

E.M. Khoroshun¹, V.V. Makarov¹, V.V. Nehoduiko¹, S.A. Shypilov¹, S.I. Panasenko⁴,
S.V. Tertyshnyi^{2,3}, R.S. Vastyanov³

Military Medical Clinical Centre of the Northern Region of the Command of Medical Forces,
Armed Forces of Ukraine, Kharkiv, ¹Kharkiv National Medical University, Kharkiv

²Military Medical Clinical Centre of the Southern Region of the Command of Medical Forces,
Armed Forces of Ukraine, Odesa, ³Odesa National Medical University, Odesa

⁴Poltava State Medical University, Poltava

A CASE OF CHEST GUNSHOT SHRAPNEL BLIND WOUND WITH MAMMARY GLAND DAMAGE

e-mail: tertyshnyi.sergey@gmail.com

The purpose of the study was to demonstrate the features of diagnosis and surgical treatment of gunshot shrapnel blind wound of the chest with damage to the mammary gland. Injured K., 27 years old, received a chest wound in a bulletproof vest while performing a combat mission after being dropped from a drone. An hour after the wound, she was delivered to the advanced surgical group in satisfactory condition, where a chest X-ray, antibiotic prophylaxis, tetanus toxoid, and dressing were performed. After 2 hours she was hospitalized with the following diagnosis: isolated gunshot shrapnel blind wound of the right breast. The surgical treatment was performed in the following scope: primary surgical treatment of the wound, removal of the foreign body (metal fragment). The foreign body was removed using a flexible device for removing ferromagnetic foreign bodies. Authors attracted attention that mammary glands gunshot wounds are a rare occurrence in general structure of gunshot wounds. The use of personal protective equipment does not always protect mammary glands from gunshot foreign bodies due to the poorly covered lateral surfaces. Authors concluded that modern surgical magnetic instrument use contributes to minimally invasive removal of gunshot foreign bodies from the mammary gland.

Key words: gunshot wound, mammary gland, metal fragment, foreign body, magnetic detection.

Е.М. Хорошун, В.В. Макаров, В.В. Неодуйко, С.А. Шипілов, С.І. Панасенко,
С.В. Тертишний, Р.С. Вастьянов

ВИПАДОК ВОГНЕПАЛЬНОГО ОСКОЛКОВОГО СЛІПОГО ПОРАНЕННЯ ГРУДЕЙ З УШКОДЖЕННЯМ МОЛОЧНОЇ ЗАЛОЗИ

Метою дослідження було демонстрація особливостей діагностики та оперативного лікування вогнепального осколкового сліпого поранення грудей з ушкодженням молочної залози. Клінічний випадок стосується пораненої Л., 47 років, яка отримала поранення у груди в бронезилеті під час виконання бойового завдання після скиду з дрону, доставлена через годину після поранення до передової хірургічної групи в задовільному стані, де виконано рентгенографія органів грудної клітки, антибіотикопрофілактика, протиправцевий анатоксін, перев'язка. Через 2 години була госпіталізована з діагнозом: ізольоване вогнепальне осколкове сліпе поранення правої молочної залози. Було виконано таке оперативне лікування: первинна хірургічна обробка рани, видалення стороннього тіла (металевого осколка). Стороннє тіло видалено за допомогою гнучкого пристрою для видалення феромагнітних сторонніх тіл. Автори відзначають, що вогнепальні поранення молочних залоз є рідким явищем в загальній структурі вогнепальних поранень. Застосування засобів індивідуального захисту не завжди призводить до захисту молочних залоз від сторонніх тіл вогнепального походження за рахунок мало прикритих бокових поверхонь. Автори висловлюють, що використання сучасного хірургічного магнітного інструменту сприяє малоінвазивному видаленню сторонніх тіл вогнепального походження з молочної залози.

Ключові слова: вогнепальне поранення, молочна залоза, металевий осколок, стороннє тіло, магнітодетекція.

The study is a fragment of the research project "Development of modern methods of diagnosis and treatment of purulentseptic complications in combat surgical trauma", state registration No. 0120U101834.

Gunshot wounds of the chest are associated with high morbidity and mortality due numerous vital organs location here [2]. The heart, lungs, both ascending and descending parts of aorta, superior and inferior vena cava, vertebrae together with spinal cord - are they all susceptible to injury during chest trauma [13]. Complications associated with mechanic trauma include cardiac tamponade, pneumothorax, hemothorax, loss of sensory and motor function etc. due to severe spinal cord injury, vertebral fractures, and various cosmetic issues requiring a multidisciplinary surgical approach. Gunshot wounds are well known to be equal to 10 % of penetrating chest injuries according to USA data, and their prevalence varies worldwide up to 95 % in countries engaged in war [3, 11, 13].

