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ASSESSMENT OF THE CLINICAL AND NOSOLOGICAL CHARACTERISTICS OF TRAFFIC INJURIES IN CHILDREN AS A MEDICAL AND SANITARY CONSEQUENCE OF A MAN MADE EMERGENCY SITUATION

Summary

All over the world, children's injuries receive considerable attention. Road traffic injury is the main cause of child death.

The aim of the research. To study and evaluate the clinical and nosological characteristics of traffic injuries in children as a medical and sanitary consequence of an emergency situation.

Research materials and methods. This work is a continuation of the previous research [2], and is based on the study and retrospective analysis of 259 cases of children injured as a result of a traffic accident in the Kyiv and Chernivtsi regions in 2018-2019. The array of this study was formed by the method of irreversible randomization from the total array of 1,671 cases of traffic injuries that occurred in urban and rural areas of these regions. This work was carried out within the framework of the Doctoral Thesis «Traffic accidents (clinical-epidemiological, clinical-nosological characteristics, clinical features of the course of the traumatic process, principles of medical care)», approved by the Academic Council of the «Ukrainian Scientific and Practical Center of Emergency Medical Aid and Disaster Medicine» of the Ministry of Health of Ukraine (Minutes of the meeting of the Scientific Council No. 6, December 15, 2020), in accordance with the provisions of the Declaration of Helsinki and approved by the Bioethics Commission of the «Ukrainian Scientific and Practical Center of Emergency Medical Aid and Disaster Medicine» of the Ministry of Health of Ukraine (Protocol No. 10, December 8, 2020).

Research results. As a result of the research it was established that in the total number of children with road traffic injuries, the largest specific weight have children with the extent of damage to two anatomical and functional areas (AFA) – 47.67 %, and the smallest specific weight – four AFA (13.95 %). In 84.88 % of traffic injuries in children, they are polysystemic, i.e. two or more AFA are damaged, in the mass of the dead, the specific weight of such an injury is 90.91 %. The highest mortality rate was observed in children with damage to three AFAs (15.00 %), with damage to one AFA the mortality rate was 7.69 %, with damage to two AFAs – 14.63 %, with damage to four AFAs – 8.33 %. In the total number of injured children, the most frequent injury is to the head (82.56 %), and the least frequent is damage to the abdomen and pelvis with a specific gravity of 13.95 %. Limb injuries (56.98 %), chest injuries (41.86 %) and spine injuries (16.28 %) are also quite common in children. The combination factor in the general field is 2.26, in the field of the dead – 2.46 and in the field of the survivors – 2.23. The highest mortality is observed in victims with abdominal and pelvic trauma (25.0 % each), which is almost twice as high as the mortality in the general population (12.79 %). In second place is the mortality rate of children with chest trauma – 19.44 %, with head trauma – 16.90 %, with spinal trauma – 7.14 %. The lowest mortality rate was recorded for children with limb injuries – 4.08 %.

Conclusions. 1. Traffic injuries in children in 84.88 % of cases are multicomponent, the combination ratio in the total mass is 2.26. 2. Head (82.56 %), limbs (56.98 %) and chest (41.86 %) are most often injured in traffic accidents. 3. The highest mortality rate is observed in children with pelvic and abdominal trauma (25.0 % each).

Key words: Traffic Injury; Children; Clinical and Epidemiological Characteristics; Emergency Situation.

Introduction

Injuries to children receive considerable attention worldwide [1, 3-5]. Road traffic injuries are the leading cause of death and disability not only among adults, but also among children [1, 3, 4, 6-10]. Taking into account the current Ukrainian legislation, road traffic accidents are considered an emergency situation in Ukraine (clause 1.6 of article 2 of the Code of Civil Protection of Ukraine [11]).

In different countries of the world, the infant mortality rate ranges from 3.5 % (Sweden) to 19.1 % (Romania) [6, 12-18], in Ukraine, according to our data, the mortality rate is 12.79 % [2].

Recently, all over the world and especially in Ukraine, road traffic injuries have received a lot of attention [2-4, 9, 16-20], but the available sources of scientific information, especially in Ukraine, do not sufficiently reflect their clinical and nosological characteristics in children.

Since clinical and nosological characteristics (extent of damage, damaged anatomical-functional area and combination factor of damage) are risk factors and can influence the outcome of the traumatic process in road

accident victims, they should be taken into account when developing clinical routes and clinical protocols for the provision of medical care [21-22]. That is, the clinical and nosologic signs of road traffic injury are the fundamental basis for the above-mentioned protocols and routes.

