MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS
INSTITUTION OF EDUCATION
"GOMEL STATE MEDICAL UNIVERSITY"

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TRANSPORTATION INJURY. DAMAGE AND DEATH FROM THE ACTION OF HIGH AND LOW TEMPERATURES. DAMAGE AND DEATH FROM THE ACTION OF OTHER PHYSICAL FACTORS. FORENSIC MEDICAL EXPERTISE OF FIRE-SHOOTING DAMAGES.

Educational and methodical recommendation
for 5th year students of medical and physical science faculties
in the discipline "Forensic medicine"

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TRANSPORTATION INJURY. DAMAGE AND DEATH FROM THE ACTION OF HIGH AND LOW TEMPERATURES. DAMAGE AND DEATH FROM THE ACTION OF OTHER PHYSICAL FACTORS. FORENSIC MEDICAL EXPERTISE OF FIRE-SHOOTING DAMAGES.

(total lesson time - 6 academic hours).

RELEVANCE OF THE TOPIC

Topic is a prerequisite for understanding the patterns of development and formation damage due to the transport trauma correlation and interdependence pathophysiological and pathomorphological changes as a result of high and low temperature, electricity and other physical factors, morphological features of gunshot wounds. It is also necessary in the future professional activity of a doctor, for clinical diagnosis and analysis of the sources of diagnostic errors in clinical practice.

PURPOSE AND ACTIVITIES

Examine BASIC e methods and determine the presence of damage due to the transport injury death from the action of high and low temperature, electricity and other physical factors, gunshot wounds. To study the basic principles of conducting a forensic medical examination. Familiarize camping with the features of a forensic medical examination of the corpse to the place of its discovery, the order of seizure and direction of cadaveric material on forensic histological and forensic chemical research.

TASKS

1. Give a general definition and classification of transport injury.
2. To be able to give a definition of an automobile injury, a railway injury.
3. To be able to distinguish the mechanisms of damage formation under the action of high and low temperatures, electricity and other physical factors.
4. Give a general definition and classification of firearms, damage arising from the action of firearms, determine the position of the victim during the shot.
5. Be able to explain the rules of the production of forensic medical, forensic and biological, forensic histological, forensic chemical examinations.
6. To be able to answer the questions that are resolved during the examination of transport injuries, high and low temperatures, electricity and other physical factors, gunshot injuries.
7. To be able to distinguish between normative documents governing the production of forensic medical examinations.

KEY LEARNING QUESTIONS

1. General characteristics of modern transport injury and its types. The value of forensic medical examinations in the investigation of transport accidents.
2. Car injury and its types. Mechanisms of formation and features of damage in the main types of car injury.
3. Peculiarities of inspection of the place of a motor vehicle accident. The value of forensic medical examination for the investigation of road accidents.
4. Railway injury, its types, nature of damage.
5. Damage from high and low temperatures and other physical factors.
6. Local effect of high temperature on the human body. Burns. Burn disease. Outcomes of burns. Differential diagnosis of burns from flames and hot liquids.

7. Examination of corpses found in the fire. Determination of the lifetime of the flame. Burning corpses.
8. The general effect of high temperature on the human body. Heat and sunstroke, thanatogenesis, sectional diagnostics.
9. Local action of low temperature. Frostbite, their degree, morphological characteristics. Signs of corpses freezing.
10. Low temperature general action. Death from general cooling of the body and its signs on the corpse. Conditions conducive to death from general cooling.
11. Electrical trauma. Mechanisms of the action of electric current on the human body. Conditions affecting the outcome of electrical injury. Morphology of electrical injury. Genesis of death due to electrical injury.
12. Features of the inspection of the scene of the incident and forensic medical examination in cases of damage by household and technical electricity.
13. Lightning injuries, thanatogenesis, sectional diagnostics.
14. The effect of high and low pressure of the gaseous environment on the human body.
15. Firearms and their types. Explosive trauma, its features and morphological characteristics.
16. Shot mechanism, additional shot factors. Types of bullet action. The Vinogradov phenomenon. Signs of damage when fired from different distances.
17. Diagnostics of the entrance and exit bullet wounds, determination of the direction of the wound channel in the body. Blind, through, girdle and tangential wounds. Bullet detection and meaning.
18. Damage with a shot (carton) charge. Damage when fired with blank cartridges. Features of fire damage when fired from a gas or gas-shot weapon. Damage from shots from atypical, homemade and pneumatic weapons.

RELATED RELATED MATERIALS

1. Macro preparations:
- "bumper-fractures" of long bones;
- samples Martial x chuck s of size: small-, medium-, large-caliber, magnum;
- hunting cartridge with contents;
- types of charges from shells;
- wound channel with a gunshot bullet wound of flat bones.

2. Educational reports (standards and examples) on various types of gunshot injury.
3. Photos of electric damage, bullet and shot fire damage, depending on the distance of the shot.
4. Additional preparations (targets) with a view of additional factors of the shot, depending on the distance of the shot.

MATERIALS FOR CONTROL OF THE TOPIC ASSEMBLY

Terminology

Transport - various means and mechanisms designed to move people and goods in space.

Transport injury - mechanical damage caused by the external or internal parts of the vehicle during its movement, as well as arising from a fall from a moving vehicle.

Car injury - mechanical injury caused by the external or internal parts of a moving car, as well as arising from a fall from a moving car.

A collision with a motor vehicle is an injury from a collision of a moving car with a person.

Transfer by road - damage resulting from hitting the wheel, friction wheel on the surface of the body by stretching and drawing of fabrics, impaction I the victim's body between the moving wheel and the road.

Railway injury - mechanical injuries caused by the external or internal parts of the rolling stock, as well as arising from a fall from it.

Sunstroke - a complex of pathological changes in the body, there was ayuschy from direct sunlight on the bare head and neck that leads to local overheating, affects the central nervous system, even in the absence of pronounced thermoregulation disorders.

Burns are the result of thermal, chemical, electrical or radiation effects on the body.

Hypothermia - complex functional disorder in the body when lowering the body temperature below +35 ℃ , characterized the second Xia sharp oppression of all vital functions.

Local frostbite - pathological changes in the soft tissues, arising Suitable topically exposed to low temperatures on the exposed parts of the body (nose, ears, legs).

Electrical trauma - local and general changes in the body caused by the action of electrical energy.

Electric current is the directed (ordered) movement of charged particles: electrons, ions, etc.

Ionizing radiation - radiation which is generated in the radioactive decay of nuclear transformations deceleration of the charged particles in the material and the formation of the interaction with the environment ion s different signs.

Decompression sickness - Complex pathologic changes in the organism originated constituents with a sharp decrease in ambient atmospheric pressure.

Ballistics is the science that studies the laws of motion of projectiles.

Wound Ballistics - the science that studies the laws of motion of the projectile fire, in the human body.

Vinogradova phenomenon - deposition of soot on the second layer on the inner surface of the first layer of the multilayer targets when firing with n e close distance.

Input gunshot wound - wound in entering the wound body I present the projectile, the main features of which are tissue defect, wiping rib.

Output gunshot wound - a wound in the body out of the gunshot wounding projectile.

Contusion bullet effect - causing a bullet having a low kinetic energy, surface bruised wounds, abrasions, hemorrhages.

The bullet penetration action is the formation of a typical bullet entrance hole with a tissue defect.

Defect tissue (minus fabric sign Pirogov-Eden) - Otsu m action (defect) tissue in the input gunshot wounds caused straight on Bivni effect wounding of the projectile.

Distance shot - qualitative characteristic distance from the muzzle of the weapon barrel to infestation of affected surface defined by the limits of additional factors in the s arrow.

Additional factors of the shot - a set of gaseous substances and discrete particles flying out of the bore of the weapon together with the projectile or instead of it during a blank shot.

Shot - a projectile in the form of small lead balls, intended for shooting from a hunting weapon.

Contusion tissue area - an area fire traumatic changes around the wound channel not exposed to direct contact. Nome wounding projectile impact.

Zone molecular tremors - pole peripheral portion zone of tissue within which they are able to continue necrobiosis may necrotic.

Primary necrotic zone - the central (closest to the wound) of the area of tissue contusions, wounds immediately after dying.

Caliber - distance between the opposing fields of grooves or rifling (depending on the country of manufacture), expressed in millimeters or fractions of an inch for a rifle or the bore diameter of the weapon barrel at 22 cm from the muzzle for shotguns.

Nikiforov-Chavigny sign - attribute sequence of cracks flat bones, consisting in that the cracks formed as a result of subsequent traumatic impact, no Perez e cabins cracks formed as a result of previous traumatic exposure.

Firearm - specially designed mechanical device, wherein for imparting motion wounding e mu projectile energy is used propellant gases.

Weapon - a product specifically designed to attack or of a shield.

Cartridge - unitary munition into which are integrated in one unit of means liner shell capsule, and powder charge originating from a mixture which serves to ignite the powder upon firing.

Clitellum metallization - applying the metal around the inlet opening of fire due to its erasure from the surface of the bullet when it goes through the skin.

The wiping belt is a ring-shaped deposit of grease, grime and metal around the fire inlet.

Bullet - small steel or lead projectile uncovered (nonenveloped) partially (soft point) or completely (envelope) of indoor sheath of more dense material that is used to fire the guns, rifles, submachine guns and pistols.

The wad - laying separating the powder from the fraction (powder wad), etc. e obstacle rash fractions from the cavity of the sleeve (shot wad).

Shot distance - the range of the bullet from the muzzle of the weapon barrel to the obstacle, expressed in units of length. Unlike firing distance, firing distance is quantitative.

Punching mark - full or partial fingerprint muzzle loop cf. e of arms in the form of bruise or produced in the skin around the inlet opening firearm when firing at close range.

FORENSIC-MEDICAL EXAMINATION TRANSPORTATION INJURY

Accidents on road, rail, air and water transport are often accompanied by human casualties and large material losses. Most traffic accidents and fatalities occur within a very short period of time, often in the absence of witnesses or when their testimony is extremely contradictory. This makes it very difficult to investigate incidents. In such incidents, a qualified forensic medical examination is required.

Damage from various types of transport is, by its nature, related to damage from blunt objects and has characteristic features.

Currently, the following classification of transport injury has been adopted:

I. Road - land:

- automobile (trucks and cars);
- tractor (caterpillar and wheeled tractors);
- motorcycle (motorcycles with a sidecar, motorcycles without a sidecar).

II. Railway (electric locomotive, diesel locomotive, railway carriage, tram, metro).

III. Aviation (plane, helicopter).

IV. Water transport (river and sea vessels, boats, yachts).

Damage from other modes of transport is rare and of lesser importance.

From the point of view of the scope and tasks of forensic medical examination, traffic accidents can be divided into two groups. The first group includes accidents involving damage from vehicles and goods. In this case, forensic medical examination has a relatively limited application and is used mainly to resolve issues related to the physical condition of the driver, which can be essential for establishing a causal relationship between his actions and the resulting consequences. The second group deals with incidents involving the infliction of damage directly to the victim. It is in this group that the participation of a forensic expert in examining the scene of the incident is of great importance.

The expert resolves a number of issues that help the investigator quickly navigate in the conduct of operational actions at the scene. For this, it is enough for an expert to inspect the corpse, its clothes, to study the situation of the incident. Moreover, it should be borne in mind that the resolution of these issues in the forensic medical examination bureau after the transportation of the corpse may no longer be possible. Such issues include: determining the time of death, determining the change in body position after death, transferring a corpse to another place, and a number of others.

Determining the time of death by a forensic expert on the scene sometimes becomes extremely important, allowing the investigator to immediately plan his actions correctly. This, in particular, will help, if necessary, to confirm or reject the driver's alibi. In practice, there are cases when the driver, denying the fact of a collision, indicates that the victim was injured before he arrived at the scene. In the absence of witnesses, the resolution of the issue largely depends on the results of the forensic medical examination.

The operative actions of the investigator at the scene of the incident may require the expert to first resolve the issues of lifetime or postmortem injury, cause of death, mechanism of injury, etc.

The first two questions are of great importance when simulating transport damage (for example, when gunshot wounds, stab and chopped wounds, etc. are found on a corpse).

Based on the external examination of the corpse and the data obtained during the inspection of the scene of the incident, the expert can give a preliminary opinion on other issues of interest to the investigation - the fact of a transport injury, type, brand of vehicle. The resolution of these issues corresponds to the first task of the inspection of the scene of the accident - to establish the fact and place of the transport accident, as well as the time and place of the crime. The next issue to be clarified is the reconstruction of an objective picture of the incident. Inspection should provide data that can decipher the situation as fully as possible before the incident, immediately at the time of the incident and after it. The detection of damages (dents, scratches) on a vehicle, traces of blood, parts of clothing and other material evidence on the ground is of forensic importance. At the scene of the accident, the expert has the opportunity to directly compare the damage found on the corpse and its clothes with damage to the parts of the vehicle, which provides important information about the mechanism of the accident (localization of the impact by the vehicle, the nature of the fall, etc.). This is also facilitated by the study of the position of the corpse, the interposition of the body and the vehicle, the nature of blood leaks, the detection of paint particles from the vehicle on the victim's clothing and body, contamination of the body and clothing with road mud, fuel oil, investigation of the nature of clothing tears, etc. The examination of the corpse's clothing in traffic accidents should be recognized as mandatory as, for example, in case of gunshot injuries.

When assessing the general importance of the inspection of the scene of the accident from the point of view of the tasks of forensic medical examination, it is necessary to emphasize the special value of the data related to the mechanism of injury. Their use ensures the completeness and reliability of the examination.

To clarify the mechanism of transport injury, the data obtained during the inspection of the scene of the accident are of particular importance; impact about which at the time of the accident the victim could be damaged, the nature of the road surface and other factors.

In this regard, it should be recognized that the mandatory participation of a forensic medical expert in the examination of the scene of the incident should also be recognized in those cases that are accompanied by non-fatal injuries to the victims. As can be seen from the above, this is of great importance for resolving questions about the mechanism of damage origin. In addition, in certain cases, it is advisable for the investigator to inspect the scene of the incident with the participation of a forensic expert and at a later date (if it is impossible for the expert to participate in the initial examination of the scene), as well as during repeated examinations to clarify the details that emerged during the forensic investigation. medical examination and criminal investigation. The above description of the activity of a forensic expert assumes his active participation in the examination of the scene of a transport accident, determined by his competence.

When examining the scene of the incident, the expert directly finds out a number of details that have a forensic medical significance and are subject to consideration during the subsequent examination (examination of the corpse, examination of the victims, etc.). The participation of a forensic expert in the examination of the scene of a transport accident is not limited to the examination of the corpse and some material evidence (for example, traces of blood). Such a limitation of the expert's tasks may incorrectly orient the investigators and cause significant harm to the interests of the investigation of transport accidents.

2. ROAD INJURY

2. 1. Car injury

Traffic injuries are the most common type of traffic accidents. Due to their specific features (massiveness of vehicles, their movement at high speed, etc.), they often end in the death of the victims, and therefore are quite often found in forensic medical practice. In the study of road traffic injuries, many different questions arise, among which the most important is the question of the mechanism of damage.

When inspecting the scene, the following can be found: traces from the wheels of a car on the ground, braking of a car, paint of a car or objects with which it was loaded, from oil, water, antifreeze, antifreeze, gasoline (diesel fuel), from being hit by a car; parts and parts of the car that were broken off and left at the scene of the accident due to the accident, etc. In some cases, these traces and objects can be used to establish not only the model (brand), but also a specific copy of the car. Of no less importance are the examination of the corpse at the scene of the incident, and the finding on the surrounding objects of traces of blood, hair, brain matter and other biological particles, which in some cases make it possible to present a picture of the incident.

