively impaired ("Normal") [17]. Although this test is usually completed within 2 minutes, some participants were unable to complete the questionnaire within 5 minutes (probably due to severe dementia, delirium, dementia with hearing impairment, etc.) [17]. Therefore, even if a patient had a test value of 0, in our previous study [17], they were classified as incomplete ("Incomplete") with advanced cognitive impairment.

MNA-SF

The MNA-SF is used by trained health professionals and nutritionists for both screening and evaluating the nutritional status [22]. In the present study, the MNA-SF was used to classify subjects into a "Well-nourished" group (score 12-14), an "At risk for malnutrition" group (score 8-11) or a "Malnourished" group (score 0-7).

Sample and procedure

Using the STMT-R and NMA-SF, we conducted a nutritional assessment and evaluated the mental status of elderly patients simultaneously at early admission and examined the age, sex and clinical outcomes of the geriatric patients admitted to the ED and acute care ward. The follow-up data on death were collected until December 2023. The date of death was obtained from direct letters, hospital and nursing home clinical notes and social worker networks.

Statistical analyses

The software programs BellCurve for Excel, ver. 2.0 (Social Survey Research Information Co., Ltd., Tokyo, Japan) and JMP® 15(SAS Institute Inc., Cary, NC, USA) were used for the analyses, with the significance level set at $p<0.05$. We used unpaired *t*-tests, a chi-square test and an analysis of variance (ANOVA) for univariate analyses. The survival rates for cognitive decline and clinical data were estimated using the Kaplan-Meier method. Cox's proportional hazards regression models were then used to calculate the hazard ratios (HRs) and 95% confidence intervals (CIs).

Results

Participants' characteristics (Table 2)

Between December 2014 and September 2015, 976 patients were approached, 364 of whom were excluded for certain reasons (those admitted with critical diseases, receiving sedative medication, unable to consent, or who refused to participate, and those with more than one week of hospitalization). There were 612 participants who met

Table 1: STMT-R (Revised Version of the Simplified Short- Term Memory Recall Test

	Questions	Answers columns			Score
Immediate memory	(1) I will now say three words. Please repeat and memorize them. I will once again ask you later.		1st attempt	2nd attempt	
	a) Blue flower	a)			/1
	b) Yellow car	b)			/1
	c) White bird	c)			/1
Number repeat	(2) I will now say some numbers. Please repest them		1st attempt	2nd attempt	
	(Say the first set of seven numbers) (a) 5,9,1,7,4,2,8	a)			/1
	(Say the second set of 6 numbers after the first response) b) 6,1,7,4,9,3	b)			/1
Delayed Memory	(3) Please repest the three words that you memorised a while ago	a)			/1
		b)			/1
		c)			/1
Total score					/8

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the inclusion criteria and were enrolled in the study (55.9% female, mean age: 82.1±7.94 years old). Among these, 108 were unable to complete the test ("Incomplete" group). Among the 504 patients who completed the test, 351 had cognitive dysfunction ("Abnormal" group), and 153 did not have cognitive dysfunction ("Normal" group). Based on the MNA-SF measured simultaneously, 339, 236 and 37 patients were assigned to the "Malnourished", "At risk for malnutrition" and "Well-nourished" groups, respectively.

Most of the hospitalized patients were in their 80s, but there was no significant difference in age between genders. When the STMT-R scores and age were compared, we noted that there were more patients in the "Abnormal" and "Incomplete" group as age increased, which suggests that the cognitive function declines with age. Regarding the nutritional state, we also observed that there were more patients in the "Malnourished" and "At risk for malnutrition" groups as age increased, which suggests that the nutritional state also declines with age.