The aim of the research. To study and evaluate the clinical and nosological characteristics of traffic injuries in children as a medical and sanitary consequence of an emergency situation.

Research materials and methods

This work is a continuation of the previous research [2], and is based on the study and retrospective analysis of 259 cases of children injured as a result of a traffic accident in Kyiv and Chernivtsi regions in 2018-2019. The array of this study was formed by the method of irreversible randomization from the total array of 1,671 cases of traffic injuries that occurred in urban and rural areas of these regions. Randomization of the sample was carried out

according to the age of children 0-18 years. Road traffic injuries in children represent 15.50 % of the total mass of injured people. According to the law of large numbers, the volume of the research array is higher than necessary and sufficient. As in the previous study, we used the age gradation: nursery period (0-3 years), preschool period (3-6 years) and school period (6-18 years). This gradation of age periods corresponds to the social function of children's life activities and, as noted in the previous article, is optimal.

We analyzed the main clinical and nosologic characteristics: the volume of the lesion, the damaged anatomical and functional area (AFA). For the purpose of the clinical focus of the study, the influence of the size of the lesion and the damaged AFA on the outcome of the course of the traumatic disease was studied, i.e. a distribution according to these characteristics was made in the mass of the dead and in the mass of the children who survived. The mortality rate among children was 12.79 %. To determine the probability of the data, we used non-parametric and parametric methods of statistical analysis, as well as the law of formal logic and fractal analysis with the calculation of the distribution dissipation index. Calculations were performed in the Statistica system.

This work was carried out within the framework of the Doctoral Thesis «Traffic accidents (clinical-epidemiological, clinical-nosological characteristics, clinical features of the course of the traumatic process, principles of medical care)», approved by the Academic Council of the «Ukrainian Scientific and Practical Center of Emergency Medical Aid and Disaster Medicine» of the Ministry of Health of Ukraine (Minutes of the meeting of the Scientific Council No. 6, December 15, 2020), in accordance with the provisions of the Declaration of Helsinki and approved by the Bioethics Commission of the «Ukrainian Scientific and Practical Center of Emergency Medical Aid and Disaster Medicine» of the Ministry of Health of Ukraine (Protocol No. 10, December 8, 2020).

Research results and their discussion

One of the important clinical and nosologic characteristics of a road traffic injury is the extent of damage.

In accordance with the purpose of our study, we divided the study field according to the extent of damage (the number of damaged anatomical and functional areas) in the entire field. The results of this analysis are shown in Fig. 1.

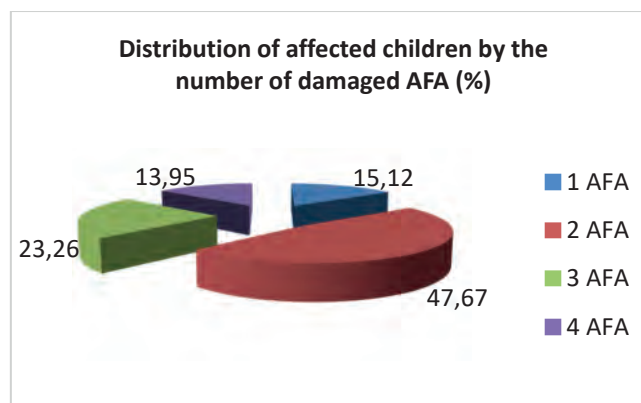


Fig. 1. Distribution of the array by the volume of the lesion

As can be seen from the data in the diagram (Fig. 1), in the entire array, the largest specific weight of affected children is given by the volume of damage to two AFAs – 47.67 %, and the smallest specific weight of children is given by the volume of damage to four AFAs – 13.95 %. Victims with damage to one AFA make up 15.12 %, with damage to three AFA – 23.26 %. The coefficient of the ratio of the maximum indicator of specific gravity to the minimum indicator of lesion

volume is 3.42, which indicates a high dispersion of the distribution.

Thus, in 84.88 % of traffic accidents in children they are polysystemic, i.e. two or more AFAs are damaged.

To verify the influence of the size of the lesion on the occurrence of a negative outcome of the course of the traumatic process in children and the distribution of victims in the resulting groups by the size of the lesion, a corresponding analysis was conducted, the data of which are shown in Table 1.

