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# MORTALITY ANALYSIS IN BLUNT COMBINED TRAUMA AND POLYTRAUMA

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*Summary*

**Introduction.** Modern traumatism from the standpoint of clinical epidemiology meets the classification criteria of a global pandemic. Important factors triggering the global clinical and epidemiological picture are the unsatisfactory state of prevention of all types of injuries in developing countries, traffic injuries in industrialized countries and the progressively increasing number of armed conflicts.
**The aim of the study.** To conduct a comparative clinical and epidemiological analysis of mortality in blunt combined trauma and polytrauma.
**Materials and methods.** A retrospective single-center cohort 10-year clinical and epidemiological study of 933 fatal clinical cases of blunt combined trauma on the basis of polytrauma department of the Kyiv City Clinical Emergency Hospital has been conducted. Clinical diagnoses and forensic medical conclusions were transformed into Hannover Polytrauma Score scale codes. The clinical and epidemiological experiment was based on the clustering of the research array according to the severity of the injury.
**Results.** As a result of the clinical and epidemiological experiment, 5 stable clusters which can be characterized as separate randomized clinical-epidemiological groups were obtained. Clinical profile was determined by the dominant injury: cluster-1 (patients with an extremely severe thoracic profile), cluster-2 (patients with a severe thoracic profile), cluster-3 (patients with an extremely severe abdominal profile), cluster-4 (patients with a severe neurosurgical profile), cluster-5 (patients with an extremely severe neurosurgical profile).
**Conclusions.** Lethal blunt combined injury has a clear hierarchical structure based on the severity of the injury and the presence of dominant damage to the corresponding anatomical and functional area. The results obtained during the current study indicate the need to find new technological approaches to the treatment of extremely severe injuries, as well as treatment and prevention of the development of complications of severe injuries in order to reduce mortality in polytrauma.

*Keywords:* **mortality, combined trauma, polytrauma, clinical epidemiology, cluster analysis**

## INTRODUCTION

According to the classification criteria of clinical epidemiology, modern traumatism with its high rates of morbidity, disability and mortality, should be considered as a global pandemic. Despite the consolidation of international resources and the efforts of individual states around the problem, about four million people died from injuries at the beginning of the current century. As of 2020, epidemiological projections suggest that this number will exceed six million deaths from injuries per year. Thus, over the past five years, injuries have become the second most common cause of death and disability. The main factors determining the global clinical and epidemiological picture are traffic injuries in industrialized countries, the low prevalence of preventive measures for all types of injuries in developing countries, and the progressive increase in the number of armed conflicts [1-4].

## THE AIM OF THE STUDY

To conduct a comparative clinical and epidemiological analysis of mortality in blunt combined trauma and polytrauma.

## MATERIALS AND METHODS

A represented single-center retrospective cohort clinical and epidemiological study was conducted in descriptive and analytical manners. At the descriptive stage of the study, a screening of 3,098 medical records of patients who received treatment in the polytrauma department of the Kyiv City Clinical Emergency Medical Hospital between 2002 and 2011 was carried out. The studied qualitative and quantitative indicators were entered into spreadsheets of the Microsoft Office Access 2007 database management system. Clinical diagnoses and forensic medical conclusions were transformed into morphological codes of the Hannover Polytrauma Score (HPS) with the assignment of a corresponding numerical index of trauma severity (TS).

Subsequently, all isolated and blunt combined trauma (BCT) without a thoracoabdominal component were excluded from the study. Thus, the research sample consisted of 2009 clinical cases of BCT. In the total sample, 1076 (53.6 %) clinical cases of BCT with a favorable course of injury and 933 (46.4 %) lethal clinical cases were the subject of this study. The age of the patients ranged from 11 to 95 years. The gender distribution was as follows: 484 (24.1 %) women and 1525 (75.9 %) men.

