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Abstract **УДК 614.86:616-01-07-08-036.8:614.2(477.52)**

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PATHOGENETIC PARTICULARITIES OF THE ROAD TRAFFIC INJURIES OF THE PRESENT

The purpose of the work is to analyze the structure and characteristics of injuries resulting from traffic accidents, which will undoubtedly contribute to the development of pathogenetically grounded treatment measures and will reduce the level of negative consequences.

Materials and methods. The severity of road accidents in Ukraine and the Sumy region was investigated by determining the F'_t factor, calculated as the ratio of the number of casualties and deaths to the total number of accidents. In order to assess the severity of injuries suffered by the victims, a standardized PTS-Hannover Damage Assessment System was used. To determine the causes and nature of the traffic accident, there was carried out an inspection and an anonymous non-personal survey of 124 traumatized patients who were undergoing treatment in the medical institutions of the Sumy region.

Results. The reasons and circumstances under which traffic accidents occurred, with 124 people being injured, the structure and character of the damage they received have been analyzed. It has been established that the integral ten-year value of F'_t in Ukraine is (0.23 ± 0.004), and in the Sumy region it is (0.41 ± 0.013). The trend is determined to increase the severity of accidents both in the Sumy region and in Ukraine as a whole. The main causes of road accidents were violations of the road safety rules by the drivers (54.03 %) and driving in the state of alcoholic intoxication (16.94 %). In most cases, the victims suffered multiple and combined injuries. Most often there was a combination of skeletal and craniocerebral trauma (18.55 %), and skeletal trauma connected to the craniocerebral injury and trauma of the chest (11.29 %). When studying the variety of lesions, the changes in nosological structure of characteristic and specific road traffic injuries were noted.

Conclusions. The main causes of the road accident occurrence were the violations of traffic safety rules by the drivers and driving in a state of intoxication. Most often, the victims had a combination of skeletal and craniocerebral trauma, and a skeletal trauma connected to the craniocerebral injury and trauma of the chest. Over the past 10 years there have been changes in the structure of specific and typical road traffic injuries, which, in our opinion, are due to the constructive features of a modern motor transport vehicle, means of internal and external passive safety.

Keywords: road accidents, circumstances of injury, damage characteristics.

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Резюме

ПАТОГЕНЕТИЧНІ ОСОБЛИВОСТІ ДОРОЖНЬО-ТРАНСПОРТНОЇ ТРАВМИ СЬОГОДЕННЯ

У роботі проаналізовані причини та обставини, за яких сталися дорожньо-транспортні пригоди, під час яких постраждали 124 особи, вивчені структура та характеристики отриманих ними ушкоджень.

Автори приходять до висновку, що за останні 10 років відбулися зміни нозологічної структури специфічної та характерної дорожньо-транспортних травм, що обумовлено конструктивними особливостями сучасного автомобіля, засобами внутрішньої та зовнішньої пасивної безпеки.

Ключові слова: дорожньо-транспортні пригоди, обставини травмування, характеристики ушкоджень.

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Introduction

Road traffic traumatism in Ukraine is an extremely urgent problem, the scale and consequences of which should be considered as one of the risk factors for national security. In the last years, the situation has worsened due to the rapid growth in the number of private vehicles and extremely poor road infrastructure [1, 2, 3].

Road traffic accidents not only cause economic losses, but also exacerbate adverse demographic trends. According to the World Health Organization (WHO) and the World Bank, the annual loss for the economy of Ukraine from road traffic accidents (RTA) reach $ 5 billion, which is 3–6 % of the country's GDP. In 24 years as a result of road traffic accidents more than 150 thousand persons died, more than 1 million suffered injuries, and about 500 thousand got disabilities [4, 5].

Transport trauma is a complex of mechanical action of the vehicle on the human body parts and the damage caused by it, causing health problems or death. The type and localization of damage, its combination and severity depend on the design features of the vehicle and its speed, participation in road traffic, the mechanism of traumatization (impact, run over, dragging, compression, etc.) [6, 7].