Table 1

Analysis of the distribution of the study array by the size of the lesion in the resulting groups

Extent of damage (number of AFA)	The survived			Those who died			General array	
	% *	%**	rank	% *	%**	rank	%	rank
1	92,31	16,00	3	7,69	9,09	3	15,12	3
2	85,37	46,67	1	14,63	54,55	1	47,67	1
3	85,00	22,67	2	15,00	27,27	2	23,26	2
4	91,67	14,67	4	8,33	9,09	3	13,95	4
5	-	-	-	-	-	-	-	-
Total	-	100,0	-	-	100,0	-	100,0	-

Notes: * distribution of the array of victims according to the outcome of the traumatic process in groups according to the volume of damage;

** distribution of the array of victims in the effective group.

As a result of the analysis of the data in Table 1, the regularity of the coincidence of the ranking places in the result groups and in the general array of the study was determined, but the specific weight indicators differ. In the array of survivors in all groups, according to the number of damaged AFA, the specific gravity indicators are close in value and within the limits of statistical error. In the array of victims, such indicators are somewhat different. Damage to five AFA was not observed to a statistically significant extent.

In the array of injured children who survived, the largest specific weight is given by victims with damage to two AFA (46.67 %), and this indicator is close to the indicator of specific weight in the general array, the difference is 1 %, which is within the limits of statistical error. Victims with damage to two AFA (22.67 %) are in second place, with damage to one AFA (16.00 %) in third place, and four AFA (14.67 %) in the last place. The maximum-to-minimum ratio of the survivor array is 3.18, indicating a high dispersion of the distribution.

In the array of injured children with a negative course of the traumatic process, in the first place with a specific weight of 54.55 % there are also victims with damage to two AFA, which is by 6.88 % in the absolute value of the intensive indicator, or by 14.43 % from the indicator of the basic level more than the index of the total array. In the second place are the victims with the volume of damage to three AFA (27.27 %), which is 4.01 % in the absolute value of the intensive indicator, or 17.24 % more than the indicator of the basic level. The third place is occupied by victims with damage to one and four AFAs with a specific

weight of 9.09 %. The coefficient of the ratio of the maximum to the minimum in the mass of the dead is 6.0, which indicates a very high dispersion of the distribution.

In victims with damage to one AFA, the mortality is 7.69 % and is the lowest, that is, by 5.10 % in the absolute value of the intensive indicator, or by 39.87 % of the base level less than the mortality in the general array of the study. In the group of victims with two damaged AFAs, the mortality rate is 14.63 %, which is 1.84 % in the absolute value of the intensive indicator, or 14.39 % more than the base level indicator. Mortality is highest in victims with damage to three AFAs (15.00 %), which is 2.21 % in absolute value of the intensive indicator, or 17.28 % more than the indicator of the basic level. In victims with damage to four AFA, the mortality is 8.33 %, which is 4.46 % in the absolute value of the intensive indicator, or 34.87 % of the base level more than the indicator of the general array.

The performed polychoric analysis of the data in Table 1 made it possible to establish that there is a positive ($\varphi = 0.0085$), weak ($C = 0.070$), but unlikely ($\chi^2 = 2.20$) relationship, occurring with a degree of freedom greater than 1, which indicates the influence of many other risk factors. Such risk factors include the severity of damage and the specific damaged AFA.

Also, an important clinical and nosological sign that characterizes a road traffic injury and has an impact on the outcome of the traumatic process is a proven damaged AFA. The results of the distribution of the array of affected children according to the sign of damaged AFA in the general array of the study are shown in Figure 2.

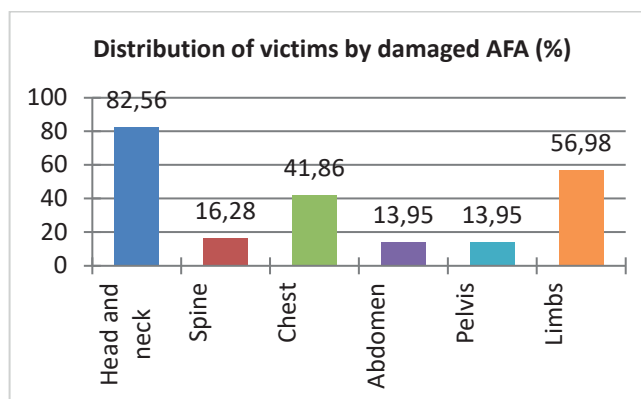


Fig. 2. Distribution of victims by damaged AFA (%)

As can be seen from the diagram (Fig. 2), in the total number of injured children, the most common injury is the head (82.56 %), and the least common is the injury to the abdomen and pelvis with a specific gravity of 13.95 %. Limb damage (56.98 %) and chest damage (41.86 %) are also quite common in children. The coefficient of the ratio of the maximum to the minimum indicators is 5.92, which indicates a very high dissipation of the distribution.

