

Traffic accidents: Is a crash helmet mandatory for pedal cyclists?

Curovic, Ivana¹; Vukovic, Marko² Radojevic, Nemanja¹

1. Department of Forensic Medicine, Clinical Centre of Montenegro, Podgorica
2. Clinical Centre of Montenegro, Podgorica

Corresponding author
Curovic, Ivana MD MSc
Department of Forensic Medicine
Clinical Centre of Montenegro
Ljubljanska bb
MONTENEGRO, 20000 Podgorica
+382 69 171 636
inacurovic@gmail.com



Abstract

Introduction Traffic accidents are the third leading cause of death, following cardiovascular events and malignancies. The motorcyclists and the pedal cyclists are in high fatal risk mainly due to specificity of their vehicle's construction. Crash helmets for motorcyclists are mandatory in most countries. Estimating the forensic characteristics of fatally injured pedal cyclists, the necessity of using helmet will be evaluated.

Material and methods Using observational retrospective study, medicolegal characteristics are compared between 27 fatally injured pedal cyclists and 32 motorcyclists, by the type of accident, and the cause of death.

Results Crash-fall ratio in pedal cyclist group is 26:1, comparing to 24:8 for motorcyclist, which is significantly different ($p=0.030$). There is no statistical difference comparing the number of participants who sustained fatal head injury between the groups ($p>0.05$), as well as between those with the neck injuries. Motorcyclists had significantly higher rate of thoraco-abdominal fatal injuries ($p=0.014$). Despite of non-wearing helmets, only 41% motorcyclists' deaths were caused by fatal head injuries. There exists a significantly lower rate of thoraco-abdominal injuries in pedal cyclists versus motorcyclists, which indicates their head is the most frequently injured part of their body.

Conclusion Nevertheless helmet use is rare in pedal cyclists and most legal systems do not regulated it, the results of presented as well as of the other similar studies, suggest that wearing of crash helmet is necessary. The recommendation based on presented study is addressed on changing legal regulation to mandatory helmet wearing in pedal cyclists, as it is regulated for motorcyclists.

Key words: Forensic Medicine; Brain Injury, Chronic; Head Injuries;; Accidents, Traffic

Introduction

The global road death toll has already reached 1.24 millions per year, and it is on the course to triple to 3.6 million per year by 2030. (1) In modern societies, traffic accidents are the third leading cause of death which follows cardiovascular events and malignancies. Fatalities in road traffic accidents are the most

common cause of death below the age of 50 years, and in youngsters this trend is even more marked. (2) The pattern of injury, fatal or otherwise, varies considerably depending upon whether the victim is a vehicle occupant, a motorcyclist, a pedal cyclist, or a pedestrian. Beside pedestrians who are the most vulnerable category, the motorcyclists and the pedal cyclists are also in high fatal risk due to specificity of their vehicle's construction

accompanied with misbalance between the forces present during the ride and the protective potential of their equipment. (3)

A well-known fact is the motorcycle, by its design, is very dangerous. The same speed in a car accident that could lead to insignificant injuries of drivers or passengers in the four-wheeled vehicle, can lead to death of a motorcyclist. Having in mind the fact that there are less motorcycles than cars, especially in developed countries, the frequency of injuries and deaths in motorcyclists is higher than in car occupants. (4) Protective, crash helmets for motorcyclists are obligatory in most countries, but the severity of the impact often defeats the protective effect of the helmet. (2)

Estimating the forensic characteristics of fatally injured pedal cyclists, the necessity of using protective helmet was evaluated.

Materials and methods

In observational retrospective study, medicolegal characteristics are compared between 27 fatally injured pedal cyclists and 32 motorcyclists. The data are collected from autopsy records, police investigation sheets, and postmortem interviews with family members.

After short epidemiological evaluation of groups, two cohorts were observed by the type of accident (crash versus fall / running off the road), and the cause of death. All of the demised pedal cyclists had not a crash helmet, while the motorcyclists who had crash helmet at the time of the accident were excluded from the study. Participants who survived the accident for some time (e.g. in the intensive care unit), as well as those with any of pre-existing health condition, were excluded from the study due to medical complications that might affect the immediate cause of death.

