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## **MAIN FACTORS CAUSING NEGATIVE COMPLICATIONS OF THE FUNCTION OF THE LOWER LIMBS AFTER RECEIVING MECHANICAL TRAUMATIC INJURIES**

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### **Abstract**

The article is devoted to an important and relevant area of forensic and clinical research to clarify and implement in medical theory and practice the main factors that cause negative complications of lower extremity function after fractures and other injuries due to mechanical trauma during traffic accidents ( further - road accident) and lead to permanent disability of more than 33%. Therefore, the aim of the study was to identify the criteria that indicate the occurrence of severe consequences of mechanical injury in the form of permanent disability of more than 33%, and to determine the value of these prognostic criteria.

The material of the study was 180 forensic examinations and tests and medical records of victims of road accidents. Of these, 120 examinations and research - the main group, and 60 - control. A number of current legal documents describing the concepts and types of disability have also been studied.

The methods were scientific analysis of legal sources and methods of descriptive statistics of medical and forensic documentation.

The results of the study allowed us to identify 8 groups of symptoms that cause the negative consequences of post-traumatic changes in the form of permanent disability of more

than 33%. Based on the study of these signs, prognostic criteria for modern forensic assessment of the severity of injuries burdened with loss of general ability to work in the above range were developed.

The ranking of these prognostic criteria in the main group (voters) was carried out.

A number of clinical and forensic features of modern forms and types of mechanical trauma of the lower extremities during an accident and the consequences of such injuries have been identified.

A number of inconsistencies of by-laws regulating forensic medical examination in the field of glossary on permanent disability are shown.

Conclusions and recommendations for improving the theory and practice of forensic determination of the degree of disability are given.

**Keywords: forensic medical examination; injury of the lower extremities; car injury; signs of negative consequences of fractures; prognostic criteria for severe consequences of mechanical injury; features of forensic examinations; modern forms and types of mechanical trauma of the lower extremities.**

**Actuality of theme.** Forensic assessment of the severity of injuries to the lower extremities that occur during mechanical trauma and are often accompanied by closed fractures of their bones, based on the principles of the Criminal Code of Ukraine and departmental bylaws [1, 2]. The assessment of any negative complications of these injuries is also determined by these regulations.

Therefore, to identify clinical and forensic features of modern forms and types of mechanical leg injuries is an important area of research and application, which will be the cornerstone for substantiation and development of prognostic criteria for modern forensic assessment of the severity of injuries, especially in closed fractures of large tubular bones of the lower extremities. According to many researchers on all continents, the prevalence of injuries of the lower extremities persists. For example, a study of the incidence and mortality of 2,093 pedestrian injuries at the Puerto Rico Trauma Hospital during 2000–2014 showed that the most common injuries were lower extremity injuries (46.6%) [3].

On the other hand, a significant part of departmental bylaws determining the consequences of foot injuries and criteria for assessing the degree of permanent disability is outdated and not updated for decades (17.01.1995) [2, 4, 5, 6].

The chosen direction of research also actualizes the high level of mechanical factors, first of all cars, and modern manufacturability of the last. Over the last 30-50 years, cars have

become smart comfortable vehicles compared to the inconvenient and dangerous cars and trucks of the past.

Recently, significant negative factors for resistance to foot injuries are the rapid pace of climate change, improving social living standards by reducing physical activity, progressive hypodynamics, leaching of natural foods from our diet, systematic violation of circadian rhythms and / or food intake, bad habits, deviant demographic and gender trends, extreme sports, respectable age and more.