In order to verify the influence of the damaged AFA on the outcome of the traumatic process in children injured as a result of a road accident, the array was divided into effective groups. The data of the analysis are given in Table 2.

When analyzing the data in Table 2, the coincidence of the ranks in the survivors' array with the general array can be traced, but the indicators of specific weight are slightly different. Head and neck injuries are most often observed in

children who survived traffic accidents (80.00 %), the least often observed injuries are abdomen and pelvis – 12.00 % each. Spine injuries as a component of polysystemic trauma in children occur in 17.33 %, chest injuries in 38.67 %, limb injuries in 62.67 %. The combination ratio for child survivors is 2.23, which means that, on average, each affected child suffers damage to at least two AFAs.

In the array of victims with a negative result of the course of the traumatic process, 100.0 % of the victims have head and neck injuries. There is no coincidence of ranks in the array of the dead. Damage to the chest is in the second place by specific gravity – 63.64 %. Damage to the spine in victims of this result group is the least common (9.09 %). Abdominal and pelvic injuries occur in 27.27 %, which is 2.3 times more than in survivors. Limb injuries occur only in 18.18 %, which is 3.5 times less frequent than in survivors. The combination factor in deceased children is 2.46.

Table 2

Analysis of the distribution of the array of affected children according to the damaged AFA in the resulting groups

Damaged AFA	The survived			Those, who died			General array	
	% *	%**	rank	% *	%**	rank	%	rank
Head and neck	83,10	80,00	1	16,90	100,0	1	82,56	1
Spine	92,86	17,33	4	7,14	9,09	5	16,28	4
Chest	80,56	38,67	3	19,44	63,64	2	41,86	3
Abdomen	75,00	12,00	5	25,00	27,27	3	13,95	5
Pelvis	75,00	12,00	5	25,00	27,27	3	13,95	5
Limbs	95,92	62,67	2	4,08	18,18	4	56,98	2
The combination factor	-	2,23	-	-	2,46	-	2,,26	-

Notes: *distribution of the array of victims according to the outcome of the traumatic process in groups of damaged AFA; ** distribution of the array of victims in the effective group.

On the other hand, the highest mortality rate in victims of specifically damaged AFA is in victims with abdominal and pelvic trauma (25.0 % each), which is almost twice as high as the mortality rate in the general population. In second place is the mortality rate of injured children with a chest injury – 19.44 %. The mortality rate for victims with a head injury was 16.90 %, which is also higher than the mortality rate in the general population. The lowest mortality rate was recorded for children with limb injuries (4.08 %), which is three times lower than the mortality rate in the general population. The mortality rate is also lower than the general rate for victims with a spinal cord injury – 7.14 %.

Polychoric analysis of the data in Table 2 allowed us to establish that there is a positive ($\varphi^2 = 0.0413$), moderate ($C = 0.0200$) and probable ($\chi^2 = 10$) relationship between the damaged AFA and the outcome of the traumatic process in children with DTT .69), and the above provisions are within the limits of the probability field.

In the analysis of clinical cases it was found that the very high mortality rate in children with abdominal and pelvic injuries is due to untimely compensated and uncontrolled bleeding.

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Conclusions

1. Road traffic injuries in children are severe and multicomponent in 84.88 % of cases. The combination factor in the whole array is 2.26, which determines the volume and severity of damage.

2. There are clinical and anatomical forms of damage that are most characteristic of traffic injuries. For example, children's head (82.56 %), limbs (56.98 %) and chest (41.86 %) are most often injured as a result of traffic accidents.

3. Mortality as a result of road traffic injury in children remains significant and probable and depends on the clinical and anatomical form of damage. The highest mortality is observed in pelvic and abdominal injuries (25.0 % each), the lowest – in limb injuries (4.08 %).

Perspective of further research

In the near future, it is planned to study the severity of road traffic injuries in children on a life-like model, which will allow further development of clinical routes for the injured child and substantiate clinical protocols for the provision of medical care at various stages of care.

