Epidemiological investigation of hospitalized patients with traumatic fractures: a cross-sectional study

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Abstract

Objective: This study was performed to explore major risk factors for traumatic fracture by comparing related data of hospitalized patients with traumatic fracture and patients with lumbar disc herniation.

Methods: Patients with traumatic fracture and patients with lumbar disc herniation requiring surgical treatment in the orthopedics department of our hospital from March to May 2018 were divided into a fracture group and a non-fracture group. Clinical data were collected from the two groups by questionnaires. Major risk factors for traumatic fracture were analyzed using multivariate logistic regression.

Results: Univariate analysis showed statistically significant differences in family history of fracture, smoking history, drinking history, sex, sleep duration, chronic disease history, osteoporosis history, age, body mass index, occupation, and education level between the two groups. Multivariate logistic regression analysis showed that patients aged 25 to 44 years were more prone to traumatic fracture than patients aged ≥ 65 years, male patients were more prone to fracture than female patients, drinking alcohol was a risk factor for traumatic fracture, and sufficient sleep duration (>7 hours/night) was a protective factor for traumatic fracture.

Conclusion: Young age, male sex, and drinking are risk factors for traumatic fracture, whereas sufficient sleep duration is a protective factor.

Keywords

Traumatic fracture, risk factor, age, sex, sleep duration, drinking

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Introduction

Traumatic fracture is common in the clinical setting, and the number of patients is increasing every year.[1,2] The China National Fracture Study (CNFS) was an epidemiological survey of fractures in China.[3–7] The CNFS showed that the incidence rate of traumatic fracture in China was 3.21‰ and identified many risk factors for traumatic fracture. A history of fracture in the young adult and elderly populations is an important risk factor[3,8,9] that may be related to factors such as loss of bone mass after fracture, decreased coordination and balance ability, personal lifestyle, attention to traffic safety, compliance with work safety guidelines, and attention to production safety.[10] Family members might affect one another with respect to lifestyle, safety awareness, and compliance with production and traffic rules.[11] Our research group performed a national epidemiological survey of fractures in a nationwide population, but few studies have focused on the risk factors for hospitalized patients with traumatic fracture. Therefore, to address this knowledge gap, the present study included patients with traumatic fracture and patients with lumbar disc herniation who received surgical treatment during the same period and adopted a questionnaire survey method to collect information of the patients and their family members, including general conditions, lifestyle behaviors, disease history, fracture history, and osteoporosis history. The risk factors for traumatic fracture were explored by performing a statistical analysis.

Patients and methods

Inclusion and exclusion criteria

The inclusion criteria for patients with traumatic fracture were (1) confirmation of traumatic fracture by an imaging study, (2) fracture requiring surgical treatment, (3) evaluation of the osteoporosis status by preoperative pelvic anteroposterior X-ray (Singh index)[12,13] or dual-energy X-ray absorptiometry, and (4) consent to participate in this study. The exclusion criteria were pathological fracture, nonunion fracture, periprosthetic fracture, unconsciousness, fracture combined with craniocerebral injury, and patient or family members with a history of mental illness.

The inclusion criteria for patients with lumbar disc herniation were (1) a definitive diagnosis of lumbar disc herniation by an imaging study, (2) a plan to undergo surgical treatment, (3) lumbar disc herniation not combined with traumatic fracture, (4) evaluation of the osteoporosis status by preoperative pelvic anteroposterior X-ray (Singh index) or dual-energy X-ray absorptiometry, and (5) consent to participate in this study. The exclusion criteria were unconsciousness, lumbar disc herniation combined with craniocerebral injury, and patients or family members with a history of mental illness.

Survey contents and methods

The questionnaire used in this study was based on the national epidemiological survey questionnaire on fractures[3] with the addition of fracture history of family members. The survey content included general information (age, sex, height, weight, marital status, education level), lifestyle and behavior (smoking history, drinking history, sleep duration), information regarding the present fracture (fracture site, time, cause of injury, complications), the patient's medical history, the patient's fracture history, and the fracture history of family members (to investigate the occurrence of traumatic fracture in immediate family members living together). Investigators were trained prior to the survey. The collected questionnaires were entered into a database using EpiData 3.1 (EpiData Association, Odense, Denmark) according to the double entry principle.

Statistical analysis

The data analysis was performed with IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp., Armonk, NY, USA), and the variable assignment is shown in Table 1. Age, sex, sleep duration, fracture history, family history of fracture, smoking history, drinking history, body mass index, chronic medical history, and osteoporosis were compared between the two groups of patients. In the univariate analysis, the χ^2 test was used to compare the count data, and variables with a P value of <0.2 in the univariate analysis were included in the multivariate logistic regression analysis to screen risk factors for traumatic fracture, with an α level of 0.05.

Ethical approval

This study was approved by the institutional review board of our hospital and registered with the Chinese Clinical Trial Registry (no. ChiCTR-EPR-15005878).

This article contains no studies with human participants or animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study.

