

Physical and nutrition statuses of geriatric patients after trauma-related hospitalization

Data from the Korean National Health and Nutrition Examination Survey 2013–2015

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Abstract

Population aging is associated with increasing numbers of geriatric trauma patients, and various studies have evaluated their short-term outcomes, assessment, and treatment. However, there is insufficient information regarding their long-term outcomes. This study evaluated the physical and nutritional statuses of geriatric patients after trauma-related hospitalization.

Data regarding physical and nutritional status were obtained from the Korean National Health and Nutrition Examination Survey VI (2013–2015).

A total of 21,069 individuals participated in the survey, including 5650 geriatric individuals. After excluding individuals with missing data, 3731 cases were included in the analyses. The average age was 68 years, and most individuals were women ($n=2055$, 55.08%). There were 94 patients had been hospitalized because of trauma. Trauma-related hospitalization among geriatric patients was significantly associated with reduced strength exercise (23.56% vs 12.99%, $P=.043$), activity limitations caused by joint pain (0.65% vs 3.31%, $P=.028$), self-care problems (8.00% vs 16.77%, $P=.008$), pain or discomfort (29.48% vs 40.51%, $P=.024$), hypercholesterolemia (27.37% vs 39.36%, $P=.037$), and mastication discomfort (39.98% vs 57.85% $P=.005$). The adjusted analyses revealed that trauma-related hospitalization was independently associated with activity limitations caused by joint pain (odds ratio [OR]: 5.04, 95% confidence interval [CI]: 1.29–19.67, $P=.020$), self-care problems (OR: 2.24, 95% CI: 1.11–4.53, $P=.025$), pain or discomfort (OR: 1.77, 95% CI: 1.08–2.89, $P=.023$), and mastication discomfort (OR: 2.06, 95% CI: 1.22–3.46, $P=.007$).

Medical staff should be aware that geriatric patients have relatively poor physical and nutritional statuses after trauma-related hospitalization, and manage these patients accordingly.

Abbreviations: BMI = body mass index, CI = confidence interval, EQ-5D = EuroQoL five-dimensions questionnaire, HbA1c = glycated hemoglobin, KNHANES = Korean National Health and Nutrition Examination Survey, OR = odds ratio.

Keywords: geriatric, nutrition, quality of life, trauma

1. Introduction

Trauma is a leading cause of disability,^[1] although advances in trauma surgery have recently improved the prognosis of patients with trauma. In addition, military surgeons have returned from several wars during the 20th century and used their experience to

improve trauma treatments and systems.^[2,3] For example, their experience has been used to develop rapid transport and triage systems, as well as surgical treatments that have improved outcomes among the general population. However, aging societies have trauma patients with constantly changing characteristics, and the National Trauma Data Bank has indicated that the proportion of ≥ 65 -year-old trauma patients at Levels I–II trauma centers had increased from 23% in 2003 to 30% in 2009. It is also estimated that >80 million Americans will be ≥ 65 years old in 2050, which is approximately double the population from 2012.^[4] Moreover, the UK Trauma Audit Research Network has revealed that the mean age of major trauma patients has increased from 36.1 years in 1990 to 53.8 years in 2013.^[5] During that period, the proportion of patients with major trauma who were >75 years increased from 8.1% to 26.9%, and the UK population of ≥ 65 -year-old individuals is expected to double by 2030.^[6]

Geriatric trauma patients have relatively poor morbidity and mortality outcomes,^[6–8] which may be related to their diminished physiological reserve.^[9,10] Furthermore, aging is associated with declines in cardiac, pulmonary, and renal functioning, as well as hypertension, diabetes, and treatment using antiplatelet and anticoagulant drugs.^[9] Therefore, geriatric patients are vulnerable to trauma and have relatively poor trauma-related outcomes.

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However, there is insufficient evidence regarding the health-related quality of life, nutritional status, and physical status of geriatric patients after trauma, although many studies have evaluated their short-term outcomes. The present study aimed to determine whether geriatric patients might experience reduced quality of life, nutritional status, and physical status after trauma-related hospitalization (vs the general population of geriatric individuals), based on data from the Korean National Health and Nutrition Examination Survey (KNHANES).

