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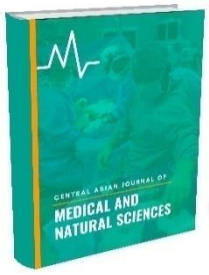

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Forensic Assessment of Trauma Injuries in The Interior of a Moving Passenger Car Equipped with Modern Safety Features

1. **Mamataliev Avazbek Ruzuvaevich Mamataliev**
2. **Shakirov Sardor Abdusaminovich**
3. **To‘ychiyev Mansurbek Muxammadjon O‘g‘li**

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[1] Candidate of Medical Sciences, Associate Professor
Andijan State Medical University
[2] Candidate of medical sciences
Andijan State Medical University
[3] Andijan State Medical University

Abstract: One of the most important issues in case of trauma in the interior of a moving passenger car is to determine the location of the victim. The basis of forensic medical diagnostics of the victim's location is the analysis of the formed injuries. According to the data of educational and classical scientific literature for the trauma in the car interior the formation of injuries on the front surface of the body (in the 1st phase of trauma), in the cervical spine, as well as injuries from the general impact concussion of the body are typical. Damages on the hands, chest and feet of the driver from the impact on the steering wheel and control pedals are the main criteria in determining the position of the victim in the car interior.

Key words: forensic medical assessment, trauma injuries, car

Introduction

WHO provides information on the annual worldwide consequences of road traffic crashes. Each year, more than 1.2 million people die from road traffic accidents worldwide, 25% of whom are between 26 and 40 years of age, and 50 million suffer injuries of varying severity. The World Bank reports annual global material damage estimated at 518 billion dollars, which is between 1.5 per cent and 2 per cent of the gross world national product. According to Europa press, the fatality rate in road accidents is likely to increase by 60 per cent over the next 16 years. WHO and the International Road Safety Council (2006) predict that in 2020 the number of road accidents worldwide could increase by 80% and the number of fatalities could exceed 2 million. Road traffic crashes may surpass strokes and AIDS in terms of

fatalities. The US National Highway Traffic Safety Administration (NHTSA) reports a high number of road accidents (more than 1.5 million per year). Every day in the United States, 117 people die in traffic accidents. In 2005, 43443 people died, including 30,000 working-age men. But the greatest burden of loss of life is borne by countries with medium and low per capita income. According to official figures, 110,000 people died in road accidents in the People's Republic of China in 2003. According to this organisation, about 600 people die every day in China, and almost 220,000 per year. At the same time, 4.44 million motor vehicles (MOTs) were produced in China in 2003 alone. In European Union (EU) countries, the number of fatal road accidents has been falling steadily. In 25 years, the number of motor vehicles in Germany has tripled, while the number of fatalities has fallen fourfold (from 21,000 in 1970 to 5,400 in 2005). The mortality rate (number of deaths / million people) in Europe decreased 2.5 times in 15 years on average, and in 1991 to 79 in 2005, which is lower than such indicator in Russia in 2005. 3 times. The RF is ahead of European states and the USA in terms of mortality rate [1]. In the Russian Federation over the past decade in road accidents killed more than 300 thousand people, and the number of victims was almost 2 million, of which 100 thousand were disabled. According to the International Road Safety Council, the rate of road accidents in the Russian Federation is 10 times higher than in the EU countries. The growth rates of the total number of road accidents, killed and injured in them, have been stable for the last 10 years. According to the Russian traffic police, every year the number of road accidents increases by 10%-15%. It is estimated that 1 person dies in a road accident every 15 minutes in Russia. Approximately 25 thousand road accidents annually involve children, of which more than 1000 die. Almost all child passengers did not use seat belts at the time of the accident, and adult drivers were intoxicated with alcohol. Children are involved in one in nine road accidents each year and account for one third of all road traffic injuries. In 2007 and 2008, 1,397 and 954 children died, respectively, and 30,686 and 21,099 were injured of varying severity [5].

According to the literature, the main damaging factors in interior trauma are interior parts and passive safety equipment. Additional damaging effects can be caused by fixed objects, glass fragments, exhaust gases, flames and combustion products of the car interior [3]. These damaging factors have mechanical, chemical, thermal and electrical effects on the human body. Damages in the interior trauma are formed as a result of the following types of mechanical impact: impact; compression of the body or its parts between the ATC parts, stretching ("whiplash" injuries of the spine), as well as phenomena caused by the indirect effect of impact: concussion of the body, bending or extension, torsion, compression, hydro- and aerodynamic phenomena [4]; phenomena arising in the organism under the indirect action of friction of the body against parts of the ATC body: displacement, compression, shear (transverse and longitudinal) [6], as well as phenomena arising in the organism indirectly under compression of the body by parts of the ATC during trauma inside the car - bending, extension, torsion [7]. In the modern literature we have not found sufficiently detailed data on the morphogenesis of injuries formed during modern trauma inside a car. One can come closer to understanding this issue by getting acquainted with the mechanism of injury formation in detail. Most often the injuries in victims inside the car are formed at collision with another vehicle, at collision with some obstacle. A frontal (frontal) or tangential (lateral) collision is distinguished [8]. Damage is formed during three successive phases. In a frontal collision, as a result of a sudden stop of the car, the body is displaced in the front and upper directions, colliding with the interior parts located in front (phase 1), after which the body is

