METHODICAL INSTRUCTION FOR STUDENTS

Topic №1. "Procedural and organizational basis of forensic medical examination and forensic odontology in Ukraine. Forensic medical thanatology."

1. Relevance of the topic. During the investigation of various crimes is required to determine the course of examination of medical or biological nature. The most important element in the organization of forensic services in Ukraine is the regional bureau of forensic expertise. Forensic Medicine - one of the separate, independent and interesting subjects of medical science. "Forensic" means that this subject is relevant to the court that the state authority in charge of settling civil and criminal cases consider, and therefore directly connected with the law.

2. Objectives:

- To analyze basic medico-legal system in the world.
- To explain structure of forensic services in Ukraine.
- To know the documentation is needed to complete forensic medical examination
- To be able to explain difference between cause of death, manner of death and mechanism of death.
- To get acquainted with ICD-10 and be able to use it.
- To now structure of the forensic medical examination.
- To classify changes after death.
- To be able to determine changes after death on a dead body.
- To interpret changes after death on a dead body. Read nomograms.

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	Obtained skills
Medical low	To have knowledge of duties and rights of expert, doctor and responsibility for the violation. To be acquainted with The Criminal Code and Constitution of Ukraine.
Anatomy	To have knowledge of structure of the human body and organs.
Histology	To explain histological structure of the human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	Definition
Forensic Medicine	Special multidiscipline science learning and answering the medico-biological questions of low practice during investigation of criminal or civil cases.
Coroner	is an elected and trained person, not obligately a physician, who examines dead bodies and investigates cause and manner of death in medico-legal cases. In many areas of the USA the coroner is also a funeral director.
Cause of death	is the disease or injury that produces the physiological disruption in the body resulting in the death of the individual, e.g., a gunshot wound of the chest.
Mechanism of death	is the physiological derangement due to the cause that results in the death, e.g., hemorrhage.
Manner of death	is how the cause of death came about: natural; accident; suicide; homicide.
ICD-10	a medical classification list by the World Health Organization (WHO). It contains codes for diseases, signs and symptoms, abnormal findings, complaints, social circumstances, and external causes of injury or diseases.
Rigor mortis	its simplest, a temperature-dependent physicochemical change that occurs within muscle cells as a result of lack of oxygen in form of rigidity and stiffness of the muscle.
Post-mortem hypostasis	Discoloration of the skin due to cessation of the circulation and passive settling of red blood cells under the influence of gravity to the blood vessels in lowest areas of the body.

4.2. Theoretical questions for the class:

- What are the basic medico-legal system in the world?
- What is the structure of forensic services in Ukraine?
- What is the cause of death, manner of death and mechanism of death? Difference between them?
- What is the ICD-10. Aims and tasks?
- What is the structure of the forensic medical examination?
- How changes after death are classified?

4.3. Practical work (tasks) which are done on the class:

- Code cause of death using ICD-10.
- Determination changes after death on a dead body.
- “Read” changes after death and interpret them.
- “Read” nomograms.

Topic contents

Forensic Medicine – Special multidiscipline science learning and answering the medico-biological questions of low practice during investigation of criminal or civil cases.

Forensic medicine (synonym: *legal medicine*) is a fundamental and independent part of medicine dealing with the interaction of medical science and practice with the law.

The practice of using the terms **"forensic medicine"** and "**medical jurisprudence**" (*medical law*) has led to considerable confusion as to their correct meaning. These definitions are closely related but somewhat different:

* Medical jurisprudence (medical law) is that part of law which is concerned with the regulations governing the professional practice of the doctor of medicine.

* Forensic (or legal) medicine is that part of medical science which is employed by the legal authorities for the solution of legal problems.

Medico-legal systems. The structure of a department of forensic medicine.

There are three main medicolegal systems in the world:

- The coroner system (adopted both in the USA and in the ex-British empire countries).
- The system of medical examiners (adopted in the USA, European. African and Asian countries).
- The system of medico-legal departments (adopted in some European countries).

Coroner - is an elected and trained person, not obligatory a physician, who examines dead bodies and investigates cause and manner of death in medico-legal cases. In many areas of the USA the coroner is also a funeral director.