2. Methods

2.1. Data collection

Data were obtained from the KNHANES VI survey (2013–2015), which is an annual population-based cross-sectional survey that is conducted by Korean Centers for Disease Control and Prevention. The multistage stratified survey collects information regarding various characteristics, including age, sex, and socioeconomic status. Participants are asked to complete a four-part questionnaire regarding their health, health-related behaviors, medical history, and nutritional status. The participants also complete health examinations, laboratory testing, and anthropometric and dental evaluations. Body weight and height are measured while the participants are only wearing light indoor clothes. All data were collected by trained medical staff after obtaining written informed consent from all participants. Approval was obtained from our institutional review board to evaluate data from all geriatric individuals (≥ 60 years old) who participated in the KNHANES VI survey.

The present study evaluated data regarding age, sex, individual income, and household income. Furthermore, cases that involved trauma-related hospitalization were evaluated to obtain information regarding the trauma mechanism and intentionality. Furthermore, data were collected regarding quality of life parameters and physical status, such as performing strength exercises (push-ups, sit-ups, chin-ups, and dumbbell or barbell exercises on at least 2 days per week), activity limitations and causes, knee joint pain, and hip joint pain. The participants also completed the EuroQol five-dimensions questionnaire (EQ-5D) regarding mobility, self-care, activities of daily living, pain or discomfort, and anxiety/depression, after receiving approval from the EuroQol Group. Body mass index (BMI, kg/m^2) was used to identify participants with a BMI of $< 18.5 \text{ kg/m}^2$ (underweight) or $\geq 25 \text{ kg/m}^2$ (obese). The upper limit of normal for glycated hemoglobin (HbA1c) was defined as 6.5%. Anemia was considered present for female patients with a hemoglobin level of $< 12.0 \text{ g/dL}$ and male patients with a hemoglobin level of $< 13.0 \text{ g/dL}$. Hypercholesterolemia was considered present for patients who were receiving cholesterol-lowering medication or who had a total cholesterol level of $\geq 240 \text{ mg/dL}$. Complaints of mastication discomfort or toothache were also recorded. Individuals with missing data were excluded from the analysis.

2.2. Data analysis

The physical and nutritional statuses were compared between individuals with and without trauma-related hospitalization. Categorical data were reported as number (percent) and analyzed using the Rao-Scott chi-square test. Continuous data were reported mean \pm standard deviation and analyzed using the *t*-test. Univariate and multivariate logistic regression analyses were performed to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for various outcomes. The regression analyses

Table 1
Baseline characteristics of analyzed geriatrics.

	Hospitalisation due to trauma		P
	No (n=3637)	Yes (n=94)	
Age	68.7 \pm 0.1	68.5 \pm 0.8	.853
Sex			
Male	1640 (46.0)	36 (41.4)	.468
Female	1997 (54.0)	58 (58.6)	
Income			
Lowest	836 (23.1)	29 (31.6)	.410
Lower middle	908 (24.2)	22 (22.4)	
Higher middle	909 (25.0)	24 (21.2)	
Highest	965 (27.7)	19 (24.8)	
Household income			
Lowest	1397 (37.0)	44 (45.8)	.283
Lower middle	1022 (28.0)	21 (19.5)	
Higher middle	670 (19.8)	17 (16.5)	
Highest	529 (15.2)	12 (18.1)	
Trauma mechanism			
Transportation accident		31 (35.9)	
Fall/slip		46 (46.5)	
Crash		11 (10.5)	
Laceration/stab/cut/penetration		5 (5.5)	
Burn		1 (1.6)	
Intentionality			
Incidents of injustice		94 (100.0)	
Intentional self-harm		0 (0.0)	
Violence of others		0 (0.0)	

Data are presented as n (weighted %). Statistics were carried out using Rao-Scott Chi-square test.

were adjusted for age, sex, individual income, and household income. All statistical analyses were performed using SAS software (version 9.4; SAS Institute Inc., Cary, NC). *P* values of $< .05$ were considered statistically significant.

3. Results

A total of 21,069 individuals participated in the KNHANES VI survey, including 5650 geriatric individuals. After excluding individuals with missing data, 3731 cases were included in the analyses. The average age was 68 years, and most individuals were women ($n=2055$, 55.08%). Ninety-four patients were hospitalized because of trauma, and these cases generally involved blunt injuries that were caused by slips and falls. All patients reported that the trauma was accidental. The geriatric individuals' baseline characteristics are shown in Table 1.