Table 2:

The basic characteristics of subjects at admission		**No.or Average**	**% or SE**
Sex	Male	270	(44.1)
	Female	342	(55.9)
Age	Average	82.1	(7.9)
Age class			
	60s	55	(9.0)
	70s	150	(24.5)
	80s	300	(49.0)
	90s	107	(17.5)
Underlying diseases			
	Cardiovascular	132	(21.6)
	Gastroinetestinal	110	(17.9)
	Musculoskeletal	100	(16.3)
	Metabolic	98	(16.0)
	Resipiratory	89	(14.5)
	Neurological	58	(9.5)
	Surgical	25	(4.1)
Route of Hospitalization			
	Ambulace car	177	(28.9)
	Others	435	(71.1)
History of dementia			
	Yes	68	(11.1)
	No	544	(88.9)
STMT-R score	Average	2.7	(2.3)
STMT-R class			
	Abnormal(≦4)	351	(57.4)
	Normal(≧5)	153	(25.0)
	Incomplete	108	(17.6)
MNA-SF score	Average	6.8	(3.1)
MNA-SF class			
	Malnourished (<8)	339	(55.4)
	At risk of malnutrition (8-11)	236	(38.6)
	Well-nourished(≧12)	37	(6.0)
Serum albumin (Alb ≧ 3.5g/dl)			
	Abnormal	310	(50.7)
	Normal	302	(49.3)
Complications			
	Pneumonia	138	(22.5)
	Urinary tract infection	22	(3.6)
	Cancer	57	(9.3)

Influence of underlying disease

Participants had been admitted for the treatment of several underlying diseases, including circulatory diseases ("C" n=132, 21.6%), gastroenterological diseases ("G" n=110, 17.9%), musculoskeletal diseases ("M" n=100, 16.3%), metabolic diseases ("I" diabetes, CKD, etc.; n=98, 16.0%), respiratory diseases ("R" almost pneumonia; n=89, 14.5%), neurologic diseases ("N" n=58, 9.5%) and surgical diseases ("S" n=25, 4.1%). When comparing rates of diseases among groups classified according to the STMT-R and MNA-SF scores, the percentage of "Incomplete" group in the respiratory disease group was higher than in the other disease groups. Underlying respiratory disease may therefore influence the cognitive function.

Influence of the cognitive function on the hospital outcome

We compared the average hospital stay among the groups. We observed the longest hospitalizations in the "Incomplete" group (70.9±4.85 days) and followed by the "Abnormal" group (45.4±2.69 days), and then the "Normal" group (38.0±4.06 days) with significant differences noted. In addition, when comparing survival times using STMT-R, a significant difference was found between the "Normal" group (2584±96.4 days), the "Abnormal" group (1929±63.6 days), and the "Incomplete" group (860±114.7 days) (Student's t-test), suggesting that survival times were shortened with

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Table 3: The basic characteristics of subjects according to STMT-R classification at admission

Characteristic		STMT-R classification			p-Value
		Normal (≧5) (n = 153)	Abnormal (≦4) (n = 351)	Incomplete (n = 108)	
Sex	Male	67	157	46	
	Female	86	194	62	0.922
Age	Average	78.6 (7.5)	82.7 (7.6)	85.5 (7.7)	< 0.001
Age class	60s	23	27	5	
	70s	54	81	15	
	80s	69	175	56	
	90s	7	68	32	< 0.001
Underlying diseases	Cardiovascular	33	82	17	
	Gastroinetestinal	31	67	12	
	Musculoskeletal	35	61	4	
	Metabolic	22	59	17	
	Resipiratory	14	36	39	
	Neurological	9	32	17	
	Surgical	9	14	2	< 0.001
	Infection(Pneumonia and/or UTI)	19	82	53	< 0.001
	Cancer	16	33	8	0.695
Days of Hospitalization		38.0 (4.06)	45.4 (2.69)	70.9 (4.85)	< 0.001
Route of Hospitalization					
	Ambulace car	44	103	30	
	Others	109	248	78	0.95
History of dementia	Yes	4	46	18	
	No	149	305	90	< 0.001
MNA-SF score		8.4 (2.5)	7.1 (2.8)	3.5 (2.2)	< 0.001
MNA-SF class	Malnourished (<8)	52	188	99	
	At risk of malnutrition (8-11)	90	137	9	
	Well-nourished (≧12)	11	26	0	< 0.001
Serum albumin (g/dl)		3.6 (0.6)	3.4 (0.6)	3.0 (0.6)	< 0.001
Serum albumin (Alb >3.5g/dl)	Abnormal	58	190	91	
	Normal	95	161	17	< 0.001
Survival periods (days)		2584 (96.4)	1929 (63.6)	860 (114.7)	< 0.001