In the United States the medical investigation of fatal cases is done most often by an elected official of the county known as a coroner. In a few states, however, similar functions are performed by a physician known as the medical examiner who is an appointed officer of the county or municipal government.

The coroner system in England and some states of the USA, this system has its own 800-year history. Originally the coroner *(crowner)* was appointed by the British King to represent the Crown as its magistrate in a certain district. The coroner typically is elected by popular vote for a term of office which varies from two to four years. The coroner is subordinated to a sheriff.

Medical examiner - is the professional physician who can solve both medical and legal problems concerning cause and manner of death, performs autopsies and advances his medico-legal work because on effect of mcreased specialization.

In the present the working place of medical examiner is the Office of Chief Medical Examiner in big cities of most states in the USA and some countries of Europe (Scotland France), the Office should be opened *nonstop* day and night with a medical examiner on duty always present. The duties of medical examiner are:

- ♦ investigation of the scene of death (together with a police, but independently of policemen)
- ♦ analysis of circumstances of death with taking the names of witnesses
- ♦ issuing the death certificate
- ♦ performing the autopsy and necessary additional examinations
- ♦ preparing the report of case investigation
- ♦ representing as a subpoena witness in a court.

The system of medico-legal departments

The medico-legal service in most European countries is built on the system of Departments of Forensic Medicine. The Department of Forensic Medicine is the basic entity for services in forensic medicine. At the universities, there are Institutes of Forensic Medicine with additional tasks as education and research. These Institutes are often regional centers for toxicology and forensic chemistry as well as for forensic serology, haematology and genetics (because of very expensive equipment and methods).

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- issuing the death certificate
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- preparing the report of case investigation representing as a subpoena witness in a court

Objects of Forensic medicine:

- Corpse
- Living persons
- Evidence
- Metter of criminal and civil cases.

The main tasks of forensic medicine

1. Autopsies in cases of:
   - ♦ violent deaths
   - ♦ sudden and unexpected deaths
   - ♦ *"mors in tabula"*
   - ♦ death in custody
   - ♦ death of foreign citizens
   - ♦ deaths caused by medical malpractice
   - ♦ exhumation.
2. Clinical seminars and case analyses (regularly with the Departments of Traumatology, Neurosurgery, Intensive Medicine. Emergency Medicine).
3. Medical reports and statements, expert opinions.
4. Forensic toxicology and drug analysis (living and dead persons).
5. Forensic serology, hematology and genetics (examination of blood and other biological materials and DNA profiling for identification).

6. Forensic alcohology (the measurement of alcohol in blood, urine and other biological fluids).

7. Forensic anthropology (identification of decomposed or skeletonized human remains by anthropological methods).

8. The presence at the scene of crime.

9. Participation in mass disasters.

10. Investigation of living persons (examination of wounding, injury and trauma, pregnancy and abortion, sexual offences, abuse of alcohol and drugs of dependence etc.)

11. Pregradual and postgradual education.

12. Scientific research.

CAUSE, MECHANISM AND MANNER OF DEATH

Deaths can be categorized as to cause of death, mechanism and manner.

A. The cause of death is the disease or injury that produces the physiological disruption in the body resulting in the death of the individual, e.g., a gunshot wound of the chest.

B. It should not be confused with the mechanism of death which is the physiological derangement due to the cause that results in the death, e.g., hemorrhage.

C. The manner of death is how the cause of death came about.

1. **Manners of death are:**

a. natural;

b. accident;

c. suicide;

d. homicide;

e. undetermined;

The term "homicide" just means that one individual killed another.

A classification of homicide does not necessarily indicate that a crime has been committed as the term homicide is not synonymous with murder.

Classification of death as murder is done by a Court not a pathologist.

The forensic examination, as opposed to forensic medicine, is a branch of practical medicine, which uses knowledge of forensic medicine to solve questions posed of investigations and court cases regarding illegal activities of life and human health.