In order to obtain randomized by TS groups from the research sample, clustering of the array of HPS indicators was carried out using the k-means method. In accordance with the theoretical and methodological premise, the hypothesis regarding the number of m clusters (by variables or observations) was not put forward. Using STATISTICA 10.0 software, a number of m clusters were randomly generated in such a way that they were as different in TS as possible. The validity of the division into clusters in STATISTICA 10.0 software was checked by comparing the values of trait variances between groups (Between SS) and within each group (Within SS). A decrease in the value of the intragroup variance and an increase in the value of the intergroup variance indicate that the feature better characterizes the belonging of the objects to the cluster, which is reflected in the higher quality of the obtained clustering. Signs with large values ($p > 0.05$) were excluded from the clustering procedure.

After obtaining stable clusters, the analysis was carried out by studying individual qualitative and quantitative features that characterize each certain cluster, which were subsequently compared with each other using various statistical methods (Mann-Whitney test, Friedman test, Kendall coefficient (concordance)). Analytical methods of clinical and epidemiological study allowed to carry out a comprehensive assessment of hypotheses about the risk factors for the occurrence of a lethal outcome and to clarify the current directions for improving the treatment results.

## RESULTS

A sample of 933 clinical cases was clustered according to the above-described method in order to identify objective factors that affect mortality in BCT, as a result of which 5 stable clusters were obtained. All clinical cases included in one or another cluster are separate randomized clinical and epidemiological groups (CEG) that have unique hierarchically ordered characteristics of TS. The above-mentioned testifies to the possibility of conducting a correct structural and comparative analysis by identifying the characteristics of individual anatomical and functional areas and other elements of different levels in the CEG and determining the relationships and connections between them. The presence of an objective criterion for assessing TS made it possible to identify the dominant injury of one or another anatomical and functional area in each CEG and to stratify accompanying injuries by severity (table 1).

*Table 1*

**Distribution of clinical and epidemiological groups according to the dominant injury (data acquired from doctoral thesis «Thoracoabdominal polytrauma with dominating chest injury» by Serhii I. Panasenko)**

| Severity of damage to individual anatomical and functional areas, score | Clinical and epidemiological group (cluster) | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Head | 1,44 | 0,63 | 0,79 | 9,14* | 19,77* |
| Chest | 20,93* | 3,78* | 10,58 | 2,84 | 4,67 |
| Abdomen | 2,78 | 1,01 | 15,01* | 0,62 | 2,49 |
| Pelvis | 1,39 | 2,07 | 2,07 | 0,63 | 0,79 |
| Limbs | 0,99 | 1,27 | 1,02 | 1,14 | 0,88 |
| Spine | 0,32 | 0,21 | 0,21 | 0,09 | 1,00 |

* dominant injury.

CEG-1 is characterized by the presence of a dominant extremely severe blunt chest trauma, combined severe trauma to the head, abdomen and pelvis; moderate limb injuries and light spinal trauma. The total TS in CEG-1 was 27.8±0.8 points, which characterizes BCT as extremely severe, or polytrauma. According to the dominant injury, CEG-1 can be characterized as a group of extremely severe thoracic profile.

CEG-2 is characterized by the presence of a dominant severe blunt chest trauma, severe combined injuries of the abdomen, pelvis and limbs; moderate head trauma and mild spinal injuries. The total TS in CEG-2 was 9.0±0.6 points, which characterizes it as severe BCT. According to the dominant injury, CEG-2 can be characterized as a group of severe thoracic profile.

CEG-3 is characterized by the presence of a dominant extremely severe blunt abdominal trauma, severe combined injuries to the chest, pelvis, and limbs; moderate head injuries and mild spinal injury. The total TS in CEG-3 was 29.7±1.3 points, which characterizes it as an extremely severe BCT, or polytrauma. According to the dominant injury, CEG-3 can be characterized as a group of extremely severe abdominal profile.

CEG-4 is characterized by the presence of a dominant severe cranial trauma, severe combined chest and limb injuries; moderate injuries of the abdomen and pelvis and mild spinal trauma. The total TS was 14.5±0.6 points within CEG-4, which characterizes it as extremely severe BCT, or polytrauma. According to the dominant injury, CEG-4 can be characterized as a group of severe neurosurgical profile.