Geriatric patients with trauma-related hospitalization experienced decreased quality of life in several dimensions, compared to their non-hospitalized counterparts (Table 2). For example, these patients were significantly less likely to perform strength exercises (23.56% vs 12.99%, $P=.043$), more likely to experience activity limitations because of joint pain (0.65% vs 3.31%, $P=.028$), more likely to have self-care problems (somewhat agree: 8.00% vs 16.77%; strongly agree: 0.55% vs 1.29%, $P=.008$), and more likely to experience pain or discomfort (somewhat agree: 29.48% vs 40.51%; strongly agree: 1.65% vs 3.58%, $P=.024$). Trauma-related hospitalization was also associated with hypercholesterolemia (27.37% vs 39.36%, $P=.037$), and mastication discomfort (39.98% vs 57.85%, $P=.005$).

The univariate and multivariate regression analysis results are shown in Table 3. Trauma-related hospitalization was associated with a lower likelihood of performing strength exercises (OR: 0.49, 95% CI: 0.24–0.99, $P=.048$) and a higher likelihood of

Table 2
Physical and nutritional status of geriatric patient after trauma-related hospitalization.

	Hospitalization due to trauma		P
	No (n=3637)	Yes (n=94)	
Strength exercise			
No	2808 (76.4)	84 (87.0)	.043
Yes	829 (23.6)	10 (13.0)	
Activity limitation (all reasons)			.535
No	3116 (86.0)	78 (83.3)	
Yes	521 (14.0)	16 (16.7)	
Activity limitation (joint pain)			.028
No	499 (13.7)	13 (13.4)	
Yes	22 (0.6)	3 (3.3)	
Non applicable	3116 (85.7)	78 (83.3)	
Activity limitation (other damage)			.118
No	509 (13.7)	14 (15.1)	
Yes	12 (0.3)	2 (1.6)	
Non applicable	3116 (86.0)	78 (83.3)	
Knee-joint pain			.937
No	2749 (75.9)	70 (76.4)	
Yes	888 (24.1)	24 (23.6)	
Hip joint pain			.505
No	3209 (88.9)	84 (91.1)	
Yes	428 (11.1)	10 (8.9)	
EQ-5D			
Mobility			.195
None	2504 (69.6)	57 (60.7)	
Somewhat agree	1069 (28.8)	35 (37.7)	
Strongly agree	64 (1.6)	2 (1.6)	
Self-care			.008
None	3309 (91.0)	78 (81.9)	
Somewhat agree	309 (8.5)	14 (16.8)	
Strongly agree	19 (0.5)	2 (1.3)	
Usual activities			.087
None	2951 (81.6)	67 (72.7)	
Somewhat agree	641 (17.3)	24 (25.5)	
Strongly agree	45 (1.1)	3 (1.8)	
Pain/discomfort			.024
None	2373 (65.8)	48 (50.9)	
Somewhat agree	1081 (29.5)	8 (40.5)	
Strongly agree	183 (4.7)	8 (8.6)	
Anxiety/depression			.091
None	3020 (83.0)	68 (74.2)	
Somewhat agree	557 (15.3)	21 (22.2)	
Strongly agree	60 (1.6)	5 (3.6)	
Weight change (for a year)			.096
None	2628 (72.6)	56 (61.53)	
Decrease	588 (15.7)	22 (21.19)	
Increase	421 (11.8)	16 (17.28)	
Body mass index			.587
Normal	2205 (60.6)	57 (57.7)	
Underweight	82 (2.3)	1 (0.9)	
Obesity	1350 (37.1)	36 (41.4)	
HbA1c			.168
≥6.5	733 (21.0)	28 (28.1)	
<6.5	2904 (79.0)	66 (71.9)	
Anemia			.421
No	3264 (90.2)	83 (87.2)	
Yes	373 (9.8)	11 (12.8)	
Hypercholesterolemia			.037
No	2642 (72.6)	59 (60.6)	
Yes	995 (27.4)	35 (39.4)	
Mastication discomfort			.005
No	2176 (60.0)	40 (42.6)	
Yes	1461 (40.0)	54 (57.4)	

(continued)

Table 2
(continued).

