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CURRENT DATA ON NON-LETHAL AND LETHAL WEAPONS: THE UKRAINIAN EXPERIENCE

Abstract. Firearms have become widespread in the world, which is conditioned by the broad spectrum of their application. At the same time, in recent decades, the so-called means of non-lethal action have also begun to gain significant prevalence, directed mostly at the work of law enforcement agencies with crowds of protesters, unarmed offenders, or as a means of self-defense for certain categories of the population. In Ukraine, all these varieties of weapons have become significantly widespread, which is обусловлено both by active combat operations and by the deterioration of the criminogenic situation. It is also worth noting that the weapons market is being actively replenished with samples of domestic production. All these factors have led to the fact that the picture concerning weapons in Ukraine has changed to a considerable extent and this requires analysis and systematization from the point of view of ballistics, criminalistics, and forensic medicine as a science, in order to assess how the scientific community has responded to these changes and how well this issue has been studied. The aim of the article is the analysis of scientific sources concerning the topic of ballistic, experimental studies regarding domestic or widespread-in-Ukraine weapons by domestic scientists working in this field. To perform this analysis, a search for scientific sources not older than 10 years concerning this topic was carried out (the search was conducted using keywords that most accurately convey the subject of the article), taking into account the results of domestic authors working in the field of criminalistics and ballistics. The conducted review of

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sources showed that there are several main centers of firearms research in Ukraine, that is, groups of authors who systematically publish data concerning this topic. The largest number of publications concerns the study of the domestic manufacturer of firearms – “Fort”, which produces both lethal and non-lethal firearms. The analysis of literary sources showed that despite its name, even non-lethal firearms can cause serious injuries, in the case of non-observance of the firing distance. At the same time, research data showed that clothing is a kind of protective layer that makes it possible to avoid the formation of serious injuries to the human body. Also, an important place is occupied by studies aimed at the identification of weapons. In this case, such a feature is often considered to be the peculiarities of the deposition of microscopic elements on the trace-receiving surface or the presence of a specific imprint of a firearm that is formed upon contact shooting. Stun guns are also sufficiently studied from the point of view of the morphology of the injuries that they can inflict, although they never became the basis for use among law enforcement agencies. Thus, it can be concluded that in Ukraine there are systematic and complete studies of various types of firearms, with an emphasis on the domestic manufacturer. These studies include both the analysis of macroscopic changes and microscopic, laboratory data, which is important for achieving accurate and statistically reliable results.

Keywords: non-lethal weapons, gunshot weapon, special means, law enforcement activity, public safety, ballistics, experimental shots.

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СУЧАСНІ ДАНІ ПРО НЕЛЕТАЛЬНУ ТА ЛЕТАЛЬНУ ЗБРОЮ: УКРАЇНСЬКИЙ ДОСВІД

Анотація. Вогнепальна зброя набула значного поширення у світі, що обумовлена широким спектром її застосування. Водночас, в останні десятиліття

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значної поширеності почали набувати також так звані засоби нелетальної дії, направлені здебільшого на роботу правоохоронних органів з натовпами протестуючих, неозброєними зловмисниками або як спосіб самозахисту для деяких категорій населення. В Україні усі ці різновиди зброї набули значного поширення, що обумовлено як активними бойовими діями так і погіршенням криміногенної ситуації. Варто також відмітити, що ринок зброї активно поповнюється і зразками вітчизняного виробництва. Усі ці фактори призвели до того, що картина, що стосується зброї в Україні значною мірою змінилася і це потребує аналізу і систематизації з точки зору балістики, криміналістики та судової медицини як науки, аби оцінити, яким чином на ці зміни відреагувала наукова спільнота і наскільки добре досліджено це питання.