CEG-5 is characterized by the presence of a dominant extremely severe cranial trauma, severe combined injuries of the chest, abdomen and spine; moderate trauma of the pelvis and limbs. The total TS in CEG-5 was 29.6±0.8 points, which characterizes it as an extremely severe BCT, or polytrauma. According to the dominant injury, CEG-5 can be characterized as a group of extremely severe neurosurgical profile.

The regularities of the severity distribution of anatomical injuries within individual CEGs are illustrated in table 2.

*Table 2*

**Distribution of clinical and epidemiological groups by severity of injuries (data acquired from doctoral thesis «Thoracoabdominal polytrauma with dominating chest injury» by Serhii I. Panasenko)**

| Clinical and epidemiological group (cluster) | Traditional gradation of the severity of injuries | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | mild | | moderate | | severe | | extremely severe | | | |
| | abs. | % | abs. | % | abs. | % | abs. | % | abs. | % |
| 1 | - | - | - | - | - | - | 172 | 18,4 | 172 | 18,4 |
| 2 | - | - | 2 | 0,2 | 320 | 34,3 | 104 | 11,1 | 426 | 45,7 |
| 3 | - | - | - | - | - | - | 151 | 16,2 | 151 | 16,2 |
| 4 | - | - | - | - | 50 | 5,4 | 62 | 6,6 | 112 | 12,0 |
| 5 | - | - | - | - | - | - | 72 | 7,7 | 72 | 7,7 |
| Total | - | - | 2 | 0,2 | 370 | 39,7 | 561 | 60,1 | 933 | 100 |

CEG-1 of the extremely severe thoracic profile consisted of 172 (18.4 %) cases of extremely severe trauma. Qualitative characteristics of such a dominant injury were the presence of: anterior or anterolateral costal valve; damage to both lungs and pleural cavities; rupture of the main bronchus; rupture of the aorta or heart, rupture of the lung, damage to the large vessels of the chest.

CEG-2 of severe thoracic profile included 426 (45.7 %) cases and consisted of 320 (34.3 %) severe, 104 (11.1 %) extremely severe and 2 (0.2 %) moderate injuries. The qualitative characteristic of the dominant injury was the presence of: a lung and heart injury; multiple unilateral rib fractures with lung rupture and pneumothorax; posterior or posterolateral costal valve; bilateral multiple rib fractures with damage to one pleural cavity and lung.

CEG-3 of the extremely severe abdominal profile consisted exclusively of 151 (16.2 %) extremely severe injuries and was characterized by the presence of: ruptures or separations of hollow organs; damage to the diaphragm with or without damage to other organs; trauma of two or more abdominal organs; damage to the aorta, inferior vena cava, hepatic or portal vein.

CEG-4 of severe neurosurgical profile with predominant severe cranial trauma consisted of almost equal shares of severe 50 (5.4 %) and extremely severe 62 (6.6 %) injuries. Accordingly, the qualitative characteristics of such dominant injuries were variable and consisted of contusions of the brain of medium severity with open fractures of the skull, compression of the brain against the background of non-severe

contusions, severe contusions of the brain with the upper parts of the trunk injuries.

CEG-5 of extremely severe neurosurgical profile was the least numerous – 72 (7.7 %) cases and consisted exclusively of extremely severe injuries, the qualitative characteristic of which was the presence of: severe brain injuries with damage to the upper or lower parts of the brain stem; crushing of the brain against the background of severe slaughter.

The leading cause of death in randomized CEGs, according to the act of forensic medical examination, is presented in the table 3.

