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Forensic Medical Assessment of Thanatogenesis in the Experience of Gunshot Injuries

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ABSTRACT

Gunshot injury remains relevant at the present time and requires serious study. During the examination of a gunshot injury, it is necessary to answer the investigator's questions about the cause of death, the type and rate of thanatogenesis, the distance of the shot, the sequence and mechanism of damage formation, and the severity of the injury. The aim of the study was to determine the type of thanatogenesis in death from various types of gunshot injuries. Standard methods of sectional research, forensic histological methods, morphological and statistical analysis, supplemented with semi-quantitative technologies of thanatogenetic analysis were used in the study. The material for this study was 85 cases of death from gunshot injuries, which was distributed by gender, age, location of the injury, type and rate of thanatogenesis, type of gunshot injury (bullet and shotgun wounds), the distance of the shot and the duration of hospital stay.

KEY WORDS Type of thanatogenesis, gunshot injury, Post-traumatic period, Momentum of death, Cause of death

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INTRODUCTION

Gunshot injuries account for the smallest proportion of violent deaths. Examination of a gunshot injury has certain features, is complex and not always well studied. Great attention should be paid to the specifics and severity of the gunshot injury [1,2].

During the examination of a gunshot injury, it is necessary to answer the investigator's questions about the cause of death, the type and rate of thanatogenesis, the distance of the shot, the sequence and mechanism of damage formation, and the severity of the injury [3-7].

The aim of the study is to determine thanatogenesis as a result of death from various types of gunshot injuries.

MATERIALS AND METHODS

The study used standard methods of sectional research, forensic histological methods, morphological and statistical analysis, supplemented by semi-quantitative technologies of thanatogenetic analysis.

The material for this study was cases of death from gunshot injuries from various types of weapons. This group is made up of 85 observations.

The material was distributed by gender, age, injury localization, type and rate of thanatogenesis, type of gunshot injury (bullet and shotgun wounds), distance of the shot, and duration of hospital stay.

RESULTS AND DISCUSSION

We examined the materials of 85 victims who died as a result of gunshot injuries under various circumstances.

By gender, the material was distributed as follows: Men–77 (90.6%), women–8 (9.4%). In the age aspect, the following indicators were noted: under 19 years – 2 (2.4%), 20-29 years–21 (24.7%), 30-39 years–22 (25.9%), 40-49 years–23 (27.1%), 50-59 years-12 (14.1%), 60-69 years–5 (5.9%). Alcoholemia was observed in 26 cases, which corresponds to 30.6%. A forensic chemical blood test for the presence of ethyl alcohol was not performed In 11 (12.9%) cases, since death occurred in a hospital with duration of hospitalization of more than 1 day. Out of 26 (30.6%) studies, mild alcohol intoxication was observed in 8 (9.4%) cases, average–9 (10.6%) cases, high–4 (4.7%) cases, and severe–5 (5.9%) cases. Shotguns were used in 37 (43.5%) cases, while bullets were used in 48 (56.5%) cases. When studying the close-range shot following data were obtained when the shot was noted in 30 (35.3 %), within the scope of the additional factors of a shot–48 (56,5%), outside the scope of the additional factors shots–7 (8,2%). According to the localization of the injury, the material was distributed as follows: isolated gunshot injury was observed in 51 (60.0%) cases, concomitant injury-in 33 (38.8%), combined injury-in 1 (1.2%) case, where a combination of both gunshot and stab injuries was established.

21 victims out of the 85 cases of gunshot cases died in the hospital at various times of the hospital period. We used the following time periods: the period of 1 day, 2-3 days, 4-7 days, more than 7 days. 9 (10.6%) victims were observed during the 1st day, 3 (3.5%) on the 2nd-3rd day, 3 (3.5%) on the 4th–7th day, and 6 (7.1%) on more than 7 days. Studying thanatogenesis in gunshot injuries, it was found that the combined type prevailed, which made up 62 observations, corresponding to 72.9%, and the isolated type – 23 (27.1%) (Table 1).

Table 1: Variants of thanatogenesis in gunshot injuries.