Мета статті – аналіз наукових джерел, що стосуються теми досліджень балістичних, експериментальних стосовно вітчизняної чи поширеної в Україні зброї з боку вітчизняних науковців, що працюють у цій сфері. Для виконання даного аналізу виконано пошук наукових джерел давністю не більше 10 років, що стосуються даної теми (пошук проводився з використанням ключових слів, що найбільш точно передають тематику статті), беручи до уваги результати вітчизняних авторів, що працюють у сфері криміналістики і балістики. Проведений огляд джерел показав, що є кілька основних центрів досліджень вогнепальної зброї в Україні, тобто, групи авторів, що систематично публікують дані стосовно даної тематики. Найбільша кількість публікацій стосується дослідження вітчизняного виробника вогнепальної зброї – «Форт», що виготовляє як летальну так і нелетальну вогнепальну зброю. Аналіз літературних джерел показав, що незважаючи на свою назву, навіть нелетальна вогнепальна зброя може викликати серйозні ушкодження, у випадку недотримання дистанції пострілу. Водночас, дані досліджень показали, що одяг є своєрідних захисним шаром, що дозволяє уникнути утворення серйозних пошкоджень тіла людини. Також, важливе місце займають дослідження, що направлені на ідентифікацію зброї. У даному випадку такою ознакою часто розглядають особливості відкладання мікроскопічних елементів на слідоприймаючій поверхні або наявність специфічного відбитку вогнепальної зброї, що утворюється при пострілі впритул. Елеткрошокери також у достатній мірі досліджені з точки зору морфології ушкоджень, що вони можуть заподіяти, хоча вони так і не стали основою для використання серед правоохоронних органів. Таким чином можна зробити висновок, що в Україні існують систематичні і повні дослідження різних видів вогнепальної зброї, з акцентом на вітчизняного виробника. Дані дослідження включають в себе як аналіз макроскопічних змін, так і мікроскопічні, лабораторні дані, що є важливим для досягнення точних і статистично достовірних результатів.

Ключові слова: нелетальна зброя, вогнепальна зброя, спеціальні засоби, правоохоронна діяльність, громадська безпека, балістика, експериментальні постріли.

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Statement of the problem. Unfortunately, statistics regarding the use of types of firearms or non-lethal weapons in Ukraine are not encountered in modern sources, or their data are exclusively clinical (the nature of injury, etc.), which does not allow them to be used in the publication. At the same time, international data clearly provide such information regarding different types of weapons. Conducted electrical weapons, according to the analysis of 33 literature sources in the meta-analysis by Baliatsas and co-authors, showed that, in general, this type of weapon is quite safe and different durations of exposure do not cause severe consequences. Thus, the review included sources where the duration of exposure was both up to 5 and up to 15 seconds. In all cases, the adverse consequences of the use of such weapons were superficial injuries from darts. At the same time, it is worth noting that all studies were conducted with the participation of physically healthy volunteers [2].

Similar conclusions regarding the relative safety of electric shock devices are presented by Stevenson and Drummond-Smith in their work, where they analyzed data from the police of Great Britain. The analysis of 948 cases of TASER use showed that medical care in emergency departments was needed only in 16.8% of cases, and hospitalization was needed only in 0.3% of the total number of incidents [23].

The study of 2864 episodes of weapon use by police officers over 9 years showed that kinetic impact projectiles were used by police in only 33 cases. 17 cases ended without any physical injuries in persons against whom the weapon had been used, 15 persons had minor injuries, and only 1 person had an injury of moderate severity, namely a liver rupture [3].

The analysis of California databases from 2016 to 2021 recorded 3677 episodes of weapon use by law enforcement officers. Of these, 942 cases were fatal and 2735 cases ended with severe consequences. It was the use of firearms that most often caused fatal cases (in 58.9% of cases) [5].

The analysis of 26 publications, which in total covered 1984 victims of the action of kinetic impact projectiles, revealed that in 53 cases their use ended fatally (that is, a lethality rate at the level of 3%). In 300 persons, persistent loss of function or disability was recorded after the use of this type of non-lethal weapon. In 71% of cases, the injuries were classified as severe. Among the fatal cases, 49.1% of cases were injuries to the head and neck, 27% with trauma to the chest and abdomen. 84.2% of all eye injuries (310 cases in total) ended in blindness [8].

