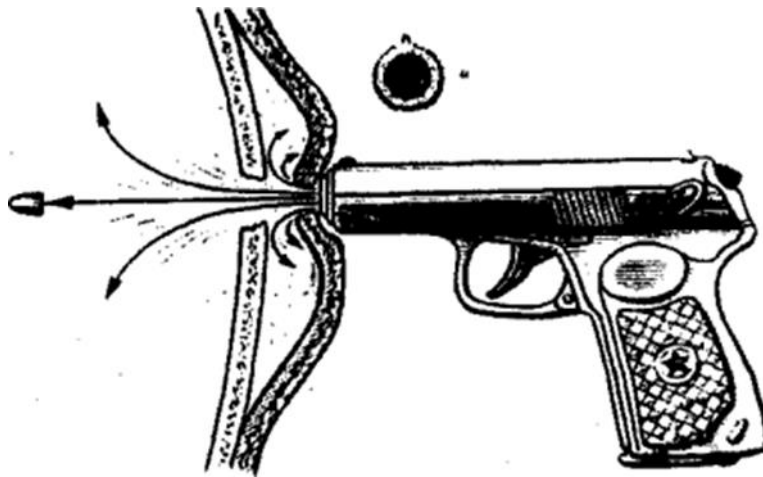


**Module 1. The organization of forensic -medical examination and general problems of forensic medicine. Forensic-medical principles of examination violent and natural death**

**Sub module 4. Forensic-medical examination of damages and death caused by mechanical factors**

## **Theme 11. Forensic-medical examination of firearm injuries**

*Guidelines for students and interns*



**Модуль 1. Організація судово-медичної експертизи та загальні питання судової медицини. Судово-медичні засади експертизи насильницької та ненасильницької смерті**

**Змістовний модуль 4. Судово-медична експертиза ушкоджень та смерті від механічних чинників**

## **Тема 11. Судово-медична експертиза вогнепальних ушкоджень**

*Методичні вказівки  
для студентів та лікарів інтернів*

**МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ**  
**Харківський національний медичний університет**

**Module 1. The organization of forensic -medical examination and general problems of forensic medicine. Forensic-medical principles of examination violent and natural death**

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Module 1. The organization of forensic-medical examination and general problems of forensic medicine. Forensic-medical principles of examination violent and natural death. Sub module 4. Forensic-medical examination of damages and death caused by mechanical factors. Theme 11. Forensic-medical examination of firearm injuries: guidelines for students and interns / comp. Vasil Olhovsky, Mykola Gubin, Petr Kaplunovsky, Vjacheslav Sokol. - Kharkiv: KNMU, 2013.

Compilers: Vasil Olkhovsky  
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Модуль 1. Організація судово-медичної експертизи та загальні питання судової медицини. Судово-медичні засади експертизи насильницької та ненасильницької смерті. Змістовний модуль 4. Судово-медична експертиза ушкоджень та смерті від механічних чинників. Тема 11. Судово-медична експертиза вогнепальних ушкоджень: методичні вказівки для студентів та лікарів інтернів / упор. В.О. Ольховський, М.В. Губін, П.А. Каплуновський, В.К. Сокол. – Харків: ХНМУ. – 2013.

Упорядники: Ольховський В.О.  
Губін М.В.  
Каплуновський П.А.  
Сокол В.К.

**Substantiation of the Topic.** At peacetime gunshot wounds occur rather seldom in the practice of forensic expert. A great amount of different types of light guns, variety of ways of cartridge equipment and different ranges of damage in each case produce rather variegated picture of gunshot wounds morphology. Knowledge of gunshot wounds mechanisms and their peculiarities are necessary not only to decide expert problems, but also in medical practice for correct and timely diagnostics of such decisions, to choose correct method of treatment, and, accordingly, to render an effective medical aid during peace and war time.

**Duration of practical classes:** 3 academic hours

**Purpose of the Practical Class:** to acquaint the students with types and structure of guns, mechanism of shot, accompanying factors of shot, and peculiarities of formation of gunshot wounds, methods of Forensic examination, and to gain practical skill in decision of basic expert questions.

