



# Injuries associated with motorcycle accidents

## *Motosiklet kazalarına bağlı yaralanmalar*

Banu ALICIOGLU,<sup>1</sup> Erol YALNIZ, Deniz ESKIN, Baris YILMAZ

Trakya University Medical Faculty, <sup>1</sup>Radiology Department Radiology Department, Orthopedics and Traumatology Department

**Amaç:** Son yıllarda motosiklet kullanımının yaygınlaşmasına paralel olarak motosiklet kazalarında da artış gözlenmektedir. Ülkemizde motosiklet kazaları/yaralanmaları konusunda fazla çalışma yoktur. Bu çalışmada motosiklet kazalarına bağlı yaralanmaların profili araştırıldı.

**Çalışma planı:** 2003-2007 yılları arasında motosiklet kazası nedeniyle üniversite hastanemizde tedavi edilen 212 hasta (204 erkek, 8 kadın; ortalama yaş 36±16; dağılım 2-79) geriye dönük olarak değerlendirildi. Olguların yaş ve cinsiyetleri, mevcut travmaları, hastanede kalış süreleri kaydedildi. Yaralanmalar yerleşimlerine göre gruplandırıldı.

**Sonuçlar:** Sıklık açısından yaralanmaların dağılımı şöyleydi: Kas-iskelet sistemi (n=106, %50), kafatası travmaları (n=103, %48.6), maksillofasyal (n=38, %17.9), göğüs (n=15, %7.1), omurga (n=10, %4.7) ve karın bölgesi (n=6, %2.8) yaralanmaları. Üst ve alt ekstremitelerde birden fazla kırığı olan olgu sayısı sırasıyla 17 (%8) ve 43 (%20.3) idi. Ekstremitte yaralanmalarında tibia-fibula kırıklarının (%17.9) omuz yaralanmaları (%11.3) izlemekteydi. Yirmi üç olguda (%10.9) hem ekstremitte hem de kafa yaralanması vardı. Hastanede yatış süresi ortalama 12.2±16.8 gün (dağılım 1-150 gün) bulundu. Sekiz olgu ortalama yedi gün yoğun bakımda tedavi gördü. Komplikasyon olarak, olekranon ve tibia plato kırığı bulunan bir olguda (%0.5) pulmoner emboli gelişti. Motosiklet kazaları dokuz olguda (%4.3) ölümlle sonuçlandı.

**Çıkarımlar:** Motosiklet kazaları önlenabilir veya zararı azaltılabilir nitelikte olduğundan, risk faktörleri ülkemiz için belirlenmeli, gerekli trafik yasa ve önleyici kurallar çıkarılıp uygulanmalı ve eğitim programları yaygınlaştırılmalıdır.

**Anahtar sözcükler:** Trafik kazası; motosiklet; risk faktörü; sosyoekonomik faktör; yaralanma/epidemioloji.

**Objectives:** In recent years, there has been a significant increase in motorcycle accidents in parallel with the increasing number of motorcyclists. Data on motorcycle accidents/injuries are relatively limited in Turkey. This study sought to determine the injury profile of patients involved in motorcycle accidents.

**Methods:** This retrospective study included 212 patients (204 males, 8 females; mean age 36±16 years; range 2 to 79 years) who were hospitalized for injuries caused by motorcycle accidents. Data on age and sex, injury patterns, length of hospitalization were recorded. Injuries were grouped according to localization.

**Results:** The frequencies of injuries in descending order were as follows: musculoskeletal system injuries (n=106, 50%), skull injuries (n=103, 48.6%), maxillofacial injuries (n=38, 17.9%), thoracic (n=15, 7.1%), vertebral (n=10, 4.7%), and abdominal (n=6, 2.8%) injuries. Multiple fractures in upper and lower extremities were seen in 17 (8%) and 43 (20.3%) patients, respectively. The most frequent extremity injuries were tibia-fibula fractures (17.9%) followed by shoulder injuries (11.3%). Both extremity and skull injuries were seen in 23 patients (10.9%). The mean hospital stay was 12.2±16.8 days (range 1 to 150 days). Eight patients required intensive care for a mean of seven days. As a complication, one patient (0.5%) with olecranon and tibial plateau fractures developed pulmonary embolism. Motorcycle accidents resulted in mortality in nine patients (4.3%).

**Conclusion:** Since motorcycle accidents are preventable or associated risks for injuries are reducible, risk factors for our country should be determined, necessary laws and restrictive regulations should be put into practice, and educational programs should be implemented.

