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The effect of ethyl alcohol on the severity of injury in mortal victims of traffic accidents

Abstract

Introduction

Traffic accidents are a serious civilization, social and medical problem. They are one of the main causes of injury that can lead to permanent damage to health and even death. In most of the victims of traffic accidents, fatalities are mostly caused by plural and multi-organ injuries. A significant factor affecting not only the increase in the risk of traffic accidents, but also their effects is ethyl alcohol, as a significant proportion of victims of traffic accidents are alcohol-related victims. This is the circumstance in which the supposedly "positive" impact of ethanol on the effects of injury, namely the severity of injuries, is said. However, such statement seems too simplistic, because the reaction of the body on the injury is conditioned by many other factors. In order to effectively deal with the consequences of the injury, it is important to assess the severity of the injury. Perhaps one of the factors that need to be taken into account in this assessment should be ethyl alcohol, that may have a significant impact on the severity of the injury in victims of traffic accidents.

The aim of the research

1. Assessment of the state of sobriety of the victims of traffic accidents and the scale of this phenomenon in individual groups of road users.
2. Assessment of the relationship between the state of sobriety and the severity of injuries expressed in the severity scores of injuries in traffic accident victims.

Material and methods

The data for the analysis was obtained from the documentation conducted at the Department of Forensic Medicine of Warsaw Medical University. All victims of traffic accidents from the area of the Warsaw Agglomeration, recorded in the death register, were included in the retrospective analysis in 2009-2013.

The research was divided into 4 stages.

In the first stage of the study, out of 12 283 reported deaths, the baseline was identified, it mean the base of 1210 fatalities victims of traffic accidents, including age, gender, primary cause of death, sectional findings, and blood alcohol, muscle and vitreous body, confirmed by toxicology performed by gas chromatography. On the basis of the results of the toxicological studies recorded in the death records, victims of fatal traffic accidents in the baseline were divided into: the study group - alcohol victims at the time of the incident ($\geq 0,2\%$) and a control group - sober victims (0%). There were no victims in the material collected, where the ethyl alcohol concentration was greater than $0,0\%$ and less than $0,2\%$. Victims of traffic accidents were categorized according to the mechanism of injury and the damage type on the basis of the information obtained from the death register in both groups. Considering the parameters such as gender, age, type of injury, injury mechanism and ethyl alcohol concentration, an analysis of demographic data of the studied population was performed.

In the second stage, taking into account the results of previous analysis, the target database of 200 cases was created. The selected cases were pedestrians hit by the passenger car. Based on the documentation verified circumstances of death (place of occurrence, place of death, type of vehicle) and type of injury (organs injured and extent of damage). The victim's age was sorted into ranges and the corresponding ICD-10 classification codes were assigned to the identified injuries, and to the injury mechanism. In addition, injury figures were assigned a number of severity scores based on AIS scale.

In the third stage of the study, all injuries were assessed according to sectional protocols in individual victims by the scales like Life Threat Indicator (LTI), International Classification based Injury Severity Score (ICISS) in variants involving 10 and 15 injuries, i.e. ICISS-10 and ICISS-15, Injury Severity Score (ISS) and New Injury Severity Score (NISS). Next, based on the obtained results, the severity of injuries was divided, respectively for each scale.

In the fourth stage of the study, statistical analysis was carried out in groups of target database, taking into account parameters such as gender, age, place of occurrence, place of death, severity of injury and the concentration of ethyl alcohol. The influence of risk factors on the severity of injury expressed by the injury severity scales (LTI, ICISS-10, ICISS-15, ISS, and NISS) was assessed in one- and multidimensional analysis.

Results

Number of victims of traffic accidents in the years of the study, i.e. 2009-2013 had a downward trend until 2012. A further increase in the number of traffic accident victims was observed in 2013.

The largest group of traffic accidents in the Warsaw Agglomeration during the analyzed period were pedestrians (41,34%), including pedestrians who were under the influence of alcohol (50,27%).

The highest percentage of fatal pedestrian victims were men (66,49%). The gender disproportion was significant particularly in the group of pedestrians under the influence of ethyl alcohol, where the men were almost six times more than women.

Ethyl alcohol concentrations reported were significantly higher in pedestrian victims compared to other road users. The average alcohol concentration in the pedestrian group was $2,04 \pm 0,90\%$. Moreover, there was a significant relationship between the ethyl alcohol concentration and the gender of pedestrians observed, $p < 0,0001$. With the increase in alcohol concentration, the number of deaths among men increased. On the contrary, with the increase in alcohol concentration, the number of fatalities decreased in women.

