FEDERAL STATE AUTONOMOUS EDUCATIONAL
INSTITUTION OF HIGHER EDUCATION
"PIROGOV RUSSIAN NATIONAL RESEARCH MEDICAL
UNIVERSITY" OF THE MINISTRY OF HEALTH
OF THE RUSSIAN FEDERATION

The Department of Forensic Medicine

GUIDELINES ON FORENSIC MEDICINE. GUNSHOT INJURIES

Study guide

Edited by I.V. Buromsky and E.M. Kildyushov

Translated from Russian by E.V. Egorova

Extended edition

Moscow
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ПРАКТИКУМ ПО СУДЕБНОЙ МЕДИЦИНЕ.
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The guidelines are intended for students as a study guide for preparation for practical trainings and independent work.

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Requirements for Volume and Level of Knowledge Acquisition of the Program Section

The volume and level of knowledge acquired from the Program Section is intended to form soft skills, general and special professional skills (acquirement of knowledge, skills and competence), which are necessary for a doctor in case of being involved in an investigation to assist law enforcement in detection, withdrawal and recording of crime traces as well as making up issues, which are to be determined by expert evaluation; participation in the examination of medical records submitted for the expertise and making a conclusion about presented issues in frames of professional scope in case of suspected gunshot and explosive injuries.

The criteria for acquiring the necessary scope of knowledge and achievement of the necessary level of knowledge acquisition are the following:

Gaining apprehension:

- about firearms, its classification and ammunition;
- about the mechanism of gunshot and its accompaniment;
- about damaging factors of gunshot and explosion;
- about distinctive features of expert examination of a corpse in the case of gunshot injuries and (or) explosive trauma;
- about the main techniques and methods of laboratory study of objects of forensic medical examination and their use for the settlement of questions arising in the process of gunshot and explosive injuries examination.

Knowledge acquisition:

- medical and juridical aspects of person's death pronouncement, determination of its cause and its causal relationships with gunshot or explosive injury;
- mechanisms of formation and features of external presentations of gunshot and explosive injury;
- order and methods of a corpse inspection at a place of its discovery, its specifics in case of a suspected gunshot or explosive injury;
- means and methods for revealing material evidences of biological origin, their withdrawal, packing and submission to an expert investigation in case of a suspected gunshot or explosive injury;
- order and methods of a live person's examination to record the presence of gunshot or explosive injuries and determine severity of health harm caused by them;
- main means and methods of laboratory investigations of objects submitted to a forensic expertise in case of suspected gunshot or explosive injuries; diagnostic capabilities of such means and methods; structural forensic medical units where such investigations may be carried out;
- principles of interpretation of the results of laboratory studies of objects submitted to forensic medical examination.

Skills acquisition:

- to evaluate and analyze data of medical records in case of gunshot and explosive injuries;
- to consistently present a case and defend one's own point of view, including in case of being involved in a trial as an expert or a specialist;
- to help law enforcement officials in statement of questions, which are to be resolved by a forensic expertise in case of suspected gunshot and (or) explosive injuries, if necessary — offer law officials advice in the frame of his/her competence scope.

Skills obtaining:

- systematic expert evaluation of incident circumstances in case of gunshot or explosive injuries, evaluation of medical records and medical data contained in case's files;
- description of pathomorphological changes occurring in case of gunshot and (or) explosive injuries, making a provisional conclusion about their intravital (post mortal) formation, their term, sequence and mechanisms of formation; the ability of a person to perform active targeted actions after the injury or the development of a pathological state;

- establishment of the severity of harm caused to human health as a result of gunshot and (or) explosive injuries;
- formulation of forensic diagnosis and making an expert's conclusion.

Essential knowledge to study the section:

- basic knowledge of normal and pathological anatomy, topographic anatomy and operative surgery, general surgery, normal and pathological physiology, histology, traumatology and orthopedics.

Purpose of practical classes:

1. Correction and arrangement of knowledge obtained during self-preparation for a classroom session in according with the above mentioned requirements for the content and the level of the program apprehension.

2. Getting skills to describe and evaluate the gunshot and fragment injuries of soft tissues, bones and internal organs.

3. Getting skills to make a forensic diagnosis and an expert conclusion in cases of death from gunshot or explosive injuries.

Procedure for the Conduct of Practical Classes

The purpose of practical classes is achieved by means of discussion with a tutor the questions, which appeared during self-preparation for practical classes; acquaintance with bone and wet mounts, training models and charts; accomplishing a training task with making a forensic diagnosis and an expert conclusion.

The control of the initial level of knowledge (preparation for the classes) is carried out by completing the task using the test items of the initial level of knowledge (the passing score is 70% or more of the total).

Monitoring the achievement of the required scope and level of section's content apprehension (final control) is carried out by performing the following steps: tasks using test points of acquired level of knowledge (the passing score is 70% or more of the total); participation in the discussion of the description of bone and wet preparations; defense of the solved problem and the subsequent interview with the tutor on the material of the section.

Distinctive Features of the Examination of the Corpse in the Place of its Discovery

In cases of *gunshot injuries* it is necessary to note: the position and pose of the corpse, the position of the firearm, slugs, expended cartridge cases, wads and other elements of ammunition in relation to fixed points (orienteers) and the corpse (together with a criminalist); the distances between them; clothing damages: the nature, localization, shape, size, colour of foreign depositions around clothing damages, as well as on the inside; the presence of bullets, shotgun pellets, wads and other elements of ammunition in the clothing, between its layers and in its pleats (upon detection of any it is necessary to render assistance to the investigator upon the collection of trace evidence in order to send it to analysis).

Upon the description of injuries it is necessary to indicate their localization and distance from the heels, the presence of defects ("shortcoming of tissue"), size, distinctive features of the edges, the presence of abrasion collars, soiling, a muzzle mark, traces of gunshot residue; the presence of soot, grains of gunpowder, blood splatter on the wrists/hands. If necessary the swabs (prints) from the hands and other body parts are taken on the spot for further determination of gunshot elements. The correspondence of the damages on the clothing and body, the presence of both shoes on the body are noted.

In cases of explosive injuries it is necessary to note: the position of the corpse (corpses) in relation to fixed points (orienteers) and to the explosion epicenter. In cases of body destruction — the position of each detached piece of clothing and body part in relation to fixed points and the explosion epicenter and the distances from them.