**Direct purpose of study:**

1. To be able to investigate and to describe firearm injuries of human tissues;
2. To diagnose entry and exit gunshot wounds;
3. To determine a distance and direction of a shot.

**Basic level of knowledge and skills (before the practical class):**

1. An essence about trauma and traumatism
2. Morphological appearances of inflammation, healing, bleeding etc.
3. Clinical and morphological characteristics of scratches, bruises, wounds, fractures

**Visual Aids and Material Tools**

1. Different natural specimens (human skin with wounds, internal organs, bones injured due to action of firearms) are the objects of the investigation;
2. Studying tables, photos, video.

#### **Technological card of carrying out of practical classes**

<b>№</b>	<b>Level</b>	<b>Time (min)</b>	<b>Manuals</b>	<b>Place of carried</b>
1	Control of initial level of knowledge on the topic	15	Oral answering	Class room
2	Analysis the scheme of the description of damages	10	Tables with scheme	Class room
3	Studying theme of classes, description of damages of a skin on natural preparations	30	Natural preparations	Class room
4	Conclusion about character of described damages	15	Natural preparations	Class room
5	Studying theme of classes, description of damages of a bones on natural preparations	30	Natural preparations	Class room
6	Conclusion about character of described damages	15	Natural preparations	Class room
7	The decision of situational tasks	15	Situational tasks	Class room
8	Classes summarising	5	-	Class room

## **BLOCK OF INFORMATION**

Gunshot wounds occur relatively seldom in the practice of forensic expert. Nevertheless their research is obviously important, as at this research the expert can resolve many questions having sometimes extreme value for the inspector. For a correct estimation of features of fire arm injuries it is necessary to know about a firearms, the mechanism of formation of damages.

### **Firearms**

#### **Mechanism of formation of firearms damages**

It is necessary to distinguish 4 kinds of action of a bullet, namely:

- 1) penetrative - when the bullet possesses significant kinetic with energy also operates as a punch, beating out a slice of a tissue (more often in total this action is observed in the field of an entrance aperture);
- 2) wedge-shaped (shown in the field of an exhaust outlet) - when kinetic energy of a bullet is considerably lowered, and it only moves apart tissues, as a wedge;
- 3) contusion or bruised - when the bullet, having insignificant kinetic energy (for example, spent, at passage through a barrier before hit in a body), operates, as a blunt firm object, causing grazes, abrasions without formation of a wound);
- 4) explosive (it can be observed in two cases) - when the bullet has a special explosive or, possessing the big kinetic energy, it gets in hollow body filled by a liquid where makes so-called hydrodynamical influence.

#### **Features entrance and exit gunshot wound**

The entrance aperture on a body refers to as an entrance bullet wound. The form of a bullet wound usually round or oval. Thus the aperture has a number of the characteristic attributes caused by penetrative action of a bullet. Among these attributes it is necessary to pay attention to the following:

1. **Defect of a tissue** (minus a tissue) is a place of the skin which have been beaten out by a bullet.
2. **Abrasion collar**- a ring of pink-red color formed because a bullet, entering into a body, involves a skin and a lateral surface tears off epidermis on edge of an aperture for the width 0,1-0,3 cm.
3. **Dirt collar** — a ring of grey or black color in width 0,1-0,3 cm. It's formed because the bullet carries on itself various parts (a soot, a powder deposit, traces of greasing, a rust) and, entering into a body, leaves (wipes off) these parts around of an entrance wound. Dirt collar can partially or completely be imposed on waist of the abrasion.
4. **Metallic collar** is formed as a result of adjournment erased scales of metal of an internal surface of the trunk, the bullet, and also an explosive mix of capsule and can be revealed radiographic, chemical, electrographic or spectrographic by methods of research.

