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RESEARCH

FACTORS AFFECTING MORTALITY IN GERIATRIC PATIENTS WITH HEAD TRAUMA

ABSTRACT

Introduction: With aging, the anatomy and physiology of the body undergo changes. This leads to a change in the body's capabilities in response to trauma, resulting in increased trauma-induced morbidity and mortality.

We aimed to investigate the factors influencing the prognosis and mortality of geriatric patients with head trauma.

Materials and Method: A total of 1060 patients aged 65 and above who presented with head trauma within a three-year period were studied. The patients' collected data included gender, age, trauma presentation, Glasgow Coma Scale, Revised Trauma Score, cranial physical examination findings, localisation of the fracture in the cranial regions, cranial pathology, additional organ injury and survival/death status.

Results: Of the 1060 geriatric patients enrolled in the study, 500 (47%) were male and 560 (53%) were female. Of these patients, 1005 (94.8%) survived and 55 (5.20%) died. Among the deceased patients, 37 (37.3%) were male and 18 (32.7%) were female. The most common presentation was observed in the young old group (aged 65–75) with 513 patients. According to the causes of trauma, the most common cause was due to falling. The male gender was found to be at risk of mortality in all patients aged 65 and above. According to the computed tomography findings; intracranial haemorrhage, contusion, subarachnoid haemorrhage, epidural hematoma, subdural hematoma and intracranial edema were factors associated with increased mortality.

Conclusion: Males and cranial pathologies are associated with a higher mortality in geriatric patients with head trauma.

Key Words: Geriatric; Craniocerebral Trauma; Mortality.

ARAŞTIRMA

GERİATRİK KAFA TRAVMALI HASTALARDA MORTALİTEYİ ETKİLEYEN FAKTÖRLER

ÖZ

Giriş: Yaşlılıkla birlikte vücut anatomisinde ve fizyolojisinde değişiklikler olur. Buna bağlı travmaya karşı cevap yetenekleri değişmekte buda travmaya bağlı morbidite ve mortaliteyi arttırmaktadır.

Geriatrik yaş grubundaki kafa travmalı hastalarda prognoza ve mortaliteye etki eden faktörleri tespit etmeyi amaçladık.

Gereç ve Yöntem: Üç yıllık sürede kafa travması sebebiyle başvurmuş olan 65 yaş ve üstü 1060 hasta incelendi. Hasta verileri cinsiyet, yaş, travmanın oluş şekli, Glasgow Koma Skalası, Revize Travma Skoru, kraniyal fizik muayene bulguları, kafa kemiklerindeki kırık lokalizasyonu, kraniyal patoloji, ek organ yaralanması, yaşam ve ölüm durumu idi.

Bulgular: Çalışmaya alınan 1060 geriatrik kafa travmalı hastanın 500'ü (%47) erkek, 560'ı (%53) bayandı. Hastaların 1005'i (%94.8) yaşadı. Hastaların 55'i (%5.20) öldü. Ölen hastaların 37'si (%67.3) erkek, 18'i (%32.7) kadındı. En çok başvuru toplamda 513 hasta ile 65-75 yaş olarak tanımlanan erken yaşlılık grubundaydı. Travma oluş sebeplerine göre en sık basit düşme vardı.65 yaş ve üzeri tüm hasta gruplarında erkek cinsiyette olmanın mortalite için bir risk faktörü olduğu görüldü. Bilgisayarlı tomografi görüntülerine göre intrakraniyal kanama, kontüzyon, subaraknoid hemoraji, epidural hematom, subdural hematom ve intrakraniyal ödem mortaliteyi arttıran bulgulardı.

Sonuç: Geriatrik kafa travmarında erkek cinsiyet ve kraniyak patolojiler yüksek mortalite ile ilişkilidir.

Anahtar Sözcükler: Geriatri; Kafa travması; Mortalite.

Introduction

The increasing elderly population and opportunities for elderly people to lead a healthy and active life has enhanced the number of geriatric trauma patients.