Changes after Death

EARLY CHANGES:

- Rigor mortis

(Rigor mortis is, at its simplest, a temperature-dependent physicochemical change that occurs within muscle cells as a result of lack of oxygen. The lack of oxygen

means that energy cannot be obtained from glycogen via glucose using oxidative phosphorylation and so adenosine triphosphate (ATP) production from this process ceases and the secondary anoxic process takes over for a short time but, as lactic acid is a by-product of anoxic respiration, the cell cytoplasm becomes increasingly acidic. In the face of low ATP and high acidity, the actin and myosin fibers bind together and form a gel. The outward result of these complex cellular metabolic changes is that the muscles become stiff.)

Rigor develops uniformly throughout the body but it is first detectable in the smaller muscle groups such as those:

- around the eyes and mouth, the jaw, neck – 1-6 hours;
- Limbs 6-12 hours;
- All body 12-24 hours.

(It appears to 'spread' down the body from the head to the legs as larger and larger muscle groups are rendered stiff. That it can never provide an accurate assessment of the time of death and in practice should never be used alone. The chemical processes that result in the stiffening of the muscles, in common with all

chemical processes, are affected by temperature: the colder the temperature the slower the reactions and

vice versa. It is also important to be aware of the microenvironment around the body when assessing rigor: a

body lying in front of a fire or in a bath of hot water will develop rigor quickly, whereas rigor will progress

slowly in a body lying outside in winter.)

The passive settling of red blood cells under the influence of gravity to the blood vessels in lowest areas of the body due to cessation of the circulation of blood. It produces a pink or bluish color to these lowest areas.

(Hypostasis is not always seen in a body and it may be absent in the young, the old and the clinically anemic or in those who have died from severe blood loss. It may be masked by dark skin colors, by jaundice or by some dermatological conditions.)

(As most bodies fall down or lie horizontally when dead and most are placed in a supine position, hypostasis

commonly forms on the back, buttocks, thighs, calves and the back of the neck. However, hypostasis occurs only where the superficial blood vessels can be distended by blood and, if the body is lying on a firm surface, the weight of the body will compress those areas of the skin that are in contact with the surface and prevent the filling of the blood vessels.

These compressed areas will remain pale and their pallor will be all the more striking because of the surrounding hypostasis.

This is commonly referred to as blanching. Blanching may also be caused by pressure of clothing or by contact of one area of the body with another.)

There are, however, a few color changes that may act as indicators of possible causes of death: the cherry pink color of carbon monoxide poisoning, the dark red or brick red color associated with cyanide poisoning, and infection by *Clostridium perfringens*, which is said to result in bronze hypostasis.

post-mortem hypostasis

estimate time of death

- *Absence of post-mortem hypostasis - 0-3 hours*
- *Reinstating after 1 min - 3-6 hours*
- *after 3-5 min - 6-12 hours*
- *Become bit pale - 12-24 hours*
- *Does not change - 24 hours and more*

COOLING OF THE BODY AFTER DEATH

The cooling of the body after death can be viewed as a simple physical property of a warm object in a cooler environment.

(Newton's Law of Cooling states that heat will pass from the warmer body to the cooler environment and the temperature of the body will fall. However, a body is not a uniform structure: its temperature will not fall evenly and because each body will lie in its own unique environment, each body will cool at a different speed, depending upon the many factors surrounding it.)

Factors affect the rate of cooling of a body:

- *Mass of the body.*
- *Mass/surface area.*
- *Body temperature at the time of death.*
- *Site of reading of body temperature(s).*
- *Posture of the body – extended or curled into a fetal position.*
- *Clothing – type of material, position on the body – or lack of it.*
- *Obesity – because fat is a good insulator.*
- *Emaciation – lack of muscle bulk allows a body to cool faster.*
- *Environmental temperature.*
- *Winds, draughts, rain, humidity etc.*

Nomograms

1. Connect the points of the scales by a straight line according to the rectal and the ambient temperature. It crosses the diagonal of the nomogram at a special point.
2. Draw a second straight line going through the center of the circle, below left of nomogram, and the intersection of the first line and the diagonal.
3. The second line crosses the semi-circle of the body weight: the time of death can be read off. The second line touches a segment of the outermost semi-circle.

Here can be seen the permissible variation of 95%.