**Key words:** Accidents, traffic; motorcycles; risk factors; socio-economic factors; wounds and injuries/epidemiology.

During the last decade, in our country, as all through out the world, using motorcycles has increased a good deal. Motorcyclers can be studied in two different groups. The first group prefers using motorcycles due to its being economical and convenient in city traffic. These people are commuters that ride motorcycle to work and the private companies' dispatch carriers who use motorcycles because they are swift, and also includes the motorcyclers of small towns and cities. In this group, the preferred motorcycles are the ones usually considered as "light weight", that is the ones with engine capacity below 125cc. The latter is formed by the ones who use motorcycles as a sportive activity and hobby. Riders of this group are generally well educated and middle-aged from high and upper social classes. These riders not only have taken training in motorcycle safety and riding but also use the necessary safety equipments. These licensed riders usually prefer "heavy weight" (engine capacity >125cc) motorcycles and mind the rules for safe driving more than the first group.<sup>[1-4]</sup>

In parallel with the increase of the motorcyclers on the roads, the ratio of the accidents that the cyclers participate increases. As motorcycles are relatively unsafe vehicles, the riders must be considered as unprotected vehicle users. Even in the developed countries where the mortality and the morbidity rate are low, the accident risk of motorcyclers is 20 times more per kilometer than the drivers of other vehicles.<sup>[4,5]</sup>

These accidents mostly resulted in traumas that cause lost time injury, as well as physical, physiological and cognitive deficits which may impose deeply.<sup>[3]</sup> In many countries, as a preventive measure many researches are done on how and where the accidents occur, and on demographical and sociocultural features of the cyclists. However, in our country there are just a few examples of this kind of researches. In this study we have scanned though the motorcycle accident victims who have been treated or hospitalized by our university hospital orthopaedics and traumatology service as well as other service wards in the past five years. As the usage of low engine powered motorcycle is very common in our town, each case is on these type accidents.

### Patients and methods

The medical files of motorcycle accident victims, who were hospitalized or treated in our university hospital services, during the past five years, through

May 2003 to May 2007, were scanned retrospectively. It is seen that during this period totally 212 motorcycle accident victims were treated or hospitalized in our university hospital's orthopaedics and traumatology service (n=83) or other services (n=129) and controlled by the orthopaedics and traumatology service. Age, gender, traumas, hospitalization period as well as the term they stay in intensive care unit are recorded. Traumas are grouped as extremity, skull injuries (skull fracture, brain edema, subarachnoid hemorrhage, epidural hemorrhage, subdural hemorrhage, diffuse axial injury, commotio, parenchymal hematoma) maxillofacial injuries, spine, thorax, pelvis and as abdominal injuries. Extremity injuries are also grouped in itself according to the seriousness of the injury as one or injury of the upper extremity, and one or more injury of the lower extremity. Cases with dislocations are also grouped separately. Musculoskeletal injuries, head and face injuries are put into separate groups.

### Results

204 of the cases are men (96,2%), while eight are women (3,8%); the age average is  $36 \pm 16$  (distribution 2,79; median 32). The distribution of the injuries is as seen in Table 1. The most frequent injury is the musculoskeletal injuries. When this first group is regrouped in itself bone fractures and lower extremity injuries are seen as the most frequent ones (Table 2). In terms of frequency tibia-fibula injures (23%) are followed by shoulder injuries (fracture- dislocation) (14%). 106 of the total cases (50%) has at least one extremity injury. The number of the victims that have one fracture in upper extremity is 33 (15,6%), while the number of multiple fractures is 17 (8%). The cases that has only one fracture in lower extremity are 27 (12, 7%) and cases of multiple fractures are 43 (20,3 %).

**Table 1.** The distribution of the motorcycle accidents injuries.

	Number	Percentage
Limbs	106	50.0
Skull	103	48.6
Maxillofacial	38	17.9
Spine	10	4.7
Chest	15	7.1
Abdomen	6	2.8
Pelvis	1	0.5

**Table 2.** The distribution of musculoskeletal injuries (n=106)

	Number	Percentage
Lower limb		
Femur	23	10.9
Knee	18	8.5
Tibia-fibula	38	17.9
Ankle-foot	15	7.1
Hip	6	2.8
Pelvis	1	0.5
Upper extremity		
Shoulder	24	11.3
Humerus	9	4.3
Elbow	4	1.9
Forearm	14	6.6
Wrist-hand	15	7.1

There are twelve cases with dislocations (5,7%), ten spine injuries (4,7%), and one pelvis fracture. Five of the vertebral fractures (2.4 %) three of which are accompanied by dislocation are in the cervical area. There are two cases that has broken C1 and C2, one case has thoracic vertebra fracture while there is lumbar vertebra fracture in two others.