	Hospitalization due to trauma		P
	No (n=3637)	Yes (n=94)	
Toothache (for a year)			.972
No	2240 (61.3)	57 (61.1)	
Yes	1397 (38.7)	37 (38.9)	

HbA1c=Hemoglobin A1c.
Data are presented as n (weighted %). Statistics were carried out using Rao-Scott Chi-square test

activity imitations because of joint pain (OR: 5.11, 95% CI: 1.24–21.00, $P=.024$). Trauma-related hospitalization was also associated with increased risks of self-care problems (OR: 2.34, 95% CI: 1.20–4.55, $P=.012$), pain or discomfort (OR: 1.78, 95% CI: 1.09–2.91, $P=.021$), hypercholesterolemia (OR: 1.72, 95% CI: 1.03–2.89, $P=.040$), and mastication discomfort (OR: 2.06, 95% CI: 1.23–3.44, $P=.0058$). The adjusted analyses revealed that trauma-related hospitalization was independently associated with activity limitations caused by joint pain (OR: 5.04, 95% CI: 1.29–19.67, $P=.020$), self-care problems (OR: 2.24, 95% CI: 1.11–4.53, $P=.025$), pain or discomfort (OR: 1.77, 95% CI: 1.08–2.89, $P=.023$), and mastication discomfort (OR: 2.06, 95% CI: 1.22–3.46, $P=.007$).

4. Discussion

Many studies have revealed poor outcomes among geriatric trauma patients,^[6–8] which led to the development of tools to predict their outcomes and improve their treatment.^[8,11,12] However, to the best of our knowledge, the present study is the first to evaluate the health-related quality of life, nutritional status, and physical status of geriatric trauma patients, and we identified several problems related to their physical and nutritional statuses after trauma-related hospitalization. They had more risk for activity limitations caused by joint pain, self-care problems, pain or discomfort and mastication discomfort. Additionally trauma-related hospitalization was also associated with non-significant increases in mobility problems, activities of daily living problems, and anxiety or depression. Furthermore, patients with trauma-related hospitalization were more likely to experience changes in their weight, anemia, HbA1c levels of $\geq 6.5\%$. Therefore, it is important to consider these patients' quality of life, as well as their mortality or morbidity. A collaborative approach should be developed to combine the expertise of surgeons, intensivists, psychiatrists, nutritionists, nurses, and social workers.

Only a small proportion of geriatric patients were hospitalized because of trauma (2.5% of the eligible individuals), compared to 6.7% of individuals who had experienced an injury in a previous KNHANES survey (797 of 11,837 individuals).^[13] Furthermore, a previous study has revealed that the incidences of trauma-related hospitalization were 2.3% among men and 1.7% among women.^[14] Thus, the low incidence of trauma-related hospitalization indicates that big-data studies may be needed to identify significant differences in the physical and nutritional statuses of geriatric trauma patients.

The EuroQol group developed the EQ-5D tool to rapidly assess health-related quality of life^[15] using five questions regarding mobility, self-care, activities of daily living, pain/discomfort, and anxiety/depression. This tool has been used to evaluate patients' overall health status and health-related quality of life in cases that involved cardiac arrest, burns, critical illnesses, and geriatric patients.^[15–19] In the present study, the EQ-5D tool identified

Table 3
Univariate and multivariate regression analysis of physical and nutritional factors.