According to the mechanism of occurrence, motor vehicle injuries are divided into the following types:

1) impact by parts of a moving vehicle;
2) pressing the body with the wheel to the ground;
3) full moving of the body by the wheel;
4) falling from a moving vehicle;
5) trauma inside the cabin;
6) pressing by a car against a stationary object;
7) collision of a car with other types of transport;
8) combined types of car injuries;
9) other cases.

Each of these types of car injuries, in turn, consists of several successive phases, accompanied by a certain nature of damage and their localization.

Impact by parts of a moving vehicle (collision)

In stroke affected parts of the moving vehicle are four phases: the first - a collision with a motor vehicle affected when marked damage from shock and concussion of the body; the second is the fall of the victim on the car, while damage occurs when it hits the body of his car; third - throwing the body and falling to the ground, from which the damage is located on the side opposite to the impact; fourth - sliding of the body on the ground with corresponding injuries

When an injured person is struck by parts of a moving freight (carriage type) car, three phases are distinguished: the first is a collision of the car with the victim, when damage from the impact and concussion of the body is noted; the second is the repulsion of the body and its fall to the ground, from which the damage is located on the side opposite to the impact; the third - sliding of the body on the ground with corresponding injuries.

Trauma inside the cab (passenger compartment) of the car

With other types of car injuries, a different number and combination of phases is noted. So, in cases of injury inside the cab, two phases are distinguished: first, collision of the body with parts of the car, when the damage is localized, as a rule, in the front; the second - pressing the body by the control parts to the cabin wall

Compression of the human body between cars and stationary objects

Similar phases are noted in cases of pressing the body by parts of the car to stationary objects.

Moving with the wheel (s) of the car

When driving a car wheel through the victim's body, the following phases are distinguished: first - a blow to the body by the wheel; the second is the rolling of the wheel onto the body, compression and stretching of the soft tissues, thus a "primary pinch" occurs; the third - the wheel rolling over the body - the tread pattern remains on the body; the fourth - rolling of the wheel with the repulsion of the body in the opposite direction - sliding of the body on the ground with friction and the occurrence of deep abrasions.

Falling out of a moving vehicle

When falling from the body of the car, the following phases are distinguished: first - hitting a part of the body; the second - falling and hitting the hard surface of the road; the third is sliding along the road.

The damage caused by car accidents is very diverse. They can be divided into three groups: 1) damage characteristic of an automobile injury; 2) damage from vehicles, but not typical for car injuries; 3) injuries similar to other types of injuries, in particular, with injuries from sharp objects, from firearms, etc.

2.1.1. Injuries typical for car trauma

The most typical injuries for car injuries include imprints on the surface of the tread of a car wheel. Individual features (defects, various wear, patches, protrusions) are often noted on the tread of a tire of a car in use, which makes it possible to identify not only the model (brand), but also a specific copy of the car by their imprint. Imprints on a corpse or on clothes from other parts of a car, in particular bolts, nuts and other parts that can also be used to identify the car that caused damage, are of important forensic and forensic significance.

Trauma is also characteristic (pressure of individual parts of the body with their compaction due to bone fractures, ruptures of internal organs, muscle flexing (flattening of the chest, flattening of the head, stretching of the limbs). Sometimes compression and flattening of the body are not accompanied by a violation of the integrity of the skin, especially in cases when the victim was wearing thick, thick clothing. Imprints of clothing and its folds on the skin of the corpse may indicate the compression of the body.

When the wheel of a car is completely moved through the chest, multiple, bilateral, mainly triple fractures of the ribs are noted, more often in accordance with the axillary lines. At the same time, there are fractures of the spinous processes of the thoracic vertebrae and shoulder blades, as well as tears, tears, crushing and movement of internal organs. These injuries are most extensive from the side of wheel movement. Sometimes muscle shedding from bones occurs to form pockets filled with blood (especially when moving a limb).

Extensive multiple fractures of the pelvis with damage to the ischial and pubic bones and the formation of bilateral double vertical fractures indicate strong compression of the body and are characteristic of moving with the wheels of a car.

On the contrary, when struck and run over by a car, fractures of the pelvic bones are rare and are more often limited to isolated damage to individual bones (especially when moving a limb).

When struck and run over by a motor vehicle moving at high speed, signs of a concussion are often found on the corpse of the deceased. These include hemorrhages at the roots of the lungs (in the pulmonary ligament), under the epicardium at the base of the heart, rupture of the intima of large vessels, hemorrhages and ruptures of the ligamentous apparatus of the liver, hemorrhages in the tissue of the spleen, mesentery of the small intestine, the thickness of the liver, in the area of the hilum and under the capsule of the kidneys ... Impact and collision with a car at a speed of about 100 km / h may be accompanied by a significant concussion of the body with a rupture or even detachment of internal organs (heart, lungs, spleen, liver).

Traces of dragging, in the form of multiple parallel scratches against the background of sagged skin, as well as transverse splinter less fractures of the leg or hips (bumper fractures) should be attributed to injuries characteristic of an automobile injury. The latter are formed from the impact (buffer) of a car moving at high speed. By the localization of bumper fractures and, in particular, by the level of their location from the soles, one can judge the height of the location of the bumper of the car, i.e. about certain models (brands) of cars.

Examination of victims of car accidents is often associated with the solution of many complex issues by an expert. The mechanism of incident occurrence is of primary interest to the investigating authorities.

Significant difficulties arise due to the impossibility of examining and examining the damage immediately after the incident due to the condition of the victim, the extent and severity of the damage. Their assessment is based on records in the medical history, which usually do not satisfy the medical examiner. They do not take into account what is necessary for the examination. It is difficult to judge the damage from the available X-rays. You need to know the injuries typical of a motor vehicle injury: marks on the skin that can persist for a long time, bone fractures in certain places (bumper fractures). An accurate description of the damage, their localization, measurement of the level of damage is required. Everything should be plotted on the diagrams. The display of the circumstances of the incident can be carried out with another person of the same height and build. The garment should be viewed on the same person or mannequin. Comparison of damage to clothing and on the body with parts of a car can give an idea of the mechanism of their origin. All moments of such a comparison must be photographed, and the photographs must be attached to the expert's opinion. It is more expedient to carry out such a comparison as an investigative experiment.

2.1.2. Injuries that are not typical of an automobile injury and simulate other types of damage

In car accidents, damage that is not typical of a car injury is possible. Usually they are not associated with a run over by wheels or hit by protruding parts of a car. These injuries are very diverse. These include: bruising, abrasions, bruised wounds, depressed and perforated bone fractures, isolated ruptures of internal organs.

Damage not typical of a car injury is more likely to occur when hitting the ground or surrounding objects as a result of being thrown by a hitting vehicle or falling out of a moving vehicle. The difficulties of the examination in such cases are due to the fact that during the examination there are injuries similar to injuries from a fall from a height. In contrast to the latter, in a car accident, signs of body dragging can be detected due to the summation of two types of movements: translational and falling.

The most difficult to diagnose injuries are similar to cut, chopped, stab wounds, i.e. feigning other types of injury. These injuries more often arise from impacts by protruding parts of a car, when the victim's body is thrown onto sharpened protruding objects. In cases of moving the body with wheels, bone fragments can cause damage to muscles and skin, similar to wounds with sharp objects.

In case of car injuries, peculiar head injuries are described, simulating household injuries with a blunt object. They are observed when a cyclist is hitting his head following a truck, with a sharp and unexpected braking of the latter. In such cases, the cyclist hits his head on a car, receiving a depressed fracture of the frontal bone with brain damage. Any other damage on the corpse of the deceased, his clothes, as well as on the bicycle may not be found.

With a sharp braking of a car moving at high speed, significant overloads develop, as a result of which the weight of the internal organs seems to increase many times. Therefore, in some diseases (for example, with hypertension, atherosclerosis, coronary heart disease), rupture of cerebral vessels, cardiac arrest and sudden death of the driver may occur. The latter can lead to an accident with fatalities.

A large proportion of car injuries are the result of an accident.

There are isolated cases of suicide, when the victim deliberately throws himself under a car. There are also murders by deliberate collision of a car, as well as simulation of accidental car injuries in order to conceal other methods of murder.

2.4. The main issues solved by the forensic medical examination in case of a road accident

In case of a road (automobile, motorcycle, tractor) injury, the following questions may be asked for the permission of a forensic medical expert:

1. What injuries were found on the victim (living face, corpse)?
2. What is the mechanism of formation of these damages?
3. Could this damage have been caused by being hit by a vehicle? If so, in what part of the body, at what height, in what direction was the initial blow struck?
4. What is the potential for damage to certain parts or parts of the vehicle?
5. Is there any damage caused by a wheel (caterpillar) running over? On what part of the body and in what direction did the wheels (tracks) of the vehicle roll?
6. In what position was the victim in relation to the vehicle at the time of the injury?
7. Has the vehicle been dragged? If so, what is its direction, in what position was the body during dragging?
8. Could the damage found on the deceased be formed in the event of an injury in the cab of the car (tractor)?
9. Is it possible to tell from the location and characteristics of the damage what place the victim occupied in the cab of the car (tractor)?
10. Could the damage found on the deceased be formed when falling out of a moving vehicle?
11. Has the victim suffered from diseases of the organs of sight and hearing?
12. What is the sequence for causing damage?
13. Was the fatal injury inflicted in vivo?
14. What is the cause of death?
15. Did the victim take alcohol (drugs) shortly before his death?
16. Are trauma changes found in a vehicle (car, motorcycle, tractor), traces of blood? If it is blood, what is its species? If this is human blood, then what is its group specificity and gender?
17. Is the hair found on a vehicle (car, motorcycle, tractor) human or animal hair? If it is human hair, which part of the body? What is its group affiliation?
18. What is the potential for damage to a specific vehicle?
19. What is the possibility of all damage in the given conditions of the road accident?

3. RAILWAY INJURY

3.1. Possible circumstances of rail damage

Death on the railroad bed in the overwhelming majority of cases is associated with injuries that depend on the movement of railroad transport. Below is a list of possible accidents accompanied by traumatic death on the railway, according to O.K. Porksheyan:

1. Accidents related to train traffic:

- in case of accidentally hitting a moving railway rolling stock or throwing away persons caught on the railroad bed; when trying to cross the track or being on tracks for other purposes (for example, when repairing under a carriage that suddenly starts moving);

- when falling from a moving rolling stock;
- in the event of a blow by parts of a moving railway rolling stock of an injured person who is at a railway track within the outline of the dimensions of the rolling stock, or an impact by objects loaded on platforms and protruding beyond the dimensions of the rolling stock;
- when squeezed between buffers;
- when squeezed in the automatic coupler mechanism;
- when hitting track structures (viaducts, arches of tunnels) when moving on the roofs of cars;
- in case of electric shock from wires of the electric network of the railway (for example, passage on the roof of a carriage);
- in case of train wrecks.

2. Accidental death on the railroad bed, independent of the movement of the rolling stock:
- during loading and unloading operations;
- when hitting a barrier at crossings;
- during repair work on the tracks;
- from other reasons.

3. Suicides with the use of rolling stock for this purpose are carried out:
- laying on one of the rails of the head, neck, body;
- sudden appearance in front of a moving railway rolling stock or between wagons;
- falling from a moving train;
- by touching the wires of an electric railway, for which a suicide climbs onto the roof of a carriage, electric locomotive, diesel locomotive, steam locomotive.

4. Suicides on the railroad bed are possible by using firearms or piercing-cutting weapons.

5. Murders on the railroad bed, not related to the use of railway rolling stock, can be committed with the help of firearms and edged weapons, blunt heavy objects, strangulation by hands, etc. It is not so uncommon for a criminal to carry out his plan on a railroad track with the aim of subsequently placing the victim's body under a moving train to simulate an accident or suicide.

Forensic classification of railway injuries (according to O.H. Porksheyan)

1. Damage caused mainly by the wheels of railway transport when rolling them over a body located on the rails:
- pressure bands;
- wiping stripes;
- separation of the head from the body (complete, incomplete);
- division of the body into two halves (complete, incomplete);
- separation of limbs (complete, incomplete).

2. Damage arising from impacts and friction on the railway track and caused mainly by parts of locomotives, cars located below their frames (excluding wheels):
- detachment of the limbs;
- traces of dragging;
- open and closed bone fractures;
- varying degrees of damage to internal organs: from minor up to their displacement and loss through open cavity wounds.

3. Damage resulting mainly from being thrown by parts of a moving railroad transport:

- traces of impact by parts of a moving railway transport; extensive abrasions on the skin, bruising, bone fractures;
- fall marks on the body.

4. Damage, formed mainly in connection with the presence of the victim at the track within the dimensions of the rolling stock at the time of its movement:

- damage typical of those caused by solid blunt objects;
- in cases of compression between the platform and a moving vehicle - body stretching.

5. Damage associated mainly with falling from a moving train:

- in case of falling under the rolling stock - typical for damage by wheels, parts located below the frames of the locomotive, carriages, body dragging;
- when falling from a moving railway vehicle without subsequent falling under it - typical for falling from a height.

6. Damage associated mainly with electric shock while being on the roofs of cars moving along the tracks of the electrified railway:

- electro tags, signs of asphyxia;
- typical for falling from a height in the event that, after being electrocuted, the victim falls from the roof of the car.

7. Damage, mainly associated with crushed buffers and in the automatic coupler mechanism:

- closed fractures of the ribs, spine, shoulder blades;
- ruptures of the diaphragm, tears and ruptures of internal organs, their displacement; passage of the lungs through the mouth, perineal ruptures with prolapse of intestinal loops; the formation of traumatic hernias (inguinal, femoral) with filling of hernial sacs with internal organs, up to the heart and stomach;
- prints of the contours of the buffers on the skin of the chest and back.

3. 1. 1 . Damage typical of railway injury

Train injuries are severe and usually result in death at the scene of the accident. In this case, damage occurs as a result of rolling over the body of the wheels of the transport (pressure bands and rubbing, dismemberment of the body); typical, not associated with the action of wheels (traces of dragging, separation of limbs, compression of the body between buffers or in the automatic coupler mechanism); atypical and simulating other types of injury.

The pressure strip is the imprint of the wheel on the skin surface. Its width ranges from 7 to 13 cm. In the first hours after the injury, it is soft, pale pink; by the end of the day it becomes parchment density, dark brown.

The wiping line is the area of skin sagging along the edge of the pressure strip, it is formed by rubbing the skin against the side surfaces of the wheel. Its width varies significantly from 2 to 15 cm. If there are several layers of clothing on the body, a rubdown strip does not form.

The separation of the head from the body, as well as the dismemberment of the body, depend on the wheel rolling over the body. In some cases, it is possible to divide the body into many parts. The separation of the limbs occurs with a kind of multi-splintered bone fracture, and the end of the severed bone, facing outward from the track, turns out to be straight, while at the end, facing the inside of the track, an oblique fracture is noted. Such fractures of tubular bones depend on the location of the wheel crest (flange) along the inner edge of the rail.

Typical non-wheel-related rail injuries include dragging on the body, tearing off limbs, contamination, body dismemberment, body compression between buffers or in an auto-coupler mechanism. The nature of the traces of dragging is very diverse, while particles of the ballast layer of the track and traces of lubrication are often visible on the sieged surface.

Tearing off the limbs can occur not only from the action of the wheels, but also when struck by protruding parts of the moving train, especially with the fixation of the limbs by any part. Due to the large acting force in a railway injury, the body can be dismembered into many parts, and they can be detected at a considerable distance from the scene. In such cases, there will be no pressure or rub stripes along the separation lines of the limbs.