The exit wound is formed as a result of wedge-shaped actions of a bullet in this connection it has fissure or star-shaped form. At its research it is necessary to pay attention to absence of defect of a tissue, collar of the abrasion, dirt collar and metallizations. It is necessary to mean, that edges of a wound in these cases are rough, big-notched (character of edges of a laceration), are turned outside. It is necessary to remember also, that on occasion in the field of an exhaust outlet defects of a tissue can be observed (if the channel of the wound is short and the bullet has not lost penetrative ability) and so-called false collar of the abrasion, formed when during the moment of an output of a bullet the skin has been pressed to something dense. Unlike true false collar of the abrasion has non-uniform width.

### **Definition of a distance of a shot and accompanying components**

**Distance of a shot** is a distance from muzzle cut of fire-arms up to amazed object. Correct definition of a distance of a shot has the big practical value. It is necessary to know, that in forensic medicine distinguish three distances of a shot: contact shot, close shot and distant shot. Formation of an entrance bullet wound at various distances is influenced with accompanying components of a shot.

**Accompanying components of a shot** are all that take off from the channel trunk of fire-arms during the moment of a shot, except for a shell (bullets, fractions). It is necessary to carry a prebullet column of compressed air, a flame, powder gases, a soot, not burned down grains of gunpowder, a particles of metal, gun greasing.

Air of prebullet space takes off from the channel of a trunk with speed of movement of a bullet.

**A fire of the shot** is a volume of gas in which there is a burning. It is necessary to remember, that at a shot smoky gunpowder from the channel of a trunk throws out the torch of the flame consisting of heated and fused particles of the rests of burning of gunpowder and capsule of a charge. At a shot by air without smoke gunpowder occurs explosion of products of incomplete combustion at contact with oxygen. Smoky (black) gunpowder gives a flame and a plenty of the fine heated particles which can cause subsidence of tissues, hair, burns of a skin, fire of clothes.

At shots by modern smokeless gunpowder the action of a flame is less expressed by gunpowder and extends on 20-30 cm from muzzle cut whereas at a shot smoky gunpowder the flame can extend up to 100 cm.

**Powder gases** - a product of combustion of gunpowder at a shot. It is necessary to consider, that powder gases possess mechanical, chemical and thermal action.

**Soot of a shot** are fine particles of various structure which are born from the channel of a trunk by powder gases. It is necessary to know, that the soot of smoky gunpowder consists basically of carbon and its salts. The soot of without smoke gunpowders is formed owing to decomposition of products of capsule structure, instead of gunpowders and consists of metals (lead, copper, antimony, etc.). It is necessary to consider, that intensity of adjournment of a soot, the form of its adjournment, the area depend on concrete distance of a shot and positions of the weapon in relation to amazed object. At a shot under a right angle the soot is

postponed in the form of a circle. More close to a wound its color is more sated, than to periphery. At a shot under a corner the form of adjournment of a soot gets a figure of an ellipse. The wound thus settles down more close to the party of an ellipse, the shot whence has been made. Some kinds of the weapon have a muzzle-brake device. At a shot adjournment of a soot gets the original form, it consists of separate sites according to windows of the muzzle-brake device. This attribute is valuable to an establishment of a kind of the weapon. The soot flies on distance till 30-50 cm.

**Grains of gunpowder** – it's half-burned or not burned down particles, taking off from the channel of a trunk. It is necessary to mean, that they, possessing the certain weight, can abrasion an epidermis, take root into a skin and in wound channel. The special research of grains of gunpowder can establish its kind.

A shot in an emphasis is a shot during which muzzle of the gun joins to a surface of a body. It is necessary to distinguish three kinds of an emphasis:

1. Full contact– muzzle of the gun is hermetically put to a body. In these conditions prebullet air causes damage earlier, than a bullet which passes through the formed wound. At this kind of an emphasis around of a wound the print of muzzle of – special print (stamp-print) can be formed. The stamp-print can look like a graze, abrasion, a parchment spot. It is formed mainly because of action of gases which extending under a skin, press down it to muzzle of the gun. Thus protruding skin under action of gases can be such, that grasps the details of a trunk located on significant enough distance from muzzle of the gun, for example, a front sight, its rack, post.