Late Changes

- ***Putrefaction***

(In temperate climates the process is usually first visible to the naked eye at about 3–4 days as an area of green discoloration of the right iliac fossa of the anterior abdominal wall. This change is the result of the extension of the commensal gut bacteria through the bowel wall and into the skin, where they decompose hemoglobin, resulting in the green color. The right iliac fossa is the usual origin as the caecum lies close to

the abdominal wall at this site. This green color is but an external mark of the profound changes that are occurring in the body as the gut bacteria move out of the bowel lumen into the abdominal cavity and the blood vessels. The blood vessels provide an excellent channel through which the bacteria can spread with some ease throughout the body. Their passage is marked by the decomposition of hemoglobin which, when present in the superficial vessels, results in linear branching patterns of brown discoloration of the skin that iscalled ‘marbling or net of putrefaction.)

- ***Mummification***

A body lying in dry conditions, either climatic or in the microenvironment, may desiccate instead of putrefying.

(Mummified tissue is dry and leathery and often brown in color. It is most commonly seen in warm or hot environments such as the dessert and led to thespontaneous mummification of bodies buried in the sand in Egypt.)

- ***Adiopocere***

is a chemical change in the body fat, which is hydrolyzed to a waxy compound not unlike soap.

(The need for water means that this process is most commonly seen in bodies found in wet conditions (i.e. submerged in water or buried in wet ground) but this is not always the case and some bodies from dry vaults have been found to have adiopocere formation, presumably the original body water being sufficient to allow for the hydrolysis of the fat.)

Control tests

1. What is carried out at external research bodies in the morgue?

A. Description of injury

B. Investigation of clothes

C. Research extent of dead men's changes

D. Description of the anatomical and constitutional features

E. All of the above

2. The doctor examines the dead driver and establishes that PML completely disappears under the thumb pressure. Estimate postmortem interval.

A. Not more than 8-10 hours.

B. 14-18 hours.

C. 20-24 hours.

D. 30-36 hours.

E. more than 36 hours.

3. The forensic examination under the Criminal Procedure Code must be appointed for:

A To establish age

B. Establishing the causes of death

C. Establishing the nature and severity of injuries

D. When sex crimes

E. All of the above

4. The kind of examination assigned for decision on matters of medical or biological character during the case investigation by police department and court is called:

A. Forensic medical examination
B. Forensic examination
C. Criminal examination
D. Juridical examination
E. Human examination

5. What is the difference between Forensic medicine and Forensic examination?

A. Forensic medicine is a medical discipline, but forensic examination means a practical expert activity
B. Forensic examination is a medical discipline, but forensic medicine means a practical expert activity
C. They are the same
D. Forensic examination doesn't have any relations to medicine
E. They are different fields of sciences

6. What kind of forensic examination is appointed in cases of malpractice?

A. Special
B. Initial
C. Additional
D. Repeated
E. Commission

7. Commission examination in medical cases is performed by

A. High qualified experts of Bureau of Medico-Legal Examination
B. A doctor of policlinics
C. Pathologist
D. Investigating police-officer
E. Surgeon

8. Indicate a doctor`s duty to each other:

A. All are correct
B. A physician shall not entice the patients from his colleagues
C. A physician shall observe the principles of the "Declaration of Geneva" approved by general Assembly of the World Medical Associations
D. A physician shall always maintain the highest standards of professional conduct
E. A physician shall deal honestly with the patients and colleagues, and strive to expose those physicians deficient in character or competence

9. What types of juridical responsibility do you know:

A. Administrative
B. Discipline
C. Civil
D. Criminal
E. All are correct

10. Patient M. was admitted to the hospital with abdominal pain. He was examined by a surgeon but an urgent surgical pathology was not diagnosed. Therefore,

conservative treatment of gastritis was recommended. Some days later the patient died. Autopsy revealed acute gangrenous appendicitis. Which unfavorable result of the doctor`s activity took place?:

A. All are true
B. All are false
C. Medical error
D. Accident
E. Professional offence of a medical worker

E-1; A-2; 3-E;4-A; 5 - A; 6 - E; 7 - A; 8 - A; 9 – E; 10 - C.

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2. Color Atlas of the autopsy / Scott A. – Wagner Boca Raton London New York Washington, 2004, p. 226.

