Original Article

The Outcomes of Head Trauma Due to Road Traffic Accident in Hospitalized Elderly Patients

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Abstract

Introduction: Head trauma is one of the most important causes of death in trauma centers. In particular, treatment of head injury in the elderly seems more complicated than that of the young and middle aged. This study aimed to identify the outcomes of head trauma due to road traffic accidents (RTAs) in elderly patients. **Materials and Methods:** In a descriptive-analytical study, records of 294 elderly patients with head trauma due to RTA retrieved from health information system were reviewed using a checklist. The outcomes of patients were evaluated using the Glasgow Outcome Scale. Complete recovery and partial disability were considered as favorable outcomes, whereas severe disability, vegetative state, and death were defined as unfavorable outcomes. Descriptive factors and adjusted coefficients were calculated using SPSS software. **Results:** Of 294 elderly patients, 77.2% were men. About half of the road accidents had occurred in urban areas (58.8%). Less than half of the injured elderly were pedestrian (44.9%). The mean Glasgow Coma Scale of patients equaled 13.42 ± 3.29. Unfavorable outcomes were observed only in 20.4% of the patients. There were significant differences in head injury severity between the groups with favorable and unfavorable outcomes ($P < 0.05$). Moreover, intraventricular hemorrhage was significantly associated with the highest prevalence of unfavorable outcome followed by intracranial hemorrhage. **Conclusion:** The results of our study mentioned that most of the elderly who had accidents were pedestrian, most of which occurred in the cities. Moderate and severe head injuries in patients had unfavorable clinical outcome.

Keywords: Elderly, head trauma, road traffic accident

Introduction

Road traffic accident (RTA) has become a critical issue in public health which leads to about 1.35 million mortalities and 10 million morbidities around the world.[1] RTA is one of the five main causes of global burden of disability-adjusted life years. Most of mortalities and morbidities due to traffic accidents occur in developing countries.[2] Today, due to the increase in elderly population and the impact of high-speed motorization, RTAs pose a critical health threat for the elderly as traumatic brain injury (TBI) is one of the most important causes of death among them.[3-5] According to the World Health Organization, head trauma is responsible for death or hospitalization of 10 million people per year.[6] About 1.4 million cases of head injury are recorded in the US each year, causing >90,000 permanent disabilities and 50,000 deaths; in particular, 155,000 head injuries (and 12,000 deaths) occur in the elderly in the USA annually.[7] In developed countries, the death rate due to head injury is about 21% within

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the 1st month of injury which increases to 50% in developing countries.[8] Iranian studies have reported that in accidents, most of the injuries belonged to head than other organs.[5,6,9] The elderly, due to skeletal and muscular problems, and slowness in their activities and reactions at the time of accident cannot save themselves. Moreover, they usually suffer from chronic diseases such as osteoporosis which elongates hospitalization and affects the fracture rate, increasing the risk of death.[10] Elderly patients with head injury may need a longer period of care than young or middle-aged patients,[11] so the cost of care for them is likely to be significantly higher.[12] The last decade has seen the growing number of elderly patients affected by TBI, a major challenge for health-care providers.[13] Totally, older age is a negative predictor of TBI outcomes.[14,15] There are two principal factors that predispose the elderly to a greater risk of head injury in trauma: as age increases, the dura mater moves closer to the skull, and the greater use of aspirin and other anticoagulants generates a greater risk of head injury.[16] The number of elderly road users (vehicle occupant or pedestrian) has increased enormously, and older drivers may also affect other road users, increasing the risk of death and disability.[17] The specific risk factors that contribute to mortality and morbidity in this age group include vision problems, slow movement, reduced bone density, associated illnesses, body weakness, cognitive impairment, and being under drugs and alcohol influence.[16] The present research was designed to investigate the outcomes of head trauma in the elderly at a trauma center in the North of Iran due to the following reasons. Few studies have investigated head trauma outcomes in the elderly in Iran or in other countries. Moreover, head trauma in the elderly is an important issue which cannot be neglected, especially in Guilan as a province with the oldest population across the country, considering the fact that head trauma is reportedly one of the main causes of death due to road accidents among the elderly. Furthermore, no previous studies have identified adjusted risk estimates in multivariate models, so our results can potentially be directed toward developing preventive strategies to reduce the occurrence of head injuries in elderly population.

Materials and Methods

Type of study

This was an analytic cross-sectional study.

Sampling method

The study included the records of 294 elderly patients (aged ≥65 years) with head trauma due to RTA who had been hospitalized in Poursina Hospital, Rasht, as the main referral center for traumatic patients in Guilan. The patients were classified according to the (International Classification of Diseases) ICD-10 coding in the Medical Records Department of the hospital.