2. Loose contact shot - nonhermetic, at which a muzzle of the gun only puts to a body.

3. Partial or lateral - a shot from the weapon under a corner, when muzzle of the gun joins to a body only by one part. Thus can observe attributes of a shot in an emphasis and from close distance - a print of a part of muzzle of gun and adjournment of a soot (from a blunt corner). It is necessary to remember, that at all kinds of an emphasis a characteristic (specific) attribute is adjournment of a soot on a course of the wound channel, on internal surfaces of the stratified tissues (for example, on skin rags, an internal surface of a firm brain environment, bones of a skull), presence carboxihemoglobin in blood in the field of an entrance aperture and sometimes formation in its zone of hypodermic emphysema with diameter till 5 cm.

From close distance it is necessary to understand as a shot such distance when besides a shell on a leather additional factors of a shot operate. And depending on distance on which these factors extend, around of a wound action all of them (can be revealed at very close distance) or only one of them (for example, grains of gunpowder). To define precisely in centimeters a distance of a shot under additional factors in essence it is impossible. For the decision of this question in practice it is necessary to resort to experimental shooting from the same weapon and an ammunition passing on case, observing thus a number of special conditions. It is necessary to remember, that display of action of additional factors of a shot in itself specifies that wound - fire, that an aperture - entrance, that the shot is made from the close distance, the certain direction, and also in the dressed or naked body.

The distant from shot distance is characterized by that on a body one shell (a bullet, fraction) operates only. Under these conditions the wound, describing is formed by attributes which are described above.

### **Gunshot wound (bullet) channel**

**Gunshot wound the channel** - a way laid by a shell in a body, is continuation of a bullet wound. It is necessary to understand, that its features are defined by kinetic energy of a bullet and resistance of tissues. If energy has enough to punch all fabrics a bullet, having laid in them the channel, leaves a body outside through a target wound. Such channel refers to through. If energy has not enough, the bullet remains in a body, and in this case the channel refers to blind. At research of a gunshot wound without fail it is necessary to establish a kind of the bullet channel. It is necessary to distinguish 7 kinds bullet channels:

1. A straight line - passes through all tissues and organs on one line.
2. Broken - arises when after passage of a bullet there is a displacement of internal organs (for example, displacement of loops of intestines, compression of a lung in connection with hemopneumothorax, etc.). It is necessary to know, that at two bullet channels if one of them broken, and other straight line, it is possible to establish sequence of causing of wound - a straight line can be only after broken.
3. Rejected - it is formed when in a body occurs ricochet (rebound) of bullets. By practice and experimental researches it is established, that if the bullet meets a barrier (not necessarily firm) under a corner up to  $15^\circ$ , approximately in 25% cases occurs it ricochet.
4. Tangential - it is possible to observe, when the bullet operates on a tangent on round parts of a body (a head, a shoulder). It is necessary to distinguish two their subspecies - closed when there is entrance and target apertures and between them a short bullet channel, and opened when the wound having the form of a trench is formed. It is necessary to remember, that last kinds of wound are very difficult for diagnostics as practically do not possess characteristic attributes of fire damages owing to what demand special researches.
5. Surrounding - it can be formed when a bullet, possessing small kinetic energy, having punched a leather and having met a bone (for example the skull, a rib), as though slides after it continuing the way on hypodermic subcutaneous fat, and leaves in the opposite side. At external examination the impression is made, that is available getting (for example, in a cavity of a skull, a chest cavity) wound whereas actually it is not present.
6. Interrupted - arises when the bullet passes through some parts of a body (for example through a forearm and a thorax).

It is necessary to mean, that in similar cases it is possible to run into a mistake - to draw a conclusion that was two wounds (forearms and breasts) whereas the shot was one and the bullet was one. In cases of the positive answer it is possible to recreate a pose in which there was a person during the moment of causing to it of



wound.

7. Plural - it is possible to observe when bullet before hit in a body or in a body for whatever reasons makes fragments, forming a little bit blind or through wound channels.