If necessary, physical evidence of biological origin (traces of blood, hair, particles of brain matter, soft tissues, small fragments of bones, etc.) found on a section of a railway track, track structures, on parts of a locomotive and carriages, are seized according to the usual rules. The packages where they are placed must indicate the exact place from which this or that object was taken.

3.1.2 . Rail damage, atypical for rail injuries

Atypical for railway injuries include injuries that more often arise from throwing the victim's body and hitting him on any protruding objects. In this case, depressed fractures of the bones of the cranial vault with damage to the substance of the brain and hemorrhages under its membranes, subcutaneous ruptures of internal organs, fractures of the ribs, bones of the extremities, etc.

Among the atypical for railway transport, there are injuries that simulate injuries from cutting, chopping, stabbing weapons or from the action of firearms. They arise either from blows by protruding parts of the rolling stock, or more often due to rupture of the skin with bone fragments in open fractures. Correct forensic diagnosis of such injuries is facilitated by the detection of typical railroad injuries on the corpse. Determination of damage, atypical for railway transport, sometimes raises suspicion of outside violence, followed by placing the corpse on the railroad bed. In such cases, it is of great importance to determine the lifetime of injuries, which is one of the most important issues of forensic medical examination of a railway injury. In this case, a special place belongs to the histological method of research, i.e. detection of signs of reactive inflammation that has already begun.

In case of railway injuries, traces of blood at the scene of the accident, as well as hemorrhages in the circumference of the wounds, are insignificant and often do not correspond to the extent of the injuries found. A similar phenomenon can be explained by the rapid onset of death, flexion of soft tissues and a sharp contraction of blood vessels. The sometimes observed anemia of damaged tissues depends on the large compression of them by the weight of a railway car.

Damage caused by rail (haulage) transport occurs in other industries, such as mines. They differ from ordinary railway injuries both in the mechanism of their occurrence and in the nature of the damage detected.

When a moving trolley hits the wheels, as a rule, no compression and dismemberment bands are observed, since the trolley does not have the same weight as a railway car and has a relatively lower speed. Therefore, when it encounters an obstacle in the form of a human body, the trolley usually derails and inflicts damage to the victim not with the wheels, but with the body.

DAMAGE AND DEATH FROM HIGH AND LOW TEMPERATURE. DAMAGE AND DEATH FROM THE ACTION OF OTHER PHYSICAL FACTORS .

Extreme temperatures.

The human body is equipped with a perfect thermoregulation mechanism, which allows maintaining a constant body temperature with significant fluctuations in ambient temperature. The constancy of body temperature is maintained by self-regulation of the processes of heat generation and heat transfer. Heat production is directly related to metabolic processes. Heat transfer is carried out by means of heat radiation (about 55 % of the total volume of heat transfer), heat conduction (about 15%), evaporation of sweat (about 27 %) and heat transfer with body secretions (about 3 %). Prolonged exposure to extreme temperature conditions can lead to a disorder of thermoregulation and death of a person.

High temperature action.

General action of high temperature.

Overheating. A hyperthermic coma, which in the past was subdivided into solar and heat strokes, usually develops with prolonged exposure to an atmosphere with a temperature of more than 34.50C. The temperature on the skin surface at which heat transfer occurs by radiation, conduction, convection and evaporation from the forehead and chest is 31–340C, for the extremities it is 27–300C. The high external temperature negates the heat transfer by convection, which in such conditions is carried out only by evaporation of sweat. Evaporation of one liter of sweat consumes about 600 kcal. However, in conditions of high ambient humidity, this type of heat transfer slows down. At an ambient temperature of more than 370C, the body is unable to give off heat and begins to heat up. The human body is able to carry out thermoregulation if the ambient temperature is less than 450C. At a relative humidity of 85%, overheating can already occur at a temperature of 300C. Overheating is also promoted by work, which is accompanied by an increase in the formation of heat in the body and tight clothing. The duration of exposure is also important. A short-term increase in body temperature up to 40C is usually not accompanied by sharp dysfunctions. When the temperature rises to 410C, the activity of the central nervous system is upset (headache, drowsiness, apathy, delirium, darkening of consciousness and convulsions). Epistaxis and increased breathing may occur. Excessive sweating leads to dehydration and electrolyte disturbances. Expansion of the peripheral vascular bed against the background of developed hypovolemia leads to a drop in blood pressure and cerebral hypoxia. An increase in body temperature over 410C usually leads to death due to depression of the respiratory center. At the same time, respiratory depression can develop both during exposure to the sun, and 6-8 hours after insolation. With gradual heating (in dry air), the body can withstand external temperatures up to + 1600C. The body does not seem to accept this temperature, keeping its own temperature close to normal. Evaporation of sweat absorbs a significant amount of heat from the layer of air that is directly adjacent to the skin, and thereby reduces body temperature. A significant increase in body temperature leads to the expression of a huge amount of proteins, called "heat shock proteins" (HSP). HSP synthesis begins a few minutes after heating. This reaction is regarded as protective (against death in the development of heat shock). It has been shown experimentally in tissue culture that severe heat stress induces apoptosis (Greek “leaf fall”) or death of several cells or groups of cells. Moderate stress (hyperthermia) protects cells from apoptosis and necrosis due to the preservation of the ability of cells to synthesize HSPs. HSP synthesis is a nonspecific stress response and, in addition to hyperthermia, occurs under the action of cytotoxins, ischemia, and peroxidation. The risk of getting heatstroke rarely increases when you are in the cab of a car in hot weather. At an outdoor temperature of + 300C in a car with raised windows, the temperature can rise to + 50C within 10 minutes. It is especially dangerous to leave children in such conditions. Due to the imperfect thermoregulation system, heatstroke develops faster and has more serious consequences. In principle, if a person is healthy, then being in conditions of high temperature is for him only one of the types of physiological stress, which the body is quite capable of. However, for people with CC disease, overheating is very dangerous. The blood vessels dilate and the blood thickens due to the great loss of water. Sinus tachycardia has occurred, and it is not always possible to restore a normal heart rhythm. Overheating is no less dangerous with varicose veins.

Sunstroke, in contrast to heat, arose from the action of direct sunlight on an uncovered head and neck, which leads to local overheating that affects the central nervous system, even in the absence of pronounced violations of heat regulation. An overdose of sun exposure has the same consequences as superficial thermal burns, but with a delay of several hours. Blade manifestations of solar and heatstroke are similar.

Soot in the respiratory tract is one of the main signs of a person's lifetime getting into a fire flame (lifetime smoke aspiration). The presence of soot in the smallest bronchi and alveoli is of diagnostic value. Soot particles are obtained by contact from the surface of the bronchioles onto a glass slide. With putrefactive changes in the corpse, a photo of the respiratory tract in the IR range is possible. Sometimes soot is found in the sinuses of the frontal bone, in the cavities of the heart in the lungs and in the urine. Lifetime action of the flame. Significant signs: detection of carboxyhemoglobin. Stripes of clear skin, corresponding to the places of the former folds formed when the eyes were closed. Fatty pulmonary embolism. The protein content in intravital burn bladders is twice that in postmortem bladders.

Local action of high temperatures.

Burns are the result of thermal, chemical, electrical or radiation effects on the body. In our country, a four-step classification of burns has been adopted (depending on the depth of tissue damage). The first degree is characterized by redness and swelling of the skin. Such a burn occurs with a short-term exposure to a temperature of about 70C. The second degree involves the presence of burn blisters. Bubbles may not appear immediately, but after a few hours, as the fluid sweats out of the vessels, which raises the surface layer of the skin. There is also swelling of the subcutaneous tissue. In place of a burst or torn bladder, moist pink-red skin is visible. In case of third-degree burns, there is partial skin necrosis with preservation of dermal elements (IIIA) or necrosis to the subcutaneous layer (IIIB) with the formation of a necrotic scab. The dead skin area is dense, ash gray or dark brown, depending on the nature of the thermal agent. The fourth degree is characterized by necrosis of muscles, tendons, joints and bones, which occurs from prolonged exposure to very high temperatures. The skin looks dry, tough, its superficial layers are black. In addition to the depth of the lesion, the area of the lesion is important for the development of burn disease. The average value of the total surface of the human body is taken as 16 thousand square cm. In case of burns, more than 50% of the body surface, shock is observed in all victims and is the main cause of death. To determine the area of burns, simple rules are often used. An adult's palm is approximately equal to 1% of the surface of the body. The area of individual parts of the body is equal to or divisible by 9% of the total surface. The surface of the head and neck is 9%, the face is 3%, one upper limb is 9%, one lower limb is 18%, the front and back surfaces of the body are 18% each, the perineum is

1%. Burns I, II, III degree, occupying about 5% of the body surface, usually do not lead to death, occupying 15-20% - are life-threatening (15% fatal). The larger the area of the burn, the greater the percentage of dying. With burns that occupy half of the surface of the body, people rarely survive. Chemical burns are the result of the action on the tissue of substances with a pronounced cauterizing property (strong acids, alkalis, heavy metal salts, phosphorus). The effect of strong acids and salts of heavy metals on tissues leads to coagulation, coagulation of proteins and their dehydration, therefore, coagulation necrosis of tissues occurs with the formation of a dense crust of dead tissues, which prevents the action of acid on deep-lying tissues. Alkalis do not coagulate proteins, but dissolve them, saponifying fats (colliquation necrosis) and cause deeper tissue necrosis, which takes the form of a whitish soft scab.

Hot water burns. The presence of single or multiple small burn areas near the main burn surface is the result of liquid splashing. The absence of "secondary droplets" indicates that the burn occurred through the fabric (clothing). In the near future after the defeat, it is not difficult to distinguish flame burns from scalding by the appearance of the burned areas and the presence or absence of scorching of clothing. When scalding, there is never charring. Burnt skin without traces of soot, soft, doughy. Her hair is not singed. Burn blisters with colorless or light yellow contents, the surface of the skin in the place of burst blisters of parchment density with a translucent network of vessels. On the edges of the burn there are scraps of gray skin. With steam burns, the skin looks like pink-white marble. If the hot liquid flows down the body in streaks, then burns corresponding to their outlines (landcard shape) are formed, which make it possible to judge the position of the victim at the time of the burn. Clothes are not damaged by hot liquids and steam, but traces can be found on them that indicate the nature of the liquid (milk, tar, etc.). In some cases, parts of clothing that are tight to the body protect the skin from the action of hot liquids and steam. Such intact areas can repeat the contour of the clothing that covered them (belt, shoes, etc.).

When exposed to fire, the burned surface of the skin is dry and dense with dark red, brown or black patches. The hair is singed, its free ends are as if swollen like a club. Soot deposits are present. Clothes are damaged (from slight discoloration to charring). Tongues of flame directed upwards sometimes cause burns and traces of soot characteristic by the appearance, allowing to determine the position of the body. Hot liquids spread throughout the body and leave streaky burns. Traces of flammable liquid often remain on clothing. The location and shape of burns sometimes indicate the mechanism of damage (falling into hot liquid, pouring it over, etc.). The medical treatment and healing processes alter the appearance of the burned surface and prevent the detection of signs that indicate the nature of the thermal agent. If burns lead to rapid death (within half an hour) or if a thermal agent acts on the body within this time after death, then almost the same skin changes occur, and it is very difficult to differentiate whether they are alive or after death. In appearance, such surfaces do not differ. In such cases, the determination of carboxyhemoglobin and fatty pulmonary embolism can be used to justify the diagnosis of survival. For histological examination, it is necessary to take a large number of pieces from different places of the burn surface on the border with intact tissue, which sometimes makes it possible to distinguish intravital from postmortem changes. For the same purpose, histological studies must be subjected to the root of the tongue, tissue of the larynx, pharynx and bronchi (to detect soot). It is also advisable to investigate the nodes of the autonomic nervous system and the adrenal glands. When a corpse is charred, the tissues of the body surface that were in contact with the floor are better preserved. The charred soft tissues are hardly cut with a knife, the muscles are shortened, and the corpse takes the "boxer pose" (the head is tilted back, the limbs are bent and brought to the body).

On the skin, from the action of the flame, cracks are formed, similar to cut wounds, however, in the depths of the burn cracks, transverse vessels are visible. When the head is burned, postmortem accumulations of blood are formed between the dura mater and the bones of the skull, which must be differentiated from intravital epidural hemorrhages. The charred internal organs become dry, dense, and their size decreases. Bones, when charred, first turn black, and then lighten and become whitish and fragile (white and gray heat). Teeth are usually better preserved than other objects, but become fragile. Longitudinal cracks can occur on the tubular bones, easily developing into fractures.

Chemical burns are caused by acids (sulfuric, hydrochloric, nitric, hydrofluoric, etc.), alkalis (caustic soda, caustic potash), heavy metal salts (zinc chloride, silver nitrate), phosphorus and some volatile oils. The depth of a chemical burn is difficult to determine, because in the next few hours after the injury, the affected area does not change immediately. At the same time, deaths from chemical burns are extremely rare. When burned with sulfuric acid, the scab is at first white, then it acquires a blue-green tint and finally becomes black. When burned with hydrochloric acid, the scab is initially soft, yellow-brown in color, but after a few hours it dries up and hardens. After its rejection, a bleeding granulating surface is exposed. When damaged by salts of heavy metals of high concentration, a dry limited scab of various shades is formed. Alkalis act more slowly, lastingly and penetrate deeper into tissues than acids, dissolving proteins and saponifying fats. When exposed to them, the image is a soft, smearing, loose whitish scab without sharp boundaries. When burned with phosphorus, the skin becomes covered with a steaming scab that glows in the dark. Later, a yellow-gray belt appears around the site of necrosis, turning into brown. Easily dissolving in fats, phosphorus penetrates deeply into tissues, causing, in addition to local burns, general poisoning. Molten bitumen, when it comes into contact with the skin, adheres tightly to the surface of the body, and it can be removed with great difficulty.

With superficial burns, soft smooth scars are formed, and with deep burns, the scars are dense, prone to wrinkling. Rejection of a scab in a chemical burn usually occurs after 10-15 days, after which a wound is formed, covered with flaccid granulations with weak subsequent epithelialization. Acid burns heal faster, leaving deep scars.

In the metallurgical industry, the greatest number of burns is observed in foundries and rolling shops, where they arise from the action of molten metal during pouring and from drops and jets from ladles when spraying the produced metal.

In children, burns are much more common, since children's skin is very delicate and thin and those temperature factors that do not have a noticeable effect on the skin of an adult can easily lead to the development of a burn in children.

Burning in a home stove requires 3 kg of firewood per 1 kg of body weight and at least 20-25 hours of burning. The corpse of a newborn baby can be burned up within an hour and a half. The time required for combustion depends on the type of furnace, the type of fuel and the combustion mode. The use of flammable liquids speeds up the combustion process. When examining the ash from the oven: sometimes it is possible to find the remains of charred bones, teeth, dental crowns and other fire-resistant objects (hairpins, hairpins) in it.

Large conglomerates of stove ash actually turn out to be burnt remnants of bones, which is revealed during histological examination. If there is a suspicion of criminal burning of a corpse, a detailed study of the heating hearth is necessary (size of the furnace, blower, temperature reached). Oily soot is always present on the walls of the hearth. The amount of ash and its location in the hearth, as well as its nature and appearance (fine, with pieces of coal, fragments of bones). At least four samples of ash (at least 50 g) are removed from different places of the furnace and blower into separate bags, and at the end of the inspection - all the ash. Complete burning of a corpse in an open space (in a fire) occurs in the interval of 20-50 hours under the condition of continuous intensive combustion with the use of flammable substances.