The study by Kaufman and co-authors showed that from 2009 to 2017 in the USA, more than 120 thousand cases of firearm use took place annually, of which more than 34 thousand ended fatally. Intentional use of a weapon against another person was recorded in 38.9% of all cases, accidental use in 36.9% of cases, and self-harm in 19.6%. In general, firearms as a means for suicide were used in 61.2% of cases, and exactly this means had the highest level of lethality in suicides – 89.4% [10].

A review of 19 publications regarding the topic of the use of non-lethal means by law enforcement officers showed that conducted electrical weapons were used in about 24.5% of cases, OC spray in 20.2%, baton in 30.4% [15].

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In the study by Petersen with co-authors, which covered more than two thousand cases of police use of force in the USA, it was established that almost half of the incidents are not accompanied by injuries to civilians, and lethality is minimal (0.1%). Among special means of non-lethal action, the most widespread are devices for firing electric shock cartridges (CEW/CED), which make up 72% of all cases. At the same time, the lowest risk of severe injuries is associated with the use of chemical agents (only 4% of hospitalization cases), whereas the use of police dogs turned out to be the most traumatic method, leading to hospitalization or death in 37% of adjusted cases [18].

However, the use of kinetic means during civil unrest can have catastrophic consequences. The study of events in Chile recorded numerous cases of eye injuries, where in 70.5% of victims these were caused exactly by kinetic projectiles. Almost half of the patients already at the first examination had severe visual impairment or complete blindness, and a significant part of the cases was accompanied by open eye injuries and the presence of intraorbital foreign bodies. Surgical treatment in many cases turned out to be insufficient, which forced resorting to evisceration of the ocular contents, the consequence of which was irreversible blindness in one eye [19].

The general statistics of visits to emergency departments due to firearm injuries in the USA also demonstrate an alarming tendency toward growth. The data indicate that after 2019 the weekly frequency of such visits increased substantially, reaching a peak in 2020 (a 1.59-fold increase). The most critical situation was observed among young people aged 15-24 years, although the maximum relative increase in traumatism was recorded in the children's group (0-14 years). The researchers emphasize a clear connection between the level of firearm traumatism and the degree of social vulnerability of the counties where the incidents took place [25].

The purpose of the article – to examine domestic scientific publications on research on non-lethal weapons, their effects on the human body, the versatility of action, and the possibility of identification.

Research objects and methods. A review of the latest literary sources on the topic of the impact, identification and mechanism of action of domestic non-lethal, lethal weapons, including electric crowd control devices, firearms and non-lethal weapons, was conducted. The scientometric databases Scopus, Web of Science, and Google Academy were used for the search. The search depth was up to 10 years. Sources were selected for the review, where the research was carried out by domestic authors, and preference was also given to the study of domestic non-lethal means. The search was performed using keywords relevant to the topic of the review.

Presentation of the main material.

Research results and their discussion

The study of the impact of firearms on the human body is carried out by using various experimental models, whether with the use of ballistic gel or tissues of organic origin [1, 22, 24]. The study of the morphological features of a close-range shot indicates a significant dependence of the nature of the injuries on the weapon model

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and the distance. When firing from a Glock-17 pistol at distances of 0–1 cm, a significant defect is formed on fabric barriers (from 30×25 mm to 65×10 mm), and the thermal effect of gases and powder is traced up to 1 cm. In contrast, in the Beretta 92FS, a significant rupture of the fabric (up to 81×32 mm) and thermal changes are observed at a greater distance - up to 3 cm. The wipe ring for the Glock-17 becomes noticeable from a distance of more than 10 cm, soot is deposited up to 30 cm, and individual powder grains are detected at a distance of up to 130 cm. For the Beretta, these indicators differ somewhat: the wipe ring appears already from 5 cm, soot settles up to 20 cm, and powder grains reach 150 cm. An important diagnostic feature for the Glock-17 is the diameter of the sparse dispersion of powder grains, which increases from 55 mm at short distances to 130 mm at a distance of half a meter, leaving only isolated traces at a distance of up to 100 cm [4].

