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RESEARCH

DEMOGRAPHIC PROPERTIES AND FACTORS AFFECTING MORTALITY OF ELDERLY PATIENTS RELATED WITH MOTOCYCLE INJURIES

ABSTRACT

Introduction: To determine the socio-demographic attributes, trauma scoring systems' relationship to mortality rates and the factors affecting mortality of the victims of motorcycle accidents (VMAs) over 65 who arrive at the emergency department.

Materials and Method: A descriptive study was conducted in a university-based hospital. Patients were divided into two groups: survival (group A) and deceased (group B).

Results: A total of 108 patients who were VMAs were identified. 96 patients were in group A and 12 were in group B. We especially noted the existence of internal injuries, head injuries, multiple injuries and alcohol intake (p=0.029) as risk factors affecting mortality. The Injury Severity Score (ISS) and Abbreviated Injury Scale (AIS) were found to be higher in group B compared to group A (p= 0.003, 0.001, respectively). The Glasgow Coma Score (GCS), Trauma Injury Severity Score (TRISS) and Revised Trauma Score (RTS) were found to be higher in group A compared to group B (p< 0.001 for both).

Conclusion: Most of the motorcycle-related injuries in elderly involved men, and occurred in urban areas, during the summer and on weekdays, with a mechanism of falling off the motorbike. Skin and musculoskeletal systems were injured most frequently in our study.

Key Words: Aged; Accidents; Traffic/mortality.

ARAŞTIRMA

MOTOSİKLETE BAĞLI YARALANAN YAŞLI NÜFUSUN BAZI DEMOGRAFİK ÖZELLİKLERİ VE MORTALİTEYİ ETKİLEYEN FAKTÖRLER

ÖZ

Giriş: Son zamanlarda motosiklet ilişkili yaralanmalar nedeniyle oluşan ölümlerin sayısında artışlar görülmektedir. Çalışmamızda acil servise başvuran 65 yaş üstü motosiklet kazalarından etkilenmiş hastaların sosyo-demografik özellikleri, travma skorları ile birlikte mortalite oranları ve mortaliteyi etki eden faktörlerin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Çalışmamız tanımlayıcı tipte bir araştırmadır. Hastalar Grup A (yaşayan grup) ve Grup B (ölen grup) olmak üzere iki ayrı gruba ayrılarak değerlendirilmiştir.

Bulgular: Çalışmaya dahil edilen 108 hastanın; 96'sı Grup A'da, 12'si Grup B'de idi. Özellikle çoklu organ yaralanmaları (p<0.001), kafa yaralanmaları (p=0.008), iç organ yaralanmaları (p=0.001) ve kaza esnasında alkollü olunmasının (p=0.029) mortaliteye etkili faktörler olduğu tespit edilmiştir. Grup B'de A ile karşılaştırıldığında travma skorlarından Yaralanma Şiddeti Skoru(ISS) (p=0.003) ve Kısaltılmış Yaralanma Skoru (AIS) (p=0.001) ve Grup A'da, B ile karşılaştırıldığında Glaskow Koma Skalası(GKS) (p<0.001) ve Revize Edilmiş Travma Skorlarında (RTS) (p<0.001) istatistiksel olarak anlamlı yükseklik tespit edilmiştir.

Sonuç: Yaşlılarda motosiklet ilişkili yaralanmaların çoğu erkeklerde, kentsel alanlarda, yaz mevsiminde, hafta içi günlerde motosikletten düşme şeklinde oluşmuştur. En sık cilt ve kas iskelet sistemi yaralanmıştır. Yaşlı nüfusta görülen motosiklet kazaları kafa travmaları ve çoklu yaralanmalar nedeniyle önemli bir sorun oluşturmaktadır.

Anahtar Sözcükler: Yaşlı; Kaza; Trafik Kazası/mortalite.

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Introduction

Advanced age and diminished senses are well-recognized risk factors for adverse effects after trauma. Mortality and morbidity rates increase in elderly trauma patients (1-3). In Turkey, road traffic injuries (RTIs) are the most important cause of trauma, as is the case worldwide.

