

## HEALTH DAMAGE ASSESSMENT IN VICTIMS OF NON-LETHAL KINETIC WEAPONS

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**Abstract.** The aim of the study was to assess the severity of health damage in victims of self-defense non-lethal kinetic weapons.

**Materials and research methods.** The medical records (form 003/u) of 67 victims of NKO who received medical care in the Arkhangelsk Regional Clinical Hospital in 2009-2019 were studied.

The degree of health damage severity was assessed according to the method approved by the order of the Russian Ministry of Health and Social Development of April 24, 2008 № 194n. For multiple and combined injuries the degree of severity of the injury was determined according to the criterion which corresponded to a higher degree of severity. Quantitative (mean values) and categorical (extensive values) variables were used for statistical analysis. Boundaries of their 95% confidence intervals (CI) were calculated using the WinPepi program.

**Results of the study and their analysis.** Analysis of the study results showed:

- The damage to health of severe and moderate severity was detected in 34.3% of the victims with predominant wounds to head, neck, chest, and abdomen;
- In chest wounds, including those without penetrating wound channel, CT scanning is indicated from one to three days to diagnose lung contusion, which is not reliably visualized on an overview radiograph;
- In nonpenetrating abdominal wounds, damage to internal organs due to hydrodynamic shock is not excluded. In this case it is necessary to hospitalize victims for one or three days for clinical observation and ultrasound control. In doubtful cases diagnostic videolaparoscopy should be performed.

**Key words:** damage to health, non-lethal kinetic weapons, victims

**Conflict of interest.** The authors declare no conflict of interest

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## ОЦЕНКА ВРЕДА ЗДОРОВЬЮ У ПОСТРАДАВШИХ ОТ ПРИМЕНЕНИЯ НЕЛЕТАЛЬНОГО КИНЕТИЧЕСКОГО ОРУЖИЯ

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**Резюме.** Цель исследования – оценить степень тяжести вреда здоровью у пострадавших от применения нелетального кинетического оружия (НКО) самообороны.

**Материалы и методы исследования.** Материалом исследования были медицинские карты (ф. 003/у) 67 пострадавших от НКО, получивших медицинскую помощь в Архангельской областной клинической больнице в 2009–2019 гг.

Степень тяжести вреда здоровью оценивалась по методике, утвержденной приказом Минздравсоцразвития России от 24 апреля 2008 г. №194н. При множественных и сочетанных ранениях степень тяжести вреда здоровью определяли по критерию, который соответствует более высокой степени тяжести.

Для статистического анализа использовались количественные (средние величины) и категориальные (экстенсивные величины) переменные. По программе WinPepi были рассчитаны границы их 95%-ных доверительных интервалов (ДИ).

**Результаты исследования и их анализ.** Анализ результатов исследования показал:

- вред здоровью тяжелой и средней степени тяжести был выявлен у 34,3% пострадавших с преимущественными ранениями в области головы, шеи, груди и живота;
- при ранениях в грудь, в том числе и при отсутствии проникающего характера раневого канала, показано выполнение компьютерной томографии в срок от одних до трёх суток для диагностики ушиба легкого, который на обзорной рентгенограмме достоверно не визуализируется;
- при непроникающих ранениях живота не исключается повреждение внутренних органов вследствие гидродинамического удара. При этом необходима госпитализация пострадавших на одни–трие суток для клиническо-

го наблюдения и ультразвукового контроля. В сомнительных случаях следует выполнить диагностическую видеолапароскопию.

**Ключевые слова:** вред здоровью, нелетальное кинетическое оружие, пострадавшие

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### Introduction.