When analyzing damage on 12 torso simulators made of ballistic gel, it was established that most clothing defects have an oval or round appearance with edges turned inward. A characteristic feature is the soot zone, which often has a crescent-shaped band in the lower part, and on the inner surface of the fabric it is deposited more intensively, acquiring the shape of a candle flame. The authors also detected the phenomenon of volcano-shaped bulging of the fabric. In 64.6% of cases, a double stamp-imprint is recorded around the entrance opening, and the edges of the damage itself may rise above the material, forming a three-dimensional structure. [6]. Studies of the “Fort-12”, “Fort-17”, and “Fort-14TP” pistols confirmed that such a double stamp-imprint occurs only under the condition of a shot in tight contact when there is more than one cartridge in the magazine, since its formation is associated with the backward movement of the slide. This allows experts to establish the sequence of shots and the fact that the weapon was loaded with several rounds [9].

The ballistic assessment of traumatism when using the “Fort-500A” and “Fort-500M1” rifles with the “Teren-12P” bullet indicates the high danger even of non-lethal ammunition. The calculations demonstrate a 50% risk of sustaining severe closed trauma to the chest and abdomen at the AIS-2 - AIS-3 level at distances of up to 30–50 meters. Even at minimum velocities, the danger of serious damage to the abdomen remains up to 40 meters, and the critical trauma level AIS-4 is predicted at distances of up to 10 meters. At the same time, the actual bullet velocity at a distance of 3.5 meters sometimes significantly exceeds the parameters declared by the manufacturer [7]. In cases of the use of atypical, converted, or reactivated weapons, such as the Stalker-M906 or the Nagant revolver, contact shots lead to fatal penetrating head injuries with massive destruction of the brain substance and multiple skull fractures [21].

Experimental studies on gelatin blocks showed that the “Fort 12R”, “AE 790G1”, as well as “Fort 9R” and “Fort 17R” pistols consistently form wound channels with a depth of 1 to 6 cm depending on the type of barrier and the distance. A wound channel at a depth of 6 cm occurred only when shooting at bare blocks, and at a depth of 5 cm when firing in contact, apart from bare blocks - in blocks covered with cotton.

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A contact shot through cotton or denim often contributes to deeper projectile penetration compared to bare gelatin. At the same time, the “Fort 9R” usually demonstrates larger temporary cavity indicators compared to the “Fort 17R”, especially at shallow depths ($p<0.05–0.01$). The protective properties of clothing appear selectively: cotton better reduces the penetration depth for the “Fort 9R”, whereas for the “Fort 17R” leatherette proved to be more effective. [11, 16, 17]. Similar patterns are also observed for the “Fort-12”, where the morphology of the opening and the metallization zone, which reaches 250 cm, clearly correlate with the shooting distance [20].

The differential diagnosis of firearm injuries and electrical injuries also requires taking into account the microelement composition. The XRF method makes it possible to detect a specific deposition of metals (Fe, Cu, Zn, Pb) along the edges of a firearm wound, which helps in weapon identification [12]. In cases of the use of electric shock devices (ESD), such as the WS-704, ESP Power Max, or 1101 “Police”, paired or grouped defects with charred edges are formed on the fabric, the arrangement of which corresponds to the configuration of the electrodes. Metallic deposits in such zones are identical to the composition of the electrodes (predominantly nickel, copper, chromium, or iron) [14]. It is interesting that tight contact of the electrodes with the skin for 5-8 seconds may leave no visible traces, whereas a spark discharge from a short distance (0.5-1 cm) causes pronounced macroscopic changes similar to thermal burns, even through layers of fabric [13].

Conclusions. Domestic research is mainly aimed at studying the effects of domestic weapons, both lethal and non-lethal. The studies are often comprehensive and include analysis of the effects of weapons on both bare targets and targets with obstacles (in particular, clothing).

Most often, studies are carried out on weapons manufactured by Fort.

Studies of stun guns, in addition to macroscopic damage, have a well-described microscopic picture of the affected tissues and valuable laboratory diagnostics.