The state of the clothing and shoes, the presence of damages and soiling on them are noted. The damages to the corpse are described with the indication of their localization, shape, size, presence of fabric defects, detached body parts and traces of thermal influence, places of greatest damage and lodgement of secondary missiles. It is necessary to pay attention to the correspondence of the damages on clothing to the damages on the body, the presence and direction of taeniate and radially dispersing abrasions and tangential wounds.

Suggested list of questions subject to resolution by expertise in cases of gunshot injuries:

1. Is the injury a gunshot one (it is necessary to indicate the presence of damages and traces that appear as a result of gunshot residue or damaging factors of a fire shot; morphological features, localization of entrance and exit wounds)?
2. What is the direction and type of wound track (during the examination of the wound track the entrance and exit wounds or the entrance and bottom of wound canal are determined)?
3. What are the characteristics of the projectile (if it is present — the shape, size, mass and other parameters)?
4. How many gunshot injuries were detected?
5. What is the sequence of appearance of the detected gunshot injuries?
6. What was the range of fire of each fire shot that caused the detected gunshot injuries?
7. Are there any signs of interaction of the projectile and an intermediary target?
8. Do the number and nature of gunshot injuries on the corpse and clothing garments correspond to each other?
9. Could the detected injuries have been caused by the victim himself/herself?

Suggested list of questions subject to resolution by expertise in cases of explosive injuries:

1. Are there any damages on the corpse and clothings that were caused by an explosion?
2. Do the body fragments found in the place of explosion belong to one corpse?
3. What damaging factors affected the victim (the presence of signs of explosive gases and soot, fragments of shells, secondary projectiles)?
4. What is the mechanism of injury appearance as a result of the explosion?
5. How far was the victim from the explosion epicenter?
6. Was there any intermediary target between the victim and the explosion epicenter?
7. What was the pose of the victim at the moment of explosion?
8. What was the relative position of separate body parts and the explosive device at the moment of explosion?

Special Aspects of the Examination of the Corpse with Gunshot or Explosive Injuries

The analysis of accompanying documents

In the process of looking through the records of the examination of the place of accident it is necessary to pay attention to: the pose of the corpse, the nature of putrid phenomena; in cases of gunshot injuries — the presence and placement of fire arm, cartridge case, bullets, bullet and shotgun pellet perforations; the nature of blood splatter; distinctive features of entrance and exit wounds; the location and expressiveness of gunshot traces; in cases of explosive injuries — the presence and placing of fragments of an explosive device; damages from fragments and explosive wave; the location and expressiveness of smudge prints, the nature of blood splatter, penetration of secondary projectiles in the body.

External examination

Upon description of the clothing (having preliminary unfolded it) it is necessary to specify: the localization of damages; their shape, size, distance from seams and other definite orienteers; the direction and nature of wound edges; the presence of additional tears (specify the direction and length of each); the presence or absence of fabric defects (juxtaposition of damaged edges when putting them close to each other); the localization of blood splatter (its expressiveness, size, shape, direction of bleeding); the correspondence of damages on different layers of clothing and on the skin.

In cases of gunshot injuries, it is necessary to note the presence of fire shot traces: singeing of fabric (easier to detect under side lighting), the presence of soot, grains of gun powder (measure the area and distance from damages in different directions).

In cases of explosive injuries, it is necessary to note the thermal influence of explosive gases, that cause singeing and burning of clothing, melting and alloyage of separate fibers of synthetic fabrics, smoking of clothing; fragment wounds, usually, of different forms (straight-lined, spherical, arcual, oval, polygonal, with the indication of presence or absence of fabric defects); the presence of tears on clothing as a result of hyperextension; the presence and nature of foreign particles on the clothing. It is necessary to examine both the inner and outer parts of the clothing.

In cases of gunshot injuries, it is necessary to describe the localization of the entrance and exit wounds, their interposition, the total damage

area (in cases of shotgun pellet damages), the distance between separate damages, the nature of each wound (localization, size, shape). In doing so, it is necessary to note the following:

- whether the wound edges are everted or inverted;
- if the edges are ruptured — the length and direction of the disruption;
- the presence or absence of skin damages (this is identified by carefully aligning the edges of the wound. In cases of "shortcoming of tissue" it is impossible to align the edges of the wound, or folds appear in the corners of the wound);
- the presence of abrasion collars and bullet wipe around the wound (their location, size, density, colour and other features). An abrasion collar can be located either on the circumference of a wound or on one side of the edge of the wound in the shape of a stripe 0,1–0,5 cm wide. A bullet wipe usually repeats the abrasion collar and is sometimes hard to notice due to the presence of blood traces. Soot soiling, lubricating oils, foreign particles can be found deposited in the bullet wipe. In order to examine such traces it is reasonable to use methods of stereomicroscopy;
- rim of air abrasion (described similar to the description of abrasions; it can look like 1–3 abrasions concentrically situated around the wound 0,1–0,5 cm wide or like abrasions of crescentic shape);
- upon the description of grains of gun powder — the distance between separate grains in the peripheral parts, their colour, total distribution area, relation to the skin damages;
- the presence of a muzzle mark (it can look like an abrasion or a bruise).

Internal examination

The distinctive features of studying and describing gunshot wound tracks:

- it is prohibited to probe a wound and to retrieve the projectile with metallic objects;
- the study is conducted by layer-wise dissection of soft tissue; in doing so, it is necessary to indicate the localization of the damage, shape, size, foreign inclusions, the thickness of damages tissue, the presence of hemorrhages (their colour and size);
- as a result of the examination the following is determined:
  - type of wound track (blind, dipnoous, tangential; straight, lacerated, interrupted, engirdling, graduated);
  - the length of the wound track;

– the direction of the wound track (in relation to the vertically positioned body: from the top downward, anteroposterior, from left to right);
– distinctive features of the wound track (in particular, if gunshot residue is present; indicate the type and localization of it).

In cases of explosive injuries, body damages are usually of open complex nature with major destruction. Closed isolated damages of internal organs are typical results of explosive waves, the latter also gives rise to baro- and acoustic trauma. In cases of body fragmentation, it is necessary to examine all presented body parts, to work out a detailed diagram and take photographs of the body or its parts.

Model Plan of a Statement (Findings) in Cases of Gunshot and Explosive Injuries

In cases of *gunshot injuries*, it is necessary to indicate whether the present injury is a gunshot one. In order to do so, it is necessary to run differential diagnostics with other types of mechanical damages.