Depending on their peculiarities, the damages arising as a result of different types of transport traumas, are divided into specific, characteristic and uncharacteristic. The specific ones include injuries occurring in the places of contact of parts of the vehicle with the human body and often reflect their shape and size. The characteristic traumas include injuries corresponding to the mechanism of traumatization. Uncharacteristic signs include other traumas that do not resemble the above [8].

The study of evolutionary changes in specific traumas as a result of transport injury is given a lot of attention in foreign publications, while in the domestic scientific literature there are only a few publications [9, 10].

The objective of the study is to analyze the structure and characteristics of injuries resulting from road traffic accidents, which will undoubtedly contribute to the development of pathogenetically justified therapeutic measures and will reduce the level of adverse effects.

Materials and research methods

We have analyzed the reporting documentation of MI "Sumy Regional Center of Emergency Medical Care and Disaster Medicine" of the Main Department of Statistics in Sumy Region [11].

During the study of severity of road traffic accidents that occurred in Ukraine and Sumy Region over the past 10 years, we determined the factor $F'_т$, which is calculated as the ratio of the number of casualties and deaths to the total number of accidents:

$$F'_т = (N_п + N_з) / N_{дтп.}$$

To assess the severity of injuries in the casualties we used a standardized system for assessing the severity of traumas PTS-Hannover (Polytrauma-shlussel, or Hannoverian Polytrauma Score) proposed by H. J. Oestern and H. Tscheme in 1985, as the most adapted to be used in patients with transport trauma in the prehospital and early hospital stages and prognostically reliable [12]. The indicator of injury severity determines the morphological damage caused by trauma to the

body and is characterized by the sum of anatomical damage that occurred during an accident. It is a relatively stable indicator that can be determined as a result of life-time diagnostic measures or pathoanatomical studies.

In order to determine the causes and nature of the accident, examination and anonymous survey of 124 injured persons who were treated in medical institutions of Sumy Region were conducted.

The analysis was conducted in compliance with the moral and ethical norms and principles of the Declaration of Helsinki, Convention of the Council of Europe and relevant laws of Ukraine on human rights. All calculations and data analysis were performed according to the criteria and requirements of evidence-based medicine. The obtained findings and conclusions are within the probability limits.

Study results and discussion

During 2009–2018, in Sumy Region 21,569 road traffic accidents were reported, in which 853 people died and 7,868 people were injured. Within 10 years, the number of car accidents decreased from 2,578 in 2009 to 1,779 in 2018, with the number of casualties dynamically changing from 1,022 to 729. In order to study the severity of road traffic accidents that occurred in Ukraine and Sumy region over the period of 10 years, we calculated the factor of severity of road traffic accidents $F'_т$. The results are shown in Table 1.

Table 1 – Severity rate of accidents in 2009–2018

No.	Year	Severity rate $F'_т$	
		Ukraine	Sumy Region
1	2009	0.22	0.40
2	2010	0.21	0.37
3	2011	0.23	0.39
4	2012	0.22	0.34
5	2013	0.22	0.40
6	2014	0.24	0.45
7	2015	0.26	0.48
8	2016	0.23	0.41
9	2017	0.24	0.45
10	2018	0.23	0.41
Mean value		(0.23 ± 0.004)	(0.41 ± 0.013)

Table 1 shows that the integral ten-year value of $F'_т$ in Ukraine is (0.23 ± 0.004), and in Sumy region it is (0.41 ± 0.013). Although the absolute number of accidents decreased by 30.99 %, and the number of casualties – by 28.67%, there is an increasing trend of the severity of accidents in Sumy Region and in Ukraine as a whole.

During the course of the study, we carried out the distribution of road traffic accidents according to the causes of their occurrence. Obtained results are shown in Table 2.

Table 2 – Distribution of road traffic accidents according to the causes

Cause of occurrence	Number		R*
	abs.	%	
Traffic offence	67	54.03	1
Vehicle abuse	8	6.45	4
Drunk driving	21	16.94	2
Pedestrian offence	16	12.90	3
Unsatisfactory condition of the road surface	6	4.84	5
Poor visibility	3	2.42	6
Concatenation of circumstances	3	2.42	6
Total	124	100	

*R – rank

Data, shown in Table 2, shows that the major causes of road traffic accidents were traffic offence (54.03 %) and drunk driving (16.94 %).