Motorcycles are the most perilous form of motor vehicles. Contrary to other motor vehicle accidents, in a motorcycle accident the victim's body is the hood that absorbs all kinetic and compressive energy caused by the crash (4). Specifically, there has been a significant increase in the rate of mortality among older motorcycle riders in recent years (5). Although there are studies on motorcycle related injuries (MCRIs) in our country, specific data on MCRI in the elderly population is very limited.

The objective of this study was to determine the sociodemographic attributes of the victims of motorcycle accidents (VMAs) over 65 who applied to our emergency department (ED), to define the factors affecting mortality, to compare the significance of the trauma scoring systems that evaluate the mortality rate, and to make suggestions to decrease morbidity and mortality caused by MCRIs.

Materials and Method

A descriptive study was conducted in a university-based hospital in Edirne. All 65+ year old patients who suffered from motorcycle-associated injuries, and presented to the ED between January 1, 2010, and January 1, 2012, were included in the study. The study protocol was carried out in accordance with the Declaration of Helsinki (as revised in 1983) and was approved by the Ethical Committee of the Faculty of Medicine.

Data were collected from the medical records of patients captured on a standard form, and are shown in Tables 1 and 2.

Other output variables, based on previous studies in similar subjects, are: injury severity markers such as trauma scores (Glasgow Coma Score (GCS), Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), Revised Trauma Score (RTS), Trauma Injury Severity Score (TRISS)); patients with multiple injuries; rates of hospitalization; whether an operation is required; intensive care unit (ICU) admission; length of hospital stay (LOS); and in-hospital mortality rate (1,2,6,7).

Patients younger than 65 years, patients with incomplete file information, and patients who are still under treatment in the hospital were excluded from the study.

Statistical Analysis

All data were analyzed using SPSS for Windows, Version 15 (SPSS Inc., Chicago, IL, USA). Categorical data were compared using the c^2 test. The Kolmogorov Smirnov test was used to examine whether the values defined by the measurement fit the normal distribution. The comparison of the data that fit the normal distribution was made using Independent Samples T-tests and the comparison of the data that did not fit the normal distribution was made using Mann-Whitney-U Tests. A p value less than 0.05 was considered as statistically significant.

Results

Demographic Characteristics of Motorcycle Related Injuries

The total ED attendance for the 24-month study period was 52,071 of which 1,171 (2.25%) were for RTIs. A total of 241 (20.6%) of these 1,171 patients were VMAs. During the study period, 108 VMAs presented to the ED who were at least 65 years of age and constituted the elderly population. 96 patients (88.10%) were in the survival group and 12 (11.9%) were in the deceased group.

Diagnosis, Admitting Departments and Outcomes

The distribution of the injuries and diagnosis, admitting departments and outcomes are detailed in Table 1. The trauma scores are detailed in Tables 1 and 2.

Discussion

Motorcycles are a very popular mode of public transportation since the motorcycle is a low-cost vehicle, is easier to maneuver, has a shorter acceleration time, is convenient in city traffic, and reduces air and noise pollution (8,9). Recently, there has been a significant increase in MCRIs and mortalities, parallel with an increase in sales (9). There is evidence of a growing number of VMAs cared for in the ED. A total of 2,389,488 motorcycles are registered in Turkey. A total of 21,604 accidents related to motorcyclists occurred during 2010. The number of riders killed was 184, and number of riders injured was 18,667 (10).

The number of women in the geriatric age group, in general, is higher than men, but the number of men involved in motorcycle accidents is higher than the number of women (3). In fact, the percentage of men injured in motorcycle accidents is between 86% and 95.8% (11-13). A similar result was found in this study, with the rate of men involved in motor-

Table 1— Demographic Characteristics Over 65 Years Old Patients Suffered from Mcris Who Were Admitted to the ED