If the present damage is considered a gunshot injury, it is necessary to identify the following:

1. Type of wound (gunshot, pellet, fragment), its nature (dipnoous, blind) and its location (what part of body).

2. The localization of entrance and exit wound(s), their amount and distance from the heels.

3. The type of wound track(s) and its (their) direction and extent on separate areas (in clothing, in soft tissue, in internal organs, in bones).

4. The shooting distance: at point-blank range, within the range of the gunshot residue, beyond the range of the gunshot residue (in cases of shotgun pellet wounds — infliction of injury within the range of the concise pellet action, upon the projection and pattern of the pellets).

5. The interposition of the muzzle and the body of the victim at the moment of the fire shot(s).

6. The possibility of the appearance of the entrance wound upon the victim conducting the fire shot by himself/herself.

7. Intravitam appearance of the gunshot wounds and their remoteness.

8. Cause of death, the presence of cause-effect relationship between the gunshot wound and the death.

9. The capability of the victim to perform purposeful action after the inflicted gunshot wound.

In cases of explosive injuries, it is necessary to indicate in the statement the following:

1. The explosive nature of the injury. The following may point to this nature: the combined nature of the wound, multiple conjoined damages, destruction of tissue, organs and body parts with the possible detachment of peripheral body parts (fingers, wrists, feet); mainly blind nature of the injuries with radially directed wound tracks of different lengths, some of which may contain fragments of the explosive device; different sizes and lengths of the wounds; abrasion collars and soiling on the edges of the wounds; the presence of closed isolated damages of the internal organs; traces of thermal and chemical influence of powder and the debris of explosives.

2. Intravitam appearance of the gunshot wounds and their remoteness.

3. The fact of the action of the gunshot residue and their characteristic (gun powder, soot soiling, debris of the container, secondary missiles).

4. The mechanism of appearance of the wounds, the range of the explosion, the presence or absence of any intermediary target.

5. The orientation of the explosive in relation to the body of the victim.

6. The position of the victim at the moment of the explosion.

7. The possibility that the victim caused the wound by himself/herself.

8. The possibility of causing of the wound in the predetermined conditions.

Laboratory Methods of Study

It is reasonable to conduct comprehensive and complex instrumental and laboratory studies of the injuries caused by fire shots or explosions in order to acquire the maximum of necessary information in the matter under inquiry. The sequence of conduction of different studies is determined according to the principle of maximum preservation of the object of studies, which is subject to subsequent examination.

Photography of the object of the study. The most frequently used methods of study in cases of gunshot and explosive wounds are macro- and microphotography, contrast photography and photography of objects in reflected infrared and ultraviolet rays.

- Macrophotography means taking photos of various objects with the use of a measuring scale, arrows, indicators and a background,

without using a microscope. The only possible feature to be used is direct enlargement (up to 20 times), which in its turn allows to detect and record small details of the wounds.

- Microphotography means taking photos with the use of a microscope for purposes of getting a picture of such small details of the wound that cannot be otherwise seen upon mere visual inspection (grains of gunpowder and their parts, small metal particles, fragments of the intermediary target).
- Contrast photography is used in order to detect poorly visible details of the relief (microrelief) and to transfer the image from barely discernible colour differences into expressed differences of a black-and-white image.
- The photography of objects in reflected infrared rays is used in order to detect bullet wipe, soot and grains of powder on dark-coloured fabric and in cases of blood soiling.
- The photography of objects in reflected ultraviolet rays is used in order to detect gun-lubricating grease.

X-ray methods are used in order to determine the nature of the gunshot injury, the localization of damaged bones and internal organs, shapes and size of fragmentation wound tracks, the detection of foreign matters, the determination of level of metal spattering on the skin and tissue around the entrance wound, the determination of the number and localization of separate pellets, etc. The implementation of maximally soft- and hard-radiation makes it possible to detect stuck fragments of the containers of the firearms, fragments of the exploder machine metal, etc.

Histological examination is used in order to determine the intravitam appearance of injuries and remoteness of injury, to determine the shooting distance and type of gunpowder, to conduct differential diagnostics of the entrance and exit wounds, to determine the nature of particles of the damaged intermediary target, etc. In cases of explosive injuries, the histological examination of separate body fragments allows to determine their morphological constitution and belonging to organ and tissue. The objects of a histological examination are skin and subcutaneous tissue (edges of gunshot wounds and the skin nearby), soft tissue of the wound track.

Biological study is used in order to determine the presence of blood, blood type, blood group, gender identity of blood, origin of blood, the presence of hair, bones, and pieces of soft tissue.

Genetic research of fragments of unidentified bodies (method of DNA fingerprinting and tissue genotyping) is used for purposes of identification.

Forensic-chemical study is conducted in order to determine the content of carboxyhemoglobin in the biological material, as well as chemical elements typical for combustive and lubricating materials.

Spectroscopic analysis is used in order to detect the metals of the fire shot (in the bullet wipe, soot, on barriers), to determine the range of fire (based on the alteration of metal content), to determine the type and identification of a particular projectile (based on the content of soot and on the state of the bullet wipe). The objects of a spectroscopic analysis are usually skin grafts, bones, fabrics with traces of damage, projectiles and their parts. It is mandatory to send a control sample for study (a piece of skin graft, bone). The presence and proportion of metals typical for the gunshot residue, in the soot and bullet wipe allow to make a conclusion on the gunshot nature of the wound and type of projectile.

Medico-criminological study is conducted for purposes of acquiring objective information that would allow law-enforcement agencies to reconstruct the circumstances of the incident resulting in death (post-event analysis). The objects of the medico-criminological study can be clothing, organs and foreign matters retrieved from the body.

- ***Medicolegal trace examination*** is based on the study of damage-traces, soiling-traces on the body and clothing, which allow to determine the probable type of firearm that delivered the fire shot and caused the wound.
- ***Medico-legal ballistic research*** is a research, the objects of which are gunshot and explosive wounds of the body and associated mechanisms of clothing damage appearance; other traces on the body and clothing, appearing as a result of the gunshot or explosive wounds; projectiles, their parts, retrieved from the body and clothing, as well as pieces of metal; the indication of characteristics of the gunshot and explosive wounds and traces associated with them on the body and clothing, recorded in the criminal case file and medical documentation in written, graphical, photographical, x-ray, mathematic and other forms; a firearm as a probable means of the cause of damage; samples of ammunition and the indication of the characteristics of different models of ammunition; documented indications of the process of appearance of the gunshot wounds and associated traces under study in the form of a dynamics model of the gunshot wound, obtained by experiment in the process of testing.