*Table 3*

**Distribution of the leading cause of death in clinical and epidemiological groups (data acquired from doctoral thesis «Thoracoabdominal polytrauma with dominating chest injury» by Serhii I. Panasenko)**

| Leading cause of death | Clinical and epidemiological group (cluster) | | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | | | |
| | abs | % | abs | % | abs | % | abs | % | abs | % | abs | % |
| Visceral combined trauma | 28 | 3,0 | 20 | 2,1 | 46 | 4,9 | - | - | 2 | 0,2 | 96 | 10,3 |
| Skeletal trauma | 18 | 1,9 | 100 | 10,7 | 6 | 0,6 | 4 | 0,4 | - | - | 128 | 13,7 |
| Skeletal and visceral trauma | 44 | 4,7 | 64 | 6,9 | 59 | 6,3 | 2 | 0,2 | 4 | 0,4 | 173 | 18,5 |
| Chest trauma | 38 | 4,1 | 48 | 5,1 | 14 | 1,5 | - | - | - | - | 100 | 10,7 |
| Abdominal trauma | 4 | 0,4 | 30 | 3,2 | 18 | 1,9 | - | - | 2 | 0,2 | 54 | 5,8 |
| Limb trauma | 4 | 0,4 | 10 | 1,1 | - | - | - | - | - | - | 14 | 1,5 |
| Trauma to the pelvis | 2 | 0,2 | 24 | 2,6 | 2 | 0,2 | - | - | - | - | 28 | 3,0 |
| Spinal trauma | - | - | 12 | 1,3 | - | - | 4 | 0,4 | 6 | 0,6 | 22 | 2,4 |
| Head trauma | 34 | 3,6 | 118 | 12,6 | 6 | 0,6 | 102 | 10,9 | 58 | 6,2 | 318 | 34,1 |
| Total | 172 | 18,4 | 426 | 45,7 | 151 | 16,2 | 112 | 12,0 | 72 | 7,7 | 933 | 100,0 |

Note: $\chi^2$-19,157; w – 0,479; p – 0,014.

Analysis of the data represented in table 3 showed that the distribution of patients by the leading cause of death in randomized CEGs among patients who died is weakly consistent, and the revealed patterns are statistically significant ($p<0.05$).

In CEG-1 of extremely severe thoracic profile, the most common cause of death was combined skeletal and visceral injury – 4.7 %, chest trauma – 4.1 %, head injuries – 3.6 %, visceral injury – 3.0 %, skeletal trauma – 1.9 %. Other causes of death accounted for less than 1 % of cases.

In CEG-2 of severe thoracic profile, the most common cause of death was head injuries – 12.6 %, skeletal trauma – 10.7 %, combined skeletal and visceral injuries – 6.9 %, chest trauma – 5.1 %, abdominal trauma – 3.2 %, pelvic injury – 2.6 %, visceral injury – 2.1 %, spinal injuries – 1.3 %, limb injuries – 1.1 %.

In CEG-3 of extremely severe abdominal profile, the most common cause of death was abdominal injury – 1.9 %, combined skeletal and visceral trauma – 6.3 %, combined visceral injuries – 4.9 %, chest trauma – 1.5 %. Other causes of death in this CEG accounted for less than 1 % of cases.

The most frequent cause of death in CEG-4 of severe neurosurgical profile was head injury – 10.9 %, other causes of death in this CEG accounted for less than 1 % of cases.

Similarly, in CEG-5 with an extremely severe neurosurgical profile, head injuries were recognized as the most frequent cause of death – 6.2 %, and other causes of death in this CEG accounted for less than 1 % of cases.

According to forensic medical conclusions, 965 cases of various infectious – 136 (14.1 %) and non-infectious – 829 (85.9 %) complications have been recorded, which contributed to the fatal outcome (table 4).

Analysis of the data presented in table 4 showed that the distribution of patients by types of complications that contributed to the fatal outcome in randomized CEGs among patients who died is fully consistent, and the revealed patterns are statistically reliable ($p<0,05$).