Every year more than 80 000 people who are aged 65 years and over visit the emergency services due to traumatic brain injury. Three quarters of them are hospitalized. In geriatric patients, the rate of hospitalization of non-fatal traumatic brain injuries is twice fold higher than the general population. The main reasons for this situation are increased cerebrovascular atherosclerosis, increased adherent to the skull of the dura with aging and increased cerebral atrophy, decreased of free radicals clearance rate, used of aspirin and anticoagulants due to chronic diseases (1).

The most common head traumas in the elderly occur due to traffic accidents, falling and assaults. Numerous studies have reported falling as the most frequent etiological factor of head traumas, with the most common type of injury being laceration and cuts in the scalp. Although rare, intracranial pathologies may also be seen (2).

The mortality rates are two to five times higher in patients aged 65 and above than in younger patients who have similar Glasgow Coma Scale (GCS) and intracranial pathologies (3). The mortality rate in elderly patients with intracranial bleeding due to a traumatic brain injury ranges between 30% and 85% (1). Patients with GCS ≤ 8 at presentation have poor prognosis (3). The mortality rate is 38% in young patients with a serious cerebral injury (GCS <8), while this rate raises to 80% in patients aged over 55 years (4).

In this study, we aimed to examine the clinical features and factors affecting mortality in geriatric patients with head trauma who were admitted to the Emergency Department (ED) of our hospital.

Materials and Method

In this study, 1060 patients aged 65 years and above, presented to the Diyarbakır Dicle University Medical Faculty, Emergency Department due to head trauma within a three-year period between the 1st of January 2013 and the 31st of December 2014, and whose medical records we could access, were examined. Patient screening was retrospectively performed according to the ICD-10 code set in the 'Probel' program, which is used at our hospital as a hospital information management system. The exclusion criteria consisted of patients whose data could not be reached, age was under 65 years, or those who were aged 65 or older with no history of head trauma. All of those patients were excluded from this study. Patients' data were recorded on prepared standard forms, with parameters including gender, age, cause of trauma (e.g., gunshot wounds, sharp object injury, vehicle traffic accident, non-vehicle traffic accident, fall from a height, simple fall, beating and other accidents), GCS, Revised Trauma Score (RTS), cranial physical examination findings, localisation of a fracture in the cranial region, intracranial pathology, additional organ injuries and mortality status.

This study received a 26/12/2014 dated and 09 numbered approval from the Dicle University Medical Faculty Ethics Committee.

When evaluating mortality, the patients were divided into two groups as surviving (n=1005) and died patients (n = 55). The parameters that we thought might be effective for evaluating mortality included gender, the cause of trauma, trauma scoring systems, cranial physical examination findings, localisation of a fracture in the cranial regions, intracranial pathology and additional system injuries were examined among both patient groups.

The data obtained from this study were analysed utilizing Statistical Package for the Social Sciences 18.0 software, and $p < 0.05$ values were considered to be statistically significant. In the statistical evaluation of the data obtained, categorical data are expressed as frequency (n) and percentage (%), while continuous data are summarised as the mean ± standard deviation. A univariate statistical analysis was performed using a Chi-square test for categorical variables and a Student's t-test for continuous variables. P values < 0.05 were considered to be statistically significant.

Results

Out of the 1060 geriatric patients enrolled in this study, 500 (47%) were male and 560 (53%) were female. Of these patients, 1005 (94.8%) survived and 55 (5.20%) died. Among died patients, 37 (37.3%) were male and 18 (32.7%) were female. The male gender was found to be among the factors affecting mortality (Table 1).

Regarding age, our patients were distributed between 65 and 99 years old. The most common presentation was observed in the young old group (aged 65-75 years) with 513 patients. The least common presentation was observed in patients aged 85 and above, by 193 admissions. The mean age was found to be 75.17 ± 7.56 years in the males and 77.03 ± 8.22 years in the female patients. Given the distribution of the pa-

Table 1— Effects of Gender and Age Groups on Mortality in Geriatric Head Traumas.