Conflict of interest: none.

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ОЦІНКА КЛІНІКО-НОЗОЛОГІЧНОЇ ХАРАКТЕРИСТИКИ ДОРОЖНЬО-ТРАНСПОРТНОЇ ТРАВМИ У ДІТЕЙ ЯК МЕДИКО-САНИТАРНИЙ НАСЛІДОК НАДЗВИЧАЙНОЇ СИТУАЦІЇ ТЕХНОГЕННОГО ХАРАКТЕРУ

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Резюме

У всьому світі травматизму дітей приділяється значна увага. Дорожньо-транспортна травма посідає основне місце серед причин, які призводять до загибелі дитини [1].

Мета дослідження. Вивчити й оцінити клініко-нозологічну характеристику дорожньо-транспортної травми у дітей як медико-санітарного наслідку надзвичайної ситуації.

Матеріали і методи дослідження. Дана робота є продовженням попереднього дослідження [2] і ґрунтується на вивченні та ретроспективному аналізі 259 випадків постраждалих дітей унаслідок дорожньо-транспортної пригоди (ДТП) в Київській та Чернівецькій областях за 2018-2019 роки. Масив даного дослідження формувався методом беззворотної рандомізації із загального масиву 1671 випадку дорожньо-транспортної травми (ДТТ), які сталися у міській та сільській місцевості зазначених областей. Дана робота виконана в рамках дисертаційної роботи за темою «Дорожньо-транспортна травма (клініко-епідеміологічна, клініко-нозологічна характеристика, клінічні особливості перебігу травматичного процесу, принципи надання медичної допомоги)», затвердженою на Вченій раді ДЗ «Український науково-практичний центр екстреної медичної допомоги та медицини катастроф МОЗ України (протокол засідання Вченої ради № 6 від 15 грудня 2020 року), з дотриманням умов Гельсінської декларації та схвалено комісією з біоетики ДЗ «Український науково-практичний центр екстреної медичної допомоги та медицини катастроф МОЗ України (протокол № 10 від 08 грудня 2020 року).

Результати дослідження. У результаті виконаного дослідження встановлено, що в загальному масиві дітей з дорожньо-транспортною травмою найбільшу питому вагу мають діти з обсягом ураження дві анатомо-функціональні ділянки (АФД) – 47,67 %, а найменшу питому вагу – чотири АФД (13,95 %). У 84,88 % дорожньо-транспортна травма у дітей є полісистемною, тобто пошкоджуються дві і більше АФД, у масиві померлих питома вага такої травми становить 90,91 %. Найвища летальність спостерігалася у постраждалих дітей з пошкодженням трьох АФД (15,00 %), при пошкодженні однієї АФД летальність була 7,69 %, при пошкодженні двох АФД – 14,63 %, а при пошкодженні чотирьох АФД – 8,33 %. У загальному масиві постраждалих дітей найчастіше зустрічається пошкодження голови (82,56 %), а найрідше – пошкодження живота й таза із показником питомих ваг по 13,95 %. Також досить часто у дітей зустрічаються пошкодження кінцівок (56,98 %) і пошкодження грудної клітки (41,86 %) та хребта – 16,28 %. Коефіцієнт поєднання в загальному масиві становить 2,26, у масиві загиблих – 2,46, а у масиві тих, що вижили, – 2,23. Найвища летальність спостерігається у постраждалих з абдомінальною травмою і травмою таза (по 25,0 %), що майже вдвічі перевищує летальність у загальному масиві (12,79 %). На другому місці перебуває летальність у постраждалих дітей, у яких була наявна торакальна травма – 19,44 %, при травмі голови летальність становила 16,90 %, при травмі хребта – 7,14 %. Найменша летальність зафіксована у постраждалих дітей з пошкодженням кінцівок – 4,08 %.

Висновки. 1. Дорожньо-транспортна травма у дітей у 84,88 % випадків є багатокомпонентною, коефіцієнт поєднання в загальному масиві становить 2,26. 2. Найчастіше у дітей внаслідок дорожньо-транспортної пригоди пошкоджуються голова (82,56 %), кінцівки – (56,98 %) та грудна клітка (41,86 %). 3. Найвища летальність спостерігається у дітей з травмою тазу та абдомінальною травмою (по 25,0 %).

Ключові слова: дорожньо-транспортна травма; клініко-нозологічна характеристика; діти; постраждалі; надзвичайна ситуація.

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