*Table 4*

**Distribution of complications that contributed to the fatal outcome in clinical and epidemiological groups (data acquired from doctoral thesis «Thoracoabdominal polytrauma with dominating chest injury» by Serhii I. Panasenko)**

| Clinical and epidemiological group (cluster) | Nature of complications | | | | Total | |
|---|---|---|---|---|---|---|
| | infectious | | non-infectious | | | |
| | abs. | % | abs. | % | abs. | % |
| 1 | 20 | 2,1 | 152 | 15,8 | 172 | 17,8 |
| 2* | 94 | 9,7 | 361 | 37,4 | 455 | 47,2 |
| 3** | 22 | 2,3 | 132 | 13,7 | 154 | 16,0 |
| 4 | - | - | 112 | 11,6 | 112 | 11,6 |
| 5 | - | - | 72 | 7,5 | 72 | 7,5 |
| Total | 136 | 14,1 | 829 | 85,9 | 965 | 100,0 |

Note[1]: * – simultaneous infectious and non-infectious complications occurred in 29 patients; ** – simultaneous infectious and non-infectious complications occurred in 3 patients.
Note[2]: $\chi^2$-5,000; w – 1,000; p – 0,025.

Infectious complications that contributed to the fatal outcome were most often diagnosed in CEG-2 of a severe thoracic profile – 9.7 %, in CEG-3 of an extremely severe abdominal profile – 2.3 %, and in CEG-1 of an extremely severe thoracic profile – 2,1 %. In other CEGs, infectious complications did not have a significant impact on the resulting fatal outcome.

Infectious complications and their combinations contributing to the fatal outcome had a significant variability of manifestations. A total of 248 infectious complications contributing to the fatal outcome were recorded: mono- and multi-organ dysfunction and insufficiency against the background of septic processes – 57 (23.0 %), pneumonia – 49 (19.8 %), peritonitis – 34 (13.7 %), pneumonia with lung abscess – 27 (10.9 %), meningitis/encephalitis/ ventriculitis – 21 (8.5 %), hematoma suppuration – 18 (7.3 %), sepsis – 17 (6.9 %), pleurisy – 11 (4.4 %), myocarditis – 5 (2.0 %), apostematous nephritis – 4 (1.6 %), intestinal obstruction – 3 (1.2 %), eventration – 2 (0.8 %).

Non-infectious complications that contributed to the fatal outcome had a significant impact on the result in all CEGs and were most often diagnosed in CEG-2 of a severe thoracic profile – 37.4 %, CEG-1 of an extremely severe thoracic profile – 15.8 %, CEG-3 of an extremely severe abdominal profile – 13.7 %, CEG-4 of a severe neurosurgical profile – 11.6 %, CEG-5 of an extremely severe neurosurgical profile – 7.5 %.

Non-infectious complications and their combinations that contributed to the fatal outcome had a rather wide range of manifestations. A total of 1,071 non-infectious complications contributing to the fatal outcome were recorded: blood loss – 395 (36.9 %), shock – 253 (23.6 %), cerebral edema – 203 (19.0 %), brain entrapment – 143 (13 .4 %), fat embolism – 23 (2.1 %), pulmonary embolism – 13 (1.2 %), brain stem damage – 12 (1.1 %), spinal cord edema – 11 (1.0 %), vein thrombosis of the lower extremities – 7 (0.7 %), disseminated intravascular coagulation syndrome – 5 (0.5 %), stress ulcers – 3 (0.3 %), marantic thrombus – 2 (0.2 %), myocardial infarction – 1 (0.1 %).

It should be noted that CEG-2 of severe thoracic profile and CEG-3 of extremely severe abdominal profile are characterized by the simultaneous presence of infectious and non-infectious complications that contribute to a fatal outcome.

## DISCUSSION

From an epidemiological point of view, polytrauma is a severe injury of more than one anatomical and functional area. From a clinical point of view, polytrauma has a broader interpretation and is defined as a severe, combined, and multiple injury leading to shock. Sometimes polytrauma is determined by the morphological component of TS, namely, the severity of injury. The discrepancy between the severity of injuries and the severity of the patient's condition is considered a key clinical feature as a functional component of TS. The generally accepted opinion in clinical epidemiology is that the clinical interpretation of the term «polytrauma» makes it impossible or significantly difficult to work correctly with trauma banks and trauma registries. Modern Euro-Atlantic clinical and epidemiological studies are based on work with trauma banks and trauma registries, while in Ukraine similar practice is limited to the creation of small and narrowly profiled clinical and epidemiological arrays. Similar studies (case-control) with small samples have a low level of evidence [3,5-7]. In the structure of fatal cases of BCT, according to morphological criteria, 507 (54.3 %) cases of polytrauma structured into four clinical and morphological groups were identified.