Alongside with an establishment of a kind of the bullet channel at research of fire damage it is necessary to establish a kind of a direction of the channel. It is necessary to know, that distinguish 3 kinds of a direction of the bullet channel: single, double and threefold-in dependences on its attitude to the conditional planes which are passing through a body of the human body – sagittal, horizontal and frontal. If the channel lays only in one plane, the name its (direction) double (for example, in front-back, and from below-upwards, on the right-on the left and from below-upwards and others). If the channel does not lay in one of planes, its direction threefold (for example: in front-back, on the right-on the left and from below-upwards or behind beforehand, on the right-on the left and from above-downwards, etc.). If the channel lays in two planes and is perpendicular the third it refers to single (for example, in front-back, on the right-on the left or from above-downwards and others).

At research of firearm injuries it is necessary to consider, that in bones the bullet channel has the original form. In particular, in flat bones (a skull, a scapula, a coxae, etc.) it has the form of the truncated cone extending aside of flight of a bullet.

In long tubular bones at gunshot wounds splintered or holed-splintered fractures more often are formed. Having compared parts of the bones, in the field of an input of a bullet it is possible to find out an aperture of round forms from which mainly radial cracks forming scratches triangular or trapezoid shapes are formed. In the field of an output of a bullet of a crack mainly longitudinal, incorporating among themselves cross-section.

It is necessary to remember, that at research of fire damages on the bones, sometimes later many years, and sometimes and decades, the establishment not only entrance or an exhaust outlet, a direction of a shot and calibre of a bullet, but also the decision of other questions - about system of fire-arms, a chemical compound of an environment of a bullet, distance of a shot and sequence of causing of damages is possible at plural wounds.

## SCHEME OF DESCRIPTIONS OF INJURIES

The description of damages must include following data:

1. **Localization.** At definition of localization of damage it is necessary to specify **anatomic area** of a body in which it is located (for example, in the field of a forehead, on a forward surface of a thorax, on a stomach, etc.), and then to detail an arrangement (under condition of vertical position of a body). Detailed elaboration of an arrangement of damage should be made under the attitude (distance) to **anatomic reference points** (the lower angle of the scapula, the lower end of the xiphoid process, a junction between left clavicle and sternum, etc.) and if necessary in view of the conditional lines lead through a body of the person (for example, on a breast at the left in the fourth intercostal space on an axillary line is available...). At transport

damages it is expedient to specify and height of an arrangement of injury, measuring it from plantar surface of the foot of the victim (the last can promote an establishment of a part of the machine which have caused damage).

2. **A kind of injury.** After an establishment of localization it is necessary to name a kind of injury. Thus it is necessary to use the definitions standard in medicine - a graze, a scratch, bruise, a wound, etc.

3. **The shape of injury.** It is necessary to specify the shape of injury with reference to **geometrical figures** (oval, round, triangular, rectangular and others). If the shape of injury not precisely corresponds geometrical, add a word **incorrectly** (is wrong-oval, is wrong-triangular and others). It is admissible also the specified forms of damage with reference to the form of letters of the Russian alphabet (the T-shaped form, the Y-shaped form, X-shaped, etc.).

4. **The sizes of injury.** It is necessary to specify the sizes of damage in centimeters. Thus if an injury has length and width it is necessary to specify all over at first and after smaller size (for example 3×0,5cm). To define length of a wound follows at its shown edges, that in some cases matters for an establishment of the sizes of an operated part of the instrument. Injury can sometimes have the form of two, three beams converging in one point. In these cases it is necessary to define length of beams and their direction.

5. **Direction of the length of injury.** In cases when length of damage more than its width, it is necessary to note a direction of the length. The direction of the length determines under its attitude to a vertical axis of the person (for example, a direction of the length of wounds vertical, horizontal, from top to down and from left to right, etc.).

6. **Color.** It is necessary to specify color at the description bruises and abrasions.

7. **Character of edges and the ends of a wound.** It is necessary to remember, that edges of a wound can be equal, smooth, rough, ragged smallnotched, bignotched, the ends of a wound – sharp, rounded off, rectangular, doubled (M-shaped). In some cases between edges of a wound, at its ends, in depth (at the bottom of a wound) can be observed in connective crosspieces (tags). It should be without fail noted at the description of injury.