Histological examination of intravital burns determines the presence of arterial and capillary hyperemia, stasis, edema, hemorrhages with elastic fibers in the area of hemorrhage, dystrophic changes in the dermis and epidermis. However, all of the above signs are also found during the burning of a corpse in the near future after death (due to the excitement of the skin). More reliable signs are arterial thrombi in the vessels of damaged areas, marginal standing and migration of leukocytes, necrotic changes in the peripheral nervous system, in the skin and muscles. In vivo bladders of burns, there is twice as much protein as in posthumous ones. There is also a fatty embolism of the vessels of the lungs and other organs. In the burnt corpses, there are postmortem epidural hemorrhages, which have a sickle shape with liquid blood between the dura mater and even with blood clots. In contrast, intravital epidural hemorrhages have a fusiform shape and are tightly attached to the dura mater.

A burn disease can manifest itself as a slight malaise or a severe disorder of all body functions. The course of the burn disease is divided into four periods. In the first, severe painful irritations occur, which can lead to the development of shock, especially if the burn is located in the genital area. The state of shock in the first hours is expressed in the agitation of the victim, and then in severe general depression. The defeat of the nervous system in shock is accompanied by impaired blood circulation, respiration, kidney function and a change in the composition of the blood. The pulse becomes fast and threadlike, and the blood pressure drops. Body temperature first rises and then falls below normal. The second period begins on the 3-4th day and is accompanied by the phenomena of intoxication of the body associated with the development of infection and the entry into the blood of decay products of burnt tissues. A febrile state sets in, and severe changes in the liver and kidneys appear. Blood and protein are found in the urine. Post-burn anemia develops. In the lungs, foci of inflammation appear. The burn surface suppurates, which causes intoxication. The third period develops approximately 10 days after the burn, when, due to the increased development of infection and poisoning of the body, infectious complications occur - purulent nephritis and purulent foci of inflammation in other tissues and organs. The temperature rises to 40C and heart failure develops. In the fourth period (one month after the burn), general wound depletion may occur, as a result of prolonged absorption of decay products from festering wound surfaces. Bedsores appear. Purulent complications and malnutrition of internal organs lead to their dystrophy.

It is generally accepted that all burns are either primarily infected, or bacterial contamination occurs already in the first hours after the injury. Conditionally pathogenic microflora is found on the burn surface already in the first day after injury. However, the isolated microbe may not be the causative agent of infection, but a representative of the microflora that colonizes the wound.

The stages of development of the infectious process are classified as follows (B.A. Pruitt, 1993):

1) Colonization:

- superficial (in which microbes are present only on the burned wound surface);
- penetration (microbes in the modified layer-by-layer scab);
- proliferation (change in the number of microorganisms in the substructural space);

2) Invasion:

- micro-invasion (microscopic foci of microorganisms in the altered tissue adjacent to the sub-scab space);
- generalization (micro-focal or widespread penetration of microorganisms deeper into the altered subcutaneous tissue);
- microvascular (involvement of small blood and lymph vessels).

Hormonal changes, in burn patients, are a two-phase process, beginning with an ebb tide, followed by a tidal phase. The ebb phase begins immediately after the burn and lasts for the first 2–3 days (shock phase). It is characterized by an adaptive response to burn injury and includes increased ejection, an initial decrease in O2 consumption, a decrease in circulatory blood volume, hypotension, and acidosis. Hormonal changes during the reflux phase contribute to the preservation of the BCC, improve hemodynamics and increase vascular tone in order to reduce the loss of intravascular fluid. During the ebb phase, increased levels of antidiuretic hormone, growth hormone, adenocorticotropic hormone (ACTH), b-endorphins, thyroid-stimulating hormone and catecholamines. All of them contribute to the preservation of intravascular volume and cause vasoconstriction. The hot flush phase immediately follows the reflux phase and lasts until the burn heals. It is characterized by hypermetabolism with an increase in cardiac output, a maximum increase in O2 consumption, metabolic rate and heat production. In this phase, weight loss and significant changes in oxidation substrates occur. Hormonal changes during low tide help the body to cope with increased energy requirements and also suppress non-essential metabolic activity (for example, gonadal function). During this phase, the level of four hormones increases: cortisol, catecholamines, glucatone and insulin. The interaction of these (main) hypermetabolic hormones increases glucose levels in organs and tissues (due to the breakdown of protein and fat and a subsequent increase in CO2 production). They also act on skeletal muscle and increase glycogenesis, protein lysis and insulin resistance. In addition, the level of repin and angiotensin increases, which have an important hemodynamic effect. They cause hypertension, which often accompanies painful burns.

At autopsy, upon death from shock, there is a sharp general plethora of internal organs, sometimes small epicardial and subpleural hemorrhages. You can notice swelling of the edges of the lungs and edema of their posterior regions. At death during the period of intoxication, changes in internal organs associated with a violation of their nutrition and metabolism (dull appearance, flabbiness) are noted. Edema and pneumonia in the form of dense gray or red airless foci. Sometimes there are scattered small hemorrhages in the substance of the brain and cerebral edema. At death during the period of infection complications are observed abscesses in various organs and tissues, small ulcers on the mucous membrane of the stomach and intestines, enlargement of the spleen, purulent inflammation of the kidneys. In the first five days after the injury, there is a sharp swelling and blood soaking of the dermis. There is no demarcation shaft.

Small in area infiltrates, neutrophils are found in the area of the preserved hair follicles. The detection of microorganisms in the sub-scab space on the 6–12th day after the injury clinically coincides with the period of onset of suppuration and rejection of the burn scab. In this case, massive neutrophil infiltration is revealed, especially in the area of formation of the demarcation shaft. By the end of the third week after the injury, epithelialization of superficial and borderline burns and deep burn wounds with granulations occur. Vessels appear on the lower border of the demarcation shaft, which indicates the development of granulation tissue. With a favorable course of the wound process in the granulation tissue, the number of newly formed vessels and connective tissue cellular elements increases. A particularly favorable sign indicating the cessation of wound infection and wound healing is the appearance of young adipose tissue cells. First, fibroblast-like cells with numerous fatty vacuoles appear. Such cells acquire the ability to proliferate. Finally, mature adipocytes are found in the form of cricoid cells. With an unfavorable course of burn disease, changes are noted on the part of granulations, which become thinner, become vitreous, bleed easily and have foci of secondary necrosis. The formed granulation tissue again undergoes edema, there is stasis of blood in the vessels and intense infiltration with leukocytes.

General hypothermia of the body.

Hypothermia (hypothermia). The constancy of body temperature is due to the balance between the processes of heat generation and its loss. The main sources of heat production are muscle work and metabolic processes. With a decrease in body temperature below +35 ^{0} C, functional disorders develop in the body, characterized by a sharp suppression of all vital functions. Being unclothed at ambient temperaturesWednesday near zero leads to death in 10-12 hours. Staying in water under the same conditions causes death within 10 minutes, since the heat capacity of water is four times, and the thermal conductivity is 25 times higher than that of air. In the initial stage of cooling, pathological excitement of the subcortical parts of the brain occurs, manifested by confusion, delirium and euphoria, while maintaining the ability to move independently. The second stage of hypothermia is characterized by the extinction of vital functions. The "biological zero" of vital activity is distinguished not only for different organs, but also for different functions within the same organ. Independent movements stop when the body temperature drops to +31 ^{0}C, consciousness is lost at +26 ^{0}C, and death usually occurs from cessation of breathing when the body temperature drops to +15 - +20 ^{0} C. At the same time, among warm-blooded animals there are those that tolerate a decrease in body temperature to -3 ^{0}C (crystallization points of weak salt solutions) ... The Arctic ground squirrel (Spermophilus parryii) inhabiting Alaska can easily endure months of freezing at its normal temperature of 37 $^{\circ}$C, falling into a reversible state of suspended animation.

With hypothermia, a spasm of peripheral vessels occurs, which for some time delays the drop in temperature. However, it is impossible to completely stop peripheral circulation, and with continued cooling, a certain amount of cold blood still enters the internal organs, causing inhibition of their function (inhibition and loss of consciousness, bradycardia, etc.). Therefore, general cooling is characterized by the development of drowsiness, lethargy, slowing down of speech, stiffness of movements. The occurrence of hallucinations (for example, the feeling of being in a warm room) is noted. When the body temperature drops below 30 $^{\circ}$ C, a clinical picture of "imaginary death" may appear: pulse and blood pressure are barely perceptible, reflexes are not detected. However, this condition, with adequate treatment, has a fairly high reversibility. With continued cooling, the process ends with a weakening of respiratory and cardiac activity, clouding of consciousness and convulsions.

The first sign of Desyatov is that at death from hypothermia, the blood in the left half of the heart is lighter than in the right.

The second sign of Desyatov is the bright red color of the glans penis when exposed to a low temperature in vivo.

Kasyanov's sign - proliferative-necrobiotic changes in the rectal tubules of the kidneys and in the tubules of the testicles, arose under the influence of cold. The cells of the tubules take on an ugly shape, the number of nuclei in them increases. Instead of round or oval, the nuclei take on a fusiform shape.

Puparev's sign is a strong contraction and wrinkling of the scrotum. Retracting the testicles into the inguinal canals.

Pukhnarevich's sign (reduced and empty stomach) at death from hypothermia.

A sign of Paradise is the presence of icicles at the openings of the mouth and nose and frost on the eyelashes with intravital hypothermia.

Fabrikantov's sign: single small hemorrhages in the connective membranes of the pelvis of one of the kidneys (in the area of the cups) in death from hypothermia. Similar hemorrhages occur during aspiration and carbon monoxide poisoning, but in these cases they are more massive, numerous and bilateral.

Lakassan and Kryukov's test (absence of glycogen in the liver).

Vishnevsky spots are the most reliable sign of death from hypothermia. They represent superficial erosions on the gastric mucosa with traces of poured blood at the bottom of these areas. The dysfunction of the vessels of the abdominal cavity arising in the process of hypothermia leads to focal necrotic changes in many internal organs. However, these changes become noticeable precisely in the stomach, where aggressive media (hydrochloric acid and proteolytic enzymes) quickly destroy areas of the necrotic mucous membrane. Interacting with hemoglobin, hydrochloric acid forms hydrochloric acid hematin in the form of dark brown lumps at the apex of the folds. Erosions have a point-like appearance, and blood freely located on their surface is easily washed off with a stream of water. In newborns, Vishnevsky spots are not formed due to the lack of hydrochloric acid in the gastric juice. Vishnevsky spots do not appear with achilia (absence of hydrochloric acid due to anacid or hypocidal gastritis).

Keferstein's spots (red spots on the skin outside the areas of cadaveric spots) occur during hypothermia due to partial freezing of blood in the surface vessels. In this case, hemolysis occurs, and the stained blood serum permeates the surrounding tissues.

Sign of Samson-Gimmelstierna - overflow of the bladder.

The bright red color of the lungs and cadaveric spots is due to hyperoxygenation of the blood due to tissue hypoxia and non-assimilation of O_2 blood by the tissues while maintaining external respiration.

When dying from hypothermia, the characteristic posture of a corpse (curled up in a "ball") is often encountered, which is in vivo and associated with an attempt to conserve heat. Pronounced "goose bumps" are also formed in vivo and remain on the corpse due to muscular rigor mortis. One of the signs of the in vivo action of low temperature are cases of the so-called "self-criticism" - gnawing at the tips of the fingers, up to the removal of the nail phalanges. An attempt to warm the freezing fingertips reflexively transforms first into light biting, and then into biting off soft tissues. The phenomenon of paradoxical undressing arising as a result of a perverse reaction to the action of low temperature is considered a sign of the action of low temperature. When the central nervous system is inhibited, the center of thermoregulation is inhibited, and the person experiences a sensation of hyperthermia. Frost can be found at the openings of the mouth, nose and on the eyelashes, and even icicles, which were formed when the tear fluid and moisture released during breathing freeze. You can identify areas of chills (contraction) of the scrotum. There is a complete absence of glycogen in the liver, skeletal muscles and myocardium. In a biochemical study, glucose is not detected in the blood, which indicates the complete consumption of the energy substances of the cells, the maintenance of a low body temperature.

In response to irritation by cold, the human body responds with a kind of complex physiological reactions aimed at maintaining the temperature constant of the body. Compensatory and adaptive reactions of the body aimed at maintaining thermal homeostasis are manifested by changes in the endocrine glands. So, in the thyroid gland, the gland of the usual follicular structure is reorganized into glands of the transitional and desquamative types (the process of resorption and proteolytic hydrolysis of thyroglobulin is enhanced, providing a high level of release of thyroid hormones and their entry into the bloodstream). The morphological expression of an increase in the functional tension of the thyroid gland is the rearrangement of the follicular epithelium into desquamative types. The desquamative type represents an extreme increase in stress, when the reserves of hormones (intrafollicular colloid) are almost completely depleted. In response to a superstrong external stimulus (cold), there is an increase in the activity of the most important regulatory systems - the nervous and endocrine systems. In the pituitary gland, thyroid gland, adrenal glands, testes, various kinds of structural rearrangements (local hyperplasias) are revealed. Before exposure to a cold stimulus, the cellular structures are at different levels of functional stress. In a stressful situation, there is a great need for the secretion of the glands (hormone) and the entire parenchyma of the gland is included in the reaction to maintain the thermal homeostasis of the body. However, different complexes of cellular elements begin structural transformation from different levels of the previous functional state. Those of them who were at the height of functional stress even before the stress state undergo structural changes in a short period of time. At the level of the microvasculature, this manifests itself in the form of foci of hyperplasia up to areas of the type of adenomatous structures. Pseudo-iron structures that form in the endocrine organs (adrenal glands, etc.) are a kind of adaptive reaction, the meaning of which is to try to create a "depot" for hormones. Similar changes can be found in the pituitary gland and in the thyroid gland. The accumulation of colloidal droplets (up to colloidal edema of the stroma) represents a return to the apical type of secretion lost in phylogenesis, i.e. functioning as an exocrine gland. An increase in the functioning mass. The usual response to stress is abrupt dilatation and blood overflow of sinusoidal capillaries passing between the cell complexes. At the same time, due to the lengthening of the contact of blood with cellular structures (parenchyma of the glands), two tasks are solved: a greater amount of hormones of the adenohypophysis are delivered to the cells, and a greater amount of secretion of the glands (hormones) is released into the bloodstream. Hypothermia leads to inhibition and blocking of tissue processes, primarily tissue respiration. As a result, a state of tissue hypoxia occurs in the body. In this case, a sharp decrease in metabolic processes occurs, the tissues are not able to assimilate O_2 from the blood. Tissue hypoxia is accompanied by blood hyperoxygenation. Death occurs from hypoxia and anoxia of the brain and heart. Hypertrophy is noted in the adrenal cortex. The glomerular zone is represented by concentric structures or clusters. The bundle zone is enlarged, represented by cell structures of a prismatic or polygonal shape. Most of the cells are significantly depleted in lipids. The deepest layer of the cortical substance is reticulate, indistinctly delimited from the bundle zone. There is a complete absence of glycogen, which indicates the intense work of the cortex. Some of the cellular structures are in a state of necrosis and necrobiosis, which is also a consequence of the high functional activity of the adrenal glands, accompanied by an intense process of self-renewal. Due to tissue hypoxia, the permeability of the vascular wall increases, and the shaped elements go beyond the boundaries of the vessels without violating the integrity of their walls. With a decrease in temperature in the kidney tissue, the function of the renal tubules is impaired, and diuresis becomes abundant. In the pancreas, at the macroscopic level, swelling, edema and significant cyanosis are most often noted. Often, small focal subcapsular hemorrhages and organ hyperemia are recorded. Histological examination in the parenchyma of the gland shows foci of acini discomplexation with fuzzy or homogenized cytoplasm. The boundaries between cellular structures inside the lobules are blurred. The secretory process in zymogenic cells decreases, which is manifested by the formation of granules of different maturity in them. There is a sharp plethora of capillaries and swelling of their walls with foci of plasma impregnation. In general, destructive processes are most pronounced in the exocrine part of the gland and blood vessels, and compensatory processes are most pronounced in the endocrine section.