Variable	n (%)	Mean SD
Male gender		103 (95.4)
Age (years)	72.74±7.67	
65-74 years (elderly)	66 (61.1)	
≥75 years (very elderly)	42 (38.9)	
Victims of motorcycle accidents		
Rider	88 (81.5)	
Pedestrian	18 (16.7)	
Passanger	2 (1.9)	
Geographical location		
Urban (Inhabited area)	91 (84.3)	
Rural (Uninhabited area)	17 (15.7)	
Injury Mechanism		
Falling from the motorcycle	73 (68.1)	
Collision with another vehicle	10 (9.1)	
Collision with fixed objects	7 (6.4)	
Collision with pedestian	18 (16.7)	
Days of the Week		
Weekdays	73 (67.6)	
Weekend	35 (32.4)	
Season		
Summer	52 (48.1)	
Autumn	17 (15.8)	
Winter	10 (9.2)	
Spring	29 (26.9)	
Way of Transferring		
Referred from another hospital	103(95.4)	
Without admitted to any other hospital	5 (4.6)	
Arrival Time to Hospital		
<1 hour	65 (60.1)	
2-6 hours	29 (26.9)	
>6 hours	14 (13.0)	
Alcohol intake	20 (18.5)	
Belonged to themselves	79 (89.8)	
Driving experience of riders (years)	13.62±12.05	
Helment-wearing		
Rider	3 (3.4)	
Passanger	-	
Diagnosis		
Fractures	49 (45.4)	
Isolated upper extremity	12 (11.2)	
Isolated lower extremity	23 (21,3)	
Pelvic	3 (2.8)	
Spine	2 (1.9)	
Rib	9 (8.3)	
Contusions/abrasions	89 (82.4)	
Lacerations	41 (38.0)	
Internal injuries	69 (63,9)	
Abdomen	3 (2.8)	
Liver contusion	2 (1.9)	
Spleen contusion	1 (0.9)	
Head-Brain	51 (47.2)	
Diffuse axial injury	4 (3.7)	
Parenchymal contusion	11 (10.2)	
Subdural hemorrhage	7 (6.5)	
Epidural hemorrhage	4 (3.7)	
Subarachnoid hemorrhage	10 (9.3)	
Brain edema	15 (13.9)	
Thorax	9 (8.3)	
Pneumothorax	4 (3.7)	
Hemothorax	3 (2.8)	
Pulmoner contusion	2 (1.9)	
Multiple injuries	5 (4.6)	
Other*	1 (0.9)	
Injury severity markers		
Intensive care unit admission	13 (16,5)	
Death	12 (11.1)	
Patients requiring operation	37 (34.2)	
Length of hospital stay (LOS) (days)		19.8±2.3
Trauma scores		
GCS		13.87±2.93
13-15 (minor)	94 (87.0)	
9-12 (moderate)	4 (3.7)	
3-8 (severe)	10 (9.3)	
ISS		10.58±6.47
1-8 (minor)	33 (30.5)	
9-15 (moderate)	53 (49.1)	
≥16 (severe)	22 (20.4)	
AIS		4.36±2.15
TRISS		18.72±6.19
RTS		7.47±1.15
Prognosis		
Discharged from ED	29 (26.9)	
Admitted to hospital	79 (73.1)	
Orthopaedics and Traumatology	33 (30.6)	
Neurosurgery	17 (15.7)	
Thoracic Surgery	8 (7.4)	
Plastic and Reconstructive Surgery	6 (5.6)	
General Surgery	2 (1.9)	

Contunied

Table 1— Demographic Characteristics Over 65 Years Old Patients Suffered from Mcris Who Were Admitted to the ED

*Crush injury at lower extremity.

GCS: Glasgow Coma Scale, ISS: Injury Severity Score, AIS: Abbreviated Injury Scale, RTS:Revised Trauma Score,TRISS: Trauma Revised Score and Injury Severity Score.

Table 2— Demographic Characteristics, Diagnostic Findings and Trauma Scores for Patients with Over 65 Years Old Patients Suffered from Mcris Who Were Admitted to the ED Who Either Died or Survived Groups