thrown to the opposite side (phase 2). In phase 3 (optional), the body may be crushed by deformed parts of the cabin. The severity of injuries formed in the 1st phase of the collision is usually maximum. The cause of damage formation is primarily the impact, but there may be compression by deformed parts of the vehicle, general impact commotion of the body, bending or overextension of some parts of the body, for example, the cervical spine [9]. In frontal collisions there is an inertial displacement of the driver's (VD) and passengers' (P) bodies, which results in the formation of contact injuries from impacts on the interior elements and control parts of the vehicle, as well as injuries caused by the general impact commotion of the body. After that the body is thrown backwards, which completes the formation of injuries from the general impact commotion of the body. The contact injuries of the second phase are so vague that their detailed characterisation is practically absent in the modern literature [5]. The nature of injuries in VD and P is determined by the peculiarities of the collision, the design features of the ATC, its speed, the location of the victim inside the car, the position of the body and the features of clothing [4]. It is also known that in the most frequent and traumatic 16 frontal collision, front seat passengers (FSP) are injured 7 times more often than UA and 5 times more often than FSP. Consequently, the distribution of injuries based on the location of the injured person is an important diagnostic feature. The position of VD inside the car is more resistant to displacement during sudden braking than that of P, as it is fixed with hands on the steering wheel and feet on the pedals. At sudden changes in the direction of motion of the vehicle, the body of the driver is easily displaced and traumatised by interior parts.

The so-called "stamped" injuries, which reflect the relief of the traumatising surface of objects and are formed only when the victim is in a specific place, are of great importance in deciding where to place the victim in the car. However, the presence of clothing and "trauma-proof" interior details usually prevent the formation of such injuries. The main differential criteria in forensic medical diagnostics of the place of the victim's location inside the car are the type, severity and topography of injuries - precipitations, bruises, wounds, fractures etc. A.S. Novosyolov [2] systematised these features of interior trauma as injuries in the "upper", "middle" and "lower" levels at the VD and (PPS), which allows to diagnose the location inside the car in an accident with frontal collision of ATC. However, the proposed features have not been studied in rear seat passengers (RSPs), which suggests relevant research. The types of motor vehicle accidents in which the maximum number of casualties are recorded are: pedestrian accidents and in-cabin trauma [9]. Thus, the study of motor vehicle trauma in general and in-cabin trauma in particular is an important task, the solution of which remains urgent. Taking into account the current level of forensic medical knowledge, the expert is able to determine the lifetime and age of injuries, the mechanism of formation, the place of application and direction of action of the traumatic force, the position of the human body to the traumatic parts of the vehicle, the type of vehicle, the victim's ability to act independently, the presence or absence of the influence of alcohol intoxication and painful disorders, the cause of death and the degree of harm to human health [10]. Most often in case of in-cabin trauma the expert is faced with the task of determining the position of the victim in the passenger compartment. As a rule, there is a need to identify the person who drove the vehicle or was in the front passenger seat at the time of the accident. But in a number of cases there is a need to accurately determine the position of the victim on the rear seat. The specified questions are solved by careful study of the formed damages Different sources of traumatisation of drivers and passengers, unequal intensity and

direction of inertial displacements of their bodies in the first and second phases of in-saloon trauma contribute to the formation of various damages with different localisation, frequency of their occurrence that makes their study an actual task. Earlier studies were carried out in which it was suggested to solve the question of the location of the victim by the localisation and nature of the injuries. As an additional criterion, a quantitative sign of the formation of individual injuries was proposed. As expert practice has shown, this approach proved to be quite effective. Comparison of localisation, frequency and type of injuries of soft body coverings, skeletal bones and internal organs of the driver and passengers in case of trauma in the passenger compartment of a modern moving passenger car revealed significant frequency differences. At the same time, there were contradictory data on the statistical evaluation of the localisation of primary injuries in drivers and front seat passengers in different types of cars, as well as insufficient study of the nature of injuries in rear seat passengers. To overcome these contradictions, it was proposed to group injuries with different localisation on the basis of the same mechanism of their formation into different complexes. At the same time, changes in the design features of modern passenger cars have changed the nature of trauma and thus caused additional difficulties in determining the position of the victim in the passenger car interior according to the nature of injuries sustained in a road traffic accident.

Conclusions: In this regard, in diagnosing the place of position of the victim as criteria along with the localisation of injuries, began to use additional signs such as the presence or absence of injuries to individual body parts. Therefore, obtaining new data on the type, number and localisation of all injuries formed in the driver of a modern car in a road accident is an urgent task.

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