The incidence of chest gunshot wounds in modern military conflicts equals to 8–12 % but it should be mentioned that 79.4 % of which are impenetrable and 20.4 % are penetrable with intrathoracic organs damage [1, 3, 6–8]. Chest injury is one of the leading causes of death from trauma, as well as temporary and permanent disability in people under 40 years of age both in our country and abroad [1, 2, 12].

Unfortunately, such statistics look depressing in Ukraine as a result of the enemy's full-scale military aggression and military actions involving significant military contingents [5, 6].

One could read periodically articles devoted to mammary glands gunshot wounds in the world literature that outline the rarity of such injuries [1, 9, 11, 13]. The mammary gland is a paired organ that is part of the female reproductive system. Being a modified sweat gland, it is responsible for milk production (and/or lactation). Externally, the mammary gland is covered with skin, has a nipple and areola. The main part of the gland is glandular tissue, which is divided into lobes by connective and fatty tissues [9, 11].

Breast gunshot wounds diagnosis hence is based on the study of complaints, anamnesis, examination data, laboratory and instrumental studies. The leading methods of clinical observation are radiation [1, 2, 8]. Treatment of breast gunshot wounds is performed according to general principles of gunshot wounds treatment [3, 6, 7, 12, 15].

At the same time, it must be taken into account that the degree of damage depends upon the certain factors such as the bullet speed, the amount and direction of transmitted energy, the distance travelled by the projectile, the bullet both shape and hardness as well as the structures meet before and during penetration [10, 14]. The profile of the entrance hole, the path taken through the body and the biological characteristics of the tissues also affect the degree of damage [14]. Important that internal ruptures, tissue compression or temporary cavitation along the path of the projectile could resulted in shocking consequences [2, 7, 15]. Sometimes, rarely, a bullet enters a gunshot wound without a visible exit hole and vice versa [1, 2, 6, 10–12]. The bullet both trajectory and final destination in such situations might be unpredictable [14].

We encountered a fairly rare case of gunshot wound to the breast in everyday practice and believe that the features of diagnosis and treatment of gunshot wounds to the breast are interesting for surgical specialists. As far as we know a case of a mammary gland gunshot wound with a metal fragment (foreign body) retained in the organ was not described yet in available literature.

The purpose of the study was to demonstrate the peculiarities of diagnosis and surgical treatment of gunshot shrapnel blind chest wound with mammary gland damage.

Materials and methods. Wounded K., 27 years, received a chest wound in a bulletproof vest while performing a combat mission after being dropped from a drone, was delivered an hour after the wound to the advanced surgical group in satisfactory condition. She was given a chest X-ray, antibiotic prophylaxis, tetanus toxoid, and dressing. 2 hours after she was admitted to the Military Medical Clinical Centre of the Northern Region of the Military Medical Centre of the Armed Forces of Ukraine and was hospitalized in the surgical department of this Centre. The following diagnosis was formulated: isolated gunshot shrapnel blind wound of the right breast.

The injured woman was admitted in satisfactory condition. The level of consciousness on the Glasgow Coma Scale was 15 points. The patient complained on aching pain inside the wound of the right mammary gland. A wound of 15×5 mm with rough edges without signs of bleeding is determined in the lower outer quadrant during the right breast examination. A painful foreign body up to 10 mm is determined during the right breast palpation.

The following laboratory tests were performed: general clinical blood tests, urine tests, biochemical blood tests, blood coagulogram using “Respons 920” (Germany), “Lab Analyt” (China), “Huma Clot Duo Plus” (Germany), “Labline 40” and “Sunrise” (Austria) devices with additional “BIORAD” and “BIOSAN” equipment.

Multispiral computed tomography of the head, chest, abdominal cavity and pelvis was performed using the “Revolution EVO” (USA) device with a tomograph step of 0.5 mm and a foreign body (metal fragment) measuring 8×7 mm was detected in the right breast. Electrocardiography was performed with the help of “KHAI REOK” electrocardiograph (Great Britain).

The following surgical treatment was performed – the wound primary surgical treatment and the foreign body (metal fragment) removal. The foreign body was removed using a flexible device for ferromagnetic foreign bodies removing [12].

Results of the study and their discussion. No pathology was detected during the patients' examination in general blood and urine tests as well as in biochemical blood tests.

The data of the patient's head and chest organs multispiral computed tomography on the first day after injury upon admission are presented in Fig. 1.