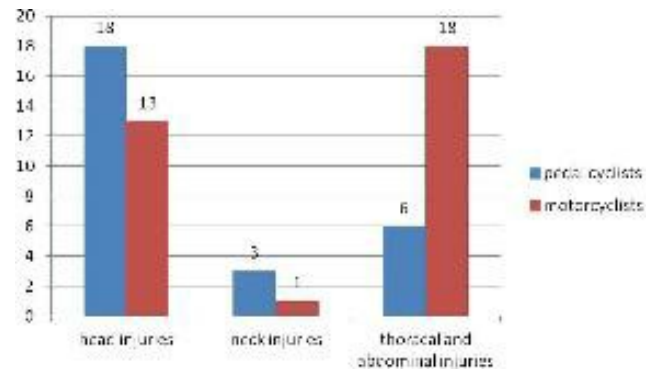
The statistical evaluation of results was performed by the "SPSS ver.12 for Win" software package. The data were statistically analyzed using descriptive statistics tools, Kolmogorov-Smirnov test (K-S test for normality of the distribution), Student T test, and non-parametric Z test for proportions. P value below 0.05 was considered as significant, since below 0.01 was considered highly significant.

Results

First group was consisted of 24 male, and 3 female fatally injured pedal cyclists, mean age 46.0 ± 15.1 , max 79, min 11, median 52. The cohort of 32 fatally injured motorcyclists had mean age 32.8 ± 13.8 , max 63, min 9, median 30, all males. The statistical significance was achieved comparing the age between the groups ($p = 0.012$). Z-test showed no significant difference in sex ratios between the groups ($p > 0.05$). Both groups had normal distribution ($p > 0.05$).

Crash-fall ratio in pedal cyclist group is 26:1, comparing to 24:8 for motorcyclist, which is significantly different ($p = 0.030$).

Cause of deaths for both groups are given in Figure 1. There is no statistical difference comparing the number of participants who sustained any of the fatal head injury between the groups ($p > 0.05$), as well as between those with the neck injuries. Motorcyclists had significantly higher rate of thoraco-abominal fatal injuries ($p = 0.014$).



1. Figure 1 Distribution of causes of death for both groups.

Discussion

The pedal cycle has the instability like the motorcycle, but far lower speed. When it comes to injuries, head injuries dominate in accidents. Other injuries are from the primary impact with a striking vehicle, which may hit the rider in different levels of the corpse. Secondary damage may occur from striking the ground, and it is localized to the shoulder, chest or arms. (2) The head and the extremities are in the greatest risk for the injury between pedal cyclists, and the most common causes of death are craniocerebral injuries. (5-8)

Despite of the fact that pedal cyclists drive more slowly than motorcyclists, the exposure of their bodies to the forces present in accident are as potentially fatal as for the motorcyclists. In the study under review here, almost all pedal cyclists (26/27) died in a crash with motorized vehicle – cars, while, as expected, some of the motorcyclists sustained fatal injures during the fall due to the high speed drive. The obtained result related to the fact that the significant difference was not achieved for the proportions of fatal head injuries between the pedal cyclists and motorcyclists, suggests that the pedal cyclists' head is also in high vulnerability for sustaining fatal injuries in crash accidents with motorized vehicles.

In our study, when it comes to motorcyclists, the most frequently cause of death is related to the injuries of thoracic and abdominal organs. Larsen and Hardt-Madsen's analysis in Denmark showed high injury rates for chest and abdomen, too. (9) The rib fractures and visceral damage, e.g. rupture of the liver and spleen, arise by falling from the motorcycle. An injury common with motorcycles is the "tail-gating" accident, where a rider drives into the back of a truck so that the machine passes underneath, but the head of the motorcyclist impacts upon the tail-board. (2) According to Bothwell, head injuries are often severe, causing 80 % of deaths (10), but in our study, despite of non-wearing helmets, only 41 % motorcycle-related deaths were caused by head injuries.

We found similar data: a significantly lower rate of thoraco-abdominal injuries in crash-related pedal cyclist accidents versus motorcyclist's ones, which indicates the head is the most frequently injured part of body in pedal cyclists, too.

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Recently published data shows that use of helmets reduce the risk of head injuries by 85 to 88 per cent. (11) While motorcycle helmets reduce the incidence of head trauma in low-speed accidents, in high speeds their sole function is to prevent brain matter from being spread over the highway. (4) Since the pedal cyclists were fatally injured in low-speed accidents, and they sustained most frequently head injuries, the results of our study were in favor of using crash helmets in pedal cyclists, also.

Epidemiological studies indicate, beyond doubt, that wearing of helmets significantly reduce the occurrence and the extensiveness of craniocerebral injuries in motorcyclists. (12,13) Despite the fact that helmet use is rare in pedal cyclists and most legal systems do not regulated it, the results of presented as well as of the other similar studies (5-8), suggest that wearing of crash helmet seems to be necessary. So, the recommendation based on presented study results is addressed on changing legal regulation to mandatory helmet wearing in pedal cyclists, as it is regulated for motorcyclists.

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