Results

General information

In total, 218 patients who were treated for traumatic fracture from March to May 2018 and who met the inclusion criteria were included in this study. Eleven patients were excluded because of traumatic fracture complicated with craniocerebral injury or the presence of mental illness. Therefore, 203 patients were included in the analysis, including 132 (65.0%) male patients with an average age of 43 years (range, 11–91 years) and 71 (35.0%) female patients with an average age of 51 years (range, 14–88 years). The patients comprised 200 Han Chinese and 3 ethnic minorities. With respect to the causes of injury, 67 injuries

Table 1. Assignments and descriptions of variables affecting traumatic fracture.

Variable	Description	
Presence of fracture (Y)	No = 0	Yes = 1
Sex (X1)	Male = 1	Female = 2
Age, years (X2)	0–24 = 1, 25–44 = 2, 45–64 = 3, $\geq$65 = 4	
Smoking (X3)	No = 0	Yes = 1
Drinking (X4)	No = 0	Yes = 1
Sleep duration (X5)	$\geq$7 hours/night = 1	<7 hours/night = 2
Chronic disease history (X6)	No = 0	Yes = 1
Body mass index, kg/m^2 (X7)	<18.5 = 1, 18.5–23.9 = 2, 24.0–27.9 = 3, $\geq$28.0 = 4	
Fracture history (X8)	No = 0	Yes = 1
Family history of fracture (X9)	No = 0	Yes = 1
Ethnicity (X10)	Han = 1	Other = 2
Occupation (X11)	Office worker = 1, Farmer = 2, Manual worker = 3, Retired = 4, Student = 5, Preschool worker = 6, Unemployed = 7, Other occupations = 8	
Education level (X12)	Illiterate = 1, Primary school = 2, Junior high school = 3, Senior high school and above = 4	
Osteoporosis (X13)	No = 0	Yes = 1

resulted from traffic accidents, 60 resulted from falls, 23 resulted from falling from a height, 33 resulted from heavy objects, 5 resulted from sharp objects, and 15 resulted from blunt-force violence.

Patients with lumbar disc herniation who were admitted to the Department of Spinal Surgery in our hospital were surveyed. A total of 232 patients agreed to participate in the study, but 25 patients did not meet the inclusion criteria. Therefore, 207 patients were included in the analysis, including 70 (33.8%) male and 137 (66.2%) female patients. The patients comprised 201 Han Chinese and 6 ethnic minorities.

Univariate analysis

Univariate analysis showed that all indicators were statistically significant except ethnicity ($\chi^2 = 0.964$) and history of fracture (Table 2).

Multivariate analysis

Using the presence or absence of traumatic fracture as the dependent variable, multivariate logistic regression analysis was performed using the factors with a P value of <0.2 in the univariate analysis as independent variables, including sex, age, smoking history, drinking history, sleep duration, and body mass index. The results showed that drinking, male sex, and age of 25 to 44 years were major risk factors for the occurrence of severe traumatic fracture. Drinking was a risk factor for traumatic fracture [odds ratio (OR), 2.823; 95% confidence interval (CI), 1.298–6.140]. Patients aged 25 to 44 years were more prone to fractures than patients aged ≥ 65 years

Table 2. Results of single-factor analysis.

Variable	Fracture	Non-fracture	χ^2	P
Family history of fracture, yes/no	67/136	42/165	8.490	0.004
Smoking, yes/no	139/64	169/38	9.511	0.002
Drinking, yes/no	145/58	160/47	1.851	0.174
Sex, male/female	132/71	70/137	39.937	<0.001
Sleep duration, $\geq 7/<7$ hours/night	43/160	97/110	30.052	<0.001
Chronic disease history, yes/no	170/33	118/89	35.058	<0.001
Osteoporosis, yes/no	196/7	204/3	1.721	0.190
Age, years			101.605	<0.001
0–24	14	3		
25–44	86	8		
45–64	70	122		
≥ 65	33	74		
Body mass index, kg/m^2			11.585	0.009
<18.5	11	1		
18.5–23.0	112	118		
24.0–27.9	62	58		
≥ 28.0	18	30		
Occupation[a]	21/67/50/12/17/0/13/23	18/96/27/49/4/0/5/8	53.530	<0.001
Education level[b]	5/42/74/82	26/36/78/67	16.265	0.001
Ethnicity	200/3	201/6	0.964	0.326
Fracture history	180/23	183/24	0.007	0.933

[a]Office worker/Farmer/Manual worker/Retired/Student/Preschool worker/Unemployed/Other occupations.
[b]Illiterate/Primary school/Junior high school/Senior high school and above.

(OR, 12.836; 95% CI, 4.771–34.532). Male patients were more prone to fracture than female patients (OR, 4.057; 95% CI, 2.053–8.017). Sufficient sleep duration was a protective factor for traumatic fracture (OR, 0.479; 95% CI, 0.275–0.835) (Table 3).