Variable	Survivors n (%) 96 (88.1)	Deaths n (%) 12 (11.9)	p
Male gender	92 (95.8)	11 (91.7)	0.452*
Age (years)	72.77±7.53	72.50±9.13	0.825**
Victims of motorcycle accidents			
Rider	79 (82.3)	9 (75.0)	0.540*
Pedestrian	15 (15.6)	3 (25.0)	
Passanger	2 (2.1)	0 (0)	
Geographical location			
Urban (Inhabited area)	81 (84,4)	10 (83,3)	0,926*
Rural (Uninhabited area)	15 (15.6)	2 (16.7)	
Alcohol intake	15 (15,6)	5 (41,7)	0,029*
Driving experience of riders (years)	13.39±12.14	15.50±11.63	0.712**
Days of the week			
Weekdays	66 (68.8)	7 (58.3)	0,467*
Weekend	30 (31.3)	5 (41.7)	
Way of transferring			
Referred from another hospital	91 (94,8)	12 (100)	1,000*
Without admitted to any other hospital	5 (4.6)	0 (0)	
Arrival time to hospital (minutes)	388.69±913.97	93.75±101.40	0.556**
Diagnosis			
Fractures	43 (44.8)	6 (50)	0.703*
Contusions/abrasions	80 (83.3)	9 (75)	0.475*
Lacerations	34 (35.4)	7 (58.3)	0.123*
Internal injuries	46 (47.9)	12 (100)	0.001*
Body region injured			
Pelvic	1 (1)	2 (16.7)	0,032*
Head	41 (42.7)	10 (83.3)	0.008*
Thorax	7 (7,3)	2 (16.7)	0.268*
Abdomen	2 (2.1)	1 (8.3)	0.300*
Multiple injuries	1 (1)	4 (41.7)	<0.001*
Trauma Scorres			
ISS	9.89±6.28	16.08±5.45	0.003**
GCS	14.73±1.22	7.0±3.59	<0.001**
TRISS	18.37±6.24	21.54±5.20	0.094***
RTS	7.79±0.31	4.67±1.91	<0.001**
AIS	4.11±2.05	6.33±1.96	0.001**
Patients requiring operation	35 (36.5)	2 (16.7)	0.173*
Intensive Care Unit	3 (3.1)	10 (83.3)	<0.001*

GCS: Glasgow Coma Scale, ISS:Injury Severity Score, AIS: Abbreviated Injury Scale, RTS:Revised Trauma Score,TRISS: Trauma Revised Score and Injury Severity Score
*χ^2 test; **Mann-Whitney-U Test; ***Independent Samples T-Test.

cycle accidents higher than that of women. We believe that this is a result of the male population in our region utilizing more motorcycles, since they are still actively participating in work and social life despite their old age.

Although most of the VMAs are riders, passengers can also be injured or killed (14). In this study we found that most of the deaths involved riders; however, many pedestrians involved in accidents were also injured.

Ozkan et al. (15) showed that most motorcyclists were injured due to falling off their vehicles. Janmohammadi et al. (4) reported that the most common accident (59.9%) was collision with a car. Langley et al. (16) found the majority of

deaths (63%) were attributable to a collision with another motor vehicle. Our findings are similar to what has been previously reported: the mechanism of injury was falling off the motorcycle due to unexpected loss of control in 68.1% of the patients. Since a motorcycle is a two-wheeled vehicle, riders must spend more effort to maintain their balance. In our study, the second most common accident type was a collision with pedestrians. We can associate this with the inability of older people to protect themselves from traffic or to notice these vehicles in fast-moving traffic when walking or crossing the street, due to their visual and auditory impairments.

Bevan et al. (7) reported that most MCRIs occurred in rural areas (RA). The number of patients who died in RA is nearly 58% more than in urban areas (UA), and more severe injuries occurred in RA compared with UA (4). Our study results contrasted with these findings, showing that more MCRIs occurred in UA compared with RA. This could be due to the use of motorcycles for commuting in the heavy urban traffic in our region. Safe motorcycle-only roads can be considered for use in urban areas to reduce motorcycle accidents.

In related literature, driving experience has been reported as a preventive factor for motorcycle accidents (4,6,7,8,11). The risk of injury increases when a motorcyclist's driver's license is newer than two years old (17). Monk et al. (18) reported that riders are at greatest risk of death in their first 3 years of riding. In our study, riding experience was very high compared to the data in the literature, and there were no differences between the groups in terms of riding experience.