In particular, scientists from Puerto Rico have shown that the evening and night time of day, age, sex significantly affect the localization of mechanical injuries of pedestrians due to accidents and their mortality. Thus, in 2000-2014, the majority of injuries in the group of pedestrians were received by "men aged 35 to 64 years, with the largest number of injuries during from 20:00 to 4:00. The most common injury was an injury of the lower extremities (46.6% ), followed by intracranial injuries (35.5%), except for the youngest age group, where the opposite pattern was observed. Pedestrians in the age groups 65-74 and 75-84 years had a higher proportion of fractures of the upper extremities (respectively 31.1% and 32 , 7%), and in the groups 55-64 and 65-74 there was a higher proportion of fractures of the lower extremities (43.8%) compared to the youngest group. In addition, compared to the youngest group, the risk of death increased 14 times and 24 , 6 times in people aged 65-74 and over 84, respectively. The authors proposed changes to the legislation on pedestrian safety, educational programs, urban planning and prevention measures, which should be adapted to the needs of each age group "[3].

The separation of modern man from the physical and natural way of life weakens his strength, his own compensatory mechanisms, including the traditional ability of the lower extremities to withstand mechanical injuries.

Modern medical diagnosis of lower extremity injuries and complications of these injuries has made a big step forward in the XXI century. These include the latest high-performance radiation diagnostic equipment (radiography, radioscopy, magnetic resonance imaging, computed tomography, spiral computed tomography, etc.), ultrasound diagnostics, functional diagnostic methods (eg, biomechanical study of the support and kinematic function of the lower limbs), etc.

Therefore, the nature of injuries of the lower extremities, their severity, disability as a result of these injuries have changed significantly and require revision and modern scientific generalizations and proposals for practical medicine and expert practice.

**The aim** of our study is to determine the main factors that cause negative complications of the function of the lower extremities after receiving mechanical traumatic injuries in the form of permanent disability of 33% and above.

**Materials and methods.** From the general group of objects of research (425 forensic medical documents with medical and other information on victims with mechanical fractures of the lower extremities, which were conducted in the Kharkiv Regional Bureau of Forensic Medical Examination for the period 2012-2020), a group of 120 victims with negative complications of foot function after receiving mechanical traumatic injuries in the form of permanent loss of total working capacity of 33% and above, as well as a group of 60 people who did not have such complications (control group).

The research methods were both general scientific methods of analysis of current regulations of Ukraine, and methods of descriptive statistics of forensic material.

**Research results.** According to the literature [7-10 and others], it was found that the main signs that generate negative complications of post-traumatic life of the lower extremities in the form of loss of total efficiency of 33% and above, were as follows:

- belonging to a certain group of road accident participants;
- the presence of concomitant conditions during the accident;
- the complexity of the injury;
- character of fractures;
- treatment tactics;
- violation of pathogenetic treatment regimens.

In our opinion, the following signs of detection of a negative course on the post-traumatic process must be added to this list:

- additional diseases and conditions;
- completeness of the provided medical documentation for forensic examination.

We have taken into account all these features, expanded them and substantiated and developed on their basis prognostic criteria for modern forensic assessment of the severity of injuries burdened with permanent loss of general ability to work in the range of more than 33%.

The analysis showed that in the group of 120 victims with negative complications of foot function after receiving mechanical traumatic injuries in the form of permanent loss of total efficiency of 33% and above, the signs that cause problematic disabling post-traumatic conditions were as follows:

1. In the group "belonging to a certain group of road accident participants" 105 pedestrians had such signs, which was 87.5% (control group - respectively 55 cases, and the proportion - 91.7%). The next participants in the accident were 4 drivers of cars, which corresponded to 3.3% (control group - respectively 3 cases, and the proportion - 5%). Further, these signs were acquired by 62 people (51.7%) in a frontal collision with a car, and in the control group, this sign was characteristic of 42 people (70.0%).

2. In the group "presence of concomitant conditions during the accident" the following symptoms were 4 people (3.3%) in the form of alcohol intoxication at the time of injury, while in the control group recorded 18 people (30.0%). At the age of less than 41 years, 58 people (48.3%) were victims with this symptom, and in the control group - 49 and 81.7%, respectively. Overweight (Kettle index  $\geq 31$ ) "worked" in 18 people (15.0%), but in the control group there were 7 (11.7%).