References

1. Bachynsky, V. T., Zozulya, V. M., Palyvoda, O. G., & Pavlyukovich, O. V. (2018). Forensic medical characteristics of injuries caused by shots using “Flaubert” cartridges. Forensic Medical Examination, (1), 75-77.

2. Baliatsas, C., Gerbecks, J., Dückers, M. L. A., & Yzermans, C. J. (2021). Human health risks of conducted electrical weapon exposure: A systematic review. JAMA Network Open, 4(2), e2037209. doi:10.1001/jamanetworkopen.2020.37209

3. Beatty, J. A., Stopyra, J. P., Slish, J. H., & Bozeman, W. P. (2020). Injury patterns of less lethal kinetic impact projectiles used by law enforcement officers. Journal of Forensic and Legal Medicine, 69, 101892. doi:10.1016/j.jflm.2019.101892

4. Bondar, V. S. (2020). Forensic study of a 9.00 mm pistol “Glock-17”. Bulletin of the Luhansk State University of Internal Affairs named after E. O. Didorenko, 1(89), 229-249.

5. Dillon, D. G., McConville, S., & Hsia, R. Y. (2025). Fatal and non-fatal civilian injuries sustained during law enforcement-reported encounters in California, 2016-2021. Injury Prevention, 31(6), 561-566. doi:10.1136/ip-2024-045250

ISSN 2786-4952 Online

6. Gunas, V., Bobkov, P., Plakhotniuk, I., Olhovenko, S., & Solonyi, O. (2021). Specifics of fire damage to cotton clothing while shooting point-blank at a human torso simulator from a Fort-12RM pistol. Theory and Practice of Forensic Science and Criminalistics, 23(1), 175-187. doi:10.32353/khrife.1.2021.13

7. Gurov, O. M., Sapielkin, V. V., Shcherbak, V. V., Gladkikh, D. B., & Lys, D. O. (2021). PROGNOTIC DETERMINATION OF THE SEVERITY OF CLOSED INJURY TO THE CHEST AND ABDOMEN DURING SHOTS FROM 12-GAURE FORT-500 RIFLES WITH BULLETS OF IMPACT-TRAUMATIC EFFECT OF “TEREN-12P” CARTRIDGES. Clinical and Experimental Pathology, 20(3).

8. Haar, R. J., Iacopino, V., Ranadive, N., Dandu, M., & Weiser, S. D. (2017). Death, injury and disability from kinetic impact projectiles in crowd-control settings: A systematic review. BMJ Open, 7(12), e018154. doi:10.1136/bmjopen-2017-018154

9. Hurov, O. M., Kutsenko, S., Shcherbak, V. V., Hladkykh, D. B., & Sapielkin, V. V. (2019). The mechanism of formation of a double punch mark when fired from pistols of the “FORT” model series. Forensic Medical Examination, (1), 66-70.

10. Kaufman, E. J., Wiebe, D. J., Xiong, R. A., Morrison, C. N., Seamon, M. J., & Delgado, M. K. (2021). Epidemiologic trends in fatal and nonfatal firearm injuries in the US, 2009-2017. JAMA Internal Medicine, 181(2), 237-244. doi:10.1001/jamainternmed.2020.6696

11. Kusliy, Y. Y., Gunas, V. I., Yaremyna, I. V., Vakhovskyi, V. V., & Perebetiuk, L. S. (2023). Length of wound channels using "fort 12r" and "ae 790g1" under the conditions of use of various textile materials. World of Medicine and Biology, 1(83), 209-213. doi: 10.26724/2079-8334-2023-1-83-209-213

12. Mikhailenko, O. V., Roshchin, H. H., Dyadik, O. O., Irkin, I. V., Malisheva, T. A., Kostenko, Y. Y., ... & Hel, A. P. (2021). Efficiency of determination of elemental composition of metals and their topography in objects of biological origin using spectrometers. Indian Journal of Forensic Medicine and Toxicology, 15(1), 1278-1284. doi:10.37506/ijfmt.v15i1.13592

13. Mishalov, V. D., Varfolomeiev, Y. A., & Riumina, I. O. (2020). Morphological features of skin injuries caused by contact electric shock devices under various conditions. Morphology, 14(3), 143-147.