The lower extremities are primarily affected by cold injury. The knee joints are one of the areas with the lowest temperature compared to other areas of the body. Even in comfortable conditions, the temperature of the extremities drops to +29 ^{0} C. Figuratively speaking, hypothermia of the body begins from the extremities. Already in the compensatory phase of hypothermia, due to impaired blood circulation in the knee joints and changes in the rheological properties of blood, inhibition of metabolic processes between blood and synovia occurs. In this case, the level of ethanol in the synovium will be stabilized, while the intensive oxidation of ethanol in the blood will continue, up to the complete depletion of the body's energy resources. The data obtained by V. Korotun indicate that the concentration of ethanol in the synovium may exceed that in the blood by 1.5–2 times.

Hypothermia in water in terms of its damaging effect on the body is much more dangerous than the "land" cold. A person lives in water with a temperature of 2–3 $^\circ$C for only 10–20 minutes. In this case, after a few minutes, he may lose consciousness. When immersed in cold water, it is necessary to remain, possibly very still. On land, a person naturally warms up by making intense movements that increase blood flow to the muscles and skin. When in water, increased heat release leads to rapid hypothermia of the body. Movement in the water promotes intensive washing of the swimmer's body with cold water masses, displacing the heated layers of air and water that remain between the body and clothing. When in a life jacket, you must take a half-sitting position. In this position, water to the least extent washes the parts of the body that are most sensitive to cooling - the back of the head, head, and neck. A frozen person is not able to keep warm on his own (without heating outside), no matter how many warm clothes they put on him.

Local action of low temperatures.

Local frostbite occurs with local exposure to low temperatures on open parts of the body (nose, ears, limbs). When exposed to cold on tissues, afferent impulses arises in thermoreceptors and enters the centers of thermoregulation located in the hypothalamus along the conductive nerve pathways. There is a response neurohumoral adaptive reaction aimed at maintaining temperature homeostasis. The resulting spasm of peripheral vessels leads to a decrease in heat loss from the body surface and maintenance of blood supply to vital organs. Prolonged spasm of peripheral vessels leads to impaired microcirculation, thrombus formation and trophic disorders. Absorption of decomposition products from the necrosis zone into the blood can lead to the development of acute renal failure. The first degree of frostbite is characterized by pallor, sharp soreness and a bluish tinge. In the second degree, intradermal blisters appear, filled with a light exudate, sometimes having a jelly-like consistency. At the third degree, the content of the blisters becomes hemorrhagic due to necrosis of the entire thickness of the skin along with the germ layer and hangs down in the form of "rags". The fourth degree is associated with the death of all layers of the skin and soft tissues with the development of wet gangrene. Cooling of tissues to a temperature of +11 ^{0} C leads to the cessation of blood circulation and the beginning of cell death. Local cold injuries are of two types: injury without frostbite (as a result of vasospasm) and injury with frostbite (as a result of the formation of ice crystals in the intercellular space and vascular thrombosis). If a victim of frostbite is in a forced position for a long time (with limbs fixed in one position), the so-called trench or immersion foot develops, which is subsequently complicated by renal failure.

Electrical trauma.

Electrical trauma refers to local and general changes in the body caused by the action of electrical energy. Distinguish between the defeat of technical and atmospheric electricity.

Electric current is a directed (ordered) movement of charged particles: electrons, ions, etc. Conventionally, the direction of movement of positive charges is taken as the direction of the electric current. To greatly simplify the situation, electrons can be compared to stones falling from a mountain. The higher the mountain, the greater the speed of the flying stones. The "drop height" in an electric field can be measured in different units, but the easiest way is to measure it in volts. By the end of the fall from " h " 127 or 220 V, each electron acquires a current strength of 127 or 220 electron-volts. Due to this current strength, the electrons running along the wires do their work. The best-informed experts in this area seem to be the Americans, for whom electric shock was the favorite method of executing criminals for many decades. When assigning this rather unusual punishment, local legislators proceeded from three premises. On the one hand, it seemed to be a manifestation of humanity, depriving a person of life quickly, guaranteed and painlessly. On the other hand, it personified technical progress, which is no stranger to jurisprudence. Indeed, in the age of general electrification, it is a shame to use ancient barbaric methods like hanging a person on a rope. Finally, the impact of the current, as it were, removed the executioner from direct contact with the victim, protecting his own psyche from possible moral suffering. The latter, however, immediately seemed somewhat far-fetched, bearing in mind the presence in society of a huge number of subjects who chopped off their heads with obvious pleasure. However, after several years, Americans were surprised to find that the electric chair does not have the virtues attributed to this miracle of modern technology, concerning, for example, the personification of humanity. The impact of a current of the same strength turned out to be very individual. Some people were deprived of their lives quickly enough, but on others it did not have the desired effect, accompanied by not too aesthetic details: involuntary defecation and urination, prolonged cramps, scalding of the skin and hair (roasting alive), vomiting and bleeding from natural holes, causing fair criticism from witnesses of the execution ... According to the results of scientific research, the chair has undergone some changes. It has been found that the paths of current through the body (current loops) are extremely important in achieving the desired effect. The optimal points of contact, including the heart, in which the current causes fibrillation of the ventricles, brain and medulla oblongata, where damage to vital centers occurs. Shaving the head and moistening the electrodes at the contact points proved to be very helpful. In fact, dry and coarse skin has a resistance of 100,000 to 2 million ohms, being a poor conductor, and moisturizing reduces ohmic resistance thousands of times, increasing the body's current conductance. The well-known position on the current strength (above 0.1–0.5 A is fatal) has also been revised. It turned out that the passage of current through the "upper loop" (including the heart) provides a good effect even at 0.01A, causing much less convulsive muscle contractions. Much controversy has arisen on the pathways of the current in the body. In the end, most of the inquisitive experimenters came to the same conclusions. After overcoming the resistance of the skin, the current passes through deep tissues in parallel beams along the paths of least resistance (along the flow of tissue fluid: blood and lymphatic vessels, as well as nerve trunks). With the ability to easily convert to other types of current strength, the electricity of the current strength can cause mechanical, chemical and thermal damage. Skin and bones offer the greatest resistance and therefore the most damage to other organs. The thermal effect is manifested by burns of the skin, up to charring (electro-tags), and areas of melting appear in the bones ("pearl beads"). The strength (magnitude) of the current is determined by the ratio of the voltage and resistance of the body area at the point of contact. Or, conversely (according to Ohm's law), the voltage is equal to the product of the current strength and the resistance of the conductor. Skin lesion (electrometric) is absent provided there is little resistance and tight contact with the conductor. The smaller the contact area, the higher the current density and the more the force turns into heat. The mechanical (dynamic) action of a high-strength current is manifested in tissue separation and even the separation of body parts. The combined action of thermal and mechanical force produces an explosive effect. The biological effect of the current lies in the release of catecholamines in the organs of internal secretion. The electrochemical effect is manifested by electrolysis: ionic equilibrium is disturbed in the cells. Gases and vapors generated during electrolysis can impart a cellular structure to tissues. The non-specific action of the current is due to other types of force (for example, the high temperature of a volt arc). According to the Joule-Lenz law, the greater the current and resistance, and the longer the contact time, the more the conductor heats up. That is, the electric current damages tissues not only at the site of its application, but also along the entire path of passage through the body. In terms of magnitude, currents are divided into imperceptible (0.6-1.6mA), felt (3mA), releasing (6mA), not releasing (10-15mA), suffocating (25-50mA), fibrillation (100-200mA) and thermal currents. impact (5A and higher). The threshold value of the irritating current causing tingling sensation is 0.5–2mA. With an increase in the current strength to 15–5mA, convulsive muscle contractions occur, which do not allow the victim to disconnect from the current-carrying object on their own. A current of 25–80mA can cause convulsive contraction of the respiratory muscles in the expiratory phase. A current of 100mA causes ventricular fibrillation. The cessation of oscillations can occur as a result of the action of a single stimulus applied at the appropriate time. If the pulse is of sufficient magnitude and is applied in a narrow range of oscillation phases, in which its action leads to the disappearance of oscillations, and not to a phase shift, oscillations disappear. The perturbation of biological oscillators can be produced by a single stimulus. With a weak stimulus, only a phase shift occurs. However, an unstable phase singularity may exist. In this case, the oscillations are always restored after the disturbance. Physiological basis for understanding such dynamics. The application of a single electric shock in the critical (vulnerable) phase of the cardiac cycle during the refractory period of the ventricles leads to fibrillation. The general process of fibrillatory contraction of the heart muscle can be described as an uncoordinated, disordered and extremely bizarre contractile process in which normal systole and diastole are no longer observed and it seems that individual fibers or groups of fibers are contracting independently (hence the name fibrillation). While some areas of fibrillating tissue are at rest, areas adjacent to them can contract synchronously. On the surface of the fibrillating chamber there is an area of fine twitching, combined with coarse muscle contractions, which slowly spread throughout the muscle tissue in different directions, and when they move, block zones appear as a result of their interaction with other waves. Fibrillation is a contractile vortex (maelstrom), since the contractile impulse propagates along an annular path, repeatedly returning to this area and re-exciting it (wave trap). So, the higher the voltage, the easier the current overcomes the resistance and, it would seem, should be more and more dangerous. In fact, when an electric shock exceeds 1000 V , as a rule, an electric arc occurs and local carbonization of tissues is formed, which prevents further passage of current.

Reducing the risk of current action is manifested from a frequency of 1000 hertz and above. At a frequency of more than 70 thousand hertz, the current is safe, showing only thermal effects. Currents with a frequency of hundreds of thousands and millions of periods per second are used for therapeutic purposes (diathermy, UHF). The comparative hazard of AC and DC is voltage dependent. Up to 400 V, alternating current (with a frequency of 50 hertz) is more dangerous, at 500 V the danger is the same, and more than 500 V , direct current becomes more dangerous. In installations with voltages up to 1000 V, the source of damage is electrical networks, hand-held power tools and electric cranes. In installations with a voltage of more than 1000 V, the defeat occurred during the maintenance of power grids, switchgears and transformer substations.

In modern systems, the object of research has traditionally been only accidents associated with electric shock and (extremely rarely) murder or suicide. The effect of electric current on the body has been thoroughly studied during the period of application of electroconvulsive therapy for the treatment of mental patients. Electroconvulsive therapy consists in the fact that an electric current of up to 1.6A and a voltage of 70 to 400 V is passed through the human brain . In order not to burn the skin on the head in those places where the electrodes are applied, it is lubricated with a special conductive jelly. Electric shock works to damage the brain, although many psychiatrists deny this effect. Pathological studies show that electric current can cause intracerebral hemorrhage, cortical atrophy, hydrocephalus, partial destruction of brain tissue and the formation of fibrous scars, shrinkage of the frontal lobes of the brain, memory loss and decreased intelligence. The inclusion of an electric current in a circuit is usually single-pole, when a person standing on the ground touches one wire and two-pole, in which a person, isolated from the ground, touches two current-carrying wires. At high voltage, due to ionization of the air and an increase in its electrical conductivity, for example, in inclement weather, damage can occur without direct contact with the wire when approaching it at a distance of up to 30–40 cm (arc). Electrical injury can also occur from "step" voltage. It occurs when a high-voltage wire falls to the ground, when faulty electrical equipment is grounded, and when lightning strikes. When hit by a step voltage, the current flows from one leg to the other (lower loop). The step voltage is the potential difference between each other at a distance of one step (usually 0.8 m). The wider the step, the greater the potential difference and the more voltage a person gets under. Often, with an electrical injury, melted nails are found on the soles of shoes, melted coins and keys in pockets. On a damp earthen floor, the resistance of the ground contact is much less, therefore, there is a greater likelihood of current passing through the body. The nonspecific action of the current is due to other types of current strength (for example, the high temperature of a volt arc). An electric (volt) arc occurs when high voltage circuits are broken and is a brightly glowing flame cord. The temperature at the base of the arc reaches 12 thousand degrees.

Elektrometka first described by Austrian scientist St . Jellinek in 1927 . Most often, electrodes occur when in contact with a small conductor and are characteristic of the action of a relatively low voltage current (100–250 V). Electro-tags are formed if the skin at the point of contact with the current source was dry and had a thickened stratum corneum (i.e., in cases where the skin has a high resistance). On moist skin and in areas with a thin stratum corneum, electro-markers usually do not appear. Electro-tags are formed due to the thermal and electrolytic action of the current at a temperature of no more than 120 ^{0}C. When in contact with a conductor of a higher temperature, the electro-tags take the form of III - IV st. In such burns, signs of an electrometric look in the form of swelling of the stratum corneum with the formation of various sizes of honeycomb voids, elongation of cells and nuclei of the malpighian layer, which takes the form of brushes or palisades. Electro tags can also be detected when examining putrefactively changed corpses. Both typical electro-tags and electro-tags that turn into a burn can reflect the configuration and dimensions of the current conductor at the point of contact. Electric tags from contact with the current-carrying wire have a typical strip-like shape. Electrometallization occurs due to the melting of the metal of the conductor under the influence of the transition of electrical force to heat. Small particles of the conductor metal cover the surface of the stratum corneum and partially penetrate into its depth. Depending on the chemical composition of the conductor, the electromagnet can acquire a different color. Copper can color the electrometric in bluish, greenish and yellow-brown tones, aluminum - in gray, yellowish and brown-black. This color does not arise from other metals. To identify the configuration of the conductor, the study of electro-markers in infrared rays can be applied using an electronic-optical converter.

When examining the electrometric, it is often possible to detect the impregnation of the skin with the metal of the current-carrying conductor. For this, the method of contact diffusion chromatography is used. When the hair is damaged by an electric current, breaks and rejection of the cuticle occur with the formation of a homogeneous mass of black color. In some cases, the core cortical substance is damaged with the deposition of small point black particles in it. High voltage currents can cause the bones of the skull to separate at the seams. Occasionally, hemorrhages are found in the wall of the bladder and in the adrenal glands. In a true electrometric (in the stratum corneum), during stereo-microscopic examination, one can find small holes (holes) of the stratum corneum, along the edge of which it abruptly breaks off (without bends in depth) and is covered with a black border along the edge. At a distance from the electrometric, specific changes in the course of the excretory ducts of the sweat glands, resembling honeycombs, can be found. When the tissues of the liquid boil in areas with a thick stratum corneum, the epidermis breaks and cavities are formed in it (Shridde honeycombs). A kind of electrogenic emphysema can be found in the subcutaneous tissue. When stained with hematoxylin-eosin, the connective tissue in the area of the electrometric is intensely stained blue.

Atmospheric electricity.