Skull injuries has the second place of frequency (n=103; 48,6%). The most frequent injury is the fractured skull (n=29, 28.2 %). Total frequency of brain damages such as brain edema, subarachnoid hemorrhage, epidural hemorrhage, subdural hemorrhage, diffuse axial injury, commotio, parenchymal hematoma is 48,55 (n=50). Maxillofacial injuries have a percentage of 18,9 (n=40) (Table 3). Both extremity injuries and skull injuries (brain damages or maxillofacial injuries) are seen in twenty three cases (10,9 %).

Fifteen victims (7,1%) have chest trauma, six patients (2,8%) have abdominal injuries. Of chest trauma victims, only two of them have hemothorax and lung commotion; the others have pneumothorax and rib fracture. Three of the abdominal injuries have liver laceration, where one has splenic damage, and abdominal hemorrhage is detected in each of the cases.

The hospitalization period of the victims are approximately 12±16,8 days (distribution 1-150 days, median 7 days). The period that the patients stay in intensive care unit is approximately seven days. One case that has fractured olecranon and tibial plafond

**Table 3.** The distribution of the cranial and facial injuries.

	Number	%
Maxillofacial fracture-injury	38	17.9
Skull fracture	63	29.7
Scalp laceration	4	1.9
Intracranial injury		
Brain edema	28	13.2
Subarachnoid hemorrhage	20	9.4
Diffuse axonal injury	8	3.8
Contusion	24	11.3
Epidural hemorrhage	8	3.8
Subdural hemorrhage	10	4.7

(0,5 %) developed pulmonary embolism. Nine of the motorcycle injuries (4,3%) are resulted in death.

## Discussion

Our study, like its counterparts in other countries, reveals that motorcycle accidents resulted in mostly extremity and skull injuries.<sup>[5,6]</sup> Swedish National Traffic Institution Database groups motorcycle accident injuries according to the seriousness of injuries of either the rider and/or the passenger: mild injuries (the ones that don't have to be hospitalized), acute injuries (injuries such as fractures, dislocations, ecchymosis and deep tissue injuries, commotion, innards injuries that the patient has to be hospitalized), and injuries resulted in death (deaths that occurred at the time of the accident or within 30 days).<sup>[3]</sup> The injuries of our study fall into the second group. Additionally, there is a chance that the reason of the hospitalization may not be stated as motorcycle accident in the file of the victim, which may increase the number of the cases dramatically. Moreover, when it is considered that the victims may apply to another health organization, the actual number of cases increases. In Istanbul, it is stated that nine out of every ten new dispatch rider have an accident within a year, and every three accidents are serious enough to detain him/her from working.<sup>[1]</sup>

The major risk factors of motorcycle accidents are driving while intoxicated and exceeding the speed limit. Alcohol usage causes carelessness and loss of concentration as well as over speeding and neglecting to use safety equipments such as helmet.<sup>[3]</sup>

Accidents are also affected by the socioeconomic status of the motorcyclists. A survey in Swe-

den reveals that the males between ages 16-18 are prone to accidents.<sup>[7]</sup> Being inexperienced, usually even without a license, and not being able to foresee a possible danger due to not knowing what to do in case of emergency increase the risk of accidents of this age group. Riding motorcycle is more complicated than driving. It requires physical coordination, balance and skill. The rider must learn how to maneuver, and must have the ability to make quick decisions. The group stated above is well known as having excessive self-confidence, not obeying the speed limit restrictions, and daring dangerous act that can be named as acrobatics that invites accidents.<sup>[7]</sup>

Riders of low socioeconomic status has a risk of having accidents 2,5 times more than the others.<sup>[8]</sup> Riders of the socioeconomically rich group obey the rules of readiness as having training, using safety equipments; they have adequate parental control and also this group is more accustomed to the rules of traffic than the other as they have has some other vehicles. Moreover, in socioeconomically low group the drug abuse has a high percentage which increases the possibility of accidents.<sup>[8]</sup>

Using high engine powered motorcycles is maybe another safety factor against accidents. However, the degree of the injury is not only related to the engine capacity.<sup>[9]</sup> High engine powered motorcycle users generally have training; give importance to safety equipments and are usually above middle age. These factors are the basic features that reduce the risk of accidents. The group that keep their motorcycles as a hobby has the accidents usually early in the morning, on sunny days, dry ground, during holidays, especially on Saturdays, at the junctions, in rural areas and on gravel roads. This is because the hobby riders are more careful on wet, icy and muddy roads; and moreover as they ride for fun dry days are preferred.<sup>[3,9,10]</sup> On the other hand, dispatch riders have accidents early in the morning or late at night, and on rainy days.<sup>[7]</sup>

As the motorcycle accidents are preventable or the risks are reducible, many European countries regard motorcyclers as a vulnerable group and training of the riders and helmet usage is inspected by law.<sup>[5]</sup> Drivers under 25 years of age have to have basic training of 125 cc or below motorcycles. Here the aim is to use high engine powered motorcycles

gradually after gaining experience and skill.<sup>[6]</sup> Legal obligation of using helmet is proved to lessen fatal accidents and heavy head injuries.