Characteristics	Died n (%)	Survived n (%)	Total n (%)	p
Gender				
Male	37 (67.3)	463 (46.1)	500 (47.2)	0.002
Female	18 (32.7)	542 (53.9)	560 (52.8)	
Age groups				
65-74	23 (41.8)	490 (48.8)	513 (48.4)	0.335
75-84	18 (32.7)	336 (33.4)	354 (33.4)	1.000
85 and older	14 (25.5)	179 (17.8)	193 (18.2)	0.153

tients according to age groups, the highest number of deaths was found in 23 (41.8%) of died patients in the 65–74 age group, whereas the lowest number of deaths occurred in the 85 years and older age group with 14 (25.5%) died patients. No statistically significant difference was found between the age groups regarding mortality ($p>0.05$) (Table 1).

When the patients were examined according to trauma presentation, the most common cause of the trauma was falling, with a total of 734 (69.2%) admissions. Considering the effect of the cause of trauma, non-vehicular traffic accidents and fall from height have a significant effect on mortality ($p<0.05$) (Table 2).

The effect of the trauma scoring systems in the determination of mortality was analysed, with the mean GCS value found to be 8.67 ± 4.96 and the mean RTS value to be 5.25 ± 2.41 in died patients. These values were found to be 14.92 ± 0.60 and 7.82 ± 0.22 in the surviving patients, respectively. Low values of the mean GCS and RTS were significant in regards to mortality ($p<0.05$) (Table 3).

When our patients were demographically assessed according to the localisation of the fractures in the cranial bones,

Table 3— Effect of GCS and RTS Scorings on Mortality in Geriatric Head Traumas.

Trauma Scoring System	Died mean+sd	Survived mean+sd	p
GCS	8.67±4.96	14.92±0.60	<0.001
RVS	5.25±2.41	7.82±0.22	<0.001

GCS:Glasgow Coma Scale, RTS:Revised Trauma Score.

no fractures were identified in the cranial bones of 952 (89.8%) patients. The most common localisation of a fracture was found in the orbitonasal region. In evaluating the effect of the localisation of a fracture in the cranial bones on mortality in geriatric patients with trauma, fractures in the frontal, parietal, occipital and temporal bones were found to be statistically significantly related to mortality. The absence of a a fracture in the cranial bone was observed to be significant regarding survival ($p<0.05$) (Table 4).

When intracranial pathologies of our patients were examined with radiological imaging methods, no intracranial pat-

Table 2— Effect of Trauma Presentation on Mortality in Geriatric Head Traumas.

Trauma Presentation	Died n (%)	Survived n (%)	Total n (%)	p
GWs[1]	2 (3.60)	12 (1.20)	14 (1.30)	0.162
SOI[2]	0 (0)	2 (0.20)	2 (0.20)	1.000
VTA[3]	4 (7.30)	67 (6.70)	71 (6.70)	0.782
NVTA[4]	16 (29.1)	56 (5.60)	72 (6.80)	<0.001
Fall from height	11 (20.0)	67 (6.70)	78 (7.40)	0.001
Simle fall	19 (34.5)	725 (72.3)	744 (70.4)	<0.001
Beating	0 (0)	34 (3.40)	34 (3.20)	0.253
Other accidents[5]	3 (5.50)	42 (4.20)	45 (4.20)	0.503

[1]: Gunshot wounds, [2]: Sharp object injury, [3]: Vehicle traffic accident, [4]: Non-vehicle traffic accident, [5]: animal kicking, burns, falling from stairs, syncope.

Table 4— Effects of the Localization of Cranial Fractures, Intracranial Pathology and Additional System Injuries on Mortality in Geriatric Patients With Head Trauma.