Upon conducting the medicolegal ballistic research it is possible to determine the fact of injury infliction by a projectile; the number of damages and sequence of fire shots; the localization of the entrance and

exit wounds; the direction of wound tracks; the range of fire; the type and distinctive features of the fire arm and ammunition; the position and pose of the victim's body at the moment of infliction of gunshot wounds; the fact of infliction of gunshot wounds through an intermediary target and after the ricocheting of the projectile; the direction of the fire shot; the mechanism, conditions of appearance of damages on the body and clothing in cases of explosive wounds; the characteristics of explosives.

It is reasonable to conduct the abovementioned studies jointly with the crime scene investigators.

- ***Medico-legal micrology research*** is conducted as a separate study in cases when there is no need to conduct other studies (trace examination, ballistic research). The objects of micrology research are microparticles and microtraces in (on) damaged tissue of corpses and in the traces on clothing that are connected with the mechanism of appearance of corporal injury; information (recorded in the criminal case files and medical documentation) about the previously conducted micrology research, about the results of the forensic study of the corpse, the place of discovery of the corpse and objects sent for study. As a result of a medicolegal micrology research the following can be determined: the presence of foreign microobjects on the clothing, body, in wounds and tissue of the corpse; the fact of disposition (implantation) of substances and microobjects from the weapon on to the clothing and body and vice versa.
- ***Case study*** is conducted for the purpose of reconstructing the course of events and checking the accordance of the statements of witnesses in relation to the cause of corporal injury to the objective information obtained via investigation and research, as well as for the purpose of determining the possibility of appearance of the damages (traces) under question in the particular circumstances and conditions. The objects of case study (of reconstruction of the course of events and circumstances of the incident) can be criminal case files, completed forensic and criminological studies (trace examination, ballistic research) and complex expert studies; objects of previously conducted studies (clothing pieces of the participants of the incident, vehicles, instruments, firearms, pieces of furniture of the place of incident), as well as their samples, copies and objective models; people — real participants of the events under question and marginal participants that are recruited in the reconstruction of the events and are of importance for the situation analysis; the real place of incident (room, part of the road, landscape) or a maximally identical place to the "place of incident" (corresponds to the essential parameters recorded in documentation).

Drawing up of Forensic Medical Diagnosis and Conclusions (Statements)

In cases of gunshot and explosive injuries, the forensic medical diagnosis is formulated according to the general principles. At first, it is necessary to indicate the main injury, which led to death directly or via complications. After that, all complications are listed and described; associated illnesses and injuries are described at the end.

Examples of writing a forensic medical diagnosis

Example 1. Forensic medical diagnosis: penetrating perforating gunshot injury of the head: a gunshot injury of soft tissues in the left temporal region; perforating fracture of the left temporal bone; damage of meninx and medullary substance of the left temporal region and the right parietal lobe of the brain; perforating fracture of the right parietal bone; gunshot injury of soft tissues of the right part of parietal region. Hemorrhage in soft tissues of the head, under the *meninx* and in the medullary substance of the brain down the wound track.

Example 2. Forensic medical diagnosis: penetrating, blind gunshot injury of the chest: a gunshot injury of soft tissues of the front thoracic wall on the left in the fourth intercostal space in relation to the parasternal line; gunshot injury of the inferior lobe if the left lung, pericardium, anterior wall of the aortic ventricle.

Hemorrhagic pericardial tamponade (500 ml). Left-sided hemothorax (1000 ml). Lop-sided blood filling of internal organs. Mass imbibition of mediastinal fiber with blood.

The conclusions (statements) are executed in question-answer form or in the form of consequent answers based on the etiopathogenetic principle.

Examples of writing conclusions (statements) by an expert

Example 1. On the basis of the forensic examination of the corpse of Mr. R., 25 y.o., and the results of the medico-criminological study, considering all of the circumstances of the case and the questions set for answer by an expert, the following statements can be made (during the investigation of the corpse, the conclusions can be made):

1. Upon examination of the corpse one perforating gunshot injury of the head has been detected.

2. The entrance wound is located in the left temporal region, 175 cm from the heels; the exit wound is located in the right parietal region, 178 cm from the plantar surface.

3. The wound track is straight-lined, in the direction from left to right, from bottom to top, from front to back. Down the wound track the following is damaged: the left temporal muscle, left cranial base, meninx, medullary substance, the right parietal bone and the soft tissue of the right parietal lobe.

4. The presence of a muzzle print on the skin around the entrance wound, soot soiling on the border of the wound track, but no soot soiling around the wound, skin dispatchment in the area of the entrance wound, bright-red colour of soft tissue and blood in the first part of the wound track. This leads us to the conclusion that the fire shot was delivered at point black range.

5. The localization of the entrance wound and the direction of the wound track point to the fact that the left temporal region was turned towards the muzzle.

6. The death of Mr. R. was caused by the damage of the medullary substance of the brain inflicted by the gunshot injury, therefore, there is a cause-and-effect relationship between the fire shot and the death.

7. The gunshot injury of the head accompanied by the damage of the medullary substance of the brain is classified as grievous bodily harm (based on criteria of life hazard).

Example 2. On the basis of the forensic examination of the corpse of Mr. Zh., 36 y.o., and the results of the medico-criminological study, considering all of the circumstances of the case and the questions set for answer by an expert, the following statements can be made (during the investigation of the corpse, the conclusions can be made):

1. Upon examination of the corpse one blind gunshot injury of the chest has been detected.

2. The entrance wound is located in the left part of the chest in the fourth intercostal space in relation to the parasternal line, 160 cm from heels.

3. The wound track is straight-lined, in the direction from front to back, from right to left, from top to bottom. Down the wound track the following is damaged: the soft tissue of the thorax, pleural membrane, pericardium, aortic ventricle.

4. The presence of soot soiling on the skin around the entrance wound, at a distance of 4 cm, allows to conclude that the gunshot was delivered within the range of action of the gunshot residue.

5. The localization of the entrance wound and the direction of the wound track point to the fact that the left side of the thorax was turned towards the muzzle.

6. The death of Mr. Zh. was caused by the damage of the aortic ventricle caused by the gunshot; therefore, there is a cause-and-effect relationship between the fire shot and the death. There is a cause-and-effect relationship between the injury of the aortic ventricle and the death.