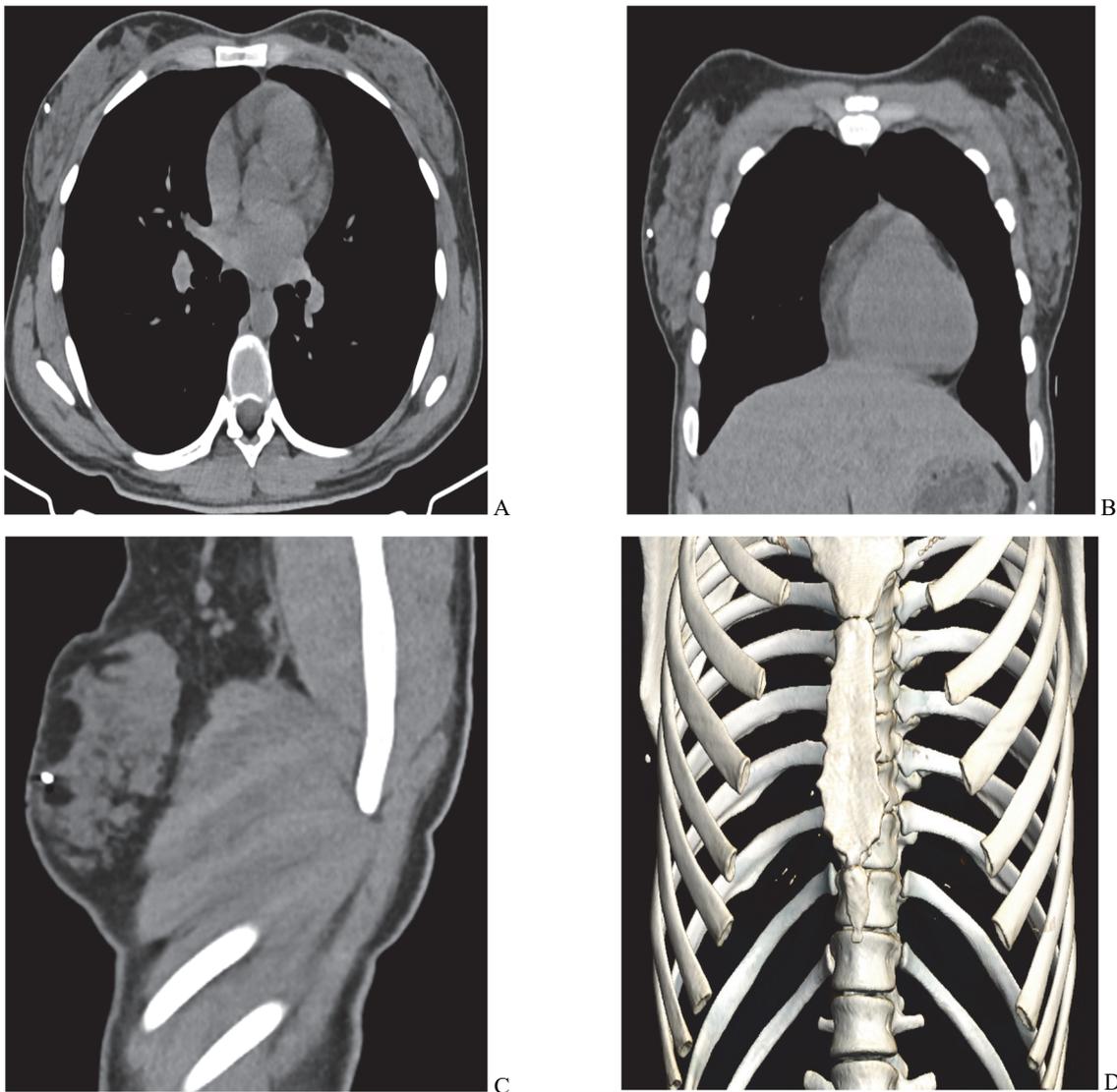


Fig. 1. Data of patient K., 27 years, head and chest organs multispiral computed tomography. The 1st day after injury: a foreign body (metal fragment) of metallic density in the right breast with the size 8×7 mm. A – axial projection; B – coronal projection; C – sagittal projection; D – 3D modelling.

The following operation was performed under intravenous anaesthesia: primary surgical treatment of the wound and foreign body (metal fragment) removal. The foreign body was removed with the help of flexible device for ferromagnetic foreign bodies removing.

The outward show of the wound and removed foreign body (metal fragment) are shown in Fig. 2.