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declines in cognitive function and nutritional status (including declines in albumin levels). Furthermore, we found that declining cognitive function tends to increase infectious complications, and that 64.5% of patients presenting with cognitive impairment in our hospital's emergency department (ED) had not been diagnosed with dementia.

Relationship between the nutritional status by MNA-SF and the cognitive decline by the STMT-R

Several studies have shown that nutritional status is associated with cognitive decline in older adults in various environments, from hospitals to community living [22]. However, these studies were cross-sectional, so we could not draw any conclusions about whether malnutrition causes cognitive decline or vice versa [4]. In our previous study, we used the STMT-R to investigate the relationship between the nutritional status and cognitive function and found a significant positive correlation between the STMT-R score and NMA-SF points (r=0.523; p<0.001), suggesting a complex relationship between cognitive impairment and nutritional status [23].

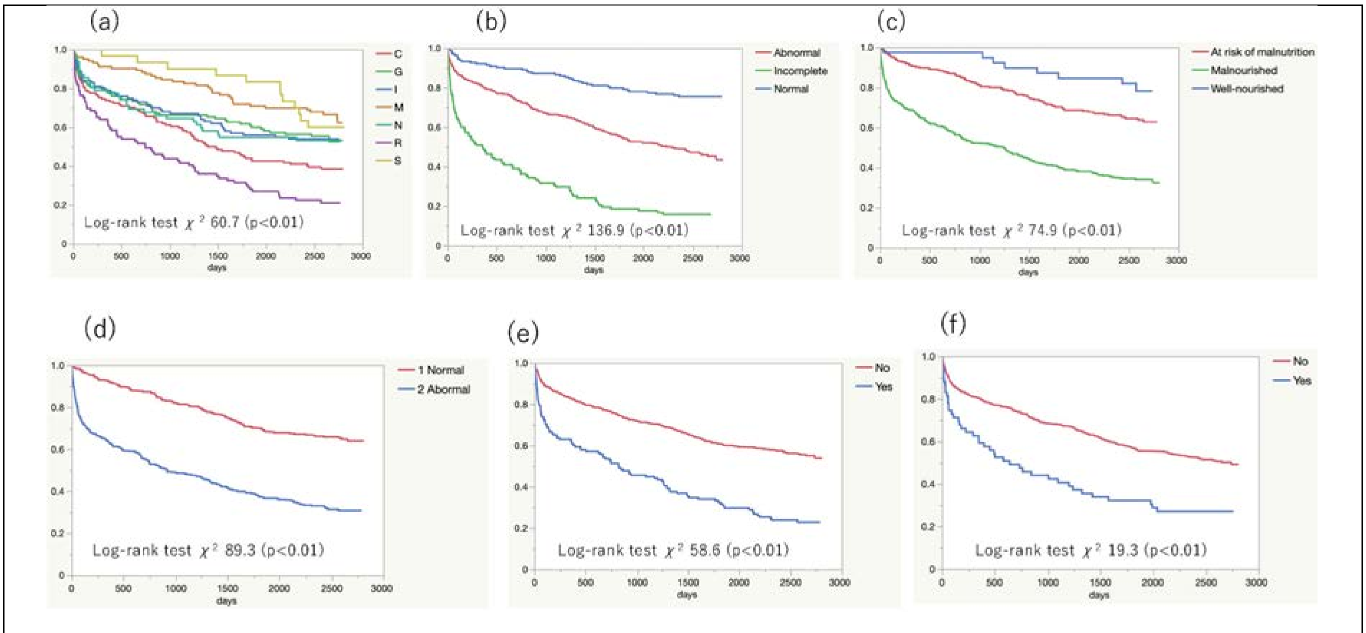
The cognitive function, clinical data and mortality (Figure 1)