Type of thanatogenesis	Ab	%
Cerebral	20	23.5
Cardiac	1	2.4
Pulmonary	2	1.2
Pulmonary+cardiac	11	12.9
Cerebral+cardiac	6	7.1
Cerebral+pulmonary	18	21.2
Cerebral+cardiac+pulmonary	27	31.8
Total	85	100

The thanatogenetic analysis revealed the predominance of the combined type of thanatogenesis, which was represented by a combination of three components (cerebral+cardiac+pulmonary), which accounted for 27 (31.8%) of observations. The combination of cerebral, cardiac, and pulmonary components was manifested by the presence of perivascular and recellular edema of the brain, neuronal ischemia, neurocyte lysis, neurocyte karyolitic, neurocyte gliosis, and neuron swelling. The pulmonary component of this type of thanatogenesis was manifested by ARDS (hyaline membranes and fibrin), pulmonary edema, pneumonia, bronchial spasm, atelectasis, and emphysema. The cardiac component of this type was manifested by fragmentation, cytolysis of cardiomyocytes, tortuosity of cardiomyocytes, karyolitic, hypertrophy, and contracture injuries. Among the isolated type of thanatogenesis, the cerebral component of 20 (23.5%) observations prevailed. The cerebral type of thanatogenesis was accompanied by destructive and cellular edema of the brain, haemorrhages under the membranes and substance of the brain, neuronal ischemia, lysis, karyolitic and gliosis of neurocyte, and swelling of neurons with gross destruction of the brain substance, as well as with damage to the skull bones. The described type of thanatogenesis is explained by localization of injuries or massive blood loss leading to cerebral edema in this group [8-10].

Table 2: Variants of the momentum of death from gunshot injuries.

Variant of the momentum of death	Ab	%
Fulminant (15-30 minutes)	41	48.2
Fast (30 to 2 hours)	28	32.9
Average (more than 2 to 6 hours)	4	4.7
Slow (more than 6 to 12 hours)	2	2.4
Long-term (more than 12 hours)	10	11.8
Total	85	100

When studying the momentum of death, we obtained the following distributions, which revealed the prevailing lightning-fast rate of death, which was characterized by an agonal period not exceeding 15-30 minutes, which corresponded to 41 (48.2%) cases [11].

As an example, we present the observation of an isolated type of thanatogenesis, which is represented by the brain component.

The body of Mr. H., 43 years old, was found near the cafe "Dream****". At the time of examination of the scene, the corpse is located on the front surface of the body; arms spread out to the sides, slightly stretched up, legs stretched out. Clothes on the corpse: a cotton jacket, gray, contains brown blots in the upper sections of the item; knitted T-shirt, black, contains similar blots mainly in the collar area; blue jeans; knitted panties, black; knitted socks, black. According to the degree of development of early post-mortem changes, death had occurred about 2-4 hours before the start of the examination. In the occipital region of the head, a wound is detected; the skin and hair are contaminated with brain matter and liquid blood. After an examination of the crime scene, the body was sent for medical forensic examination.