The damaging effect of atmospheric electricity is due to a very high voltage - up to 10 million volts with a current of hundreds of thousands of amperes. The duration of the discharge is fractions of a second. Linear lightning can have a length of up to 20 km vertically and up to 2 km horizontally and carries negative charges to the ground. Lightning has three main damaging factors - the electric current itself, light and sound power, and a shock wave. The light effect arises from the strong heating of the air. As a result of warming up and increasing pressure in the discharge zone, a sound effect arises, causing an explosive effect (thunder), capable of tearing off parts of the body and throwing a person over long distances. This effect is most pronounced in ball lightning. The temperature in the area of the lightning channel can exceed 25 thousand degrees, which causes severe thermal burns. In the forest, tree species with the most developed root system are struck by lightning. Deciduous trees, especially oaks, are damaged more often than conifers. When lightning strikes a lonely tree, it becomes the center of an electric crater, around which the current spreads along the earth's surface ("lightning spreading zone"). The leaves, branches and bark on the trunk, saturated with a huge amount of rainwater, turn such a tree into a kind of capacitive capacitor that accumulates the power of a lightning discharge and gradually releases it into the ground. When entering such a zone, a person may experience burns of the eyelids and eyeball, clouding of the cornea and lens. On the skin, tree-like marks (lightning marks) of a purple-brown color are visible along the course of the vessels. Some authors believe that the figure of lightning disappears a few hours after death. The largest traumatic lightning strike is considered to be a one-time and instant fatal injury to 68 cows, which occurred in Australia in October 2005 . The cows were hiding from the rain under a huge tree, which was struck by lightning. Lightning strikes the famous New York skyscraper Empire State Building at least 20 times a year. In houses with stove heating, lightning often enters the room through a pipe, since the smoke coming out of the pipe has a high electrical conductivity and "attracts" atmospheric discharges. The same attractive property is possessed by bursts of electromagnetic radiation that occur when a mobile phone is turned on or off.

The morphological picture is rather scarce (except for the electrometric itself), where the changes are almost pathognomonic. Macroscopically, an electrometric can have the most different (sometimes very intricate) sizes and shapes, yellow or grayish-pale color, roller-like edges and a sunken center with exfoliated epidermis and a coating of metal particles from the current-carrying conductor. In fact, this is a kind of burn. On histological preparations in places of "current signs" (entrance and exit), brush-like (in the form of a broom or palisade) stretching of cells of the malpighian layer, endothelial cells of papillary capillaries, blood into the walls of blood vessels and into tissues along the flow of the current are found. Some authors find the destruction of sarcoplasm and sarcolemma minus fibers and foci of necrosis, as well as vacuolization of the cytoplasm in the nerve cells of the brain and voids in the skin. Islets of scorched hair and anisocoria (irregular and irregular pupils) are sometimes found. Muscles along the current have the appearance of "boiled meat". To identify an invisible electrometric, the skin at the site of the alleged contact with the electrical conductor is placed in 20% solution of acetic acid. An hour later, the electrometric swells and clearly looms.

Algorithm for diagnosing death from electric shock.

Knowledge of the most common electric shock situations is absolutely essential for proper operation on the scene. If the expert during the initial examination did not suspect an electrical injury and did not use the entire arsenal of searching for direct and indirect evidence of the action of the current, during the autopsy he will be in a delicate situation, deciding the cause of death. In production, typical situations include, for example, the detection of a dead electrician, especially with the smell of alcohol. It should be borne in mind that the colleagues of the deceased (especially from the labor protection service), before the arrival of the expert, can perform a number of masking measures to conceal the fact of occupational injury. During earthworks, high-voltage cables, even disconnected, can be a source of injury, because tend to accumulate electrical charge like a high-capacity capacitor. In summer cottages, frequent whitewashing with lime mortar leads to damage to the insulating material of the wires. In garages where the air is saturated with gasoline vapors, a short circuit can lead to fire. Self-confident digging in a tube TV, which is powered by high-voltage currents, up to 13 thousand volts, is a mortal danger. Household appliances: working with wet hands. If the wire of the washing machine fails at the point where it passes through the hole in the casing, the body is energized. If you touch the washing machine and the bathtub at the same time, you can get an electrical injury. Plunging into a bath of water heated by an electric heater is akin to playing Russian roulette. Filling the kettle with tap water without first disconnecting the plug from the socket. Launching a kite in pre-storm weather: A wet thread can be a good conductor of current. The same happens when the kite clings to high voltage wires. Children urinate from swing bridges onto railway tracks. Contact with a current-carrying object may occur through the jet. When extinguishing a fire with a hose, do not fill the burning wires with water. Home repair of electrical appliances is usually not burdened with sealing the contacts. If the connection is loose, this section of the wire becomes very hot, the insulating material ignites, and the device is energized. Light bulbs and household appliances are wiped with damp rags. In a conventional socket, designed for a 60W lamp, lamps of higher power are screwed in. The socket gets hot, the insulation collapses and the table lamp or chandelier is energized. The air in the bathroom is saturated with water vapor, the floor is humid: conditions for greater current conductivity. According to the existing (building codes and regulations), it was not even allowed to install sockets and switches in the bathrooms. Under certain conditions, the current can break through the resistance of the insulating material. Gases, acid vapors, dust are very harmful. Standing in the bathroom with bare legs, do not touch the lamp holder. It must be remembered that a conventional switch opens the contact only in one wire, and the voltage in the second wire, the socket and the bulb remains. When the current-carrying wire falls on the metal roof of the house, this roof, together with the drain pipes, turns out to be connected to the power grid. Damage can occur through a wet rope hanging from an electric wire (wire breaks occur during heavy snowfalls). There are known cases of injury from radio or communication wires if they come into contact with a high-voltage line, for example, in strong winds or sticking snow, as well as through water pipes when bathing in the bathroom or washing dishes during a thunderstorm. Reinforced concrete structures of modern buildings increase the likelihood of electric shock many times over. Grounded central heating batteries are especially dangerous, being excellent conductors of current, despite being coated with oil paints. When washing hands in such a room, only a slight tingling of the current can be felt, and if you start taking advantage of the trouble here, this will create a serious danger due to the quite understandable differences in the thickness of the skin. Some house animals (hamsters, rats), as well as children, chewing electrical wires are a favorite pastime. Hanging wires with electric lamps on a Christmas tree is far from a harmless activity. Raw wood can join the chain. Fishing using an electric current, in which one end of the wire is thrown into a body of water, and the other is connected to a power source. An electric field is created in the water, and the stunned fish floats. A drunken fisherman, rushing to collect prey, himself finds himself in the role of a victim, falling under stress. The insulating qualities of workwear (including rubber gloves and shoes) deteriorate over time, not providing guaranteed protection. When investigating cases of electrical injuries, wood is often (and erroneously) considered as the best electrical insulating material. However, this is true only in relation to dry wood. With an increase in humidity from zero to indicators when the cell walls are completely saturated with water, the electrical resistivity of wood decreases sharply. An increase in temperature also leads to a deterioration in electrical insulation properties. So, for dry wood, an increase in temperature from 20 to 94 ^{0}C leads to a decrease in specific electrical resistance by one million times, and wood with a moisture content of 22-24% - only 100 times. The passage of current (breakdown) along the fibers is twice as easy as across. With an increase in the density of wood, its dielectric properties (electrical density) deteriorate. There is a special table for calculating the dielectric strength of wood. Most fatal electrical injuries are, oddly enough, low voltage. On the current-carrying conductor, you can find pieces of skin and burnt hair, and on the metal bracelet of the watch - areas of melting.

The use of electric current as a weapon in practice is usually limited to the use of electroshock devices and spark gaps. The creator of the electroshock device is considered to be an employee of the NASA space agency , Jack Korver, who designed the first such device in 1940 . One of the simplest devices is an electric baton, which is powered by a 7.2 V nickel-cadmium battery . The battery of such a device provides a discharge voltage of up to 90 thousand volts at a maximum power of 3 W , causing muscle paralysis. Such weapons meet the requirements and standards of the Ministry of Health of the Republic of Belarus and the Russian Federation. Contact electroshock devices are effective when they come into contact with a target. So, for stun guns "Malvina 200B", "Scorpion-SK" and some others winter clothing is not an obstacle, they work effectively after being immersed in water and ignite paper. In recent years, the arsenal of electroshock devices has expanded significantly due to the release of long-range weapons. Two electrodes are fired from a special pistol at a distance of up to 10–15 m, connected to the battery by thin wires. The discharge occurs when the needle-shaped tips of the electrodes are inserted into the body or clothing and is much more effective. Contact-remote firing electroshock devices can be in the form of a cartridge (electric discharge transportation unit) at a distance of up to 4.5 m. Seating slots for such a cartridge are available in a wide variety of devices. Electric current is rarely used as a weapon of premeditated murder or suicide. The effect of electroshock on a person is usually used in three situations: to destroy memory during the zombie; to cause pain during torture or interrogation; for reliable immobilization during abduction. These tasks are solved taking into account the dosage of a specific voltage. Current less than 10mA is perceived weakly or not felt at all. A current of about 20mA disturbs breathing, and at 70mA it makes it very difficult. A current of 100mA excites fibrillation of the heart muscle and can lead to death. A current of more than 200mA provides a burn and stops breathing. Starting with 2007 g . in Canada and the USA, the Air Taser is widely used by the police , which fires two spikes at a distance of about 50m. The spikes cling to clothing or skin and transmit an electrical discharge of 50 thousand volts. Since then, over 200 deaths have been recorded as a result of the use of this device. In 2009 . The Taser entered service with the British police. High voltage pulses applied to the area of the body between the electrodes cause a convulsive response in the muscles and block the transmission of control signals from the brain. The increased muscle contraction in the area of contact with the electrodes leads to their rapid depletion due to the decomposition of sugar in the blood and short-term immobilization. Therefore, in the English language literature, these devices are called paralysator . The Taser has one trick. During the shot from the barrel of the pistol, tiny pieces of paper fly out, on which the serial number of the weapon is printed (for identification of the owner).

The use of electric current for military purposes is diverse. So, even during the Second World War, the Americans carried out large-scale experiments on the degaussing of ships (gauss is a unit of electromagnetic induction) in order to make them invisible to mines with an electromagnetic detonator. When current was applied, a powerful electromagnet appeared around the steel hull of the ship, making the ship invisible to a magnetic mine. Today, at least four types of electromagnetic ammunition are known to be adopted by the US Army. One of them (W - CMD) is a graphite fiber sprayed from a cluster bomb. The fibers are spread by the wind and, due to the electrostatic effect, adhere to all electrically conductive structures, causing them to short-circuit. The weapon was first used during the American aggression against Yugoslavia.

Decompression (decompression) sickness.

Decompression sickness (lat de - extraction and compression - compression) occurs when the ambient atmospheric pressure drops sharply. At normal pressure, 100 ml of blood contains about 1 ml of dissolved nitrogen, and in adipose tissue - about 5 ml. In total, the body contains about 1 liter of nitrogen, of which 350 ml is in adipose tissue. Everyone is familiar with the formation of bubbles in a soda bottle when unsealed. In this water, CO_2 is dissolved under pressure and under pressure is retained in a tightly closed bottle. When the stopper is removed, the pressure inside the bottle decreases, the dissolved gas turns into bubbles and exits the bottle.

When submerged under water, for every 10 m, there is an increase in pressure of 1 Atm (760 mm Hg). That is, at a depth of 20 m, the pressure is 3 Atm, etc. The higher the pressure, the more nitrogen dissolves in the blood. Due to the fact that different cells and tissues have different properties, the rate of absorption and release of gas by them is also different. For example, bone tissue is saturated much more slowly than brain tissue, that is, the absorption gradient (the difference in the partial pressure of a gas in blood and tissues) has a very wide range. Blood and lymph are most rapidly saturated with nitrogen. With a sharp ascent (without decompression), gases (primarily nitrogen) from a dissolved state pass into a free (gaseous) state. This process is called degassing. Such situations are encountered when surfacing from depths of more than 13 m to the surface, depressurization of the aircraft cabin, and a sharp rise to altitude. The resulting gas bubbles disrupt normal blood circulation, and, merging with each other, cause aeroembolism. Gas bubbles are enveloped by suspended blood substances, as a result of which their resorption is hampered and they can be seen during sectional examination (frothy blood in the vascular system). With a sharp drop in atmospheric pressure, nosebleeds are possible. In addition, at a pressure above 4 Atm, nitrogen dissolved in the blood begins to have a toxic (narcotic) effect. That is why amateurs of diving, when using ordinary breathing gas in cylinders, are forbidden to dive to a depth of more than 30 m, carefully monitor the time spent under water and, especially, the rate of ascent to the surface. The first symptoms of decompression sickness are itching of the skin, sharp pains in the joints and muscles, and then damage to the central nervous system (confusion, paralysis, etc.). In severe cases, a condition develops, leading to rapid death. In addition to the complex of general asthma signs, subcutaneous emphysema, air and fat embolism can be found. The latter is formed during a very rapid decompression, accompanied by the destruction of fat cells. Due to the overflow of gases, the blood does not rot for a long time, therefore, decompression embolism can be diagnosed even with advanced postmortem changes. Clotted blood from a corpse, placed in water, float up. Gas bubbles can be found in the liver and spleen.

In healthy people, Cheyne-Stokes breathing occurs at high altitudes, especially during sleep. Low oxygen content in the blood stimulates hyperventilation, which leads to a decrease in CO_2 to the lower asymptote of the CO_2 sensitivity curve . Ventilation then drops sharply or stops altogether, until either an increase in CO_2 or a decrease in O_2 leads to its resumption. Ventilation is regulated by chemosensitive centers in the brainstem.

Mountain sickness.

Mountain sickness comes in many individual variations. Altitudes up to 1000m, as a rule, are easily tolerated by most people. When climbing up to 2500m, most people feel some discomfort, manifested by dizziness, lethargy and increased heart rate. The first signs of altitude sickness in non-acclimatized people appear at an altitude of about 3000 m in the form of gratuitous fun, reminiscent of alcoholic intoxication. With the continued ascent (up to 5000m), the clinic of altitude sickness is manifested by a disturbance in the rhythm of breathing, apathy, and complaints of suffocation. At an altitude of 5 to 7 thousand m, severe fatigue, dizziness and headaches, nosebleeds and hallucinations occur. In some cases, acute mountain sickness may appear already at an altitude of more than 1000m in people with individual instability to hypoxia. Acute mountain sickness can occur during a rapid ascent in a helicopter or a leaky plane and immediately manifest itself as a feeling of emptiness when inhaling, burning pain throughout the body and loss of consciousness. Various components may predominate in the clinical manifestations of acute mountain sickness. Acute mountain edema of the brain with a rapid ascent of 4-5 km leads to a violent hysterical outbreak, bradycardia, shortness of breath, disorientation, diplopia and hallucinations. Mountain pulmonary edema usually appears later (a few days) after ascent at an altitude of more than 4000m. Its harbinger is chills, urinary retention, bubbling breath, cold sweat and frothy-bloody sputum. Mountain respiratory arrhythmia of the Cheyne-Stokes type is accompanied by a greater form of mountain sickness. Usually it manifests itself at night with a feeling of lack of air, forcing the patient to take a forced sitting position, connecting it to the respiratory accessory muscles. Acute mountain kidney failure is the most distant manifestation of the disease, which can occur several days after climbing to an altitude. Its symptoms are shortness of breath, body aches, thirst, and a sharp decrease in urination. The specific gravity of urine rises to 1050 ml, protein, leukocytes and erythrocytes are found in the urine. Abundant edema (puffiness, swollen eyelids) appears on the face, which gradually spreads to the limbs. Pathogenetically, mountain sickness is a much more complex phenomenon than acute high-altitude hypoxia. Some people who have undergone a subacute form of altitude sickness may become acclimatized with the disappearance of all symptoms. In others, the subacute form gradually becomes chronic. At the same time, drowsiness is sharply expressed, at times the patient falls into a state resembling a coma. The face turns purple, almost black. The limbs are full of blood, the fingers thicken, and signs of heart failure may appear. The chest becomes emphysematous, there is a pronounced shortness of breath. Death occurs with symptoms of hemorrhage, vascular thrombosis and progressive heart failure. The described picture concerns mainly the erythremic type of altitude sickness. In the emphysematous type, the symptoms are focused on the respiratory system, and the overall picture is reduced to increasing heart failure.

FORENSIC EXPERIMENT OF FIRE-SHOOTING DAMAGES.