There were also significantly different age distributions of pedestrian victims (broken down by ranges) for different ranges of ethyl alcohol concentration, $p < 0,0001$. The victims are older, the higher the alcohol concentrations are observed. However, the boundary of this growth is age 45-54. In the victims over 54 years were observed significantly lower alcohol concentrations than in the younger age groups.

The most common type of injuries in pedestrians, regardless of their sobriety, were injuries to numerous body areas (88,17% in the study group versus 85,87% in the control group, $p = 0,1300$).

There was no significant relationship between the concentration of ethyl alcohol and the type of injury in pedestrians.

Among pedestrian victims in the target database after correction of the age of victims (up to 74 years of age) the proportion of men were higher than women (71,52%). Similar proportion was observed in the study group (81,58% of men).

The results of the analysis conducted among pedestrian victims (up to 74 years of age) of the target database confirmed, there was a significant relationship between ethyl alcohol concentration and the gender ($p < 0,0001$), and the age of pedestrians ($p = 0,0026$).

There was a significant relationship between the ethyl alcohol concentration and the place of occurrence, $p=0,0141$. The highest percentage of deaths among pedestrians (up to the age of 74) in the target database was found in rural areas of the Warsaw Agglomeration (45,57%). It's mostly pedestrians under the influence of alcohol, sober pedestrians were here for only 15,28%. This number increased with increase in alcohol concentration in the pedestrian victims.

There was a significant relationship between the ethyl alcohol concentration and place of death, $p=0,0018$. Pedestrians more often died at the scene (70,89%) than in the hospital (29,11%). This number was rising as the alcohol concentration in pedestrians increased.

Significant correlations between injury rating scales indicate the similarity of results obtained not only when using different scales for individual victims of the target database, but also for the all damage structure in the analyzed group.

There was no significant correlation between ethyl alcohol concentration and the results no matter which scale of severity of injury assessment was used.

Analysis of relationships between the ranges of LTI, ICISS and ISS scales and the type of injuries in pedestrian victims (up to 74 years of age) in the target database showed the significance of these compounds ($p=0,0001$, $p=0,0008$, $p=0,0280$ respectively). According to the scales, nearly all critical injuries were injuries to numerous body areas.

A significant correlation was also found between ISS scale ranges and the place of occurrence ($p=0,0306$). According to the ISS scale, the highest percentage of critical injuries was found in the rural areas of the Warsaw Agglomeration (46,21%).

Analysis of relationships between the ranges of the LTI and ISS scales and the place of death of pedestrians (up to 74 years of age) in the target database showed the significance of these compounds ($p=0,0276$, $p=0,0229$ respectively). According to the LTI and ISS scales, critical injuries were found in over 73% of deaths at the scene.

The results of multidimensional analysis showed that the influence of ethyl alcohol concentration on injury severity expressed in LTI, ICISS-10 and ICISS-15 scales depends on gender. That is because the relationship between these parameters varied between men and woman. As the alcohol concentration increased in women, the LTI, ICISS-10 and ICISS-15 values decreased (which means more severe injury).

According to LTI, ICISS-10 and ICISS-15, the concentration of ethyl alcohol did not affect the severity of the injury in men.

There was no influence of ethyl alcohol on the severity of the injury in the ISS and NISS scales. The severity of the injury depended on gender of the victim. According to ISS and NISS, these injuries are significantly heavier in women than in men.

In addition, a multidimensional analysis revealed a significant relationship between the severity of the injuries and the age of victims. According to LTI, ICISS-10, ICISS-15, ISS and NISS older victims more often died with lighter injuries.

Conclusions

1. Among the fatal victims of traffic accidents the largest group are pedestrians, with particular regard to pedestrians under the influence of ethyl alcohol.
Educational campaigns to reduce ethyl alcohol consumption should be at least equally directed to all road users, not just the drivers.
2. In rural areas a greater percentage of pedestrians are killed at the scene. This may be, among other things, result of the higher speed of moving vehicles or the inferior quality of pre-hospital care.
These areas should be managed by intensive preventive measures to increase the safety of pedestrians being unprotected road users.
3. Based on the analysis there is no evidence of protective role of ethanol. On the contrary, these results suggest that alcohol can have a negative impact on the severity of injury, especially for women.
4. Scales used to assess the severity of injury allow to show the role of ethyl alcohol in the severity of the injury to varying degree.
The more risk factors the scale takes into account, the more accurate the assessment is.
5. Gender of victims of traffic accidents was a significant factor affecting the severity of the injuries.
It may be essential to include this factor to improve the accuracy of assessment.