Data gathering

The data of hospitalized patients from March 2016 to March 2017 were collected and recorded from HIS (hospital information system) using a checklist including age, sex, location of accident, type of road, mechanism of accident, location of injury, type of head injury, severity of head injury based on the Glasgow Coma Scale (GCS), and type of treatment (medication or surgery). A GCS ≤8 was considered as severe, 9–12 as moderate, and GCS 13–15 as mild head injury. The outcomes of patients were evaluated using the Glasgow Outcome Scale (GOS). Complete recovery and moderate disability were considered as favorable outcomes, whereas severe disability, vegetative state, and death were determined as unfavorable outcomes.

Ethical consideration

The data were collected from HIS considering the confidentiality of the patients.

This article is extracted from a thesis approved by the Ethics Committee of Guilan University of Medical Sciences, Rasht, Iran (code: IR.GUMS.REC.1397.5).

Data analysis

After coding, the data were analyzed by Statistical Package for Social Sciences Version 18(SPSS 18), SPSS Inc, Chicago, Illinois, USA, using descriptive statistics as well as Chi-square test and independent *t*-test. The adjusted odds ratio of each variable for clinical outcome was calculated using multivariate logistic regression analysis. For this purpose, the variables with a significance level <0.2 in one-variable test were included in the multivariate model. The significance level was considered <0.05.

Results

Overall, 294 elderly patients with head trauma due to accident were admitted to a trauma hospital in Guilan, with a mean age (standard deviation) of 73.12 ± 6.66 years. The mean GCS of the patients was 13.42 ± 3.29. In total, 162 patients (55.5%) underwent surgery due to different injuries in various body organs other than traumatic head injury, and 130 patients (44.5%) underwent other medical treatments such as medication. The mean hospital stay was 3.92 ± 6.07 days.

The type of head injury observed in these patients included 23 (7.8%) subdural hematoma (SDH), 22 (7.5%) contusion, 19 (6.5%) subarachnoid hemorrhage (SAH), 19 (6.5%) intracerebral hemorrhage (ICH), 7 (2.4%) intraventricular hemorrhage (IVH), 6 (2%) epidural hematoma (EDH), 5 (1.7%) pneumocephalus, 5 (1.7%) skull fractures, and 2 (0.7%) depressed skull fractures. Patient outcomes according to GOS were as follows: 135 (45.9%) complete recovery, 99 (33.7%) moderate disability, 6 (2%) severe disability, and 54 (18.4%) death, so 234 patients (79.6%) had favorable and 60 patients (20.4%) had unfavorable or adverse outcome.

The results show the prevalence of favorable and unfavorable outcomes in terms of study variables. The results further suggested a significant difference in prevalence of the outcomes with the severity of head injury ($P = 0.001$) and the type of treatment ($P = 0.015$).

Severe head injury was significantly associated with the higher prevalence of unfavorable outcome (84.8%) compared to mild injury (7.3%).

Furthermore, the patients who received medication had a significantly lower prevalence of unfavorable outcome (13.8%) compared to surgically treated patients (25.3%). Among the type of contributing organ injuries, face and chest were significantly associated with a lower prevalence of unfavorable outcomes [Table 1].

IVH was significantly associated with the highest prevalence of unfavorable outcome followed by intracranial hemorrhage [Figure 1].

The adjusted odds ratio of study variables for developing unfavorable outcomes is shown in Table 2. After adjusting the significant variables in the multivariate regression model, a significant relationship was found between two variables of chest injury and GCS with developing adverse clinical outcome. Patients with chest injury were 5.41 times more likely to progress to unfavorable outcome compared to those without chest injuries. Moderate and severe head injuries were compared to mild head injury significantly associated with higher odds of developing unfavorable outcome [Table 2].

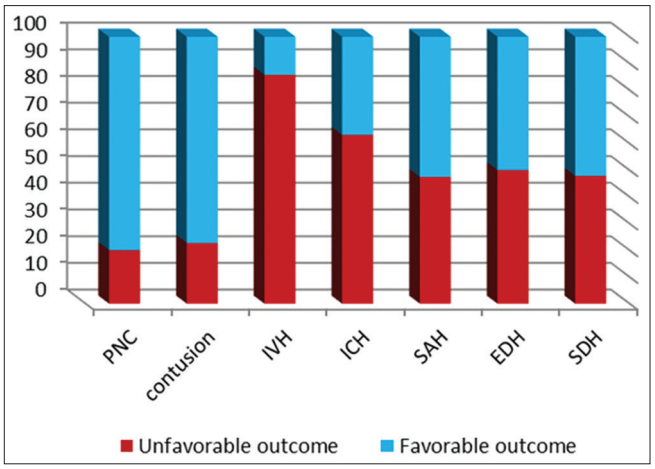

Figure 1: Prevalence of favorable and unfavorable outcomes according to the head injury type of hospitalized elderly patients with traumatic head injury due to road accident. PNC: Pneumocephalus, IVH: Intraventricular hemorrhage, ICH: Intracranial hemorrhage, SAH: Subarachnoid hemorrhage, EDH: Epidural hematoma, SDH: Subdural hematoma

