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## QUESTIONS OF DIFFERENTIAL DIAGNOSIS OF VARIOUS TYPES OF BICYCLIST'S INJURING BY A CAR

### ABSTRACT

Forensic-medical examination of the injured bicyclist in the road accident is very complex due to presence of several groups of traceforming objects, contributing to the variety of injuries. Analysis of the literature showed the necessity of creation differential-diagnostic criteria of different types of road accident according to 4 main types of car and bicyclist contact; such criteria are described in this research work. The necessity of determination of the object of primary contact in the road accident was explained. Forensic-medical importance of "traces of sliding" is mentioned. Presence or absence of such traces and their character can indicate the position of the bicyclist at the moment of accident. Character of the bodily injuries and mechanism of their forming play an important role in determination of bicyclist's position at the moment of contact. It was determined, that shin bones are the most injured parts of the body in the case of the road accident.

**Keywords:** forensic-medical examination, road accident bicyclist, "traces of sliding", shin bones, differential-diagnostic criteria

Injuring of the bicyclist by a moving car is a very specific type of traffic accident. This peculiarity is in mechanism of bicyclist's injuring, which in such case is much more complex, than in the case of usual car and pedestrian contact. Participation of more than 2 groups of traceforming objects (vehicle and road) in the forming of the person's injuries causes the complexity of the mechanism of such type of injury.

As it was mentioned above, complexity of such mechanism is based on the fact, that three groups of trace-forming objects (vehicle, parts of the bicycle, road) effect on forming of bodily injuries, but not two groups (vehicle and road) as it happens in the case of usual pedestrian's hit by a car.

Except this, mechanisms of intercontact of the car, bicycle, body of the injured person and road are various. That's why, taking to consideration all mentioned fact, we can consider that aspects of bicyclist's injuring by the moving vehicle are to be thoroughly examined.

We can state that forensic-medical examiners do not pay necessary attention on the questions of bicyclist's injuring in the car accident despite the other types of car accidents [2; 3; 5]. The present literature form this problem is outdated.

A.A. Solohin [6] only mentions such variant of vehicular accident as collision of the moving vehicle with the bicyclist. A.R. Rahimov and V.S. Smirnov discuss this problem, however they only describe some bodily injuries, which form in the result of such injuring of the person [4]. One of the modern researchers of vehicular injury's mechanism G.B. Deriagin, analyzing in details motorcyclist's injury does not pay considerable attention on bicyclist's injury [1]. The same we can tell about data of such researchers as V.F. Trubnikov and G.P. Istomin [7].

Because of the absence of the various types of car accidents' analysis, we have committed it and created differential-diagnostic criteria, which can help to determine defined type of injuring.

The research was performed on the base of materials of forensic-medical examinations, which were committed in Odessa regional bureau of forensic-medical examinations (31 forensic-medical examinations of

the corpses of dead bicyclists, 16 forensic-medical examinations of living persons – injured bicycles, 9 complex forensic-medical and transport-trasological examinations, performed in the process of investigation of car and bicyclist collision) during the period 2011-2014 years.

Analysis of mentioned above materials has given a possibility to determine 4 typical situations of bicyclist's injuring by moving vehicle:

1. Situation, when the bicyclist is on the bicycle and moves;
2. Situation, when the bicyclist is on the bicycle, but does not move (stands at the traffic lights);
3. Situation, when the bicyclist walks like a pedestrian and carries the bicycle;
4. Situation, when the bicyclist stands and holds the bicycle

Mentioned above situations are to be discussed.

The first situations is characterized with the fact, that bicycle with the bicyclist on it before the contact with the vehicle moves, the pelvic region of bicyclist's is on the bicycle's seat, and feet of the bicyclist are on the pedals (the sole surface of the bicyclist's shoes does not contact with the road).