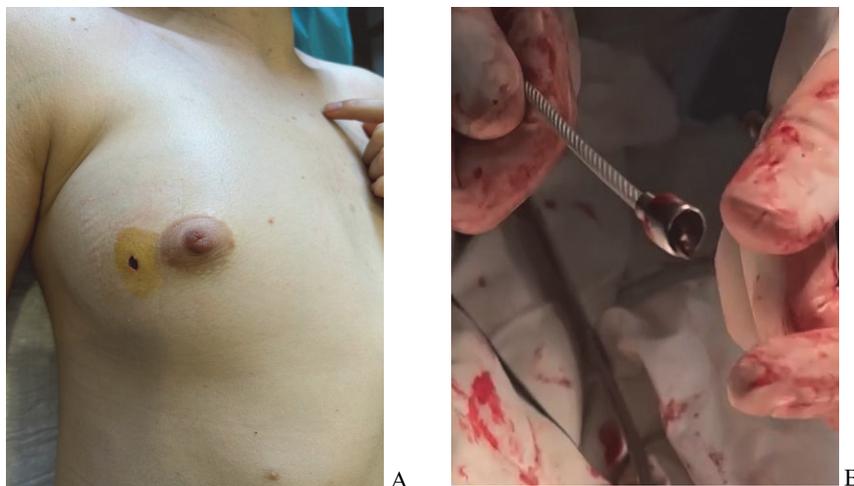


Fig. 2. The outward show of right breast gunshot wound (fragment A); Foreign body (metal fragment) removed using a flexible device for ferromagnetic foreign bodies removing (fragment B).

The postoperative diagnosis was the following: an isolated chest gunshot shrapnel blind wound with right mammary gland damage. The wound healed under a scab. The patient was discharged to the unit on the 10th day after the injury with recovery.

We consider it appropriate to discuss the positive result obtained in a patient with a traumatized breast using the original method of metal foreign body removing after a chest

gunshot wound from two standpoints - the very rare localization of the wound site and the metal fragment successful removal in a specific patient using a magnetic device.

According to published data and our observations, breasts gunshot wounds are a rare phenomenon which is associated with the small number of women in Ukrainian Armed Forces and the available means of personal protection (the availability of bulletproof vests) [1, 3, 6, 8–11].

It should be noted that breast damage and metal foreign body retention inside the organ occurred despite the presence of a protective body armour which should ideally preserve the organs integrity in case of such injuries. However, modern and new types of firearms and bullet-wound projectiles with extremely high kinetic energy are used in modern military conflicts, which wound ballistics have not yet been fully investigated [14].

Unusual bullet trajectories in case of gunshot wounds can create both surgical and/or forensic diagnostic problems [13, 14]. Being filled with vital organs chest cavity, even after the slightest movement of a penetrating bullet, can simultaneously damage them – i.e., the accent should be done on heart, lungs, aorta, large-diameter venous vessels, etc. [13]. Because the bullet has both translational and rotational motion, it has much greater kinetic energy, resulting in the vital organs greater damage [13, 14]. The energy is dissipated and attenuated as the bullet slows down in soft tissue, which we observed in our clinical case. Important that high-velocity damages might induce secondary injuries due to bone fragmentation which is extremely dangerous due to bone (bones) fragmentation by the bullet and potential increase of injury severity [13].

We want to attract attention from our own experience that in case of high-speed bullet wounding the doctor should keep in mind that the projectile trajectory will be non-linear and most likely complex. Therefore, both wounds' entrance and exit holes must be carefully examined that in our case led to metal fragments presence suspicion and their subsequent detection inside the organ using magnetic instruments.

At the same time, the organizational measures of military doctors aimed to wounded persons rapid evacuation and their subsequent effective treatment at following levels of medical support are extremely important [4, 5].

An important point in such wounded management we supposed to be the determination of foreign body (bodies) type, its (their) localization and quick removal. The principles of mammary glands foreign bodies both diagnosis and removal are the same as in soft tissues gunshot foreign bodies [6, 8, 12].

We want to stress that use of modern surgical magnetic instruments of Kharkiv production contributes to qualified and specialized surgical care to wounded persons and allows you to increase the number of gunshot foreign bodies that might be removed [3, 8, 12].

Conclusions

1. The mammary glands gunshot wounds are a rare event in the general structure of gunshot wounds.
2. The use of personal protective equipment does not always protect the mammary glands from gunshot foreign bodies due to insufficiently covered lateral surfaces.
3. The use of modern surgical magnetic instruments of Kharkiv production contributes to gunshot foreign bodies minimally invasive removal from the mammary gland.

Prospects for further researches include extension of the experience of similar staged operations performing in combined explosive chest trauma to analogous episodes in abdominal and pelvic organs explosive injuries. An additional perspective of this clinical case is the make possible to use the adaptive titanium plates together with a metal thread at the third and fourth levels of medical care.