Discussion

Age and sex

This study showed that age and sex are two important factors associated with the risk of traumatic fracture. In particular, men aged 25 to 44 years represent a high-risk population for traumatic fracture. The results of an epidemiological study by Karl et al.[14] on upper extremity fractures in the United States showed that people of 18 to 49 years of age represent a high-risk group for hand fractures. Curtis et al.[15] conducted an epidemiological study on fractures from 1988 to 2012 in the United Kingdom and found that 18 to 49 years of age was a high-risk population for fractures. Although the specific age ranges are different, all of the above studies indicate that young males are at high risk of fractures. This increased risk is mainly associated with the high exposure to risk factors for traumatic fracture in this age group. Those in the 25- to 44-year age group compose the main labor force in society. Young men, many of whom have high labor intensity, are the main work force and are exposed to many risk factors in the daily working environment. In addition, some special occupations, such as working at elevated heights and driving, are performed mainly by young men. Moreover, people in this age group actively participate in a variety of outdoor activities, increasing the risk of sports trauma.

Drinking

Drinking is a recognized risk factor for traumatic fracture.[16–18] The CNFS[3] showed that for adults over 15 years of age, alcohol consumption increases the risk of traumatic fracture. Liu et al.[19] showed that the risk of traumatic spinal fracture was 80% higher in those who did than did not consume alcohol. Similarly, Liu et al.[20] found that drinking increases the risk of fracture of the foot. The data in the present study showed that alcohol consumption can lead to an increased risk of traumatic fracture.

Drinking increases the risk of traumatic fracture, which is closely related to traffic accidents and falls caused by alcohol consumption.[21] In addition, long-term alcohol consumption can alter bone metabolism, resulting in osteoporosis and decreased bone strength.[22–24] Therefore, reducing alcohol consumption helps to avoid the occurrence of traumatic fracture. The proportion of traffic accidents that caused injuries in 2014

Table 3. Results of multifactor logistic regression analysis.

Variable	B	SE	Wald	P	OR	95% CI
Age (years)						
0–24	0.349	0.924	0.143	0.705	1.418	0.232–8.668
25–44	2.552	0.505	25.548	0.000	12.836	4.771–34.532
45–64	0.008	0.327	0.001	0.980	1.008	0.532–1.912
≥65	–	–	34.751	0.000	–	–
Sex (male)	1.400	0.348	16.236	0.000	4.057	2.053–8.017
Sleep duration (≥7 hours)	−0.736	0.284	6.736	0.009	0.479	0.275–0.835
Drinking	1.038	0.397	6.848	0.009	2.823	1.298–6.140

SE, standard error; OR, odds ratio; CI, confidence interval.

$(20.4\%)^3$ was significantly lower than that in 2012 (23.11%) and 2013 (23.14%). Decree No. 123 of the Ministry of Public Security of the People's Republic of China was formally implemented on 1 January 2013, and strict amendments have been made to forbid driving motor vehicles after drinking or when drunk.[25] Since the implementation of this decree, there has been a marked decline in various types of traffic accidents, especially in the number of people driving motor vehicles after drinking or when drunk.

Sleep duration

The data in this study showed that sufficient sleep duration is a protective factor for traumatic fracture. O'Loughlin et al.[26] reported that insomnia or sleep disorders can increase the risk of falling and estimated that approximately one-third of elderly people aged >65 years had an incidence of falling due to insufficient sleep. The CNFS[3] data showed that sleeping <7 hours a day is a risk factor for traumatic fracture for people of all ages. Stone et al.[27] found that compared with women who sleep 7 to 8 hours per night, women who sleep 5 to 7 hours or <5 hours are more likely to fall. Holmberg et al.[28] reported that sleep disorders increase the risk of the occurrence of fragility fractures in most middle-aged men. Therefore, individuals should be actively encouraged to improve their sleep quality and increase their sleep duration to help reduce the risk of traumatic fracture.

Limitations of this study

This study was a retrospective survey and might have had recall bias that affected the data analysis. The sample size was small because of the strict inclusion and exclusion criteria. Additionally, periprosthetic fractures were excluded from the inclusion and exclusion criteria of traumatic fractures, which likely resulted in a relatively lower incidence of fractures in elderly patients and a higher incidence in young patients. Related research has shown that periprosthetic fractures are a complication occurring in 1% to 3% of patients after primary total hip arthroplasty and 0.3% to 5.5% of patients after primary total knee arthroplasty.[29] That study showed that the incidence of periprosthetic fractures in elderly patients is still relatively low, so it had little influence on the results of this study. The exploration of risk factors for traumatic fracture still requires in-depth investigations through large multicenter clinical studies.

Conclusion

This study analyzed the relevant risk factors for traumatic fracture in hospitalized patients. Sufficient sleep duration is a protective factor for traumatic fracture, and drinking is a risk factor for traumatic fracture (OR, 2.823). Compared with elderly individuals over 65 years of age, those aged 25 to 44 years are more prone to severe fractures; additionally, compared with women, men are more prone to traumatic fractures.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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