14. Mishalov, V. D., Varfolomeiev, Y. A., Retroshak, O. Y., & Moscalenko, V. S. (2020). Forensic characteristics of damages to different types of fabrics (materials of clothing), which are formed due to the effect of electric shock devices. Reports of Vinnytsia National Medical University, 24(4), 577-583. doi: 10.31393/reports-vnmedical-2020-24(4)-03

15. Nielsen, M., Munkholm, J., Banner, J., & Wingren, C. J. (2025). Injury rates following conducted electrical weapons and other less-lethal force modalities in real-life police settings: A comparative literature review. Forensic Science, Medicine, and Pathology, 21(3), 1396-1406. doi:10.1007/s12024-025-01020-9

16. Perebetiuk, A. M., Gunas, V. I., Fomina, L. V., Zverkhovska, V. F., & Prokopenko, S. V. (2022). PECULIARITIES OF THE PROJECTILE PENETRATION DEPTH WHEN FIRED WITH “FORT 9R” AND “FORT 17R” PISTOLS WHILE USING DIFFERENT CLOTHING FABRIC. World of Medicine and Biology, 18(82), 230-235. doi:10.26724/2079-8334-2022-4-82-230-235

17. Perebetiuk, A. M., Gunas, V. I., Terehovska, O. I., Prokopenko, S. V., & Sergeeva, Y. Y. (2023). Indicators of the temporary cavity during shots from non-lethal firearms: an experimental study using the "Fort 9R" and "Fort 17R" pistols. Odesa Medical Journal, 183(2), 21-25. doi: 10.32782/2226-2008-2023-2-3

18. Petersen, K., Koper, C. S., Taylor, B. G., Liu, W., & Sheridan-Johnson, J. (2025). Less-lethal weapons and civilian injury in police use of force encounters: A multi-agency analysis. Journal of Urban Health, 102(2), 389-399. doi:10.1007/s11524-024-00940-1

ISSN 2786-4952 Online

19. Rodríguez, Á., Peña, S., Cavieres, I., Vergara, M. J., Pérez, M., Campos, M., Peredo, D., Jorquera, P., Palma, R., Cortés, D., López, M., & Morales, S. (2021). Ocular trauma by kinetic impact projectiles during civil unrest in Chile. Eye, 35(6), 1666-1672. doi:10.1038/s41433-020-01146-w

20. Shcherbak, V. V. (2015). Diagnostic features of a shot from a Fort-12 pistol at close range. Forensic medical examination, 1, 47-50.

21. Shcherbak, V., Sapielkin, V., Lavrynenko, O., & Melnyk, S. (2021). Peculiarities of fatal injuries from shots from converted and reactivated weapons (two cases from expert practice). Medical science of Ukraine, (17,№ 4), 108-114.

22. Sokolov, O. S. (2020). Peculiarities of Forensic Examination of Pistols and Revolvers for 4-mm Flaubert Cartridge. BULLETIN OF THE LUGHANSK STATE UNIVERSITY OF INTERNAL AFFAIRS NAMED AFTER EO DIDORENKO Founders: Luhansk State University of Internal Affairs named after EO Didorenko, 1(89), 298-310.

23. Stevenson, R., & Drummond-Smith, I. (2020). Medical implications of Conducted Energy Devices in law enforcement. Journal of Forensic and Legal Medicine, 73, 101948. doi:10.1016/j.jflm.2020.101948

24. Varfolomeiev, E. A. (2019). Current State of Forensic Medical Examination of Electrotrauma Caused by Electroshock Devices. Clinical and Experimental Pathology, (18, No. 2), 157-162.