In 2010, President V. V. Putin submitted to the State Duma of the Federal Assembly of the Russian Federation a draft law No. 402489-5 "On introducing amendments to certain legislative acts of the Russian Federation on the issue of strengthening control in the sphere of circulation of civilian weapons". As stated in the explanatory note to the document, it was proposed to amend the Federal Law "On Weapons" No 150-FZ dated December 13, 1996. In particular, it was proposed to define a new category of weapons — limited firearms, including short-barrelled and targetless weapons. The mentioned category included pistols, revolvers and firearmsless firing devices, designed to defeat the human force at a distance with a projectile of traumatic effect and not intended to cause human death. The changes allowed to apply a unified procedure of circulation and unified measures of control of weapons and cartridges with high lethal characteristics. The amendments to the aforementioned law came into force on January 15, 2011.

Firearms of limited destruction are also called non-lethal kinetic weapons, designed for self-defense of civilians and fighting of special units of the Russian Ministry of Internal Affairs against criminals. At the same time, in most cases civilians use non-lethal kinetic weapons not as an effective means of protection, but as weapons of attack [1, 2]. Currently in Russia the number of owners of non-lethal kinetic weapons and the number of requests for medical assistance from victims of their use is increasing rapidly. In the first decade of the 21st century the number of injuries from these weapons increased 9-fold [2]. In 2016 alone, there were more than 591,000 applications for the purchase of civilian weapons, of which 550,000 were granted [3].

A shooting distance from non-lethal kinetic weapons of less than 1.0-1.5 m is considered life-threatening. In 2011, rubber bullets with a metal core (reinforcing element) in 18\*45T cartridges for Osa PB-4-1 and Guardian MR-461 pistols were banned in Russia due to their significant damaging effect. Modern cartridges of traumatic action, made of elastic rubber and plastisol, have a diameter of 10.0-10.2 mm, a mass of 0.7-0.73 g and an initial bullet flight speed of 300-450 m/s [1, 4]. The severity of injuries from wounding projectiles depends on the mechanical properties of the traumatic elements, the distance of the shot, the localization of the wound, the type of clothing (winter, summer), the muscle mass, the physique and the

physical condition of the victim. When wounds to the head, neck, cardiac area are made from a distance of less than one meter the risk of serious harm to health and death is possible. Life-threatening consequences of wounds received during the use of non-lethal kinetic weapons are profuse external and internal bleeding, asphyxia, acute impairment of cerebral circulation, air embolism [1, 5, 6].

Injuries resulting from the use of non-lethal kinetic weapons are a special kind of wounds that require unified algorithms for the management of the victims. A comprehensive approach is required to systematize and streamline the knowledge required in the provision of medical care to victims of non-lethal kinetic weapons use. At present, the following aspects of the problem of non-lethal kinetic weapons use have been sufficiently studied: medical and biological peculiarities of injuries and wound ballistics; criteria and structure of injuries caused by non-lethal kinetic weapons use, comparative analysis of the contingent of victims from firearms and traumatic weapons [7-9]. In addition, data on the severity of injury resulting from the use of non-lethal kinetic weapons was published [5]. However, to date, there is no detailed analysis of the problem of assessing the severity of injury to the health of victims from the use of non-lethal kinetic weapons in the specialized literature.

**The aim of the study** was to assess the severity of injury to the health of victims from the use of non-lethal kinetic self-defense weapons.

**Materials and methods of research.** The material of the research was 67 medical records (form 003/u) of the victims of non-lethal kinetic weapons who received medical care in the Arkhangelsk regional clinical hospital in 2009-2019. The following data were taken from the medical records: date of treatment, age and sex of the victim; severity of condition at the time of treatment; anatomical area of injury; type of projectile (rubber bullet, buckshot); nature of the wound channel; volume of medical care/operative intervention provided; date of patient discharge and outcome of illness.

The average age of the victims was 30.3 years (17-55 years). The following indicators were calculated according to the above data: distribution of the victims according to age, number of wounds in anatomical areas, localization and nature of a gunshot wound, and degree of severity of damage to health. The degree of the injury's severity was

estimated according to the method approved by the Order of the Ministry of Health and Social Development of Russia No. 194n, dated April 24, 2008 [10]. For multiple and combined wounds the degree of severity of the injury was determined according to the criterion that corresponds to a higher degree of severity [6].

