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Sex Disparities in Elderly Trauma in Northern Iran

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Abstract

Introduction: Trauma is currently the ninth cause of mortality in the elderly. Several factors may have an impact on the outcomes after trauma in the elderly including background disease, sex, trauma severity, and age. The aim of this study was to understand the sex differences about trauma in this growing population.

Methods: In a cross-sectional study, the records of all the traumatic injured people above 60 years of age who were admitted to a main center of trauma hospital in north of Iran in 2012 were studied. Demographic data, characteristics of road traffic incidents, and in-hospital medical profiles were derived. The analysis of data was done by using the χ^2 test and T test with SPSS Ver. 18 software. A P value of < 0.05 was considered statistically significant.

Results: One thousand and eight-hundred thirty injured elderly patients were admitted during the study period. This amount accounted for 10.5% of the total injured. In this study 56.3% of victims were male with the mean age of 70.84 ± 8.16 years in comparison to 71.65 ± 8.59 years in women ($P < 0.05$). Sex differences were seen in Glasgow coma scale, place, mechanism of trauma, anatomical part injured, and in-hospital death rate ($P < 0.05$). Outdoor trauma was more prevalent in men and indoor trauma in women. The mechanisms causing trauma in both sexes were slipping and road traffic accidents, respectively. In men, head and neck were the most common anatomical sites injured, while most women suffered from injuries to the upper extremities.

Conclusions: It seems that elderly men are more at risk of severe injury with a higher mortality rate in comparison to elderly women.

Keywords: Trauma, The Elderly, Sex Difference

1. Introduction

The United Nations states is 60+ years to refer to the elderly population (1).

Despite the increased emphasis on taking care of the elderly, health status in this age group is still fragile. Elderly patients due to longer life expectancy and the improvement of life quality (2) are becoming a large part of our population (3). The percentage of the elderly over 65 years of age in such developed countries like Germany and Japan has increased over 20% and it is expected that this increase will continue in the developed and the developing countries by 2050 (4).

In the United States of America, the population aged 65 years and over was 35 million in 2000, making up 12% of the total population. However, by 2030, it is estimated that the number of the elderly population will reach 70.3 millions, representing 20% of the total population (5) and they will be allocated nearly 55% of the health care resources (6).

In Iran, the elderly population has been increasing over the past years, too. The population of the people aged 60 years and older was 5.4% in 1975 and it is predicted that it will reach 10.5% by 2025 and 21.7% by 2050. Iran's population will be doubled in the next 50 years, while the population aged 65 years and over will approximately have a sixfold increase (7). Also, according to the last Iranian population and housing census in 2011, the population aged 60 years and over in Guilan province is increasing compared to previous years and it is predicted that the elderly population of this province will constitute 16.6% of the total population by 2026 (8). On the other hand, the rate of road accidents in Iran is twenty times that of the world's average. Each year, road traffic accidents kill nearly 28,000 people and injure or disable 300,000 in Iran (9).

As the population ages, trauma centers see an increased proportion of elderly patients presenting with major injury. Trauma is currently the ninth cause of mortality in the elderly. Previous studies in the field of geriatric trauma illustrated factors that affect the likelihood of damage occurring in the elderly. These factors include age-related physiological changes such as reduced cardio-

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vascular function, physiological immunity decline, comorbidity, disability in compensating for severe injuries, loss of movement, and disability in maintaining balance (10-14). Numerous factors may affect the outcome after trauma in the elderly and be considered as the predictors of the outcome of this age group. One of these factors is the sex variable (15, 16). The results of the studies about the effects of gender on the outcomes of trauma were controversial. A study has shown that the injuries, fractures and, hospitalization rates in women were more than those in men (17), while another study has shown higher injuries in men compared to women (18). Another study has stated that the outcome of the accident is the same in elderly men and women (19).

These differences were further evaluated in experimental animal studies and the results demonstrated that sex hormones were responsible for these gender-based differences (20).

It is clear that the characterization of the epidemiology of injuries in the elderly provides valuable information to identify necessary intervention and research priorities.

2. Objectives

The aim of the present study was to identify and describe trauma in elderly patients and analyze sex-based disparities (21) in Guilan province, northern Iran.

3. Methods

This study was a cross-sectional study of patients' records obtained from trauma registry and hospital information system (HIS) of Poursina hospital. The records of elderly patients with an age equal to 60 or more who were admitted due to trauma were selected between March 1, 2012 and Februrary 29, 2013. A checklist was used to document necessary variables such as age, sex, mechanism of injury, the time and the place of the accident, anatomical part of the injury according to AIS classification, the level of consciousness by the Glasgow coma scale (GCS) upon, mortality, hospital length of stay (LOS), admission to ICU, and the surgical procedures done. The research protocol was approved by the research ethical committee of Guilan University of Medical Sciences.

Continuous data were presented as medians with comparisons between the groups performed using the Wilcoxon rank sum (Mann-Whitney U test). Categorical data were reported as proportions and, were, tested for significance using χ^2 or Fisher exact tests. A P value of < 0.05 was considered statistically significant.