	OR (95%CI)	P-value	adjusted OR (95%CI)	P value
Strength exercise				
No	reference		reference	
Yes	0.49 (0.24–0.99)	0.048	0.51 (0.23–1.14)	.100
Activity limitation (all reasons)				
No	reference		reference	
Yes	1.23 (0.64–2.34)	0.536	1.16 (0.62–2.14)	.646
Activity limitation (joint pain)				
No	reference		reference	
Yes	5.11 (1.24–21.00)	0.024	5.04 (1.29–19.67)	.020
Non applicable	0.97 (0.48–1.96)	0.932	1.03 (0.53–2.02)	.933
Activity limitation (other damage)				
No	reference		reference	
Yes	4.91 (0.88–27.51)	0.070	4.51 (0.80–25.36)	.087
Non applicable	0.88 (0.44–1.76)	0.726	0.93 (0.48–1.81)	.840
Knee-joint pain				
No	reference		reference	
Yes	0.98 (0.52–1.82)	0.938	0.92 (0.50–1.68)	.775
Hip joint pain				
No	reference		reference	
Yes	0.78 (0.38–1.62)	0.506	0.72 (0.34–1.54)	.403
EQ-5D				
Mobility				
None	reference		reference	
Somewhat agree	1.50 (0.91–2.47)	0.111	1.45 (0.83–2.53)	.197
Strongly agree	1.16 (0.27–5.04)	0.844	1.07 (0.22–5.20)	.934
Self-care				
None	reference		reference	
Somewhat agree	2.34 (1.20–4.55)	0.012	2.24 (1.11–4.53)	.025
Strongly agree	2.62 (0.56–12.27)	0.220	2.85 (0.56–14.43)	.205
Usual activities				
None	reference		reference	
Somewhat agree	1.66 (0.96–2.86)	0.068	1.61 (0.91–2.86)	.101
Strongly agree	1.77 (0.49–6.38)	0.382	1.69 (0.43–6.70)	.455
Pain/discomfort				
None	reference		reference	
Somewhat agree	1.78 (1.09–2.91)	0.022	1.77 (1.08–2.89)	.023
Strongly agree	2.38 (0.97–5.87)	0.059	2.29 (0.95–5.51)	.064
Anxiety/depression				
None	reference		reference	
Somewhat agree	1.63 (0.87–3.05)	0.128	1.56 (0.78–3.12)	.211
Strongly agree	2.42 (0.88–6.65)	0.086	2.13 (0.69–6.55)	.189
Weight change (for a year)				
None	reference		reference	
Decrease	1.59 (0.90–2.82)	0.110	1.64 (0.92–2.90)	.092
Increase	1.73 (0.93–3.22)	0.083	1.67 (0.91–3.06)	.100
Body mass index				
Normal	reference		reference	
Underweight	0.44 (0.06–3.32)	0.426	0.44 (0.06–3.29)	.421
Obesity	1.16 (0.71–1.90)	0.545	1.14 (0.69–1.87)	.615
HbA1c				
≥6.5	reference		reference	
<6.5	0.68 (0.39–1.18)	0.171	0.68 (0.39–1.18)	.170
Anemia				
No	reference		reference	
Yes	1.35 (0.65–2.82)	0.423	1.44 (0.69–3.00)	.328
Hypercholesterolemia				
No	reference		reference	
Yes	1.72 (1.03–2.89)	0.040	1.69 (0.98–2.89)	.058
Mastication discomfort				
No	reference		reference	
Yes	2.06 (1.23–3.44)	0.006	2.06 (1.22–3.46)	.007

(continued)

Table 3
(continued).

	OR (95%CI)	P-value	adjusted OR (95%CI)	P value
Toothache (for a year)				
No	reference		reference	
Yes	1.01 (0.62–1.65)	0.972	0.99 (0.60–1.63)	.965

HbA1c = Hemoglobin A1c.

Data are presented as Odds ratio (OR) (95% confidence interval (CI))

Statistics were carried out using logistic regression.

Adjusted variables were age, sex, income, and household income.

several significant decreases in the health-related quality of life of geriatric trauma patients.

It is interesting that geriatric trauma patients had an increased risk of mastication discomfort, as we did not limit our analysis to patients who had experienced oromaxillary trauma. A recent study has revealed that masseter muscle cross-sectional area predicted mortality among elderly blunt trauma patients,^[20] and decreased chewing ability is associated with impaired activities of daily living, cognitive function, depression, and food insufficiency among geriatric patients.^[21] Therefore, further studies are needed to understand mastication rehabilitation and nutritional challenges among geriatric trauma patients.

The present study has several potential limitations. For example, there was limited information regarding the patients' admission parameters and ward (e.g., the intensive care unit), and we could only identify patients who were or were not hospitalized because of trauma. In addition, case severity can be evaluated using the injury severity score, SOFA score, or APACHE score, although these tools are not used in the KNHANES surveys, which are performed to obtain general information for the Korean Centers for Disease Control and Prevention. This approach facilitates long-term analysis, although specific and sophisticated analysis may not be possible. However, the Korean Trauma Data Base includes information regarding trauma cases' injury severity score, abbreviated injury score, trauma and injury severity score, intensive care unit admission, morbidity, and mortality. Thus, combination of that database with KNHANES data might facilitate more comprehensive analyses, and it would also be useful to evaluate methods to improve these patients' health-related quality of life. Furthermore, evaluating data regarding intensive care unit admission might provide additional information regarding post-intensive care syndrome.^[22]

Among geriatric patients, trauma-related hospitalization was associated with reduced strength exercise, activity limitations caused by joint pain, self-care problems, pain or discomfort, hypercholesterolemia, and mastication discomfort. Therefore, trauma surgeons, nurses, physiatrists, nutritionists, and social workers should collaborate to improve the physical and nutritional statuses of these patients. In addition, further studies are needed to elucidate the long-term prognosis of geriatric trauma patients.

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