Quantitative (mean values) and categorical (extensive values) variables were used for statistical analysis. Boundaries of their 95% confidence intervals (CI) were calculated using the WinPepi program.

**Results of the study and their analysis.** The research group included 67 victims (65 men and 2 women) aged 17-55 years (mean age — 30,3 years), who received 137 gunshot wounds with rubber bullets, mainly from pistol IZh-79-9TM ("Makarych"). Fifty-one victims (76.1%) were hospitalized (95% confidence interval: 64.1-86.7); duration of hospital treatment ranged from 5 to 19 days, with an average of 12 bed-days. There were no lethal outcomes.

The group of victims was stratified as follows.

According to the number and localization of wounds:

- single wound — 39 victims (58.2%) (95% confidence interval: 45.2-70.2);

- multiple and combined wounds — in 28 victims (41.8%) — (95% confidence interval: 29.8-54.5).

The number of wounds per victim ranged from 2 to 8.

Number of wounds by anatomical region: head — 9 victims (6.6%), neck — 8 (5.8%), spine — 2 (1.5%), chest — 58 (42.3%), abdomen — 22 (16.1%), pelvis and external genitalia — 3 (2.2%), extremities — 35 victims (25.5%).

According to the nature of the wounds:

- shot at point-blank range and close range — 30 wounds (21.6%) — (95% confidence interval: 11.3-35.3);

- blind wound channel 2-10 cm long — 127 (92.7%) — (95% confidence interval: 87.0-96.4)

- through wound (auricle, scrotum and forearm) — 3 (2.2%) — (95% confidence interval: 0.5-6.3)

- tangential wounds to various parts of the body — 7 (5.1%) — (95% confidence interval: 2.1-10.2)

- fracture of bones — 12 (17.9%) — (95% confidence interval: 9.6-29.2), of which cerebral and facial skull — 5 (41.7%) — (95% confidence interval: 15.2-72.3); ribs and sternum — 3 (25.0%) — (95% confidence interval: 5.5-57.2); spinous processes of thoracic vertebrae, 2 (16.7%), (95% confidence interval: 2.1-48.4); finger phalanx and ulna, 2 (16.7%), (95% confidence interval: 2.1-48.4).

The distribution according to the localization and pathomorphology of the injuries and the degree of injury is presented in Tables 1, 2.

All the victims underwent surgical treatment of soft tissue gunshot defects: lavage, extraction of foreign body if any, and primary surgical treatment of deep wound channels. Victims with severe injuries underwent surgical treatment and abdominal operations: skull trepanation, removal of bone fragments and brain detritus — 1, thoracotomy — 4 and video thoracoscopy — 1, laparotomy and video laparoscopy — 6.

During thoracic surgeries, atypical resection and suturing of the lung wound, suturing of the pericardium and diaphragm wounds, bullet and hemothorax removal were performed — 5. Hemostasis, suturing of wounds of ileum and greater omentum were performed during abdominal surgeries by laparoscopy and videolaparoscopy. Also in case of severe injury we performed: metal osteosynthesis of facial skeleton bones — one, ligation of the upper thyroid artery in a deep wound — one, orchiectomy — one.

Victims with moderate injury underwent various variants of medical procedures: sanation bronchofibroscopy, video laparoscopy, abdominal blood removal and endoscopic hemostasis, plaster immobilization of limb segments.

Cardiac and brachial nerve plexus contusions were treated according to cardiology and neurology clinical guidelines.

The annual increase in the number of non-lethal kinetic weapons in the population and, as a consequence, the increasing number of victims' applications for medical care prompted us to correlate the results of our study with the data of other authors.

In particular, the results we obtained for the gender and age structure of the victims, the data on the prevalence of mild degree of severity of injury are comparable with previously published data [2, 5]. In our study, chest wounds predominate by localization — 42.3%, in contrast to the results of a study by Badalov et al. in which the proportion of chest wounds was 21% and that of neck and head wounds — 51% [5]. Blind wound channels prevail in our study and in publications by other authors.