4. Results

During the study period, a total of 32,003 patients were admitted whose main cause of admission was trauma (16,505 cases), of which 2,125 patients (12.9%) were $\geq$ 60 years old. 1830 records were studied.

Overall, the study population was 56.4% male (n = 1032) and 43.6% female (n = 798). The mean age in men and women were 70.84 ± 8.16 and 71.65 ± 8.59 respectively, and such a difference was statistically significant ($P < 0.05$). In both sexes, most people were aged 60 - 74 years (Table 1).

Most of the victims had a GCS more than 8, but men had a lower GCS compared to women ($P < 0.00$). There was, statistically, a significant difference between the GCS in different age groups in both males and females ($P < 0.00$) (Table 1).

There was a significant difference between men and women according to the place of trauma, as outdoor trauma in males was more prevalent, while women mostly suffered from indoor traumas (Table 1) ($P < 0.000$).

The most frequent time of occurrence was in the afternoon and the morning, respectively (Table 1). Also, with the increase in age, no significant difference was observed between women and men in terms of this variable (Table 2).

The mechanisms of trauma in both genders were slipping (falling) and road traffic accident, but the main cause of trauma in men was road traffic accident (Table 1) ($P < 0.000$).

The vertebral column was affected more in women ($P < 0.000$). In men, the most prevalent parts injured were head and neck and lower extremities respectively, while most women suffered from injuries to the upper extremities (Table 1). With an increase in the age, there was a significant increasing rate in lower extremities injuries in both genders ($P < 0.00$) (Table 2).

Intensive care admission rate was higher in older men in comparison to women, while the need for surgery rate was not significantly different (Table 2).

Out of 1830 elderly trauma victims, 134 patients (7.3%) died. Mortality rate in men and women was 9.8% (n = 101) and 4.1% (n = 33), respectively ($P < 0.000$) (Table 1). Increasing age correlated with increased fatality in all patients in our study ($P < 0.05$) (Table 2).

The median length of stay in hospital in men was longer than women (3days vs. 2 days). The results showed that the length of stay increases with age in both sexes. However, this difference was not significant.

5. Discussion

The number of the elderly people is increasing gradually in the world (22). Trauma in the elderly is a serious

public health problem. This study suggests that the gender differences in variables such as GCS, location of accident, mechanism of injury, site of body injury, and death is significant. Also, with an increase in age, there is a significant difference among GCS, location of accident, mechanism of injury, ICU admissions, and deaths variables in both men and women.

In this study, 12.9% of all the traumatic cases who were admitted to the hospital were elderly patients. O'Neill et al. reported it too be 9.1% (23). In various studies, there are inconsistent statistics (16-27). Age has been shown to be an independent predictor of mortality following trauma, and care for the elderly trauma patients is characterized by increased costs due to longer hospital stays and increased complication rates (28, 29). As the number of the elderly trauma admissions increases, the prediction of mortality and its risk factors becomes an increasingly important issue.

The observed disparities in different studies and geographical regions may be due to the differences in the definition of old age, cultural differences, source of data collection, the study group (the total referrals or admissions), or to the differences in the lifestyle of the elderly.

We observed that in the present study, the number of men was more than women. Watts et al. have shown that injured men (56%) are more than injured women (44%) (18). Such results also were seen in other studies (16, 19, 27, 30-32) The high number of trauma cases in men may be justified according to employment status, family role and responsibility, the presence of men outdoors, and motor vehicle usage. With the increase in age, the patient's ability to move decreases. On the other hand, difficulties in motor skills (25, 33) cause increasing indoor trauma. This finding was consistant with the previous studies (13, 19, 27).

There are two likely explanations for this observed change in the male to female ratio with age. Firstly, it is well recognized that high risk behavior is at a peak in young males (34-36), as this behavior decreases, the proportion of the victims of serious trauma who are male will likewise decrease. Secondly, higher rates of survival in aging females mean that the proportion of female patients suffering any condition is likely to be higher in the older patients (37), logistic regression analysis found male sex to be predictive of survival in the younger patients, the reason for this is unclear (13).

According to the GCS on admission, the results show that most elderly traumas (in both sexes) are in the subgroup GCS: 9 - 15, it suggests that minor traumas are more likely to occur in the elderly, because elderly patients can be injured with less energy (38). This study has shown that in men, unlike women, the outdoor accidents have the highest frequency of occurrence. Safizadeh et al.'s study results are consistent with our results (19). As noted earlier, it may be attributed to employment and social activities in males. The other results of this series suggest that with the increase in age in both genders, the number of indoor and outdoor injuries decreased. The significance of this result is justifiable due to a reduction in the patient's ability to move, increasing comorbidities, and also motor skills disorders (25, 33). The prevalent mechanisms causing trauma in men and women are accidents and slipping, respectively. Safizadeh et al. also suggest that motor vehicle accident-related injuries and violence in men and slipping, poisoning, snakebite, burns, and drowning in women are the most common (19). It is clear that accidents are more likely to happen in the places where men and women undertake their roles in the society. It seems that impaired judgment, vision, and hearing loss of balance difficulty in walking and slowness of movement receiving multiple treatments and other health problems are the factors that make the elderly prone to accidents (39-41). Primary health care education for the elderly, especially prevention programs, may help to increase their awareness about the risks associated with these traumas (17, 42). Also, Iranfar et al.'s study reported that 80% of the falls happen in the daytime (43). Men, on the other hand, because of social and business situations in the external environment, experience mostly traffic accidents in the afternoons, at the time they go back home.