7. The gunshot wound of the thorax accompanied with the damage of the heart is classified as grievous bodily harm (based on criteria of life hazard).

Methodology of Describing a Gross Specimen

Upon description of the gunshot injury of soft tissues, internal organs or bones it is necessary to keep up to the general order of describing damages; this order is stated in section "Injuries by hard blunt and sharp objects" of the guidelines (*I.V. Buromsky* [*et al.*], 2020). It is necessary to pay attention to the structural elements of the damages (edges, borders, fundus, surrounding tissue) in which there could be signs of the gunshot nature of the wound or the signs of action of the gunshot residue.

Examples of gross specimen description

Example 1. There is a wound of irregular round shape with a diameter of 0,8 cm in the specimen of skin of the anterior surface of the thorax. Upon tissue opposition, the edges of the wound conjoin with the appearance of folds. The edges of the wound are relatively even, inverted, on the edges of the wound there is a circular abrasion collar 0,1–0,2 cm wide, on which there is a soiling of grey-black colour 0,2–0,3 cm wide. Around the wound on an area of round shape sized 7 × 6 cm there are particles of blue-black colour lodged in the epidermis, the total amount of 32, the sizes range from single-point to 0,1 × 0,2 cm. There are also many selective areas of abrasion with brownish soft retracting fundus.

Conclusion: the injury is an entrance gunshot injury, the shooting distance: within the range of action of the gunshot residue, in particular, unburnt particles of gunpowder.

Example 2. A perforating fracture is located on the squamous part of frontal bone, 3 cm above the level of the eyebrow ridge and 3,5 cm to the left from the sagittal suture. On the external bone grafting the

edges of the fracture are relatively even with small chipped spots of the adjacent compact tissue, the diameter of the fracture is 1 cm. On the internal bone grafting the edges of the fracture have multiple chipped spots of the compact tissue, the diameter of the fracture is 1,8 cm. On the whole, the fracture has the shape of a cone with the cone basis turned inside the cranial cavity.

Conclusion: the detected perforating fracture of the frontal bone is an entrance gunshot injury.

Questions for Content Apprehension Self-Assessment

1. What are the elements of a bullet? What is their purpose?
2. What is the mechanism of appearance of gunshot injuries?
3. How do the nature and extent of damages depend on the kinetic energy of the damaging projectile?
4. What are the additional factors (gunshot residue) of a fire shot?
5. What kind of morphologic characteristics are typical of entrance and exit wounds?
6. What is a range of fire? How is it determined in forensic medicine?
7. How is the sequence of fire shots determined?
8. What requirements are there for the organization of corpse examination at the crime scene and in the mortuary in cases of gunshot injuries?
9. What is classified as an explosive injury? What are the distinctive features of the inflicted damages, the means and methods of their examination?

Test Items for Essential Knowledge Assessment

Instructions for questions 1–9:
*choose **one** the most suitable answer*

1. The following is connected with the aortic valve:
   a) aorta
   b) *superior vena cava*
   c) main pulmonary artery
   d) *inferior vena cava*
   e) pulmonary veins

2. In cases of gunshot injuries the following doctors can be attracted to the corpse examination at the crime scene as specialists, except for:
   a) ophthalmologist
   b) general practitioner
   c) phthisiologist
   d) pharmaceutist
   e) forensic medical expert

3. A "false" abrasion collar on the edges of an exit gunshot injury is formed as a result of:
   a) deposition of soot and oil soiling on the skin around the wound
   b) the presence of a shallowly situated bone at the place of appearance of the exit gunshot injury
   c) high kinetic energy of the projectile
   d) abrasion against the projectile
   e) thermal influence of powder gases

4. The following bones do not contain the maxillary sinus cavity, except for:
   a) frontal bone
   b) sphenoid bone
   c) maxilla
   d) palatine bone
   e) ethmoid bone

5. The examination of the crime scene in cases of gunshot injuries is organized and conducted by a:
   a) crime scene technician
   b) canine handler

c) investigator
d) forensic medical expert
e) public prosecutor

6. The main damaging factor in cases of gunshot trauma is:
   a) mechanical action of soot and unburnt grains of gun powder
   b) mechanical action of the projectile
   c) mechanical action of powder gases
   d) thermal action of powder gases
   e) chemical action of powder gases

7. The pulmonary valve of the heart is connected with:
   a) aorta
   b) *superior vena cava*
   c) main pulmonary artery
   d) *inferior vena cava*
   e) pulmonary veins

8. In accordance with the Rules of Determining the Life Hazard Severity in cases of gunshot injuries the following specialist has the right to conduct the forensic examination of a living person:
   a) crime scene technician
   b) surgeon
   c) investigator
   d) forensic medical expert
   e) public prosecutor

9. The following are diagnostic signs of a gunshot injury, except for:
   a) soot soiling around the wound
   b) bullet wipe
   c) circular form of a wound
   d) muzzle prints

Instructions to questions 10–33:
*there can be **one** or **several** answers for each question*
or incomplete statement

Choose:

Answer	Statement
a	If 1, 2, 3 are correct
b	If 1 and 3 are correct
c	If 2 and 4 are correct
d	If 4 is correct
e	If all answers are correct

10. The vertebrae include:
    1) spinous process
    2) coracoid process
    3) articular processes
    4) coronoid process

11. The left lung includes:
    1) superior lobe
    2) middle lobe
    3) inferior lobe
    4) osculant lobe

12. The characteristics of an entrance gunshot injury in flat bones are:
    1) even edges of the damage on the external bone plate
    2) cone-shaped chipping on the external bone plate
    3) cone-shaped chipping on the internal bone plate
    4) even edges of the damage on the internal bone plate

13. Gunshot residue includes:
    1) unburnt grains of powder
    2) soot
    3) oil
    4) bullet

14. The main functions of blood are:
    1) transport function
    2) regulatory function
    3) maintenance function
    4) thermoregulatory function

15. The damaging factors of the fire shot are:
    1) firearm and its parts
    2) powder gases
    3) pre-bullet air
    4) secondary projectiles

16. Depending on the type of energy, a bullet can cause:
    1) discontinuous action
    2) cuneate action
    3) disruptive action
    4) contusional action

17. The function of adipose tissue is:
    1) trophism
    2) thermoregulation
    3) morphogenesis
    4) building function

18. The following relates to the axial skeleton:
    1) cranial bones
    2) bones of inferior limb
    3) bones of vertebral column
    4) bones of superior limb