The second situation is characterized by the fact, that bicycle before the contact with the car stands (stands still or does not start the move), the bicyclist is on the bicycle, pelvic region of the bicyclist is on the bicyclist's seat, one foot is on the pedal, second foot – leans on the road (because of what the bicyclist does not fell down with the bicycle). Thus, the sole part of the shoes of only one foot contacts with the road.

In the third situation the bicyclist at the moment of contact with the car is in the role of walking pedestrian; the only difference is that he carries the bicycle. In this case the sole part of the both shoes contacts with the road.

The fourth situation, when the bicyclist at the moment of contact with the car is also in the role of pedestrian, which does not walk (stands on the road and holds the bicycle). The sole part of both shoes of the pedestrian contacts with the road.

It is very important for forensic-medical diagnosing to determine the object of the primary contact with the car: bicyclist's body or parts of the bicycle.

Depending on this the mechanism of the bicyclist's (bicycle's) and car contact divides on two types:

1. Cases, when the bicyclist's body primarily contacts with the vehicle;
2. Cases, when the bicycle primarily contacts with the vehicle.

All mentioned peculiarities of the bicyclist's body injuring at the moment of bicycle's parts and bicyclist contact with moving vehicle, in the case when the body contacts with the vehicle primarily, cause forming of appropriate signs (differential-diagnostic criteria), which can be used for the forensic-medical diagnosing of mechanism of the bicyclist's injuring at the moment of traffic accident. To systemize it we have created table 1.

Table 1.

Criteria, used to determine circumstances of car and bicyclist contact (for situation, when the bicyclist's body primarily contacts with the vehicle).

<i>Circumstances of contact</i>	Bicyclist, who rides on the bicycle	Bicyclist, who stands still on the bicycle	Bicyclist, who carries the bicycle	Bicyclist, who stands still on the road and holds the bicycle
<i>Character of the injuries and traces on the shoes of the injured person</i>	Absence of the characteristic for the pedestrian "traces of sliding" on the sole part of the shoes	Presence of the characteristic for the pedestrian "traces of sliding" only on the sole part of the shoes of one foot	Presence of the characteristic for the walking pedestrian "traces of sliding" on the sole part of the shoes of both feet	Presence of the characteristic for the standing pedestrian "traces of sliding" on the sole part of the shoes of both feet
<i>Character of the lower extremities' bone fractures of injured person</i>	Presence of comminuted fractures of shin with signs of effect of injuring force from external and internal surface of the shin	Presence of comminuted fractures of shin with signs of effect of injuring force from external and internal surface of the shin	Presence of comminuted fractures of shin with signs of effect of injuring force only from one surface of the shin	Presence of comminuted fractures of shin with signs of effect of injuring force only from one surface of the shin
<i>Character of the other injuries</i>	Fractures of the bones of upper extremities, trunk, cranio-cerebral injury	Fractures of the bones of upper extremities, trunk, cranio-cerebral injury	Fractures of the bones of upper extremities, trunk, cranio-cerebral injury	Fractures of the bones of upper extremities, trunk, cranio-cerebral injury

If the parts of the bicycle contact primarily with the vehicle (predominantly front or rear wheel), differential diagnostic criteria will be different. These criteria represented in table # 2.

Table 1.

Criteria, used to determine circumstances of car and bicyclist contact (for situation, when the bicycle primarily contacts with the vehicle).