References

1. Atlas boyovoyi khirurhichnoyi travmy (dosvid antyterorystychnoyi operatsiyi/operatsiyi obyednanykh syl). Pid. red. V.I. Tsimbalyuk. Kharkiv: Collegium, 2021. 385 [in Ukrainian].
2. Atlas promenevoyi diahnostryky vohnepalnykh poranen. Pid. red. V.I. Tsimbalyuk. Vinnytsya: TVORY, 2024. 472 [in Ukrainian].
3. Vohnepalni poranennya myakykh tkany (dosvid antyterorystychnoyi operatsiyi/operatsiyi obyednanykh syl). Pid. red. V.I. Tsimbalyuk. Kharkiv: Collegium, 2020. 400 [in Ukrainian].
4. Gumenyuk KV, Gangal II, Karpenko KK. Nadannya vysokospetsializovanoyi medychnoyi dopomohy viyskovosluzhbovtsham Zbroynykh Syl Ukrayiny miniinvazyvnyimi renthenendovaskulyarnymi metodykamy. Zaporizkyy medychnyy zhurnal. 2021; 23(3): 375-380. doi: 10.14739/2310-1210.2021.3.223139 [in Ukrainian].
5. Korol SO, Bely VYa, Gumenyuk KV, Hybalo RV, Grishov AA, Zagovenko MA. Aktualni pytannya ta osoblyvosti pidhotovky viyskovykh khirurhiv v umovakh povnomasshtabnoyi ahresiyi rf proty derzhavy Ukrayina. Ukrayinskyy zhurnal viyskovoyi medytsyny. 2023; 4(1): 5-12. doi 10.46847/ujmm.2023.1(4)-005 [in Ukrainian].

6. Likuvannya poranenykh z boyovymy ushkozhenyamy hrudey. Pid. red. V.I. Tsimbalyuk. Ternopil: TNMU, 2023. 236 [in Ukrainian].
7. Medychna dopomoha uchasykam boyovykh diy. Pid. red. O.M. Khvysyuk, V.H. Marchenko, B.V. Mykhaylov. Kharkiv: DISA Plyus, 2019. 576 [in Ukrainian].
8. Nastanovy z voyenno-polovoyi khirurhiyi. Pid. red. K.V. Humenyuk, S.O. Korol, R.V. Hybalo. Kyiv: Vydavnytstvo Lyudmyla, 2024. 572 [in Ukrainian].
9. Al Horani O, Al-Ghotani B, Albelal D, Alabdallah E, Kamil H, Al-Mahasna S. A case report of a bullet in the breast of a woman for four years without any complications. *Int J Surg Case Rep.* 2023; 105: 108049. doi: 10.1016/j.ijscr.2023.108049.
10. Anto J, Kumar Anil, Kumar Anurag, Anwer M, Kumar Subhash, Kumar Deepak Gunshot injury to the chest wall with an unusual bullet trajectory: A rare case report. *Int J Surg Case Rep.* 2022 Jul;96:107343. doi: 10.1016/j.ijscr.2022.107343.
11. Chung HL, Leung JWT. Foreign body granuloma from a gunshot injury to the breast. *Clin Imaging.* 2020; 68: 197-201. doi: 10.1016/j.clinimag.2020.08.021.
12. Khoroshun EM, Makarov VV, Nehoduiko VV, Shypilov SA, Tertyshnyi SV, Veryovkin IV. et al. Non-operative treatment of gunshot wounds of soft tissues. *World of Medicine and Biology.* 2024; 2(88): 180-184. doi: 10.26724/2079-8334-2024-2-88-180-184
13. Rhee PM, Moore EE, Joseph B, Tang A, Pandit V, Vercruyse G. Gunshot wounds: a review of ballistics, bullets, weapons, and myths. *J Trauma Acute Care Surg.* 2016; 80(6): 853-867. doi: 10.1097/TA.0000000000001037.
14. Tsymbaliuk V, Lurin I, Gumeniuk K, Herasymenko O, Furkalo S, Oklei D. et al. Modeling of wound ballistics in biological tissues simulators. *Medicni Perspektivi.* 2023; 28(1): 37-48. doi: 10.26641/2307-0404.2023.1.275866.
15. Tsymbaliuk VI, Abdulaev RYa, Lurin LA, Lazoryshynets VV, Usenko OY, Dykan IM. et al. Imaging of toracoabdominal gunshot wounds. Kharkiv: Fact, 2024. 152.

Стаття надійшла 14.07.2024 р.