19. A blank cartridge includes:
    1) bullet
    2) gun power
    3) pellets
    4) gas seal

20. In cases of hyalinosis of the splenic capsule the spleen is figuratively called:
    1) cycads

2) greasy
3) porphyric
4) glazed

21. In cases of chronic congestion the liver is figuratively called:
    1) glazed
    2) lobed
    3) anserine
    4) nutmeg

22. Types of wound tracks:
    1) broken
    2) engirdling
    3) disrupted
    4) bended

23. Powder gases cause:
    1) thermal action
    2) chemical action
    3) mechanic action
    4) biologic action

24. The basis for a forensic medical examination of the severity of the damage caused to human health in case of a gunshot injury is:
    1) direction of the investigator
    2) report on forensic research of a corpse
    3) resolution of the district police officer
    4) resolution of the investigator

25. The condition of formation of the Vinogradov phenomen (soot deposition in the form of radiate crown around entrance wound in cases of extensive range fire shots) is:
    1) velocity of the projectile less than 500 m/s
    2) distance between intermediary targets from 1 to 5 cm
    3) distance between the intermediary targets more than 5 cm
    4) velocity of the projectile more than 500 m/s

26. Porta hepatis includes the following:
    1) portal vein

2) common hepatic duct
3) proper hepatic artery
4) lymph tubes

27. The main reasons of death in cases of gunshot injuries are:
1) blood loss
2) acute renal failure
3) sepsis
4) acute hepatic failure

28. The venous sinus of dura mater includes:
1) cavernous sinus
2) occipital sinus
3) sigmoid sinus
4) frontal sinus

29. An entrance gunshot injury may be formed by:
1) bullet
2) pre-bullet air
3) shotgun pellets
4) parts of the firearm

30. The signs of acute blood loss are:
1) skin paleness
2) Kryukov's spots (hemorrhages under the heart sac that appear as a result of methyl alcohol intoxication)
3) anemia of internal organs
4) Minakov's spots (hemorrhage under the endocardium of the left ventricle of the heart)

31. The presence of the following points to the contusional action of the projectile:
1) entrance gunshot wound
2) bruise
3) wound track
4) abrasion

32. The determination of the following is included in the competence of a forensic medical expert in cases of examination of a corpse with a gunshot injury:
    1) shooting distance
    2) distance between the firearm and the victim
    3) cause of death
    4) type of firearm

33. The signs of vast blood loss are:
    1) skin paleness
    2) Kryukov's spots (hemorrhages under the heart sac that appear as a result of methyl alcohol intoxication)
    3) anemia of internal organs
    4) Minakov's spots (hemorrhage under the endocardium of the left ventricle of the heart)

Instructions for questions 34–42:
the question consists of two statements, linked with conjunction ***"because"****.*
First one has to decide whether each statement is true, then, if so, decide, whether causal relationship between them is true

Choose:

Answer	Statement 1	Statement 2	Relationship
a	True	True	True
b	True	True	False
c	True	False	False
d	False	True	False
e	False	False	False

34. A sign of a shot delivered at a point-blank range is the presence of a muzzle mark, **because** when a shot is delivered at a point-blank range, the gunshot residue is localized in the direction of the wound track.

35. It is possible to determine the sequence of wound appearance caused by firearms according to the intensity of the abrasion collar, **because** upon the first shot there is less soot deposition than upon the later ones.

36. In cases of gunshot injuries, the forensic medical expert does not determine the shooting distance, **because** the determination of the shooting distance is beyond the scope of his/her competence.

37. It is impossible to determine the shooting distance in cases of injuries inflicted by atypical firearms, **because** the energy of the projectile in cases of shots delivered by atypical firearms is energized by compressed air.

38. A trace examination of the projectile makes it possible to determine the exact exemplar of firearm from which the shot was delivered, **because** there is grease and unburnt powder left on the lateral sides of the projectile.

39. It is possible to inflict deathly injuries upon shooting from a gas spray gun, **because** upon shooting from a gas spray gun at point-blank range the powder gases cause mechanical action.

40. It is reasonable to retrieve the projectile from the body with forceps, **because** the retrieval of the projectile with forceps is less traumatic.

41. Injuries inflicted by a shot delivered from a powder-actuated fastening tool are referred to as gunshot injuries, **because** upon a shot from a powder-actuated fastening tool powder gases energize the damaging element.

42. The presence of particles of internal organs in the wound is a diagnostic sign of an entrance gunshot wound, **because** at the moment of appearance of a wound track the tissue presses forward in the direction of the wound track.

Instructions for questions 43–72:
there are numbered items in the left column and in the right one — marked with Latin letter items. Match each numbered item to one or more corresponding items marked with a letter. Each item marked with a letter can be used once, several times or not at all in the course of the assignment

43	Shinbone (tibia)	a. antebrachium
44	Thighbone (femur)	b. anticnemion
45	Radial bone	c. does not apply to antebrachium or anticnemion
46	Ulnar bone	
47	Humerus	

48	Spinous layer	a. epidermis
49	Granular layer	b. dermis
50	Papillary layer	c. applies to epidermis and dermis
51	Corneous layer	d. does not apply to epidermis and dermis
52	Reticular layer	

53	Multiple fragmentation damages of body	a. typical of the wave action of explosive gases
54	Pulmonary barotrauma	b. typical of the action of explosive (burst) wave
55	Avulsion of extremity	c. typical of the wave action of explosive gases and action of explosive (burst) wave
56	Fragmentation wound	
57	Prevalence of internal damages	

58	Fundus	a. stomach
59	Soma	b. pancreas
60	Tail	c. liver
61	Apex	d. other
62	Caput	

63	Cartridge case	a. part of shotgun cartridge
64	Wad	b. part of ball cartridge
65	Gun powder	c. part of a shotgun cartridge and a ball cartridge
66	Priming element	d. not a part of a shotgun cartridge and a ball cartridge
67	Striking pin	

68	Tardieu's spots (puncticulate dark-red hemorrhages under the visceral pleura and epicardium)	a. sign of acute blood loss b. sign of vast blood loss c. not a sign of acute or vast blood loss
69	Kryukov's spots (hemorrhages under the hemorrhages under the visceral pleura and epicardium)	
70	Minakov's spots (hemorrhage under the endocardium of the left ventricle of the heart)	
71	Anemia of internal organs	
72	Anemia of spleen	