(a) underlying diseases of first hospitalization (C: cardiovascular, G: Gastrointestinal, M: Musculoskeletal, I: Metabolic, R: Respiratory, N: Neurological, S: Surgical), (b) STMT-R classification, (c) MNA-SF classification, (d) Serum Albumin, (e) presence of pneumonia, (f) presence of cancer.

Figure (a) compares several underlying diseases, with respiratory disease having the lowest survival rates, followed by circulatory disease. In figure (b), when comparing cognitive functions, survival rates decreased in the order of “Incomplete”, “Abnormal”, and “Normal” groups. In figure (c), when comparing the nutritional status, survival rates decreased in the order of “Malnourished”, “At risk for malnutrition” and “Well- nourished” groups. figures (d), (e), and (f) compare the change in the survival rate depending on whether or not the patient's serum albumin level was ≥3.6 g/dl, and whether or not they had pneumonia or cancer. Patients with respiratory disease, cognitive impairment, malnutrition, hypoalbuminemia, pneumonia as a complication, or cancer at admission had a lower survival rate than controls.

Cox’s proportional-hazards regression models

Cox’s proportional-hazards regression models were used to examine the cognitive impairment during follow-



(a) underlying diseases of first hospitalization (C: cardiovascular, G: Gastrointestinal, M: Musculoskeletal, I: Metabolic, R: Respiratory, N: Neurological, S: Surgical), (b) STMT-R classification, (c) MNA-SF classification, (d) Serum Albumin, (e) presence of pneumonia, (f) presence of cancer.

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Figure 1: Kaplan-Meier curves for cognitive decline and clinical data over a nine-year follow-up.

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Table 4: Cox Proportional Hazard Ratio

N=612 (Death =349, Censored=263)		Hazard Ratio	CI 95%	p-Value
STMT-R classification				
	Abnormal/Normal	**1.68**	**1.21-2.32**	**< 0.01**
	Imcomplete/Normal	**3.53**	**2.39-5.21**	**< 0.001**
Serum albumin (Alb > 3.5g/dl)				
	No/Yes (Alb > 3.5g/dl)	**1.38**	**1.08-1.79**	**< 0.05**
MNA-SF classification				
	At risk of malnutrition/Well-nourished	0.77	0.41-1.44	0.41
	Malnourished /Well-nourished	**2.08**	**1.10-3.94**	**< 0.05**
	At risk of malnutrition/Malnourished	**1.6**	**1.22-2.09**	**< 0.001**
History of dementia				
	Yes/No	1.206	0.874-1.611	0.281
Complications				
	Cancer	**1.95**	**1.40-2.72**	**< 0.001**
	Infection(Pneumonia and/or UTI)	1.1	0.82-2.84	0.91
Age	**70s/60s**	**1.93**	**1.01-3.72**	**< 0.05**
	80s/60s	**2.97**	**1.58-5.59**	**< 0.01**
	90s/60s	**4.73**	**2.44-9.19**	**< 0.001**
Sex	**Male/Female**	**1.57**	**1.25-1.97**	**< 0.001**