This study indicates that with the increase in age in both sexes, the number of surgical cases decreases. Giannoudis et al. also stated that the percentage of the patients undergoing surgery decreases with the increase in age, 65% (under 40 years old), 47% (65 - 75 years), 38% (75 - 85 years), and 27% (over 85 years) (13). Also, with the age increase, the number of hospitalization cases in ICU reduces only in women.

Different results are seen in the mortality factor in different studies. In this study like O'Neill et al.'s (23), the highest frequency observed for mortality is in men, and women are less likely to die, while the contrary was seen in Cohort Schoeneberg et al.'s study. This means that the mortality rate in women is significantly higher than that in men (25.4% vs. 36.59%) (44). In several other studies, head traumas were identified as the leading cause of death in the elderly (24, 25, 45). The changes occurring in the brain with aging, which include changes in size, weight, and cerebrovascular auto regulation decrease account for the increased mortality in elderly patients with head trauma (46). Another reason is mentioned in Schroeder et al.'s research who have reported that after sepsis in patients with severe trauma, survival rates in women are higher than those in men because testosterone levels in men decrease while the amount of this hormone in women re-

Table 1. Frequency Distribution of Trauma Elderly Victims[a]

Variable	Men	Women	P Value
Age, y			0.75
60 - 74	688	496	
75 - 89	327	281	
≤ 90	17	21	
GCS at admission time			0.00
3 - 5	37	5	
6 - 8	27	10	
9 - 15	968	783	
Place of event			0.000
Indoor	315	524	
Outdoor	717	274	
Time of events			0.182
Morning	285	250	
Noon	92	91	
Afternoon	346	224	
Evening	150	110	
Night	130	98	
Midnight	29	25	
Mechanism			0.000
Road Traffic Accident	524	215	
Falling from height	126	45	
Slipping	286	489	
Other	96	49	
Anatomical part of Injuries			0.000
Upper limb	338	331	
Lower limb	416	287	
Head and neck	595	283	
Abdomen and pelvic	143	68	
Vertebral Column	75	150	
Face	209	96	
Chest	128	44	
ICU admission			0.112
Yes	71	43	
No	961	755	
Surgery Done			0.192
Yes	672	546	
No	360	252	
Outcomes			0.000
Death	101	33	
Alive	931	765	

[a]Values are expressed as No.

mains normal. Estrogen increases in both sexes, however, women have a higher amount of the hormone. IL-10 levels is also more common in women. Thus, differences in mortality rates in both sexes are justified by the immune and endocrine systems' interaction (47). Another important point about mortality is related to age, so that the mortality rate increases with age in both genders. Similar results have been observed in other studies (48, 49). However, converse results have, as well, been reported in several studies (25, 30, 50). Overall, the most common reasons for the high mortality in the elderly are reported as increased complications (13) and physiological and anatomical deficiency (30) combined with inadequate pre-hospital and in-hospital care (33).

Finally, the authors of this article found that the length of stay is higher in men. Increased LOS in males can be due to the high frequency of motor vehicle accidents and the head and neck trauma and severity in this group. With regard to the fact that with the increase in age, decreased physiological reserves, and the mechanisms of adaptation to trauma are disrupted (22, 51, 52) and, on the other hand, comorbidity increases (25, 33), prolonged LOS in old age is explained.

5.1. Conclusions

It seems that elderly men are more at risk of severe injury with a higher mortality rate in comparison to elderly women.

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Footnote

Conflict of Interest: The authors do not have any conflict of interest.

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Table 2. Frequency Distribution of Trauma Elderly Victims Based on Age and Sex Groups

Variable	Men		Women		P Value
	Age Group		Age Group		
	60 - 74	≥ 75	60 - 74	≥ 75	
GCS at the admission time					0.009
3 - 5	19	18	4	1	
6 - 8	12	15	6	4	
9 - 15	657	3	786	297	
Place of Trauma					0.000
Indoor	185	130	287	237	
Outdoor	503	214	209	65	
Time of events					0.104
Morning	184	101	146	104	
Noon	61	31	53	38	
Afternoon	236	146	149	75	
Evening	88	62	62	48	
Night	98	32	70	28	
Midnight	21	8	16	9	
Mechanism					0.000
Road traffic accident	373	151	167	48	
Falling from height	100	26	29	16	
Slipping	140	146	264	225	
Other	75	21	36	13	
Part of body affected					
Upper limb	231	107	217	114	0.327
Lower limb	260	157	167	120	0.01
Head and neck	398	197	188	95	0.217
Abdomen and pelvic	45	31	39	29	0.267
Vertebral Column	57	20	53	21	0.221
Face	130	76	64	34	0.227
Chest	98	33	32	12	0.214
ICU admission	33	38	24	19	0.000
Surgery done	441	231	339	207	0.259
Inhospital Death	48	53	13	20	0.000

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