Test Items For Knowledge Apprehension Assessment

Instructions for questions 1–8:
*choose **one** the most suitable answer*

1. An injury is considered a gunshot injury, if it is inflicted by:
   a) rifle butt
   b) gun stick
   c) gunshot gases
   d) bayonet
   e) gun butt

2. The caliber of the rifle gun is determined in Russia by:
   a) diameter of the bullet
   b) distance between opposite rifling lands of the gun barrel
   c) distance between the opposite rifles of the gun barrel
   d) diameter of the cartridge case
   e) amount of bullets in the loading case

3. Upon examination of an injury that looks like a gunshot wound it is first necessary to determine:
   a) direction of the fire shot
   b) shooting distance
   c) whether the injury is a gunshot injury
   d) sequence of fire shots
   e) type of weapon used

4. What points to the cuneate action of the projectile?
   a) presence of an abrasion collar
   b) presence of additional disruptions of skin
   c) folding in of the wound edges
   d) absence of tissue defect
   e) presence of bullet wipe

5. The main damaging factor in cases of empty shots is:
   a) mechanical action of the soot and unburnt powder grains
   b) mechanical action of metal particles
   c) mechanic action of powder gases

d) thermal action of powder gases
e) chemical action of powder gases

6. Gunshot residue can be found only down the wound track in cases of a fire shot:
   a) with firm contact
   b) in the range of action of shotgun pellets
   c) with loose contact
   d) in the range of action of gunshot residue
   e) out of the range of action of gunshot residue

7. In cases when a fire shot is delivered out of the range of action of gunshot residue there can sometimes be soot deposition on the second intermediary target (Vinogradov's phenomenon), the diagnostic sign of which is:
   a) deposition of soot only on the outer surface of the first layer of clothing
   b) compulsory correspondence of soot deposition on the clothing and the tears on the clothing
   c) low density of soot deposition
   d) irrelevant area of soot deposition (in the radius of no more than 2 cm)
   e) soot deposition in the shape of a radiate crown on the second intermediary target

8. The identification of the type of firearm is conducted on the basis of studying:
   a) tracer streaks on the bullet
   b) width of the abrasion collar
   c) size of the clothing defect
   d) nature of the bone injury
   e) nature of the soft tissue injury

Instructions for questions 9–33:
for each question or incomplete statement there can be
one *or* ***several*** *true answers*

Choose:

Answer	Statement
a	If 1, 2, 3 are correct
b	If 1 and 3 are correct
c	If 2 and 4 are correct
d	If 4 is correct
e	If all answers are correct

9. An injury is considered a gunshot injury, if it is inflicted by:
   1) fire shot from a military weapon
   2) explosion of gunpowder
   3) fire shot from a hunting weapon
   4) explosion of combustive and lubricating materials

10. The component elements of a service cartridge are:
   1) shell with percussion cap
   2) propellant powder grains
   3) bullet
   4) wad

11. The component elements of a shotgun cartridge are:
   1) shell with percussion cap
   2) propellant powder grains
   3) bullet
   4) wad

12. The caliber is considered as the following in different countries:
   1) distance between the rifles
   2) distance between the rifling lands
   3) diameter of the bore
   4) diameter of the cartridge chamber

13. Under the action of powder gases the bullet in a rifled weapon gains the following action (motion):
    1) onward motion
    2) uniformly accelerated motion
    3) rotating motion
    4) head-over-heals motion

14. An entrance gunshot injury may be formed by:
    1) bullet;
    2) powder gases
    3) pre-bullet air
    4) wad

15. The main signs of an entrance gunshot injury are the presence of:
    1) tissue damage
    2) abrasion collar
    3) bullet wipe
    4) gaping of wound edges

16. A bullet with high kinetic energy has the following impact on an intermediary target:
    1) contusional impact
    2) penetrating action
    3) cuneate action
    4) discontinuous action

17. A bullet that has spent its force has the following impact on an intermediary target:
    1) ontusional impact
    2) penetrating action
    3) cuneate action
    4) discontinuous action

18. The shape of an entrance gunshot injury may be:
    1) round
    2) oval
    3) slit-like
    4) stellate

19. A bullet shall be retrieved from the body by:
    1) thumb forceps
    2) dissection forceps
    3) surgical forceps
    4) fingers

20. In some cases upon the examination of a bullet retrieved from the body, it is possible to make a conclusion about the:
    1) caliber of the weapon
    2) type of weapon
    3) number of riflings in the barrel
    4) shooting distance

21. The intensity of the zone of molecular concussion is contingent on the:
    1) velocity of the bullet
    2) density of the damaged tissue
    3) mass of the bullet
    4) length of the wound track

22. The deposition of soot on clothing, around the wound and down the wound track is possible in cases of:
    1) fire shot out of the range of action of gunshot residue
    2) fire shot in the range of action of gunshot residue
    3) fire shot with firm contact
    4) fire shot with loose contact

23. The diagnostic signs of a shot delivered at a point-blank range are:
    1) "shortcoming of tissue"
    2) presence of blood in the canal of the gun barrel
    3) presence of an abrasion collar and bullet wipe on the rims of the wound
    4) ray-like abruption of the edges of the entrance wound

24. In cases of fire shots delivered at a point-blank range there can be:
    1) absence of traces of gunshot residue around the wound
    2) ray-like abruption of the edges of the entrance wound
    3) red colouring of tissue down the wound track
    4) presence of blood in in the canal of the gun barrel

25. The range of fire in cases of shots delivered by a shotgun is determined by the:
    1) presence of soot around the entrance wound
    2) presence of metal particles around the entrance wound
    3) presence of grains of gunpowder around the wound
    4) size of the tissue damage around the entrance wound

26. The compact action of shotgun pellets is characterized by the presence of:
    1) sooting of skin
    2) abrasion collar
    3) zone of metal sputtering
    4) one big and a number of small wounds around

27. Histological examination makes it possible to determine the presence of:
    1) soot
    2) grains of gunpowder
    3) metal sputtering
    4) lubricating material

28. The method of determination of metal sputtering on the wound edges is:
    1) contact-diffusion method
    2) histological examination
    3) emission spectrum analysis
    4) biochemical study

29. Soot and powder gases in the area of the entrance wound can be found:
    1) upon visual examination
    2) upon conducting a histological examination
    3) upon taking photographs in infrared rays
    4) luminescence analysis

30. Under ultraviolet rays rifle grease luminesces:
    1) with sky-blue colour
    2) with greenish colour
    3) with light-purple colour
    4) with yellow-reddish colour