Discussion

The high mortality rate from head damage in the elderly is a growing clinical problem across the world.[18] The size of elderly population, as well as their level of daily activities, is increasing, leading to a greater exposure to traumatic accidents and events.[19] The sex distribution in our study was similar to that previously reported,[20-22] but the mean age was somewhat higher (73.12 ± 6.66 years vs. 63.5 ± 4.64 years).[21] Most accidents (58.8%) occurred in urban areas on main and secondary streets (59.5%) which may have been due to the short distances and easy commuting between cities of Guilan Province. Hadirzadeh *et al*. reported that the highest mortality rates belong to traffic accidents occurring on urban roads.[23] The most common mechanism of trauma in our study was vehicle-pedestrian accident (44.9%) followed by car collisions (car occupant injuries) (25.9%) similar to findings of a study by Abou-Raya and ElMeguid in which most of the elderly who had accident were pedestrian.[17] Whereas, another study demonstrated that old pedestrians and motorcyclists were the largest groups to have accidents.[24] In our study, 46.9% of the patients had facial injuries and 41.2% suffered from lower limb injuries, which compares to a Mexican study which reported that the upper and lower extremities were the most affected areas due to trauma.[25] The mean GCS of our patients was 13.42 ± 3.29, based on which 80.1% suffered from mild head injury. Other similar studies found that most of the patients had a mild head injury on admission.[20,22] Most head injury types in our study were SDH and contusion. In several previous studies, the similar results were reported.[20,21] The present study identified a significant difference in head injuries including SDH, SAH, IVH, and ICH between two groups with favorable and unfavorable outcomes; in Sinha's study, the highest death rate as an unfavorable outcome was observed in patients with brain stem contusion and diffuse axonal injury,[20] and another study found a significant relationship between SAH and unfavorable outcome.[21] The outcomes of our patients based on GOS were 79.6% favorable (complete recovery and moderate disability) and 20.4% unfavorable outcome (severe disability and death). Two previous studies have shown poor outcomes from head trauma – Røe *et al*. reported adverse outcomes in 72% of subjects,[26] whereas an Indian study on the elderly found 25.6% mortality and 5.1% vegetative state.[20] We found that the group with unfavorable outcome had higher ages, but there was no statistically significant difference in outcomes between the two groups. An Indian study also reported that the death rate (unfavorable outcome) increased with age.[20] Furthermore, based on the results of a study by Shimoda *et al*., 75 years of age and older was the most important predictor of unfavorable outcome.[13] Susman *et al.* found that patients who died were significantly older than those who survived.[27]

The results of the multivariate model identified that the severity of head injury and chest injury was the only independent predictor of adverse outcome; the association of low GCS (<8) with poorer outcome should not be neglected which accords with other research.[20,23] This highlights the need for prompt therapeutic measures for those with reduced GCS after head injury. Chest injury due to proximity to vital organs is an important predictor of unfavorable clinical outcome. However, in results of another research, concomitant orthopedic and abdominal injuries in the group with unfavorable outcome were higher than the group with favorable outcome though this difference was not statistically significant.[23]

Conclusion

The results of our study suggested that most of the elderly

Table 1: Prevalence of favorable and unfavorable outcomes according to study variables in hospitalized elderly patients with traumatic head injury due to road accident