3. In the group "complexity of injury" disabling signs of combined injury were observed in 85 people (70.8%), and the control group showed this sign in 45 people (75.0%). With multiple trauma, this symptom was characteristic of 35 people (29.2%), and compared with the control - in 15 people (25.0%).

4. In the group "nature of fractures" the problem symptoms appeared in the form of many fragments of diaphyseal fracture in 80 people (66.7%) with indicators in the control group, respectively, 57 people (95.0%). Signs of the same nature in isolated intra-articular fractures were recorded in 11 cases (9.2%), and in the control group - in 4 people (6.7%). At intra-articular many fracture fractures the sign is fixed in 1 case (0.8%), and in control group - at 18 persons (30,0%).

5. In the group "treatment tactics" signs of negative complications during the conservative method of treatment were recorded in 42 people (35.0%), while in the control group - in 37 people (61.7%). Replacement of treatment methods in the post-traumatic period had a negative effect in the main group in 3 people (2.5%), and in the control group - in 16 (26.7%). The discrepancy between the size of the fixator and the anatomical parameters of the bones with fractures caused deterioration in 1 case (0.8%), and in the control group - in 11 people (18.3%). Intraoperative displacement of fragments of the femur, which was not corrected, as a negative problem was not observed in any case of the main group, but in the control group had 14 people, ie in 23.8% of cases.

6. In the group "violation of pathogenetic treatment regimens" as signs of complications of fracture healing processes during violation of the orthopedic regime in the immediate postoperative period, violation of the orthopedic regime during rehabilitation,

violation of postoperative radiological control, violation of perioperative antibiotic prophylaxis. groups (samples), except for 1 case (0.8%) due to violation of radiation diagnostics technology. According to this sequence in the control group (sample) was recorded in 4 people (6.7%), 4 people (6.7%), 14 people (23.8%), 3 people (5.0%) and again in 3 people (5.0%).

7. In the group "additional diseases and conditions" problem symptoms were noted in the presence of comorbid diseases in 17 people (14.2%), and in the control group - in 34 people (56.7%). In the presence of coxarthrosis in the anamnesis (first degree) - in 8 victims of the main sample (6.7%), while in the control group - in 1 person (1.7%). In the presence of gonarthrosis in the anamnesis (first degree) - also in 8 people (8.7%), and in the control group - in 23 victims (38.3%).

8. In the group "completeness of the provided medical documentation for forensic examination" there were no signs in the main group that would signal significant complications with permanent loss of total working capacity over 33%. However, in the control group, the failure to provide radiographs was recorded in 12 cases (20.0%), and the lack of data in medical records on the complications of fracture healing - in 4 cases (6.7%).

Ranking (from the strongest / most frequent criterion to insignificant) of the above prognostic criteria in the main group (sample) allows to show their next strength. 1st place is occupied by injured pedestrians (87.5%); 2nd place is in people with combined injuries (70.8%); 3rd place - in victims with many fragments of diaphyseal fractures (66.7%); 4th place - for injured persons in a frontal collision with a car (51.7%); 5th place - for persons under 41 years of age (48.3%); 6th place - in victims with conservative treatment (35.0%); 7th place - in people with multiple injuries (29.2%); 8th place - for overweight citizens (15.0%); 9th place - in people with comorbid diseases (14.2%); 10th place - in victims with isolated intra-articular fracture (9.2%); 11th place - in people with coxarthrosis and gonarthrosis (first degree), respectively, 6.7%; 12th place - for drivers of cars, as well as for people in a state of intoxication at the time of the accident, respectively, 3.3%; 13th place - in victims who changed treatment methods in the post-traumatic period (2.5%); The 14th place was taken by persons with intra-articular fractures, as well as persons who had a mismatch of the size of the fixator to the anatomical parameters of the bones, as well as persons who were treated with a violation of radiation diagnostics (respectively 0.8%). Other prognostic criteria in the main group (voters) were zero.