A firearm is damage resulting from a shot from a firearm or firearm.

In accordance with the Law of the Republic of Belarus "On Weapons": "Firearms are weapons designed to mechanically defeat a target using the energy of a powder or other charge."

A shot is the ejection of a projectile from the bore by the energy of powder gases.

Based on the study and systematization of the accumulated theoretical and practical material, fundamental differences in the nature of damage resulting from shots and explosions were revealed. In this regard, all injuries that were previously called fire damage were divided into two groups:

1. Damage caused by shots from various types of hand-held small arms (fire damage).
2. Damage resulting from explosions of various explosives and devices (explosive injury).

Basic information about the weapon .

The barrel is designed to give the bullet directional movement. The inside of it is called ***the bore*** . The front end of the barrel is called the ***muzzle*** , *the* rear end is called the ***breech*** . On the outer surface of the muzzle end, there are usually ***sighting devices of*** different designs.

The barrel bore of a conventional rifled weapon consists of a ***chamber, a bullet entrance*** and a ***rifled part.***

The cartridge is placed and fixed in the chamber **.** ***The bullet entrance*** is located between the chamber and the rifled part of the barrel. It is necessary for the correct orientation of the bullet when feeding it into the bore and facilitating its cutting into the rifling.

The threaded portion of the stem is used to make bullet By proceeding - tion swinging movement due to the motion of the bullet rifling.

The grooves are strip-like grooves of a helical shape. The protruding areas between the grooves are called groove fields.

Traces from the rifling fields remain on the bullet and are used to identify a specific weapon by comparative studies.

The caliber of a rifled weapon in a number of countries, including the Republic of Belarus, is designated by the distance between the rifling fields. It is designated both in millimeters and inches. In Russia, there are calibers 5.45, 5.56, 6.35, 7.62, 7.65, 9, 11, 43.

The caliber of hunting rifles is designated conventionally in the old way. It corresponds to the number of lead bullets that can be cast from one pound (1 lb = 453.95 g) of pure lead, making bullets to the inside diameter of the barrel. The new definition of the caliber of hunting rifles is the diameter of the barrel in the middle of it. The caliber corresponds to a certain diameter of the barrel, expressed in millimeters. The barrels of modern guns are, respectively, 8th, 10th, 12th (18.4 mm), 16th (16.8 mm), 20th (15.8 mm), 24th, 28th and 32nd calibers.

A shot is the ejection of a projectile from the barrel of a weapon under the pressure of powder gases. The impact of the striker on the cartridge ***capsule*** causes an explosion of the ***shock composition*** and the ignition of the ***powder*** , during the combustion of which a large amount of ***gases are formed*** . The transition from a solid to a gaseous state is called the ***explosive transformation of gunpowder*** . The gas pressure in the barrel chamber reaches 1000 - 2900 atmospheres. Under the influence of this pressure, the projectile moves along the bore with increasing speed. The more gunpowder and the longer the barrel, the greater the speed of the projectile flying out of the barrel. So, a rifle bullet has an initial speed of 865 m / s.

At the moment of firing the bullet when motion starts moving column of ***air*** , located in the barrel. This compressed column of air, when fired at close range, first acts on the obstacle and causes damage to clothing and body. Behind a column of air, the bulk of the ***powder gases*** escaping from the barrel bore , which broke through in front of the ***bullet*** . A bullet flies behind them, followed by the rest of the powder gases.

CLASSIFICATION OF DAMAGES
SHOT FACTORS

The gases surround the bullet in the form of a cloud. They soon dissipate. The release of gases from the barrel is accompanied by sound and *flame.* Along with the flame and the bullet, unburned *powder particles, soot, metal dust from the cartridge case, bullet and barrel bore,* as well as the *products of the explosive decomposition of the percussion composition of the primer and gun grease* fly out .

The main damaging factor of a shot from a firearm is a bullet.

Bullets are:

1. Main purpose:

a) shellless (lead)
b) shell (lead covered with a sheath of steel or cupronickel).

2. Special purpose

a) armor-piercing (steel core, lead, shell).
b) tracer (luminous composition, lead, shell).
c) armor-piercing incendiary (steel core, incendiary composition, lead, shell).
d) sighting (explosive composition at the head end of the bullet).

Bullets with a large mass, length and caliber have the greatest stability in flight and when a target is hit. Short bullets 9 mm , weighing 6.1 g . (Makarov pistol), thanks to the blunt-pointed head, quickly transfer their energy to the affected tissues and more often form blind wounds. Pointed, elongated bullets of 7.62 mm , weighing 7.9 g . (Kalashnikov assault rifle) inflict through damage more often. Soft (lead) shellless bullets have high ductility and, upon contact with a target, spend all their energy on their own deformation, thereby increasing the contact time, impact power and, due to this, lead to a high hitting efficiency.

For equipping live cartridges, as a rule, *smokeless gunpowder is used;* for equipping hunting cartridges, both *smoky* and smokeless are used. The composition of black powder includes: 75% potassium nitrate, 15% coal and 10% sulfur. In terms of the energy imparted to the projectile, black powder is about 3 times inferior to smokeless powder, it is easily ignited by fire or a spark, the flash point is about 300 ° C. During combustion, 40% of solid residues and 60% of gases are formed, as a result of which the explosion is unproductive. Smokeless powder consists of nitrated fiber, which is obtained by treating purified cellulose with nitric acid in the presence of sulfuric acid. The flash point is about 200 ^{0}C, all the products of the explosion are gaseous, as a result of which it has a high pressure and the absence of a large amount of smoke.

The damaging effect of **additional shot products is** manifested when firing *point-blank* and at *close range,* and most often in combination with the action of the main damaging factor - a projectile.

Powder fumes are traumatic and can cause breaks in skin, muscles and even bone fractures.

The flame has a thermal effect, which depends on the type of powder. A black powder flame can ignite clothing, scorch fabrics and hair, and burn skin. A smokeless gunpowder flame can cause scorching of cannon hair and clothing.

Soot , which looks like a black-gray coating and consists of small particles of salts and coal, settles on the obstacle when fired at close range. It should be noted that thanks to the studies of S.D. Kustanovich, S.M. Sokolov, V.I. Alisievich, soot, previously considered as the smallest pieces of coal (carbon) formed during the combustion of gunpowder, does not contain carbon during the combustion of smokeless powder, but consists mainly of metals (copper, lead, mercury, iron) due to the combustion products of the capsule composition, wiping the surface of the projectile, bore, sleeve.

Incompletely burnt ***powder grains*** , departing from the bore, retained on the barrier. Each powder acts like a small projectile that wounds the skin.

Metal particles from the percussion composition of the primer, sleeve, bullet, bore are deposited on the obstacle.

Particles of gun grease around the fire inlet can be detected on an obstacle when fired from a distance of 45 cm , using special research methods.

In some cases, these products can cause damage on their own, i.e. without the participation of the projectile. This can occur when fired with a *blank cartridge,* with a *tangential shot,* when the projectile flies by without touching the body, etc.

In addition, when a hunting weapon is fired, *powder* and *shot wads, special devices that affect the accuracy of the flight of the shot,* which can be found under clothing, in the wound channel , are also thrown out .

The metals that make up the soot of the shot and the rubdown belt are the most specific factors of the shot and are found in one or another quantity at all distances of the shot, which is of great diagnostic value, since helps to solve questions about the nature of fire damage, the specifics of the weapons and ammunition used, the direction and distance of the shot.

Kinetic energy (the living force of the projectile) is of great importance in the occurrence of a gunshot injury .

At high kinetic energy, the bullet has a *bursting effect,* with a decrease, it is *penetrating* and *wedge-shaped, and* at the end it is *contusional.*

With a *through gunshot wound, the* bullet passes through the human body; when *blind* - the bullet gets stuck in the body; with a *tangent* - the bullet passes along the surface of the body, sagging the skin or forms a superficial grooved wound; with a *girdle wound* - the bullet, having penetrated to the bone, slides along its surface and exits on the opposite side of the body. Through and blind wounds can be penetrating or non-penetrating. With a penetrating wound, the inlet of the wound channel communicates with the human body cavity.

In a through gunshot wound, there **are:**

1. Entrance hole;

2. Wound channel;
3. Exit hole.

For the first time, the entrance fire hole was described by N.I. Pirogov in 1849.

SIGNS OF ENTRANCE GUNSHOT WOUND

1. A tissue defect ("minus tissue" according to MI Raisky), which is formed due to the fact that a bullet, in contact with the skin, causes a sharp compression, and then a funnel-shaped stretching of the skin, while the top of the cone is knocked out (the penetrating action of the projectile). A hole is formed in the skin 1 - 2 mm less than the diameter of the bullet. The knocked-out area of skin is carried away by the bullet.

2. The shape of the inlet is usually round. If the bullet entered the body at an angle, then the hole has an oval shape.

3. Belt of precipitation. The bullet, passing through the skin, peels off the surface layers of the epidermis, as a result of which a sediment area is formed around the inlet. At first, it has a pinkish-red color, then dries up and acquires a dark brown color. The width of the siege belt is 1–2 mm , and its shape depends on the angle at which the bullet entered the skin.

4. Belt rubdown (contamination). A bullet on its surface and in the surrounding air layer carries grease, soot, metal particles, powder carbon deposits, which, when the bullet enters the body, are wiped with the edge of the inlet, as a result of which a grayish belt is formed. It is deposited on the siege belt.

The path taken by a bullet in the body is called a bullet or *gunshot wound channel.* It is not always linear. In the human body, a bullet can change its direction and then the bullet channel does not coincide with the direction of the shot. If the bullet passes through two or more adjacent anatomical regions (arm and chest), then such a wound channel is called *intermittent.* Damage along the wound channel is caused by the action of a *direct impact on the tissue* and the action of a *lateral (hydrodynamic) impact*, which is especially pronounced in the hollow organs (for example, the stomach) and in the medulla. Passing through flat bones, the bullet leaves cone-shaped circular defects, with the base directed towards the direction of the bullet's flight. Cracks can fan out from this defect. On the parenchymal organs, stellate ruptures are formed from the bullet.

Blind gunshot wound results from insufficient bullet penetration. In a blind gunshot wound, there are:

— inlet;

— wound channel.

The bullet may be wound at the end of the channel or not - which distance therefrom. There are cases when a bullet was found in the cecum with a stomach wound.

In the presence of a blind gunshot wound, the medical examiner must find the bullet, which is sometimes not an easy task.

SHOT DISTANCE
(WHEN FIRING A BULLET)

<u>Shot distance</u> - a qualitative characteristic of the distance from the muzzle of the weapon barrel to the target surface, determined by the limit of action of additional factors of the shot.

1. Point-blank shot:
   a) hermetic stop.
   b) non-hermetic stop.
2. Shot at close range.

3. Shot from a long or distant distance.

Point-blank shot

A point-blank shot means a shot from a weapon placed close to the surface of the body or clothing. With a hermetically sealed (full) stop, the muzzle of the weapon is tightly attached to the body, with an unpressurized (incomplete) stop, the muzzle of the weapon is attached to the body at an angle.

When ***full abutment*** predpulevoy air and the bullet pierce tissue after bullet hole penetrating the powder gases which expand inlet inflate the skin, sometimes crosswise tearing it tightly pressed against the skin to the muzzle partly also due to the suction barrel effect, forming a ***"punching -mark "*** (imprint of the muzzle of the weapon). The bulk of the powder gases, soot particles, metal and powder breaks into the bullet channel, settling on its walls. With a full shot at close range, additional factors of the shot do not hit the skin.

With ***an incomplete stop,*** part of the powder gases and particles breaks through between the muzzle and the skin, therefore, traces of lingual soot deposits are visible on the skin around the inlet, and skin tears are also formed, and the length of one of the rays will be longer than the rest, traces of flame exposure can be seen.

A gunshot wound when fired at close range is characterized by the following **features:**

a) the edges of the inlet with tears or tears;

b) the skin around the inlet is clean or "tongue-like" covered with soot at a short distance;

c) the edges of the inlet are covered with soot;

d) "stamp-mark";

e) the tissues along the wound channel are covered with a bloom of soot;

f) muscles in the circumference of the wound and along the wound channel of scarlet color due to the formation of carboxyhemoglobin.

g) when the weapon is at the scene of the incident, blood can be detected in the channel of its barrel (it gets inside due to the suction action).

The presence of soot and powder residues in the bullet channel is a constant sign of a point-blank shot. The rest of the signs are not constant.

Close range shot

The close range means such a shot distance at which additional factors of the shot act on the obstacle.

Pre-pole air acts at a distance of 3-5 cm , forming a "ring of air precipitation".

Powder gases have a chemical effect, they can cause ruptures of skin and clothing at a distance of 5-7 cm (rifle 7.62 mm). Valid up to 15 cm .

The flame acts at a distance of up to 20-25 cm , causing scorching of the hair, browning of the pile of the fabric, and at a distance of 10-12 cm, burns, burning of clothes.

Soot and metals can be found on the obstacle when fired from a distance of up to 40 cm in the form of a circle of regular shape in the center of black color, along the periphery of light gray, if the shot is fired, soot is deposited at an angle in the form of an oval. The diffusion diameter of soot is on average 10-11 cm .

Powders fly up to 100 cm , causing powder impregnation of the skin. It should be noted that different weapon systems powder particles fly differently: rifle 7.62 mm - up to 100 - 150 cm, AK-74 - 75 to 100 cm , the gun system Margolin 6.45 mm - 150 to 180 cm . Single powders of rifled weapons can reach a distance of up to 2 m , and hunting (16 and 20 calibers, black powder) - up to 3 meters .

The distance of a close shot is influenced by the weapon system, its design features, caliber, prescription of manufacture, the size of the charge and the storage conditions of cartridges, the deterioration of the barrel and other factors.

Some systems of modern handguns are equipped with a special device called a ***muzzle brake*** . It directs powder gases from the bore to the sides, thereby reducing the recoil of the weapon and increasing the accuracy of fire. In the presence of a muzzle brake, powder gases and soot are distributed over the obstacle in the form of a butterfly or the letter T.

In some cases, a ***muffler of*** various designs is used to reduce the sound of a shot .

Morphological signs of gunshot injuries when using weapons with silencers :

- less damage;
- weak expression of the muzzle imprint of the weapon;
- the presence of conglomerates of half-burnt soot particles;
- the presence of microparticles of rubber (plastic) from the destroyed muffler diaphragm;
- abundant, limited in area deposition of gun grease;
- increased intensity of entrenching of the inlet;
- absence of traces of mechanical, thermal and chemical action of gases when fired from a minimum distance or at close range.

Shot from a long or distant distance

A shot from a distant distance is understood as a shot from such a distance when additional factors of the shot are not detected on the obstacle, thus, only the projectile affects the bio-target.

In some cases, when fired from a long distance, soot is deposited on the outer surface of the second barrier and the inner surface of the first barrier around the inlet bullet hole, this phenomenon is called ***the Vinogradov phenomenon*** . Soot deposition is observed both on clothing and on the skin if the bullet passes through several layers of fabric: on the top layer of clothing there will be a regular wiping belt 1-3 mm wide , and on the second layer of clothing or skin covered with clothing, there will be soot deposition in form:

a) a radiant corolla 0.6-1.5 cm wide (5-10 rays);

b) two zones - central and peripheral.

The form and nature of the soot deposits in these cases are similar to the shape and nature of the smoke when fired at close distances - Niya, but are smaller and intensity.

The mechanism of soot deposition, in this case, is explained by the fact that soot particles on the bullet and flying after it in a pulsating air bag are washed off by the first layer of clothing and are carried away after the bullet. In the presence of an air gap between the layers of clothing, soot particles flying behind the bullet lose speed and settle around the inlet fire hole on the second layer of the target.