The key theoretical and methodological premise of the clinical and epidemiological study was the denial of any a priori probability of the hierarchical structure of BCT. The main task of the study was to select those CEGs that best approximate the internal separation processes of modern BCT depending on the TS of individual

anatomical and functional areas. To identify the most important factors affecting this process, a multidimensional classification of TS data of all cases of BCT was carried out by clustering. Cluster analysis is a method of classification analysis, its main purpose is to divide the set of studied objects and features into homogeneous groups or clusters. This is a multidimensional statistical method, which assumes that the set of data being investigated can be characterized by a significant volume. In that case, both the number of research objects (observations) and the characteristics that identify these objects can be significantly large. Clusters are groups of homogeneity, so the task of cluster analysis is to divide their set into m (m is an integer) clusters based on the features of objects so that each object belongs to only one group. At the same time, objects belonging to one cluster should be homogeneous (similar) and objects belonging to different clusters should be heterogeneous. The application of software clustering without the participation of the operator (researcher) in the separation of CEG indicates their randomness and the subsequent clinical and epidemiological study was carried out according to the principles of evidence-based medicine [8, 9].

The most subjective factor investigated in the analysis of fatal cases of BCT is the leading causes of death determined by forensic medical experts. To date, we do not have any confirmation that forensic medical experts are guided in their work by any systems of objectification of TS in general and by determination of dominant, competing, and accompanying injuries in particular. Evidence of the subjectivity of the expert approach is the weak consistency (w-0.479) of the indicators of the distribution of patients by the leading cause of death in randomized CEGs.

The most frequent leading cause of death recognized by forensic medical experts was head injury – 318 (34.1 %). Among other CEGs, as the leading cause of death, head injury occurred most often in the group of severe thoracic profile – 118 (12.6 %) and severe skull trauma profile – 102 (10.9 %) cases, respectively.

Skeletal and visceral injury was recognized by forensic medical experts as the leading cause of death in 173 (18.5 %) cases, mainly in the groups with extremely severe thoracic profile – 44 (4.7 %), severe thoracic profile – 64 (6.9 %), extremely severe abdominal profile – 59 (6.3 %) cases, respectively.

Skeletal injury was recognized as the leading cause of death in 128 (13.7 %) cases by forensic medical experts, mainly in the group of severe thoracic profile – 100 (10.7 %) cases, respectively.

Forensic experts recognized chest injury as the leading cause of death in 100 (10.7 %) cases, exclusively in the group of extremely severe thoracic profile – 38 (4.1 %), severe thoracic profile – 48 (5.1 %), extremely severe abdominal profile – 14 (1.5 %) cases, respectively.

Visceral combined trauma was recognized by forensic medical experts as the leading cause of death in 96 (10.3 %) cases, mainly in the group of extremely severe thoracic profile – 28 (3.0 %), severe thoracic profile – 20 (2.1 %), extremely severe abdominal profile – 46 (4.9 %) cases, respectively.

Other leading causes of death accounted for a total of 188 (12.7 %) cases, which were relatively evenly distributed among all CEGs.

In CEG-1 of an extremely severe thoracic profile, all forensic causes of death occurred relatively evenly. In CEG-2 of a severe thoracic profile, the leading causes of death were head injuries – 118 (12.6 %) and skeletal injuries – 100 (10.7 %) cases, respectively. In CEG-3 of an extremely severe abdominal profile, the leading causes of death were skeletal and visceral – 59 (6.3 %) and visceral combined injuries – 46 (4.9 %). In CEG-4 of the severe cranial profile, head injuries were the leading cause of death more often than others – 102 (10.9 %) cases. In CEG-5 of an extremely severe cranial profile, head injuries absolutely dominated as the leading cause of death – 58 (6.2 %) cases.