An external examination of the corpse found that the post-mortem changes correspond to the first day after death. The corpse of a man of the correct constitution, satisfactory nutrition. Body height is 178 cm. The hair on the head, in the occipital region, is profusely stained with dark red liquid blood with an overlay of gray brain detritus. The hair on the head is black with a single gray, straight, up to 4 cm long. In the frontal area on the left, an unevenly expressed abrasion, irregular oval shape, 3x2 cm in size, oriented from bottom to top, from left to right, located 4.5 cm from the conditional median line of the face and 4 cm from the left brow arch. In the frontal area on the left, immediately above the left brow arch, there is an irregular oval abrasion, 1.5x1.0 cm, oriented longitudinally, located 5 cm from the conditional median line of the face. In the eyelids of the right eye, mainly in the lower eyelid, with a spread to the right half of the nose and the right zygomatic region, on a 6x3 cm section oriented longitudinally, multiple wounds are discernible, with the edges of the linear shape reduced, from 0.2 cm to 0.4 cm long. Their ends are sharp, the edges are relatively smooth, comparable, and have no abrasions. In the inner corner of the right eye wound, when the edges of the linear length of 0.6 cm, focused on the numbers 1 and 7 hours conditional dial in the lower eyelid of the right eye wound, when the edges of the linear length of 1.0 cm, oriented transversely. The ends of the above-described wounds are sharp; the edges are uneven, wavy, have no abrasions; the walls are uneven, soaked in blood. The lumen of these wounds contains soft tissues and damaged skull bones. The remaining wounds are superficial, 0.1 cm deep, and in the nose area, wounds of the type of cracking, up to 0.1 cm deep; in their lumen, deep layers of skin and subcutaneous fat. The lower edge of the above-described area is located 165 cm from the level of the plantar surface of the right foot. In the occipital region of the scalp, in the projection of the top of the occipital protuberance, there is an extensive wound with a defect "minus tissue" of an irregular oval shape,3, 3x2, 5 cm, oriented longitudinally. The lower pole of the edge of this defect is located 173 cm from the level of the plantar surface of the left foot. The edge of the defect is uneven, wavy, with discernible breaks oriented on numbers 12, 2, 3, 4, 7, 8, 11 conventional watch face, length from 0.2 cm to 0.5 cm. The edge of the defect is unevenly aligned throughout the entire width from 0.1 cm to 0.3 cm. Minor defects are visible around the defect: right 0.4 cm in diameter located at a distance of 0.4 cm; diameter 0.4 cm, located at a distance of 0.3 cm from the large defect; bottom, 0.3 cm in diameter, located at a distance of 0.2 cm from extensive defect; 0.4 cm in diameter, situated at a distance of 1.5 cm from the primary defect; 0.4 cm in diameter, located at a distance of 0.8 cm from extensive defect; left, 0.4 cm in diameter, located at a distance of 0.2 cm from an extensive defect. The properties and nature of these defects resemble those described above; their edges are aligned to a width of 0.2 cm to 0.3 cm, throughout. The bruise described above is bluish-red, with indistinct contours, without soft tissue swelling. The surface of the above-described abrasions is red-brown, dried, sinking, without a characteristic pattern and flaps of detached epidermis. The thickness of the bones on the cut: frontal–0.9 cm, temporal–0.5 cm, parietal – 0.6 cm, occipital–0.6 cm. In the soft tissues of the head in the occipital region, there is an extensive dark red haemorrhage of an irregular oval shape, 10x7 cm, oriented longitudinally. Blood permeates the skin-Apo neurotic flap to its entire thickness. In the centre of the haemorrhage is the above-described defect on the skin. The walls of this defect are dyed in a light red color. There is a defect of the occipital bone at the top of the occipital protuberance 3.5 cm in diameter, from it there are multiple lines of fractures that spread in different directions, sometimes combine with each other to form many fragments of various shapes and sizes, which are held by the underlying soft tissues. These lines of fractures in their course damage the base of the skull throughout, in all cranial pits. At the bottom of the defect, multiple fragments of the bones of the arch, the base of the skull and the facial skeleton, flaps of the dura mater, fragments of the crushed substance of the brain and partially preserved brain, and foreign objects made of white metal (shot) are detected. There are multiple cracks forming bone fragments of various shapes and sizes. The parietal, occipital, temporal, frontal, sphenoid, and latticed bones are damaged. Intense haemorrhage in the ligaments and muscles of the atlanto-occipital joint. The large occipital foramen is not damaged. There are intense haemorrhages in the fat tissue of the orbits. Multiple fractures of the bones of the facial skull are determined. Bones are damaged, shattered. The right zygotic bone is fragmented, easily mobile, and sinks into the thickness of soft tissues. The left zygotic bone is intact. The bones of the nose are shattered. The resulting bone fragments are held by soft tissues, are poorly comparable with each other, and some of them are missing. The soft tissues of the face at the level of fractures are soaked with blood. The maxillary sinuses and other sinuses of the facial skull are filled with blood. The upper jaw is mobile, easily shifted to the sides. The dura mater is preserved over the preserved part of the brain; pale gray, smooth, shiny, not tense, in places tightly soldered to the bones of the cranial vault, in the sinuses of its dark red liquid blood. The soft brain membranes at the level of crushing are preserved as separate small flaps of gray-red color. The pattern of sulcus and convolutions at the level of crushing is not distinguishable. In the substance of the brain at this level, multiple gray-red, pinpoint hemorrhages are discernible, spreading in the form of a wedge directed by the base to the occipital lobes. In the posterior part of the large hemispheres of the brain, at the level of crushing, the lateral ventricles filled with dark red blood are distinguishable, as well as poorly distinguishable subcortical nuclei. On the preserved part of the brain, the soft meninges are pale gray, translucent, and moderately full-blooded. The wound channel is directed from the back to the front, from left to right and somewhat from top to bottom. This wound channel communicates with the wounds of the right eyelid. A fragment of gray plastic resembling a wad container was found. On the basal surface of the preserved part of the brain, under the soft meninges,

there is a dark red haemorrhage of an irregular oval shape, 14x11 cm, oriented longitudinally. The blood spreads to the bottom of the furrows and covers 1/3 of the height of the convolutions. The soft meninges are intact at this level. The pattern of furrows and convolutions is somewhat smoothed and flattened. There are no haemorrhages in the brain substance at this level. For the rest of the length, the pattern of furrows and convolutions is expressed satisfactorily.