Variable	Total, *n* (%)	Unfavorable outcome, *n* (%)	Favorable Outcome, *n* (%)	Crude OR (95% CI)	*P*
Age (years), mean (SD)	294	74.5 (0.8)	72.8 (0.4)	1.04 (0.99-1.08)	0.05
Sex					
Male	227 (77.2)	51 (22.5)	176 (77.5)	1	
Female	67 (22.8)	8 (11.9)	59 (88.1)	0.47 (0.21-1.04)	0.059
Location of accident					
Urban	173 (58.8)	31 (17.9)	142 (82.1)	1	
Rural	85 (28.9)	22 (25.9)	63 (74.1)	1.6 (0.86-3)	0.28
Suburban	36 (12.3)	6 (16.7)	30 (83.3)	0.92 (0.35-2.39)	
Type of road					
Road and highway	119 (40.5)	27 (22.7)	92 (77.3)	1	
Main and secondary streets	175 (59.5)	32 (18.3)	143 (81.7)	0.76 (0.43-1.35)	0.355
Mechanism of accident					
Pedestrian	132 (44.9)	32 (24.2)	100 (75.8)	1	
Motorcyclist and cyclist	86 (29.2)	19 (22.1)	67 (77.9)	0.89 (0.46-1.69)	0.051
Car occupant	76 (25.9)	8 (10.5)	68 (89.5)	0.37 (0.16-0.85)	
Transfer mode to hospital					
EMS	118 (66.7)	34 (28.8)	84 (71.2)	1	
Ambulance	41 (23.1)	9 (21.9)	32 (78.1)	0.69 (0.3-1.61)	0.536
Private car	18 (10.2)	3 (16.7)	15 (83.3)	0.49 (0.13-1.82)	
Severity of head injury (based on GCS)					
Mild	234 (80.1)	17 (7.3)	217 (92.7)	1	
Moderate	25 (8.6)	14 (56)	11 (44)	16.2 (6.4-41.2)	
Severe	33 (11.3)	28 (84.8)	5 (15.2)	71.5 (24.5-208.8)	
Treatment					
Medication	130 (44.5)	18 (13.8)	112 (86.2)	1	
Surgery	162 (55.5)	41 (25.3)	121 (74.7)	2.11 (1.14-3.88)	0.015
Face injury					
No	156 (53.1)	24 (15.4)	132 (84.6)	1	
Yes	138 (46.9)	35 (25.4)	103 (74.6)	1.87 (1.047-3.34)	
Chest					
No	260 (88.4)	47 (18.08)	213 (81.92)	1	
Yes	34 (11.6)	12 (35.3)	22 (64.7)	2.47 (1.14-5.34)	0.018
Abdomen					
No	267 (90.8)	52 (19.5)	215 (80.5)	1	
Yes	27 (9.2)	7 (25.9)	20 (74.1)	1.45 (0.58-3.6)	0.425
Spine					
No	267 (90.8)	55 (20.6)	212 (79.4)	1	
Yes	27 (9.2)	4 (14.8)	23 (85.2)	0.67 (0.22-2.02)	0.475
Pelvic					
No	274 (93.2)	53 (19.3)	221 (80.67)	1	
Yes	20 (6.8)	6 (30)	14 (70)	1.79 (0.66-4.87)	0.251
Lower extremities					
No	173 (58.8)	37 (21.4)	136 (78.6)	1	
Yes	121 (41.2)	22 (18.2)	99 (18.8)	0.82 (0.45-1.47)	0.499
Upper extremities					
No	193 (65.9)	41 (21.2)	152 (78.8)	1	
Yes	100 (34.1)	18 (8)	82 (82)	0.82 (0.44-1.52)	0.512

OR: Odds ratio, CI: Confidence interval, SD: Standard deviation, GCS: Glasgow Coma Scale, EMS: Emergency medical service

who had accidents were pedestrian, most of which occurred in the cities. Moderate and severe head injuries in patients had unfavorable clinical outcome which can be attributed to insufficient street/road lighting in addition to the lack of pedestrian bridges customized for the elderly. The amount of mortalities and morbidities due to road accidents can be reduced in this high-risk age by providing first aid in site of accident. Therefore, policy-makers and authorities in charge should provide more public facilities and transportation, construction of pedestrian bridges in high-risk areas,

Table 2: Adjusted odds ratio of unfavorable clinical outcome in hospitalized elderly patients with traumatic head injury due to road accident

Variable	Adjusted OR	95% CI	*P*
Sex (women)	0.573	0.182-1.8	0.341
Age (years)	0.977	0.914-1.04	0.491
Mechanism of accident			
Pedestrian	1	-	-
Motorcyclist	0.716	0.265-1.93	0.509
Car occupant	0.82	0.271-2.48	0.725
Face	3.11	1.11-8.7	0.03
Chest	5.41	1.77-16.6	0.003
Severity of head injury			
Mild	1	-	-
Moderate	16.33	5.95-44.8	0.000
Severe	117.6	32-432.5	0.000
Treatment			
Medication	1	-	-
Surgery	2.06	0.841-5.03	0.114
Multiple trauma	0.295	0.078-1.12	0.073

OR: Odds ratio, CI: Confidence interval

appropriate street lighting, and road repairs to prevent such injuries in the elderly.

Limitations

This study was performed in only one province of Iran and so its findings cannot be easily generalized, so there is a need for more widespread research in this field. Despite our best efforts, questionnaires for data collection process can be slightly biased, and this should be taken into consideration in future studies.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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