The risk of causing an accident and the severity of the injury in an accident are higher in older people under the influence of alcohol, compared to younger people in the same condition (19). Previous studies have reported a strong association between alcohol ingestion and VMAs visiting the ED (20). However, the relationship between alcohol ingestion and severity of the injury is controversial, as some investigations have found no association between alcohol consumption and severity or outcome (8,13), while others emphasize the effect of alcohol on the severity and mortality of injuries (20). In our study, the rate of riders under the influence of alcohol was 18.5%. Alcohol ingestion was compared in riders who died and who survived and the differences were found to be statistically significant. Therefore, serious precautions should be taken in order to reduce alcohol-related motorcycle accident deaths in aged people. Traffic controls should be applied frequently. Educational programs related to alcohol should be organized for each segment of society, including the older population. Prevention of alcohol consumption in older people not only reduces accidents, but also can be beneficial in increasing the survival rate and quality of life.

When we examined the distribution of accidents and mortality rates over the months of the year, we found lower numbers during the winter, as another outcome of this study. This rate increased during the summer when there is no rain and the weather is optimal. Coben et al. (12) asserted that 46% of motorcycle accidents happen during the summer. Janmohammadi et al. (4) reported a higher number of deaths in the summer. Most of our patient-casualties happened in the summer, similar to other studies. Since our region has a mostly agricultural economy, the reason for the higher number of motorcycle accidents could be their use by the people to commute to their own land. The older people's preference to stay at home and not to use their motorcycles during cold winter months, due to our region's harsh climate conditions, could be another reason for having fewer motorcycle related accidents and mortality during the winter.

Several studies have exhibited high rates of lower extremity, chest, head and abdominal injuries following motorcycle accidents (11,12). Vieira et al. (11) showed that the areas of the head, neck and face were the most affected by injuries, followed by extremities and pelvic injuries. Our study, similar to other studies, revealed that motorcycle crashes lead to mostly head and lower extremity injuries (9,11). Bone fractures were observed in approximately half of the injured in our study. We can associate this with the muscle atrophy, reduction in bone mass, and frequency of osteoporosis and osteoarthritis seen in older people. In particular, the weakening of immune system responses in older people causes complications due to broken bones and as a result, increases the rate of mortality (3). However, no significant correlation between bone fractures and the rate of mortality was found in our study.

The research suggests that the injuries with the highest risk of mortality for motorcyclists are to the head, abdomen and chest, in decreasing order (4). In our study it was observed that a single injury to the chest or abdomen did not affect mortality; however, head and multiple organ wounds did have an adverse effect on mortality.

Using a motorcycle helmet prevents severe brain injury and significantly reduces the mortality rate (21). Unfortunately, the wearing of helmets and other protective equipment is not very popular in our country. In our study, the rate helmet use was very low. While only three riders had a helmet, none of passengers had one. This can explain the high number of head injuries observed in our study.

In emergency cases, the need for surgery is the most important factor affecting clinical outcome and mortality rate in the elderly population (22). But in our study, requiring an operation did not affect clinical outcomes.

The hospitalization rate of geriatric trauma cases is reported to be approximately 40-50% higher than that of younger

trauma cases (3). In our study, hospitalization rates were found to be higher than in earlier studies (9,11-14,18). Also, the high rate of hospitalization and long hospitalization periods show that motorcycle related injuries keep health care professionals occupied and increase health care costs, especially for aged patients.

Trauma scoring systems such as the GCS, RTS, ISS, TRISS and AIS can be used to predict mortality and outcome (2). In this study there was a significant difference between deceased and surviving cases in terms of average values of the GCS, RTS, ISS and AIS. Average values of the GCS and RTS were low in cases of death, and average values of the ISS and AIS were high in cases of death.

Several limitations should be considered when evaluating the results of this study. First, the research was designed as a descriptive study. Second, since this was a local, single-center research project with local patient characteristics, local predisposing factors for motorcycle accidents, and many other variables that could be different in other localities, the results obtained cannot be generalized. Third, the data from the trauma registry include only patients who arrived alive at our hospital, and not those who died at the scene of the accident, or before reaching the hospital.

In conclusion, motorcycle accidents in the older generation are a major problem due to multiple injuries and isolated head traumas. Although it is not possible to prevent all motorcycle accidents, riders and passengers should be informed of safety precautions, the use of helmets should be made mandatory with serious legal enforcement, and courses should urgently be organized to educate motorcycle riders.

Conflicts of Interest

The authors had no conflicts of interest to declare in relation to this article.

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