8. **A condition of surrounding tissues.** After the description of character of edges and the ends of a wound it is necessary to note changes of surrounding tissues. Edges of a wound can be scratched, bruised. Thus it is necessary to note, on what edge (or where exactly) is available scratches, bruises, its sizes (width), etc.

Around of injury it is often possible to observe a various sort of imposing (a soot, a dirt, railway greasing, etc.). In these cases it is necessary to note a total area borrowed by imposings (sometimes with the instruction of a place of imposing – upwards, to the left, downwards, to the right from injury), with the instruction of color of imposings, their features. At absence of changes and imposings around of damages it is necessary to note, that a leather and tissues around of injury are not changed.

9. **Interposition of damages.** At presence of the several injuries which are settling down in one anatomic area, it is necessary to specify not only their localization, but also interposition under the attitude to each other.

## **QUESTIONS FOR STUDENT'S INDEPENDENT WORK**

1. Classification of firearms. The parts of the weapon cartridge and mechanism of shot. Additional factors of a shot.

2. The mechanism of action of a bullet on a body of the person depending on kinetic energy.

3. Entrance and exit gunshot wounds, special attributes, forensic medical importance

4. A signs of contact shot. A sign of suicide with firearms application.

5. A signs of close and distant shot.

6. Damages caused by pellets. The parts of the smooth bore cartridge. Definition of a distance of a shot.

7. Features of bullet damages of flat and tubular bones. Definition of direction of gunshot channel.

8. Laboratory methods of examination of firearms damages.

## **TESTS AND SITUATIONAL TASKS FOR SELF-ASSESSMENT**

1. What the main morphological sing of entrance gunshot wound ?

- A. «Minus tissue»
- B. Absents ring of abrasion
- C. Oval shape
- D. Rounded shape
- E. All are correct

2. What distances of a shot are determined in forensic medicine ?

- A. Very contact
- B. Very close
- C. Very near
- D. Near
- E. Close shot

3. What the main morphological sing of exit gunshot wound ?:

- A. Edges are irregular, serrated and everted
- B. Star shape
- C. It is bigger than entry wound
- D. Abrasion, dirt collar and metallization rings are absent
- E. All are correct

4. On forensic autopsy of a corpse it was revealed: on the outer surface of the left thigh in the middle third there is a round-shaped wound with "minus-tissue" defect; its edges are grazed, covered with greyish-black substance. Damages caused by... ?

- A. Stabbing instrument
- B. First stabbing instrument, and then cutting one.
- C. Stab-cutting instrument
- D. First gun and then stab-cutting instrument
- E. Firearms

5. On forensic autopsy of a corpse there was revealed: a round-shaped defect "minus tissue" with diameter 0.9 cm in zygomatic region with a zone of graze up to 0.2 cm wide, which is covered with thin greyish layer. There is a deposit of sooth up to 5 cm wide around the wound. The character of damage gives grounds to consider that it is:

- A. Stab wound.
- B. Exit gunshot wound.
- C. Entry gunshot wound.
- D. Stab-incised wound.
- E. Incised wound.

### **ANSWERS**

1 — A; 2 — A; 3 — E; 4 — E; 5 — C

### **After the practical class every student should know:**

1. Shot distances, forensic appearances of entry and exit firearm injuries.
2. The mechanism of action of different shells to the human tissues.
3. Additional factors of a shot upon clothes and a human body.
4. Peculiarities of firearm injuries in internal organs and bones.
5. Directions of a shot and bullet track.

### **should be able to:**

1. Describe firearm injuries of clothes, skin, bones and internal organs.
2. Determine entry hole and exit holes.
3. Estimate a distance of a shot and direction of a bullet track.



## RECOMMENDED LITERATURE

### Basic:

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**Модуль 1. Організація судово-медичної експертизи та загальні питання судової медицини. Судово-медичні засади експертизи насильницької та ненасильницької смерті. Змістовний модуль 4. Судово-медична експертиза ушкоджень та смерті від механічних чинників.**

## **Тема 11. Судово-медична експертиза вогнепальних ушкоджень**

*Методичні вказівки  
для студентів та лікарів інтернів*

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