up, after adjustment. Furthermore, in acute care, infectious diseases at admission and cancer treatment are considered to have a prognostic effect, and as a supplementary analysis, adjustment was made according to inpatient infection (pneumonia and / or UTI) and cancer treatment. Subjects were followed until December 31, 2023. We analyzed the HRs for mortality (Table 4). Significant HRs were observed for, in terms of intergenerational comparison, compared to those in their 90s (90s/60s) (HR: 4.73, 2.44-9.19, $p<0.001$), male gender (HR: 1.57, 1.25-1.97, $p<0.001$), cancer patient (HR: 1.95, 1.40-2.72, $p<0.0001$), hypoalbuminemia (Alb.≤3.5g/dl) (HR:1.38,1.08-1.79, $p<0.05$), "Malnourished" (HR: 2.08, 1.10-3.94, $p<0.001$), "Abnormal" (HR: 1.68, 1.21-2.32, $p<0.01$) and "Incomplete" group (HR: 3.53, 2.39-5.21, $p<0.0001$). Mild to moderate cognitive impairment "Abnormal" group and inclusion in the"Incomplete" group were also found to affect mortality.

Discussion

The relationship between cognitive decline and survival rates in elderly hospitalized patients is a critical area of study, given the increasing aging population. Previous literature has identified several factors that affect the survival of these patients, highlighting the interplay between the cognitive function, age, underlying diseases, and nutritional status at the time of admission [23]. Furthermore, assessing the cognitive function, age, underlying diseases, and nutritional status at the time of admission can provide a comprehensive understanding of the patient's health status and predict the prognosis. This assessment helps develop an individualized care plan, ensuring appropriate and effective treatment and care. Early identification of problems in any of these areas allows for timely interventions that can improve outcomes and the quality of life for hospitalized patients [24].

In particular, the elderly tends to have a variety of nutritional problems, such as difficulty swallowing, difficulty chewing, and ultimately malnutrition problems [19,23]. If the food intake is low, the threshold of nutrients necessary for a normal brain function will also be low [19]. Several geriatric syndromes, including cognitive disorders, are considered to be a general disorder state in the elderly population [2]. Functional deterioration may be the result of cognitive impairment [25]. Increases in mortality and dysfunction are related to the generally poor nutritional status of the elderly [25]. Infections, vulnerability disorders and poisoning are common, and complications of weight loss and malnutrition leading to general health condition changes, cognitive disorders and other geriatric syndromes are attributed to malnutrition in the elderly [19]. Recent studies have shown that the severity of cognitive impairment is positively correlated with weight loss, recurrent infection

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and frequent hospitalization [26]. Nutritional intervention has been concluded to be beneficial for high-risk groups, and the nutritional assessment of patients with dementia is of critical importance [27].

The relationship between the nutritional status of the elderly and the cognitive function is well documented and seems strong [4,6]. However, the cross-sectional design of previous studies has prevented any conclusions from being drawn concerning whether malnutrition causes cognitive decline or vice versa [4]. The relationship between the nutritional status and cognitive performance is complex [6]. The presence or risk of malnutrition may affect the cognitive ability [27], and the presence of cognitive decline affects the ability to perform daily living activities [28] and consume food, which therefore may increase nutritional risks [28,29]. In this study, we focused on the interrelationship between cognitive impairment and nutritional status in geriatric patients with acute illnesses, and evaluated the impact of age, underlying diseases, etc. on hospital outcomes and mortality, and considered the importance of nutritional management for elderly people with cognitive decline.

Our previous study found a positive correlation between STMT-R and MNA-SF scores measured simultaneously in geriatric patients with acute illness ($r=0.5227$, $p<0.001$), suggesting that the cognitive impairment may be correlated with malnutrition. This result suggests that cognitive function may be improved by nutritional intervention and comprehensive rehabilitation [23].

A recent meta-analysis demonstrated the long-term benefits of oral nutritional supplements (ONSs) for cognition, as shown by an improved MMSE score, in dementia patients [4,30,31]. However, in severe dementia patients with symptoms of "Malnourished" and in the"At risk for malnutrition" group, such as those with "Incomplete" status, a poor prognosis (discharging to the elderly home or death) was also observed with normal nutritional therapy, including ONS. Advanced dementia is associated with feeding problems, including difficulty swallowing and respiratory diseases [32]. Whether or not interventions to improve the nutritional status have a positive impact on the cognitive performance, depending on the severity, is unclear [33]. However, Volkert et al. reported that nutrition interventions in the early stages of hospitalization are effective in improving the prognosis of the patients with mild to moderate cognitive impairment where undernourishment is relatively reversible but not in patients with severe dementia or in the terminal phase of life [33]. Our study also suggests that a moderate or higher cognitive function may be associated with an improved survival, even with malnutrition. Cognitive decline was thought to affect mortality more than malnutrition.