During the forensic histological examination of the brain substance, it was found that areas with a lost modified structure with perifocal infiltration by a few red blood cells and the imposition of micro particles of bone fragments are determined. Pronounced perivascular and pericellular edema of the substance. Focal venous paresis, with their fullness with perivascular exudation of red blood cells. Burned-out neurons: cell-shading, shrinkage and loss of neurons, neuronophagia.

During the forensic histological examination of soft tissues from the wound area, it was found that infiltrating hemorrhages consisting of contoured, partially sludged red blood cells with an admixture of single white blood cells, edema of myocytes are detected; vessels are spasmodic, mainly anaemic.

Thus, the death of Mr. H., 43 years old, came from gunshot blast wounds to the head with injuries of bones of vault and base of the skull and right zygotic, maxilla and nasal bone, shells and substances of the brain, crush the big hemispheres of a brain is accompanied by focal-diffuse subarachnoid hemorrhage to the basal surface preserved brain and haemorrhages in the soft tissue of the occipital region and face.

This morphological picture corresponded to the brain type of thanatogenesis. The momentum of death is lightning fast.

CONCLUSION

The results of the study showed that the largest number of victims of gunshot injuries were men–77 (90.6%), in the age group of 40-49 years–23 (27.1%). Alcoholemia was observed in 26 (30.6%) cases. Based on this indicator, the prevalence of the average degree of alcohol intoxication was revealed–9 (10.6%). Assessing the morphology of the injury, the prevalence of isolated injuries was revealed–51 (60.0%). Among the types of firearms, the largest number of injuries was caused from a bullet weapon–48 (56.5%). The highest number of deaths occurred at the scene–64 (75.3), due to the severity of the victim's condition. The number of victims who died during the hospital period during various periods of stay was 21 (24.7%), with 10 (11.8%) fatalities prevailing on the first day.

Evaluating the variants of the course of thanatogenesis in gunshot injuries, it was found that the combined type prevailed in 62 (72.9%) cases. The combined type included markers of three components of the cerebral, cardiac and pulmonary, which were manifested by the corresponding morphological features.

Studying the momentum of death, it was found that the predominance of fulminant, which was characterized by an agonal period of no more than 15-30 minutes, which corresponded to 41 (48.2%).

The data obtained confirm the relevance of the study of forensic medical examination of gunshot injuries. It is important to note that it is promising to use new research methods to analyze such observations.

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CONFLICT OF INTEREST

Authors declare no conflict of interests.

REFERENCES

1. Zbrueva YV, Bogomolov DV, Putintsev VA. A case of death as the result of firing from self-made firearms. Systematic Rev Pharm 2020; 11:6-8.
2. Hohlov VV. Forensic medicine. Leadership. 3rd Edn. 2010; 92.
3. Dzhuvalyakov PG, Bogomolov DV, Zbrueva Yu V, Kabakova SS. Thanatogenetic analysis in pathology and forensic medicine. Lambert Academic Publishing 2017; 52.
4. Den'kovskij A.R. Essays on the pathological anatomy of a gunshot wound. Moscow: Medicine 1969; 64.
5. Makarov I. The use of a histological method in the study of gunshot injury. Forensic Med 2018; 1:76-77.
6. Makarov I.On the possibilities of identifying signs of thermal impact of shot factors during the formation of gunshot wounds. Forensic Medical Examination 2018; 61:57-61.
7. Makarov I. Some modern methods for diagnosing gunshot injuries. Forensic Med Examination 2019; 62:55-61.
8. Masljakov VV. Immediate and long-term results of treatment of patients with gunshot wounds to the abdomen. Basic Res Med Sci 2013; 7:339-343.
9. Putincev VA. Stages of development of distress syndrome as markers of the rate of dying. 2016; 1:35-37.
10. Truhan A.P. Morphological features of the wound channel of a gunshot wound. Military Med 2015; 3:90-91.
11. Putincev V.A. Morphological signs of various rates of death. General Reanimatol 2018; 4:35-43.