According to the same authors who performed an analysis of 297 protocols of the St. Petersburg City Bureau of Forensic Medical Examination for 2010-2014, grave damage to health occurred in 24% of the victims, medium — in

Таблица 1 / Table No. 1

**Распределение огнестрельных повреждений по локализации и степени вреда здоровью**  
Distribution of injuries from non-lethal kinetic weapons by degree of injury depending on localization

Локализация огнестрельных повреждений Wound localization	Количество ранений, абс./% (95% ДИ) Number of injuries, abs./% (95% CI)	Степень вреда здоровью, % (95% ДИ) Degree of injury, % (95% CI)		
		тяжелая severe	средняя moderate	легкая minor
Грудь / Chest	58/42,3 (33,9-51,1)	6,9 (1,9-16,7)	25,9 (15,3-39,0)	67,2 (53,7-79,0)
Конечности / Limbs	35/25,6 (18,5-33,7)	-	5,7 (7,0-19,2)	94,3 (80,8-99,3)
Живот, таз, наружные половые органы / Abdomen, pelvis, external genitalia	25/8,2 (12,2-25,7)	24,0 (9,4-45,1)	16,0 (4,5-36,1)	60,0 (38,7-78,9)
Голова и шея / Head and neck	17/12,4 (7,4-19,1)	17,6 (3,8-43,4)	41,2 (18,4-67,1)	41,2 (18,4-67,1)
Позвоночник / Spine	2/1,5 (0,2-5,2)	-	100 (15,8-100,0)	-
Всего / Total	137/100,0	9,5 (5,1-15,7)	21,9 (15,3-29,8)	68,6 (60,1-76,3)

**Распределение пострадавших по степени вреда здоровью и патоморфологии огнестрельных повреждений, чел./% (95% ДИ)**

Distribution of victims depending on the pathomorphology of injuries, pers. % (95% CI)

Степень вреда здоровью / Degree of injury Патоморфология огнестрельного повреждения / Pathomorphology of injuries	Число пострадавших, чел./% (95% ДИ) Number of victims, pers.% (95% CI)	% (95% ДИ) % (95% CI)
<i>Тяжелая / Severe</i>	12/17,9 (9,6-29,2)	–
Проникающее ранение грудной клетки / Penetrating chest wound	–	33,4 (9,9-65,1)
Проникающее ранение брюшной полости и забрюшинного пространства / Penetrating wound of abdomen and retroperitoneal space	–	33,4 (9,9-65,1)
Огнестрельный перелом теменной кости с повреждением головного мозга / Gunshot fracture of the parietal bone with brain damage	–	8,3 (0,2-38,5)
Перелом носоглазничного комплекса лицевого скелета / Fracture of nasopharyngeal complex of facial skeleton	–	8,3 (0,2-38,5)
Ранение щитовидной железы и верхней щитовидной артерии / Injury of thyroid gland and upper thyroid artery	–	8,3 (0,2-38,5)
Размозжение яичка / Testicular crush	–	8,3 (0,2-38,5)
<i>Средняя / Moderate</i>	11/16,4 (8,5-27,5)	–
Изолированный перелом костей / Isolated bone fracture	–	36,6 (19,9-56,1)
Ушиб 2-3-х бронхолегочных сегментов / Contusion of 2-3 bronchopulmonary segments	–	26,7 (12,3-45,9)
Ушиб селезенки и сальника / Contusion of spleen and omentum	–	16,7 (5,6-34,7)
Ушиб сердца / Heart contusion	–	13,3 (3,8-30,7)
Ушиб плечевого нервного сплетения / Contusion of brachial nerve plexus	–	6,7 (0,8-22,1)
<i>Легкая / Minor</i>	44/65,7 (53,1-76,8)	–
Раневой дефект кожи и подкожной клетчатки, ушиб подлежащих мышц / Wound defect in skin and subcutaneous tissue, contusion of underlying muscles	–	100,0 (85,8-100,0)

15 and light — in 47% of the victims. Damage to health was absent in 13% of observations. The cited work did not investigate harm to health depending on the localization of wounds, pathomorphology of injuries to organs, soft tissues, and bone and joint structures [5].