In general, non-infectious complications occurred six times more often than infectious ones, mainly in CEG-2 of a severe thoracic profile – 361 (37.4 %). Infectious complications that contributed to the fatal outcome occurred exclusively in the CEGs of the thoracic and abdominal profile.

## CONCLUSIONS

1. Lethal BCT has a clear hierarchical structure according to the indicators of TS and the presence of a dominant lesion of the corresponding anatomical and functional area, which allows to distinguish the CEG of thoracic, abdominal and neurosurgical clinical and morphological profiles, among which 54.3 % of cases are polytrauma.

2. The leading causes of death established at the expert level in CEG with extremely severe dominant injuries coincided with the clinical and morphological profile of the group, which indicates the need to find new technological approaches to the treatment of extremely severe injuries to reduce mortality in polytrauma.

3. The leading causes of death established at the expert level in CEG with severe dominant injuries did not coincide with the clinical and morphological profile of the group, which indicates the need to find new technological approaches to the treatment and prevention of the development of complications of severe injuries to reduce mortality in BCT.

***Perspectives for future studies.*** According to the results obtained in the current study, the need to conduct a clinical audit of treatment tactics for its suitability to prevent fatalities in accordance with the established

leading causes of death in BCT and polytrauma has been objectified.

## COMPLIANCE WITH ETHICAL REQUIREMENTS

The study was conducted in accordance with the main provisions and Rules of humane treatment of patients in accordance with the requirements of the Tokyo Declaration of the World Medical Association, the International Recommendations of the Helsinki Declaration on Human Rights, the Council of Europe Convention on Human Rights and Biomedicine, the Laws of Ukraine, the orders of the Ministry of Health of Ukraine and the requirements of the Medical Code of Ethics of Ukraine.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## *Резюме*

### АНАЛІЗ ЛЕТАЛЬНОСТІ ПРИ ТУПІЙ ПОЄДНАНІЙ ТРАВМІ І ПОЛІТРАВМІ

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**Вступ.** Відповідно класифікаційних критеріїв клінічної епідеміології, сучасний травматизм варто розглядати у якості глобальної пандемії. Важливими факторами, що визначають глобальну клініко-епідеміологічну картину виступають транспортний травматизм у індустріалізованих країнах, низька розповсюдженість профілактичних заходів всіх видів травматизму в країнах, що розвиваються, і прогресивне збільшення кількості збройних конфліктів.
**Мета дослідження.** Провести порівняльний клініко-епідеміологічний аналіз летальності при тупій поєднаній травмі і політравмі.
**Матеріали та методи.** Проведено ретроспективне одноцентрове когортне 10-річне клініко-епідеміологічне дослідження 933 летальних клінічних випадків тупої поєднаної травми у відділенні політравми Київської міської клінічної лікарні швидкої медичної допомоги. Клінічні діагнози та судово-медичні висновки трансформовано у коди шкали Hannover Polytrauma Score. Клініко-епідеміологічний експеримент полягав у кластерізації масиву дослідження за показниками тяжкості травми.
**Результати.** В результаті клініко-епідеміологічного експерименту було отримано 5 стійких кластерів, які можна характеризувати як окремі рандомізовані клініко-епідеміологічні групи. Клінічний профіль груп визначався домінуючою травмою: кластер-1 (постраждалі украй тяжкого торакального профілю), кластер-2 (постраждалі тяжкого торакального профілю), кластер-3 (постраждалі украй тяжкого абдомінального профілю), кластер-4 (постраждалі тяжкого нейрохірургічного профілю), кластер-5 (постраждалі украй тяжкого нейрохірургічного профілю).
**Висновки.** Летальна тупа поєднана травма має чітку ієрархічну структурність за показниками тяжкості травми та наявністю домінуючого ушкодження відповідної анатомо-функціональної ділянки. Результати, отримані в ході поточного дослідження свідчать про необхідність пошуку нових технологічних підходів щодо лікування украй тяжких травм, також лікування та попередження розвитку ускладнень тяжких травм для зниження летальності при політравмі.

*Ключові слова:* **летальність, поєднана травма, політравма, клінічна епідеміологія, кластерний аналіз**