Characteristics	Died n (%)	Survived n (%)	Total n (%)	p
Fracture localization				
Non -fracture	29 (52.7)	923 (91.8)	952 (89.8)	<0.001
Frontal	15 (27.3)	10 (1.0)	25 (2.40)	<0.001
Parietal	19 (34.5)	8 (0.80)	27 (2.50)	<0.001
Occipital	15 (27.3)	13 (1.30)	28 (2.60)	<0.001
Temporal	3 (5.50)	6 (0.60)	9 (0.80)	0.009
Orbitonasal	3 (5.5)	51 (5.10)	54 (5.10)	0.756
Intracranial pathology				
ICH	26 (47.3)	15 (1.50)	41 (3.90)	<0.001
Contussion	17 (30.9)	16 (1.60)	33 (3.10)	<0.001
SAH	29 (52.7)	18 (1.80)	47 (4.40)	<0.001
EDH	1 (1.80)	2 (0.20)	3 (0.30)	0.148
SDH	8 (14.5)	9 (0.90)	17 (1.60)	<0.001
Pneumocephalus	10 (18.2)	7 (0.70)	17 (1.60)	<0.001
Shift	3 (5.50)	3 (0.30)	6 (0.60)	0.002
Edema	5 (9.10)	6 (0.60)	11 (1.0)	<0.001
Non- pathology	23 (41.8)	948 (94.3)	971 (91.6)	<0.001
Additional system injury				
Thorax	27 (49.1)	103 (10.2)	130 (12.3)	<0.001
Abdomen	13 (23.6)	30 (3.00)	43 (4.10)	<0.001
Upper Extremity	19 (34.5)	259 (25.8)	278 (26.2)	0.158
Lower Extremity	29 (52.7)	389 (38.7)	418 (39.4)	0.047
Pelvis	9 (16.4)	53 (5.30)	62 (5.80)	0.003
Vertebrae	7 (12.7)	72 (7.20)	79 (7.50)	0.179
Maxillofacial	6 (10.9)	43 (4.30)	49 (4.60)	0.037
Non- system injury	6 (10.9)	166 (16.5)	172 (16.2)	0.348

ICH: Intracranial hemorrhage, SAH: Subarachnoid hemorrhage, EDH: Epidural hemorrhage, SDH: Subdural hemorrhage.

hology was detected in 971 patients (%91.6). The least common intracranial finding was an epidural hematoma (EDH). Findings of an intracranial haemorrhage (ICH), contusion, subarachnoid haemorrhage (SAH), subdural hematoma (SDH), pneumocephalus, shift and edema were found to be statistically significant regarding mortality due to intracranial pathology. In contrast, patients exhibiting no intracranial pathology were found to be significant regarding survival ($p<0.05$) (Table 4).

Given system injuries which accompanied head trauma in our patients, the most common additional injury was found to be lower extremity trauma, which was observed in 418 patients. The least additional injury was found to be abdominal trauma, which was detected in 43 patients. When the effect of the additional system or organ injuries on mortality in geriatric patients with head trauma was assessed, the experience of thoracic, abdominal, lower extremity, pelvic, or maxillofacial trauma were found to have a statistically significant association ($p<0.05$) (Table 4).

Discussion

The elderly population (65 years and older) is gradually increasing in developing countries. The mortality rate due to geriatric head trauma is high, with this rate ranging from 24% to 89% in geriatric traumatic brain injuries (5,6). Rates of traumatic brain injury and mortality were lower in the present study because only mild head trauma was observed in 1003 patients, no fracture was found in the cranial bones of 952 patients, and no intracranial pathology was identified in 971 patients.

In the evaluation of geriatric head trauma regarding gender, several studies have reported that the incidence of trauma is two- times higher in men than in women, the male to female ratio is 3:1 and the mortality rate is four times higher in men than in women (7). Tieves et al. (8) reported similar rates and underlined the male gender as a risk factor. In a retrospective study by Mirzai et al. (9) from Turkey, the majority of cases were found to occur in male patients. In contrast, in the present study, the female ratio was slightly higher among geriatric patients with head traumas. We also found that mild head traumas are more common among women in our region, while men are exposed to higher-energy traumas. Indeed, upon looking into the mortality rates, deaths occurred in male patients twice as frequently compared to female patients. The higher mortality rate in the male patients in our study is consistent with the literature.