With regard to predicting the prognosis and outcome according to the STMT-R and MNA-SF scores, we noted that as the cognitive function and nutritional state declined, the duration of hospitalization tended to be prolonged, along with a reduction in the rate of patients returning home, an increase in the rate of patients entering elderly care facilities and an increase in the mortality rate. In addition, regarding the nutritional status at admission, the majority of hospitalized patients were classified into the "Malnourished" group, and the ratio of this group among cases of hospital death was particularly high. While nutrition intervention was performed in this group, the cognitive dysfunction and nutritional decline were considered to have adversely affected the hospital outcome and long-term survival. Thus, both the STMT-R and MNA-SF, which can be measured within 5 minutes, are simple and sensitive evaluations for acutely ill elderly patients. A combined survival assessment with both early simultaneous measures is expected to be useful for predicting the effects of comprehensive nutritional interventions as well as hospitalization and the post-discharge prognosis in acute elderly patients with cognitive decline [23].

Limitations

Several limitations associated with the present study warrant mention. First, the lengthy hospitalization for enrolled patients was due to the age of the community-dwelling patients and the tendency to have rehabilitation functions in the Japanese acute care hospitals in the county, not including acute patients who were discharged within a week. There is thus some degree of cultural bias in the background. Secondly, in most cases, the tests were performed on the second day after admission, but in some cases, the tests were performed at an appropriate time within one week due to patient fatigue, clinical disruption, or a generally destructive ED environment [34]. Similarly, the examination time was limited. In future trials, the suitability of this test as a simple screening tool or alternative can be evaluated, but we want to improve the accuracy so that we can select the most suitable and available instrument for ED applications as an indicator of medical intervention [34]. Finally, our study suggests that early nutritional interventions may improve the prognosis for patients with a good cognitive function [4]. For clinicians, recognition of cognitive impairment and malnutrition promotes disposal decisions early in hospitalization [35] and ensures clarity of discharge instructions [34, 36]. Future trials of ED-based cognitive dysfunction and malnutrition case-finding will be needed to assess the effects of such screening on patient-oriented outcomes, like preventable recidivism (including readmission), functional decline, and the quality of life of patients and caregivers after discharge [34].

Conclusion

In our study, malnutrition, hypoalbuminemia, and cancer can significantly reduce the survival in patients with cognitive impairment on admission. Cognitive impairment

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also independently affected the survival in acutely ill geriatric patients, but these factors were closely related to each other. Therefore, increasing the awareness of emergency department clinicians and medical staff about the potential for cognitive impairment and malnutrition will facilitate early initiation of interventions (e.g., nutritional management, rehabilitation) to improve functional independence and the prognosis [34].

Availability of data and Materials

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

Abbreviations

STMT-R: Revised simplified short-term memory recall test

MNA-SF*:* Short-form mini-nutritional assessment

ED: Emergency department

MMSE: Mini-Mental State Examination

HR: Hazard ratio

CI: Confidence interval

SE: Standard error

UTI: Urine tract infection

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Contributions

Conception and design of the research: HY, TI; acquisition of data: HY, KO, KM,HY; analysis and interpretation of the data: HY, KO statistical analysis: HY, TI; drafting of the manuscript: HY, KO, TI; critical revision of the manuscript for important intellectual content: HY, KO, TI. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. All procedures were approved by the ethical review board of the Yamamoto Memorial Hospital.

Consent for publication

The manuscript has been approved by all the authors. All authors concur with the submission.

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