31. The exit gunshot wound may in some cases have:
    1) tissue damage
    2) muzzle imprint
    3) abrasion collar
    4) soot deposition around the wound

32. The sequence of inflicting of gunshot injuries may be determined by the:
    1) size of hemorrhage in soft tissue
    2) nature of damage to hollow organs
    3) correspondence of components in the abrasion collar
    4) nature of damage to flat bones

33. The presence of a disrupted wound track makes it possible to determine the:
    1) number of fire shots
    2) range of fire
    3) type of weapon
    4) pose of the victim at the moment of injury

Instructions for questions 34–52:
the question consists of two statements, linked with conjunction ***"because"****.*
First one has to decide, whether each statement is true, then, if so,
decide, whether causal relationship between them is true

Choose:

Answer	Statement 1	Statement 2	Relationship
a	True	True	True
b	True	True	False
c	True	False	False
d	False	True	False
e	False	False	False

34. The infliction of an injury with a fatal outcome upon using a blank cartridge is impossible, **because** a blank cartridge does not contain a projectile.

35. In cases of tangential gunshot injury, the possibility of damage to an internal organ is excluded, **because** a tangential gunshot injury is characterized by an open wound track.

36. In cases of a single shot from a handgun there may be two entrance wounds and two exit wounds, **because** in cases of single shots the bullet is usually fragmented.

37. The presence of "shortcoming of tissue" is not an absolute sign of an entrance gunshot wound, **because** if the bullet retains high energy, defect of tissue can appear in the area of the exit wound as well.

38. An abrasion collar is not typical of an exit gunshot wound, **because** neither soot, nor grains of gunpowder can influence the area of the exit wound.

39. The spreading velocity of the primary blast wave depends on the type of weapon, **because** the muzzle velocity varies in different types of weapons.

40. The determination of the exact range of fire (in cm) is not within the competence of a forensic medical study, **because** the determination of the exact range of fire (in cm) is the prerogative of a ballistic study.

41. The bullet wipe appears only in cases of shots delivered at a point-blank range and in the range of action of gunshot residue, **because** bullet wipe appears as a result of action of powder gases.

42. The detection of blood in the bore is a sign of a shot delivered at a point-blank range, **because** the ingress of blood into the bore is caused by the formation of negative air pressure in the bore in cases of fire shots at point blank range.

43. In cases of fire shots with hermetic contact gunshot residue is detected down the wound track, **because** in cases of fire shots with hermetic contact the wound track is like the continuation of the gun barrel.

44. Multiple entrance wounds appear in cases of birdshots delivered at a point-blank range, **because** in cases of birdshots delivered at a point-blank range wounds are inflicted by each shotgun pellet.

45. The type of firearm can be determined depending on the nature of the muzzle print, **because** a muzzle print can indicate the constructive features of the muzzle of the firearm.

46. The number of additional skin disruptions of the entrance wound upon a fire shot delivered at blank-point range allows to determine the exact type of weapon, **because** each rifled weapon has a number of rifles in the bore.

47. An abrasion collar appears only in cases of fire shots delivered in the range of action of gunshot residue, **because** an abrasion collar is formed as a result of impact of pre-bullet air and powder gases on the skin.

48. The appearance of the Vinogradov's phenomenon (soot deposition in the form of radiate crown around entrance wound in cases of extensive range fire shots) is impossible in cases of fire shots delivered from handguns, **because** the main condition of appearance of the Vingradov's phenomenon is the velocity of the bullet of more than 500 m/s.

49. It is impossible to determine the sequence of damages inflicted by series of automatic firearms, **because** automatic firearm has a high firing rate.

50. It is impossible to distinguish the first wound from the second one judging by the bullet wipe, **because** the first and second bullets carry the same amount of deposit of soot and lubricant.

51. It is possible to ascertain the sequence of damages infliction if there are two wound tracks in the thorax, one of which is graduated and the other is continuous, **because** the first injury of the thorax usually leads to lung collapse.

52. Upon an injury of soft tissue, the sequence of damage infliction can be ascertained by the intensity of hemorrhage, **because** usually the large blood vessels are damaged upon the first injury.

Instructions for questions 53–80:
there are numbered items in the left column and in the right one — marked with Latin letter items. Match each numbered item to one or more corresponding items marked with a letter. Each item marked with a letter can be used once, several times or not at all in the course of the assignment

53	"Shortcoming of tissue"	a. sign of entrance gunshot wound
54	Abrasion collar	b. sign of exit gunshot wound
55	Rim of air abrasion	c. sign of entrance or exit gunshot wound
56	Impregnation of powder grains around the wound	d. not a sign of entrance or exit gunshot wound
57	Slit-like shape of wound	
58	Presence of bone fragments or particles of internal organs in the wound	
59	Saw-edged nature of wound edges	

60	Blind wound	a. sign of gunshot wound
61	Presence of a ring of air abrasion	b. sign of shotgun wound
62	Stellate shape of wound	c. sign of gunshot or shotgun wound
63	Scalloped edges of entrance gunshot wound	d. not a sign of gunshot or shotgun wound
64	Multiple wound tracks	

65	Size of wound	a. sign of sequence of damage infliction
66	Presence of soot around the wound	b. sign of shooting distance
67	Presence of a muzzle print	c. sign of sequence of damage infliction and range of fire
68	Correlation of rifle grease and soot deposit in the abrasion collar	d. not a sign of sequence of damage infliction and range of fire
69	Presence of blood in the bore	
70	Red colouring of tissue in the wound track	
71	Connection of flat bone fracture of the "end to side" method	
72	Stepped nature of wound track in the thorax	

73	Presence of soot on the second layer of the barrier, provided there is none on the first layer	a. sign of a shot delivered at point-blank range b. sign of a shot delivered in the range of action of contributing factor c. sign of a shot delivered through a barrier d. sign characterizing the Vingradov's phenomenon e. not a sign of the above mentioned situations
74	Presence of wounds inflicted by secondary projectiles	
75	Presence of microscopic thermal wounds around the entrance wound	
76	Presence of soot around the entrance wound	
77	Deposition of soot on the barrier in the shape of radiate crown	
78	Oval shape of wound	
79	Presence of traces of impact of gunshot residue only down the wound track	
80	Abrasion of edges of the exit gunshot wound	

Recommended Literature

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Notes

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GUIDELINES ON FORENSIC MEDICINE. GUNSHOT INJURIES

Study guide

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