In a study performed by Wofford et al. (10), among geriatric age groups, the rate of trauma presentation was found to be 45.3% in the 65–74 years age group, 37.4% in the 75–84 years age group and 17.2% in the 85 years and older age group. In another study from Turkey, the distribution of trauma was found to be 48% in the 65–74 years age group, 40.8% in the 75–84 years group and 11.2% in the 85 years and older age group (11). Although some studies report that age is not a significant factor for mortality, Knudson et al. (12) argued the significance of age on mortality. In line with the literature, we found that more than half of the patients were in the 65–74 years age group, while the lowest rate of presentation was observed in the 85 years and above age group. This could be explained given the population distribution in Turkey, in which the rate of the 'young old' population is higher. However, we found that there was no significant difference between the age groups regarding mortality.

In evaluating the causes of trauma, Özdoğan et al. (13) found that 91.2% of the cases were due to traffic accidents, 3.5% were due to falls and 5.3% were due to beatings. In a study by Nakamura et al. (14), motor vehicle accidents and falls were associated with a poor prognosis. In our study, the most common cause of trauma presentation was falling. Non-vehicle traffic accidents and falling from a great height also have significant effects on mortality. This is consistent with the causes of geriatric trauma as described by Smith et al. (15).

Although, currently numerous scoring systems are used in the presentation assessment, diagnosis, treatment planning and prediction of prognosis in patients with head trauma, the most commonly utilised method is GCS (16). GCS is a valid scoring system used in head traumas and for the determination of cerebral functions and coma severity since 1974 (17). In the literature, patients with lower RTS values were found to have higher rates of mortality (10,13). Of the patients included in a study by Özdoğan et al. (13), the GCS and RTS values of died patients were lower than those of the survived patients. There is a strong correlation between a low GCS value and mortality (18). Similarly, in the present study, the GCS and RTS values were found to significantly affect mortality.

Macpherson et al. (19) reported that linear fractures are more significantly associated with an epidural and subdural hematoma than with compression fractures in patients with acute head traumas. Another study reported similar rates of cranial fracture, cerebral contusion, subarachnoid haemorrhage (SAH), subdural hematoma, pneumocephalus, edema, epidural hematoma and intracerebral hematoma (20). Mirzai et al. (9) highlighted that the most common pathology was found to be an epidural hematoma among 46 patients detected via computed tomography. Previous studies have reported that the presence of cranial fractures increases the risk for formation of an intracranial lesion (21). In the present study, no cranial bone fracture was detected in about 90% of the patients. The orbitonasal region was the most common localisation of the fractures. The higher rate of orbitonasal region fractures could be attributed to the fact that falling cases occur more commonly in the geriatric age group because of decreased reflexes as well as reduced vision and hearing abilities. Moreover, these patients experience trauma more frequently because they are unable to adequately protect themselves.

The head and extremities are the most commonly injured regions following trauma (22). In a study performed by Owens et al. (23), falling-related injuries were found to be 41% fractures, 22.6% superficial contusion injuries and 21.4% open wounds. Pathologies accompanying head trauma have been analysed in a study conducted by Fırat University from Turkey, in which the most common pathology was found to be upper extremity injuries, with the highest rate of hospitalisation attributed to be caused by low extremity traumas (24). In our study, the rate of system injuries accompanying head traumas is consistent with the literature.

In a study by Tokutomi et al. (25), intracranial mass lesions and systemic injuries were associated with a poor prognosis. In the present study, cranial fractures and intracranial pathologies (e.g., ICH, contussion, SAH, SDH, pneumocephalus, shift and edema), as well as abdominal, thoracic, pelvic and maxillofacial traumas have an effect on mortality.

In conclusion; the most common presentation of trauma was observed in the 65-74 years age group which we define as

'young old' in this study. The most common cause of trauma was due to falling, and the most common fractures were detected in the orbitonasal bones; the most common intracranial pathology was SAH, and the most common additional accompanying injuries were lower extremity injuries. The male gender, non-vehicle traffic accidents, falling from a great height, low scores of GCS and RTS, fracture in the cranium, ICH, contusion, SAH, SDH, pneumocephalus, shift and edema are the factors associated with an increased mortality. Furthermore, additional thoracic, abdominal, pelvic and maxillofacial trauma were also found to increase mortality. Geriatric head traumas are cases associated with a high mortality and require a rapid and multidisciplinary approach from the time of first admission.

Conflict of Interest

Authors declare no conflict of interest.

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