<i>Circumstances of contact</i>	Bicyclist, who rides on the bicycle	Bicyclist, who stands still on the bicycle	Bicyclist, who carries the bicycle	Bicyclist, who stands still on the road and holds the bicycle
<i>Character of the injuries and traces on the shoes of the injured person</i>	Absence of the characteristic for the pedestrian "traces of sliding" on the sole part of the shoes	Presence of the characteristic for the pedestrian "traces of sliding" only on the sole part of the shoes of one foot	Presence of the characteristic for the walking pedestrian "traces of sliding" on the sole part of the shoes of both feet	Presence of the characteristic for the standing pedestrian "traces of sliding" on the sole part of the shoes of both feet
<i>Character of the lower extremities' bone fractures of injured person</i>	Fracture of the shin bones are absent	Fracture of the shin bones are absent	Possible forming of fractures of shin with signs of effect of injuring force only from one surface of the shin	Possible forming of fractures of shin with signs of effect of injuring force only from one surface of the shin
<i>Character of the other injuries</i>	Fractures of the bones of upper extremities, trunk, cranio-cerebral injury	Fractures of the bones of upper extremities, trunk, cranio-cerebral injury	Fractures of the bones of upper extremities, trunk, cranio-cerebral injury	Fractures of the bones of upper extremities, trunk, cranio-cerebral injury

As it is seen in the tables, the most constant (not depending on the object, which contacted primarily with the vehicle – body of the bicyclist or parts of the bicycle) differential-diagnostic criteria base on the detection of typical “traces of sliding” on the sole part of the bicyclist shoes. Presence or absence of such traces and their character can indicate the position of the bicyclist at the moment of accident. Except this, character of the bodily injuries and mechanism of their forming also play an important role in determination of bicyclist’s position at the moment of contact – presence or absence of the fractures of the lower extremities bones, and mechanism of these fractures forming.

All mentioned points that analyzing character of the bodily injuries of the bicyclist and injuries and traces on its shoes (“traces of sliding”) it is possible to determine exact position of the bicyclist at the moment of traffic accident and whether it was moving or not.

The most important diagnostic criteria to solve such questions are:

- presence or absence of the “sliding traces” on the sole part of the shoes of the injured person, if they are present – exact localization and character of these traces;

- presence or absence of the injuries of the shin bones, if they are present – mechanism of their forming.

At the same time, the tasks of the future researches in this direction should be the studying of the various mechanisms of bicyclist’s injuring by the moving car, depending on the angle of car and bicycle contact and development of appropriate forensic-medical differential-diagnostic criteria.

#### References

1. Deryagin G.B., 2004. Nazemnaya transportnaya travma [Terrestrial vehicular injury]. Arhangelsk (in Russian)
2. Fetisov V.A., Smirenin S.A., Nesterov A.V., 2014. Aktual’nyie voprosy transportnoj travmy po materialam publikacij v zhurnale “Sudebno-medicinskaja jekspertiza” v period s 1958 po 2012 g. [Actual questions of vehicular injury, analyzing the publications in “Forensic-medical examination” magazine during 1958-2012 years]. Forensic-medical examination. 1, 50-54 (in Russian).
3. Nesterov A.V., 2014. Osobennosti posadki voditelej v legkovih avtomobilyah razlichnih tipov, vliyayushhiih na biomehaniku dvizheniya tela v usloviyah jekstrennogo tormozheniya [Peculiarities of driver’s position in passenger car of various types, which influence the biomechanics of body’s movement in the conditions of emergency braking]. Forensic-medical examination. 1, 18-21 (in Russian).
4. Rahimov A.A., Smirnov V.F., 1976. Nekotorye voprosy sudebno-medicinskoj jekspertizy nesmeritel’noj avtomobil’noj travmy [Some questions of forensic-medical examination of non-lethal vehicular injury]. Medicina, Tashkent (in Russian).
5. Shadymov A.B., Novoselov A.S., 2014. Sovremennyj vzglyad na travmu v salone avtomobilya [Modern view on injury inside the car] Forensic-medical examination. 2, 39-42 (in Russian).
6. Solohin A.A., 1968. Sudebno-medicinskaya jekspertiza pri dorozhno-transportnih proisshestviyah [Forensic-medical examination in the case of car accidents]. Medicina, Moskow (in Russian).
7. Trubnikov V.F., Istomin G.P., 1991. Pervaya vrachebnaya pomoshh postradavshim pri dorozhno-transportnih proisshestviyah [First medical aid injured persons in car accidents]. Osnova, Kharkov (in Russian).