25. Zwald, M. L., Holland, K. M., Sumner, S. A., Sheppard, M., Chen, Y., Wallace, A., Friar, N. W., & Simon, T. R. (2025). Trends in firearm injuries treated in emergency departments by individual- and county-level characteristics, 2019 to 2023. Annals of Emergency Medicine, 85(4), 295-301. doi:10.1016/j.annemergmed.2024.11.003

Література

1. Bachynsky, V. T., Zozulya, V. M., Palyvoda, O. G., & Pavlyukovich, O. V. (2018). Forensic medical characteristics of injuries caused by shots using “Flaubert” cartridges. Forensic Medical Examination, (1), 75-77.

2. Baliatsas, C., Gerbecks, J., Dückers, M. L. A., & Yzermans, C. J. (2021). Human health risks of conducted electrical weapon exposure: A systematic review. JAMA Network Open, 4(2), e2037209. doi:10.1001/jamanetworkopen.2020.37209

3. Beatty, J. A., Stopyra, J. P., Slish, J. H., & Bozeman, W. P. (2020). Injury patterns of less lethal kinetic impact projectiles used by law enforcement officers. Journal of Forensic and Legal Medicine, 69, 101892. doi:10.1016/j.jflm.2019.101892

4. Bondar, V. S. (2020). Forensic study of a 9.00 mm pistol “Glock-17”. Bulletin of the Luhansk State University of Internal Affairs named after E. O. Didorenko, 1(89), 229-249.

5. Dillon, D. G., McConville, S., & Hsia, R. Y. (2025). Fatal and non-fatal civilian injuries sustained during law enforcement-reported encounters in California, 2016-2021. Injury Prevention, 31(6), 561-566. doi:10.1136/ip-2024-045250

6. Gunas, V., Bobkov, P., Plakhotniuk, I., Olhovenko, S., & Solonyi, O. (2021). Specifics of fire damage to cotton clothing while shooting point-blank at a human torso simulator from a Fort-12RM pistol. Theory and Practice of Forensic Science and Criminalistics, 23(1), 175-187. doi:10.32353/khrife.1.2021.13

7. Gurov, O. M., Sapielkin, V. V., Shcherbak, V. V., Gladkikh, D. B., & Lys, D. O. (2021). PROGNOTIC DETERMINATION OF THE SEVERITY OF CLOSED INJURY TO THE CHEST AND ABDOMEN DURING SHOTS FROM 12-GAURE FORT-500 RIFLES WITH BULLETS OF IMPACT-TRAUMATIC EFFECT OF “TEREN-12P” CARTRIDGES. Clinical and Experimental Pathology, 20(3).

8. Haar, R. J., Iacopino, V., Ranadive, N., Dandu, M., & Weiser, S. D. (2017). Death, injury and disability from kinetic impact projectiles in crowd-control settings: A systematic review. BMJ Open, 7(12), e018154. doi:10.1136/bmjopen-2017-018154

Журнал «Перспективи та інновації науки»
№3(61) 2026

ISSN 2786-4952 Online

9. Hurov, O. M., Kutsenko, S., Shcherbak, V. V., Hladkykh, D. B., & Sapielkin, V. V. (2019). The mechanism of formation of a double punch mark when fired from pistols of the “FORT” model series. Forensic Medical Examination, (1), 66-70.

10. Kaufman, E. J., Wiebe, D. J., Xiong, R. A., Morrison, C. N., Seamon, M. J., & Delgado, M. K. (2021). Epidemiologic trends in fatal and nonfatal firearm injuries in the US, 2009-2017. JAMA Internal Medicine, 181(2), 237-244. doi:10.1001/jamainternmed.2020.6696

11. Kusliy, Y. Y., Gunas, V. I., Yaremyna, I. V., Vakhovskyi, V. V., & Perebetiuk, L. S. (2023). Length of wound channels using "fort 12r" and "ae 790g1" under the conditions of use of various textile materials. World of Medicine and Biology, 1(83), 209-213. doi: 10.26724/2079-8334-2023-1-83-209-213

12. Mikhailenko, O. V., Roshchin, H. H., Dyadik, O. O., Irkin, I. V., Malisheva, T. A., Kostenko, Y. Y., ... & Hel, A. P. (2021). Efficiency of determination of elemental composition of metals and their topography in objects of biological origin using spectrometers. Indian Journal of Forensic Medicine and Toxicology, 15(1), 1278-1284. doi:10.37506/ijfmt.v15i1.13592

13. Mishalov, V. D., Varfolomeiev, Y. A., & Riumina, I. O. (2020). Morphological features of skin injuries caused by contact electric shock devices under various conditions. Morphology, 14(3), 143-147.