The circumstances of traumatization of persons injured in road traffic accidents are shown in Table 3.

According to the information provided in Table 3 the majority of accidents occurred as a result of vehicle collisions (33.06 %) and hitting a pedestrian (29.84 %).

The results of the study and systematization of the nosological structure of the transport trauma are presented in Table 4.

Table 3 – Circumstances of the road traffic accident

Circumstance of the road traffic accident	Number of cases		R*
	abs.	%	
Collision of vehicles	41	33.06	1
Hitting a pedestrian	37	29.84	2
Running over by a wheel	2	1.61	8
Hitting the cyclist	5	4.03	6
Vehicle roll over	3	2.42	7
Hitting an obstacle	12	9.68	4
Hard braking	9	7.26	5
Unknown circumstances	15	12.09	3
Total	124	100	

*R – rank

The data provided in the Table show that in 61.29 % of the cases the casualties suffered from multiple and combined injuries. Most common were combinations of skeletal and craniocerebral injuries (18.55 %); skeletal, craniocerebral trauma with damage of thoracic organs (11.29 %).

During the study of the variety of injuries, we noticed that during 2009–2018 there were changes in the nosological structure of characteristic and specific road traffic traumas. So, within a specified period there was a 1.74 % increase in the proportion of thoracic and abdominal organ injuries caused by seat belt (seatbelt injury). Most common injuries in drivers were left clavicle fractures and "epaulet" chest hematomas. Prevalent injuries in passengers were right clavicle fractures. In high speed collisions there was a detachment of subcutaneous tissue as well as spleen and liver damage.

Table 4 – Distribution of the injured based on the clinical and nosological sign of injury

Type of injury	Number of the injured		
	abs.	%	R*
Isolated trauma	48	38.71	1
Polytrauma	12	9.68	4
Cranio-skeletal polytrauma	23	18.55	2
Cranio-thoracic polytrauma	11	8.87	5
Abdominal-skeletal polytrauma	7	5.65	6
Cranio-thoracic-skeletal polytrauma	14	11.29	3
Abdominal-cranio-skeletal polytrauma	2	1.61	8
Thoracic-abdominal-skeletal polytrauma	2	1.61	8
Cranio-thoracic-abdominal-skeletal polytrauma	5	4.03	7
Total	124	100	–

*R – rank

The number of cervical whiplash injury cases decreased from 20.83 to 15.28 % of the total number of the injured, who were inside the vehicle, which, in our opinion, is due to modern design solutions of the driver's and passengers' seats and probable under-diagnosis of this type of injury in case of a combined trauma.

It should be noted that there is a new separate type of injuries, associated with face, cervical spine and chest traumatization, caused by airbags – 4.67 % of persons who were inside the vehicle.

We recorded a decrease in the proportion of the so-called "bumper-fractures" in pedestrians (from 5.03 to 2.88 %).

In order to determine the severity of traumatic injuries resulting from an accident we used the PTS scale. The results are shown in Table 5.

Table 5 – Distribution of the injured based on PTS severity of injuries

PTS scale severity	Number of the injured		R*
	abs.	%	
I (up to 19 points)	76	61.29	1
II (20–34 points)	37	29.84	2
III (35–48 points)	8	6.45	3
IV (more than 49 points)	3	2.42	4
Total	124	100	–

*R – rank

Analysis of the data shows that more than half of the injured with transport trauma have a mild degree of damage, namely 61.29 %, the second degree of severity is determined in 29.84 % of the injured, the third – in 6.45 % of persons. The fourth, the most severe degree, is observed in 2.42 % of the injured. Thus, the majority of injured during road traffic accidents receive mild or moderate injuries.

Conclusions

1. The major causes of road traffic accidents are traffic offence (54.03 %) and drunk driving (16.94 %).
2. For the most part, the casualties suffered from multiple and combined injuries. Mostly common, a combination of skeletal and craniocerebral injuries (18.55 %) occurred as well as skeletal trauma in combination with craniocerebral trauma and trauma of thoracic organs (11.29 %).
3. Over the past 10 years, there have been changes in the structure of specific and characteristic road traffic traumas, which, in our opinion, is due to the design features of the modern car, means of internal and external passive safety.

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