Conditions for the formation of the Vinogradov phenomenon:

1. High speed of a bullet (more than 500 m / s).
2. The presence of two obstacles.
3. The distance between obstacles is from 0.5 to 5.5 cm .

In some cases, when fired from a long distance, there is a deposition of soot particles on the outer layer of clothing or skin not covered by clothing (according to Popov V.L.), while, unlike soot when fired at close range, these particles are easily shaken off the clothing , since they do not penetrate into the tissue and are larger in their morphology than the particles detected when fired at close range.

Ricochet

Changing the direction of the bullet from meeting an obstacle is called ricochet. A bullet can ricochet from any obstacle (N.V. Ostrogskoy described a bullet ricochet from water). When a bullet ricochets from a bone, a broken wound channel is formed in the human body, which makes it difficult to determine the direction of the shot in the direction of the wound channel.

In some cases, the bullet is deformed even before it enters the human body (as a result of a rebound). Damage caused by deformed bullets is different from that caused by undeformed bullets. Bullet deformation most often occurs when it hits objects in its path. Being deformed, the bullet cannot keep intact and disintegrates into separate fragments. Fragments of bullets form several entrance holes and wound channels. Parts of the bullets found during the examination of the corpse must be carefully described and handed over to the investigator for attachment to the case.

HUNTING WEAPONS, AMMUNITION AND EXPERTISE OF DAMAGE

Shot , ***buckshot and bullets are*** used as a projectile when firing a hunting weapon . A shot is a projectile consisting of many small lead balls. The factory fraction has predetermined sizes, each of which corresponds to a certain number. The numbering is based on the number of pellets contained in 1 ounce of lead (about 0.4 g), i.e. the lower the number, the larger the pellet diameter. There are 14 fraction numbers. Shot No. 1 has a diameter of 4 mm . Each subsequent number of the fraction is reduced in diameter by 0.25 mm . A projectile from 5.25 to 10 mm is called buckshot. Bullets for shotguns are used of two types - round and special (arrow, turbine, arrow-turbine).

In forensic practice, one has to meet with various substitutes for shot: steel balls, homemade "cut" shot, pieces of nails, small stones, peas, salt, etc.

The accuracy, speed and range of flight are influenced by: the quantity and quality of powder in the charge, the length of the barrel (reducing the barrel length significantly reduces the initial velocity of the projectile).

The dispersion of a shot charge is influenced by: barrel drilling, weapon caliber, diameter and shape of shot, shot projectile weight, quality and quantity of powder in the charge, charge density, primer strength, action of the wads, powder gases emitted from the barrel, air resistance, various barrel defects, etc. other factors.

Shot and buckshot wounds are more varied than bullet wounds. In this connection, V.I. Molchanov (1965) proposed the following classification of these injuries:

1. Damage from continuous (compact) shot action:
    a) destruction or separation of a part of the body;
    b) a through wound;
    c) partially through wound;
    d) blind injury.
    e) tangential injury.
    f) tangentially blind injury.
2. Damage from relatively continuous shot action:
    a) destruction or separation of a part of the body;
    b) partially through wound;

c) blind injury;
d) relatively blind injury.

3. Damage from shot debris:

a) multiple injuries:

— Blind;
— blind and through;
— blind, through and tangent;
— blind and tangent.

b) single (from one pellet) wounds:

— blind;
— end-to-end;
— tangents.

Shot wounds, in contrast to bullet wounds, are characterized by the following features (Lisitsin A.F., 1968):

1. The shape and nature of the wounds change dramatically depending on the distance of the shot (the area of damage increases);
2. They are more likely to be blind;
3. Since black powder is often used in hunting weapons, clothing is scorched or ignited when fired at close range.

The **classification of the shot distance is also different,** which is due to the peculiarities of the flight of the shot projectile:

1. Shot point-blank or from a distance close to the stop.
2. Shot within the limits of the compact action of the shot - 1.0-1.5 m .
3. Shot within the relatively compact action of the shot 1.5-5.0 m .
4. Shot within the limits of full dispersion of the shot (screech).

When ***fired at close range*** and within the compact action of the shot, the shot acts as one projectile. The participation of powder gases in a point-blank shot has a different effect. Depending on the location of the damage and the angle at which the shot was fired, four types of entry wounds can be distinguished:

1. Round wounds, formed by shot and wads, without additional breaks.
2. Star-shaped wounds when radial tears of the skin occur under the influence of gases.
3. Wounds with large tissue defects, due to the knocking out of skin areas by gases that exceed the diameter of the trunk bore.
4. Combined wounds, when there is a knockout of a skin area in combination with radial tears.

In the first variant of wounds, a shot projectile, entering the body in a continuous mass, forms a large wound, similar to a bullet, with a diameter of 1-2 cm , with smooth edges. The skin at the edges of the wound is usually exfoliated from the underlying tissue within a radius of 4 cm . Such an action can occur when fired into the chest and abdomen, when most of the powder gases break through into the chest or abdominal cavity, where they spread and produce significant destruction of internal organs, while the inlets remain small. Wounds of the same nature are found with injuries of the thigh and other areas of the body rich in soft tissues.

On the head and in other areas where bone is located under a thin layer of soft tissues, due to the action of gases, wounds of the second type are formed. Bursting into the initial part of the wound channel, gases spread under the skin, exfoliate it and tear it apart. In the area of the head, when shots are shot at point-blank range, mainly extensive wounds are formed, up to the complete destruction of the skull. In this case, the entrance holes reach significant sizes, and the place of the direct entrance of the projectile is sometimes determined only by the presence of traces of soot on the bones and the remnants of the belt of skin sedimentation.

Entry wounds of the third and fourth types can form in different parts of the body, but usually in those cases when the shot was fired at an acute angle or tangentially.

The size and nature of the wounds largely depend on the quality and quantity of gunpowder, the type of wad, and many other conditions, and therefore the above-described patterns in the formation of entry holes are of relative importance.

Near the edges of the entrance wounds, when firing point-blank, there are areas of skin sedimentation in the form of yellow-brown spots, located without a specific system and formed from the action of gases and soot. In the circumference of the wounds, soot and powder can be deposited to a greater or lesser extent, which depends on the density of pressing the muzzle to the body. In most cases, when fired at point-blank range, these factors are deposited in abundance on the walls of the wound channel, mainly in its initial part. A characteristic feature of a point-blank shot is also the imprint of the second barrel of the weapon near the entrance wound and the bright red coloration of muscles and blood in the initial part of the wound channel.

When **shots are fired** ***within the compact or relatively compact action of the shot, the*** formation of a central wound takes place. As the muzzle of the weapon moves away from the body, the appearance of such wounds changes. Additional tears of tissues from the action of gases decrease, and the size of the hole itself increases due to scattering of the shot. The effect of gases at a distance of 5-10 cm can still manifest itself, but not with such force as in point-blank shots. The edges of the wounds at a distance of up to 10 cm are almost even, and at a distance of 20-50 cm, serrated or scalloped. The edges of large wounds are sometimes surrounded by a belt of sagging, which is often located eccentrically, which is explained by the bruising effect of wads, which deviate from the axis of the shot and cause edge damage to the skin. The eccentricity of the precipitation belt may also indicate that the shot was fired at an angle.

If the distance of the shot exceeds 50 - 100 cm , the jagged edges of the wounds become deep, and separate small wounds appear around the large holes. This action of the fraction is called relatively continuous (relatively compact). It is observed at a distance of no more than 5 meters from the muzzle. In the formation of large entrance wounds, in addition to the closely flying shot, a column of air and gases enclosed between the pellets and wads also takes part.

The amount of powder residues around the damage gradually decreases as the distance of the shot increases. At a distance of more than 1-1.5 m from the muzzle, only single powders can penetrate into the skin. Powders penetrate through thin clothes at a distance of up to 30 cm from the muzzle. Powder soot is noticeably deposited in the area of the inlet holes when shots with black powder at a distance of up to 100-200 cm , smokeless 50-100 cm .

An essential sign of entry holes in close shot is parchment of the skin in the area of entry wounds due to the bruising effect of powders and gases, followed by drying of the damaged areas. It is usually observed when shots are no further than 50-75 cm .

With a relatively continuous action of the shot, the central holes have, as a rule, an irregular shape and deep, serrated, winding edges. The dimensions of the central wounds, especially when firing small shots, sometimes reach 10 cm in diameter or more. The skin near the edges of such wounds exfoliates from the underlying tissues to a width of up to 2-3 cm . Wounds inflicted from 2-4 meters can have different sizes, and next to them small injuries from the separated pellets are necessarily formed. Powder soot and impregnation with powders at the edges of large wounds in these cases is absent, and the effect of powder gases in the form of additional ruptures is not observed.

When fired ***outside the continuous action of the shot, the*** damage from individual pellets is essentially no different from bullet wounds. They have clearly defined belts of precipitation. The tissue defect in them is not always noticeable due to the small size of the damage. The nature of these wounds can vary greatly, depending on the size and shape of the shot, including homemade ones.

Exit wounds with shot shots are relatively rare. They are found when shooting at close range or at close range in low-volume parts of the body, as well as with tangential wounds. The shape of the exit wounds is different. With the continuous action of the shot, these are large lacerated wounds with uneven edges with a diameter of 1 to 10-15 cm , sometimes with a tissue defect. Stuck pellets can be located in the circle of exit wounds in a radius of up to 2-4 cm . There is a relative relationship between the sizes of entry and exit wounds on the head during point-blank shots. In cases where the action of the powder gases is manifested mainly in the area of the outlet openings, and they are large, additional skin breaks at the entrance wounds may be absent. If the entrance holes are large, with ragged edges, then the exit wounds are smaller or absent altogether.

Most fatal shot wounds are inflicted at close range, therefore it is most important to know the features of the common wound channel with continuous shot action. In most cases, a fraction, even if it entered the body in a compact mass, is scattered in the tissues in the form of a cone. Wads often lie at the blind end of the wound canal. When the chest is injured, they can be found in the pleural cavity, in the lungs, in the mediastinum. In case of abdominal injuries, they penetrate into the retroperitoneal space. If the powder wads are made of compressed crushed material (sawdust, wood fiber), they fly into small pieces when fired and do not always get into the wound canal. With the formation of one large entrance wound, further dispersion of the fraction in the body depends on its diameter and on the density of damaged tissues. Small and medium fractions quickly deviate from the rectilinear direction of dispersion in an area with a diameter of up to 10-20 cm , large ones up to 10 cm or less, because has a higher inertia. If the projectile passes through the bone, its dispersion is increased. The severity of a gunshot wound, in addition to its localization, depends on the kinetic energy that the projectile loses while passing through the body. This energy, in turn, is proportional to the speed and mass of the projectile. The wounding effect of the projectile affects the more, the larger the shot, the greater the speed and the greater the number of pellets. When shooting with a very small shot, the destructive effect is small, because small pellets quickly lose speed in the body and get stuck under the skin, although the amount of pellets can be large. The live power of the pellets also changes depending on the size of the charge and the type of gunpowder, as well as on the quality of the wads and some other conditions of ammunition equipment.

Blank shot damage

When fired with blank cartridges at a very close distance, severe and even fatal damage occurs, which occurs as a result of the high pressure of the powder gases and the speed of their release from the barrel of the weapon, as well as the mechanical action of the air column that flew out of the barrel bore during the shot. The mechanical action of powder gases during an idle shot is carried out when fired at close range, leading to the destruction of the underlying tissues, including the bones of the skull (for example, when shot in the mouth). When fired blank cartridge of hunting weapons felt wads can penetrate into the chest cavity at a distance of up to 3.5 m , at a distance of 2.5 m spo - sobny causing cracks calvarial bone, at a distance of 5 m can penetrate into the skin to a depth of 2 cm . The study reveals additional components of the shot, and the absence of a wound channel.

Determining the sequence of shots

In the presence of multiple gunshot injuries on the victim's body, it is necessary to resolve the issue of the sequence of their formation.

For this, the following *signs are used:*

- by the severity of the inflammatory reaction (when causing damage after a long period of time);
- by the sign of the entrance gate (there is more bleeding from the first wound);
- by the intensity of hemorrhages (more pronounced in the circumference of the first wound);
- by the amount of grease in the wiping belt (in the first wound it will be more than in the subsequent ones);
- on the deposition of soot and metallization (the deposition increases with each subsequent shot);
- soot around the second injury partially covers the soot around the first in case of adjacent wounds at close range;
- for damage to a hollow organ (inconsistency of the wound channel of the organ with the surrounding tissues);
- by the features of damage to the flat bones of the skull:

a) sign of Shavigny-Nikiforov (cracks from subsequent wounds do not intersect previous cracks);

b) additional signs (according to A.M.Demenchak);

- cracks in the inlet and outlet of the first shot are more extensive and numerous than from the second;
- at the entrance hole from the first shot, arcuate cracks may form, located at a short distance from the defect on the outer plate;
- if the inlet from the second shot is located on a crack from the first, then it may not have cracks.

GAS WEAPONS

In accordance with the Law of the Republic of Belarus "On Weapons", gas samples include samples intended for infecting a person with toxic substances ejected from the barrel bore by an initiated powder charge.

Gas barreled weapons in appearance, size and design are similar to military weapons.

There are the following types of gas weapons:

— revolvers,
— pistols,
— single shot gas weapon,
— gas firing devices,
— mechanical sprayers,

— aerosol devices.

In contrast to a combat cartridge in a gas cartridge, the role of a projectile is played by a capsule filled with a chemical substance of toxic action (chloroacetophenone - $C_6H_5COCH_2Cl$, chloromethyl phenyl ketone, phenacil chloride, phenacil chloride, CN , CS , CAP , O - Salz , Grandite , etc.) which, as a rule, is in a crystalline state. As a result of the shot, the capsule collapses against the partition located in the barrel of the gas barrel weapon, under the influence of high temperature and contact with air, the crystals of the toxic substance turn into a gaseous state, exerting a chemical effect on the mucous membranes. In the most common samples of gas barreled weapons, the effective range of destruction with a chemical agent is 2 - 3 meters . When fired from a distance of less than 1 meter , burns of the mucous membranes may occur. When fired at point-blank range, crystals that have not had time to turn into a gaseous state can have a mechanical effect on tissue together with powder gases, particles of gunpowder, paraffin, fragments of a plastic capsule, sometimes even forming skin breaks.

EXPLOSION INJURY

By explosion realize very rapid release of energy as a result of physical, chemical or nuclear materials and changes the volume expansion of the starting material or its transformation products, causing a very high pressure, which causes destruction and moving surround - conductive medium.

Initial types of explosion energy: electric, kinetic, thermal, chemical, atomic, elastic compression energy.

Explosion damaging factors:

1. Detonation wave .
2. Environmental shockwave.
3. Shell fragments.
4. Secondary projectiles.

The range of action of all factors of the explosion is not the same, therefore, the damage that occurs at different distances is different.

The following explosion distances are distinguished:

- contact of an explosive device with the body or clothing.
- close distance (within the range of explosion products).
- relatively close distance (within the range of the environmental shock wave).
- not close distance (when the fragments of the metal shell of an explosive device are hit outside the limits of the pronounced action of the shock wave).

When the *explosion comes into contact with the body* , the tissues of the contacting part of the *body* are completely destroyed with scattering of their pieces to the sides.

A *close explosion is* characterized by the action of detonation products (gases, soot, pieces of unreacted explosive).

At a *relatively close distance* , an environmental shockwave acts, causing occluded damage.

At *a short distance,* damage occurs from fragments of the shell of an explosive device and from secondary projectiles.

For explosive injury, damage to several parts of the body is most common.

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