As can be seen from the analysis, most of the prognostic criteria for foot injury, which will be complicated by a permanent loss of overall performance of more than 33%, were

statistically significant, but not all. A small difference between the control group (less than 5.0%) applies to the following criteria: persons as pedestrians, persons as drivers of cars, persons with combined trauma or multiple trauma, persons with intra-articular isolated fractures, overweight persons and persons treated with a violation of radiological diagnostics technology. Therefore, they determine only the trend, not fixed prognostic criteria.

Our study also revealed clinical and forensic features of modern forms and types of mechanical foot injury. To the clinical features of modern forms and types of mechanical trauma of the lower extremities during an accident that lead to permanent loss of overall performance of more than 33%, we include the following:

- multiple trauma;
- trauma accompanied by intra-articular isolated fracture;
- overweight (Kettle index  $\geq 31$ );
- coxarthrosis in the anamnesis (I degree).

To the forensic features of modern forms and types of mechanical trauma of the lower extremities as a result of an accident, we propose to include the following:

1. A significant increase in the number of persons acquiring the above forms and types of mechanical injury of the lower extremities during an accident.
2. Significant increase in the proportion of such injuries, which have consequences in the form of permanent loss of total working capacity over 33%.
3. Currently, there is a need to improve modern methods of detection and assessment of the severity of injuries to the lower extremities in an road accident.

The latter thesis needs the most attention, because one of the criteria for the severity of injuries, according to Article 121 "Intentional grievous bodily harm" of the current Criminal Code of Ukraine [1], is a health disorder combined with permanent disability for at least one a third. According to Article 122 "Intentional moderate bodily injury" of the current Criminal Code of Ukraine [1] "intentional moderate bodily injury, ie intentional injury that is not life-threatening and did not entail the consequences provided for in Article 121 of this Code, is such that caused long-term health problems or significant permanent disability of less than one third. That is, Article 121 deals with "permanent disability" and Article 122 deals with "significant permanent disability".

The study of the Instruction on forensic examination [4] shows that "the participation of several experts is mandatory in conducting (paragraph 2.4) ... examinations to determine the loss of general and professional capacity for work (paragraph 2.4.3)." That is, the

specified Instruction has direct contradiction with the corresponding provisions of the current Criminal code of Ukraine.

The rules of forensic determination of the severity of injuries [5] currently also have a number of disputes with the current criminal law of Ukraine, because they contain different concepts in different paragraphs on permanent disability. It reads: "Serious bodily injury (paragraph 2.1): ... A health disorder associated with permanent disability of at least one third (at least 33%). The extent of permanent (permanent) loss of general working capacity in case of damage is established after the consequence of the damage ... Under permanent (permanent) loss of general working capacity should be understood such an irreversible loss of function that is not fully restored (paragraph 2.1.6). And further: "Permanent disability of less than one third should be understood as loss of total disability from 10% to 33% (paragraph 2.2.3)". And finally: "The degree of severity of injuries with the indication of a qualification - danger to life, health disorders, permanent loss of general ability to work, etc. (paragraph 4.9.5)".

Therefore, the results of our study make a significant contribution to improving the theory and practice of forensic medicine.

**Conclusions:** 1. The relevance of the review of modern scientific generalizations and proposals for practical medicine and forensic expert practice on the nature of injuries of the lower extremities, their severity, disability as a consequence of these injuries is proved.

2. 8 groups of signs (total number - 25) are offered for detection of a negative course of posttraumatic process.

3. Prognostic criteria of modern forensic medical assessment of the degree of severity of bodily injuries burdened with permanent loss of total working capacity of 33% or more have been developed. Their ranking was carried out.

4. Clinical and forensic features of modern forms and types of severe mechanical trauma of the lower extremities in road accidents are revealed.

5. The need to improve the forensic glossary on permanent disability is shown.

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