14. Mishalov, V. D., Varfolomeiev, Y. A., Retroshak, O. Y., & Moscalenko, V. S. (2020). Forensic characteristics of damages to different types of fabrics (materials of clothing), which are formed due to the effect of electric shock devices. Reports of Vinnytsia National Medical University, 24(4), 577-583. doi: 10.31393/reports-vnmedical-2020-24(4)-03

15. Nielsen, M., Munkholm, J., Banner, J., & Wingren, C. J. (2025). Injury rates following conducted electrical weapons and other less-lethal force modalities in real-life police settings: A comparative literature review. Forensic Science, Medicine, and Pathology, 21(3), 1396-1406. doi:10.1007/s12024-025-01020-9

16. Perebetiuk, A. M., Gunas, V. I., Fomina, L. V., Zverkhovska, V. F., & Prokopenko, S. V. (2022). PECULIARITIES OF THE PROJECTILE PENETRATION DEPTH WHEN FIRED WITH “FORT 9R” AND “FORT 17R” PISTOLS WHILE USING DIFFERENT CLOTHING FABRIC. World of Medicine and Biology, 18(82), 230-235. doi:10.26724/2079-8334-2022-4-82-230-235

17. Perebetiuk, A. M., Gunas, V. I., Terehovska, O. I., Prokopenko, S. V., & Sergeeva, Y. Y. (2023). Indicators of the temporary cavity during shots from non-lethal firearms: an experimental study using the "Fort 9R" and "Fort 17R" pistols. Odesa Medical Journal, 183(2), 21-25. doi: 10.32782/2226-2008-2023-2-3

18. Petersen, K., Koper, C. S., Taylor, B. G., Liu, W., & Sheridan-Johnson, J. (2025). Less-lethal weapons and civilian injury in police use of force encounters: A multi-agency analysis. Journal of Urban Health, 102(2), 389-399. doi:10.1007/s11524-024-00940-1

19. Rodríguez, Á., Peña, S., Cavieres, I., Vergara, M. J., Pérez, M., Campos, M., Peredo, D., Jorquera, P., Palma, R., Cortés, D., López, M., & Morales, S. (2021). Ocular trauma by kinetic impact projectiles during civil unrest in Chile. Eye, 35(6), 1666-1672. doi:10.1038/s41433-020-01146-w

20. Shcherbak, V. V. (2015). Diagnostic features of a shot from a Fort-12 pistol at close range. Forensic medical examination, 1, 47-50.

21. Shcherbak, V., Sapielkin, V., Lavrynenko, O., & Melnyk, S. (2021). Peculiarities of fatal injuries from shots from converted and reactivated weapons (two cases from expert practice). Medical science of Ukraine, (17,№ 4), 108-114.

22. Sokolov, O. S. (2020). Peculiarities of Forensic Examination of Pistols and Revolvers for 4-mm Flaubert Cartridge. BULLETIN OF THE LUGHANSK STATE UNIVERSITY OF INTERNAL AFFAIRS NAMED AFTER EO DIDORENKO Founders: Luhansk State University of Internal Affairs named after EO Didorenko, 1(89), 298-310.

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24. Varfolomeiev, E. A. (2019). Current State of Forensic Medical Examination of Electrotrauma Caused by Electroshock Devices. Clinical and Experimental Pathology, (18, No. 2), 157-162.

25. Zwald, M. L., Holland, K. M., Sumner, S. A., Sheppard, M., Chen, Y., Wallace, A., Friar, N. W., & Simon, T. R. (2025). Trends in firearm injuries treated in emergency departments by individual- and county-level characteristics, 2019 to 2023. Annals of Emergency Medicine, 85(4), 295-301. doi:10.1016/j.annemergmed.2024.11.003

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