A number of publications [1, 2, 5, 6] indicate that 19.0-24.1% of the observations were life-threatening from wounds sustained from non-lethal kinetic weapon shots penetrating the chest. Our data indicate that in Arkhangelsk, wounds to the chest with minor and moderate injury predominate. Wounds to the abdomen, pelvis, and external genital organs in 40 % of cases, and gunshot wounds to the head and neck in 58.8 % of cases cause average and serious harm to health.

Of particular interest are ileum ruptures and spleen ruptures in two observations of non-penetrating wounds in which a rubber projectile was lodged in the preperitoneal tissue. The gunshot projectile has a piercing, wedging, and bruising effect on tissue. The elastic bullet of non-lethal kinetic weapons is characterized by contusion — the zone of necrosis is usually weakly expressed [11]. We believe that the cause of ruptures in the ileum and spleen in non-penetrating wounds was the hydrodynamic effect on internal organs adjacent to the abdominal wall in the zone of bullet stopping. The fracture of the nasolacrimal complex of the facial bones with hemorrhage into the accessory sinuses — in one victim — and the destruction of the testicle from the penetrating wound of the scrotum — also in one victim — were also classified as grave harm to health.

The main medical criterion for damage to health of moderate severity is a temporary disturbance of the functions of organs and systems that lasts for more than three weeks [10]. According to our data, every fifth wound inflicted by

non-lethal kinetic weapons caused moderate damage to health. In this group, 26.7% of injuries were to contusions of the bronchopulmonary segments. Pulmonary contusions were diagnosed by chest CT one to two days after a non-penetrating wound. Pulmonary contusions in victims with gunshot lung wounds were not included in this group, since according to the criterion — lung wounds cause "serious harm to health". There are no data on the frequency and volume of lung contusions due to non-penetrating wounds to the chest from non-lethal kinetic weapons available to us in the publications. This type of lung injury is subject to timely — within two to three days after the wound — diagnosis and treatment. Otherwise the lesion may be complicated by traumatic pneumonia with subsequent pneumofibrosis.

Blind, not penetrating into natural cavities, and tangential wounds of soft tissues without damage to vessels, nerves and bones resulted in short-term (less than three weeks) impairment of function. An isolated single bullet wound from a non-lethal kinetic weapon results, at a minimum, in a circular skin defect at least 1 cm in diameter, a wound canal 2 cm deep or more with muscle contusion. A point-blank and close-range shot results in a skin defect of up to 5 cm with lacerated burned edges and hemorrhage in the adjacent skeletal muscle. Healing requires primary surgical treatment of the wound, functional rest of the injured part of the body and bandaging until the soft tissue defect heals. Such an injury can be rightly considered to be a harm to health of a light degree of severity.

The obtained results on a number of positions have differences from the previously published data and, therefore, further accumulation and analysis of materials for the evidentiary assessment of the damage to health depending on the localization and pathomorphology of

the injuries inflicted with non-lethal kinetic weapons is necessary.

### Conclusions

1. The damage to health of a heavy and moderate degree of severity was revealed in 34,3% of the victims with wounds mainly in the region of the head, neck, chest, and abdomen.

2. CT scanning is indicated at one to three days for the diagnosis of lung contusion, which is not reliably visualized

on the observational radiograph if wounds to the chest are wounds, including those without the penetrating character of the wound channel.

3. In nonpenetrating abdominal wounds, damage to internal organs due to hydrodynamic impact cannot be excluded. In this case the hospitalization of victims for one or three days for clinical observation and ultrasound control is necessary. In doubtful cases diagnostic videolaparoscopy should be performed.

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