Thereafter 1991, when helmet usage is come into effect in USA, percentage of sing helmet increased from 42-59% to 92-100% and so the death rate in motorcycle accidents is reduced to 28-73%. On the other hand, in some states where the helmet usage is weak due to such reasons as it reduces the sight, impairs the hearing and increase the possibility of neck injuries because it is heavy, and even more legal obligation of using helmet constraints personal freedom the death rate of the accidents increased 23%.<sup>[11-13]</sup> When the helmet –users are compared to non –users, the latter has higher death rate, longer stays in intensive care unit and hospital, higher number of skull traumas.<sup>[12,14]</sup> A six year study in Texas shows that skull and facial injuries of the riders that use helmet is meaningfully less than the ones who do not. Facial injuries of the riders that use helmet are 19,6%, and brain damage rate is 30,7%; while non –users rate is 39,2% and 54,1% respectively.<sup>[14]</sup> The same study also reveals that neck, chest, spine, abdominal, extremity and cervical vertebra injuries have the similar values.

Mortality and morbidity of the motorcycle accidents are high. In Singapore, of 1809 motorcycle accidents 1056 (58%) is of lower extremity, 328 (18%) is of skull and 256 (14%) is of facial injuries<sup>[15]</sup>. Average age of this study is lower than ours (26,4 ±7,2) and 96% of the victims is male. In the very same study skull injury rate is very low due to the fact that the helmet usage is 100%. Hospitalization periods are also very short (approximately 5,3±days). In Tehran, 28 incidents out of 1332 resulted in death are reported as not wearing helmets.<sup>[16]</sup>

As it is clearly understood the frequency of skull and facial injuries are directly proportional to using helmet. Lower extremity and other injuries shows no significant difference (Singapore 50,3%, Tehran 49,8%).<sup>[15,16]</sup>

A questionnaire in Nigeria among motorcycle dispatch riders illustrates that 13,4% of the riders considers helmet as a waste of money, 43,8% thinks that using someone else's helmet brings bad luck of the other person as well as contamination of the hair and scalp infections. These two ideas are the main reasons that the riders deny using helmet.<sup>[17]</sup> 29,9% of the

riders take alcohol during or before the ride not to get cold.<sup>[17]</sup> This results shows that sociocultural aspects play a very important role in the accidents.

Motorcycle accidents affect social health because of its high mortality and mobility rate and lingering physical and physiological problems.<sup>[6,12]</sup> Our study pictures the severe injuries after a motorcycle accident. As our study is in retrospect some features of the victims such as sociocultural and economical status, alcohol usage, whether the riders have a license or not, how long they have been using motorcycle, whether or not they have had a training, how long have they been using motorcycles per day; road, weather and traffic conditions; if the passenger and/or the riders have used safety equipments, engine power of the motorcycle, the number of the passengers as well as the other factors (like condition of the traffic, other vehicles and pedestrians) cannot be reached. As it is discussed above, risk factors are changeable according to social, cultural and economical conditions. Risk factors for our country and possible measures accordingly must be determined. In our town, riding low engine powered motorcycle is very common, but using necessary safety equipments is relatively less. Generally two or more passengers are carried dangerously. Some of our cases being under age of ten shows this truth vividly.

Both to prevent these accidents and to reduce the fatal injuries, traffic controls must be more frequent, and riders as well as the passengers must use helmet and the necessary reflecting special outwear; drivers of other vehicles must be fostered to have the headlights on to notice the motorcyclers, and last but not least riders without a license must be prevented. Risky adolescent and young riders must be inquired on socio cultural and economical aspects, preventing measures for risky behaviors must be notified by sociologists and psychologists. Additionally, the other drivers must be trained that the motorcycles are relatively vulnerable vehicles and must be treated accordingly. Riders must be encouraged to have training and to get a license.

As a conclusion, motorcyclers are a risky and vulnerable group in traffic in terms of having accidents. Unless the necessary legal and social precautions are taken, the potential risk of accidents of this group will increase and having accidents become inevitable.

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