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2. http://www.medicalstudent.com/
3. http://www.thestudentroom.co.uk/wiki/Resources_for_Medical_Students
4. https://quizlet.com
5. http://library.med.utah.edu/WebPath/webpath.html
6. http://www.webpathology.com/
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8. http:// www.umsa.edu.ua
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METHODICAL INSTRUCTION FOR STUDENTS*:*

Topic №2. "Forensic autopsy, autopsy demonstration. Determinations of remoteness of death. Death scene examination. Making the dead body investigation report at the scene of incident. Forensic examination of the physical evidence of biological origin. Forensic medical and criminalistics methods of examination."

1. Relevance of the topic. Successful disclosing of crimes depends on the initial (urgent) investigation actions. Examination of the scene of crime is one of them and inspection of a corpse on the scene of death is a component part of such examination. According to art. 238 CPC of Ukraine it is fulfilled by an investigator in the presence of two witnesses and forensic expert. The article also states that a doctor of any specialty can be involved into inspection. Thus, every future doctor should know his duties on the place of death perfectly. He should be able to describe (according to certain rules) dead body on the death scene, to help the investigator with revealing of material evidences. That is why the theme is so actual and important for studying in high medical school.

2. Objectives:

- To know condition for autopsy performing.
- To determine stages of autopsy and aims of it.
- To acquire the skills of inspection of the body on the place of death,
- To know legislative position of the specialist in the field of forensic medicine on the scene of crime
- To be able to decide the special expert questions
- To classify changes after death.
- To be able to determine changes after death on a dead body.
- To interpret changes after death on a dead body.
- To read nomograms.

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	**Obtained skills**
Medical low	To have knowledge of duties and rights of expert, doctor on the death scene. To be acquainted with The Criminal Code and Constitution of Ukraine.
Anatomy	To have knowledge of structure of the human body and organs.
Histology	To explain histological structure of the human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	**Definition**

Autopsy	A specialized exam of a corpse to determine how someone died and investigate any diseases or injury
Forensic autopsy	Required when: crime suspected, body unidentified, no clear cause of death, accidental death
Internal exam	surgical opening of internal systems and organs
Exterior exam	Body is examined with and without clothes to look for clues and evidence
Primary crime scene	an area, place, or thing where the incident occurred or where the majority or a high concentration of physical evidence will be found, for example, where there has been a sudden suspicious death.
Secondary crime scene(s)	are areas, places, or things where physical evidence relating to the incident may be found.
Preliminary investigation	The actions taken at the crime scene immediately following the detection and reporting of the crime scene.
Physical evidence	any material that may aid in the determination of the truth during the investigation of a crime.
Crime Reconstruction	Building the crime scene to see how it happened.
Rigor mortis	its simplest, a temperature-dependent physicochemical change that occurs within muscle cells as a result of lack of oxygen in form of rigidity and stiffness of the muscle.
Post-mortem hypostasis	Discoloration of the skin due to cessation of the circulation and passive settling of red blood cells under the influence of gravity to the blood vessels in lowest areas of the body.

4.2. Theoretical questions for the class:

- What are the basic methods of the death or crime scene description?

What is the structure of the death or crime scene description process? Make «Protocol of examination of dead body on the death scene».

- What is the cause of death, manner of death and mechanism of death? Difference between them?
- What are duties and rights of expert, doctor on the death scene?
- How changes after death are classified?
- How to determine the time of death by using changes after death?

4.3. Practical work (tasks) which are done on the class:

- To determine stages of autopsy and aims of it.
- Draw a sketch of the death or crime scene.
- To make full description of the dead body on the death or crime scene.

- Determination changes after death on a dead body.

To determine time of death by using changes after death and interpret them.

Topic contents

In some “incidents,” it may be readily apparent that a crime has indeed been committed and it is a “crime scene.” The *primary crime scene* is an area, place, or thing where the incident occurred or where the majority or a high concentration of physical evidence will be found, for example, where there has been a sudden suspicious death. *Secondary crime scene(s)* are areas, places, or things where physical evidence relating to the incident may be found. The potential physical evidence will usually be transported away from the primary crime scene. Some examples include: The deceased, the get-away vehicle in crimes of armed robbery, the suspect, the suspect’s environment, the suspect’s vehicle, the weapon used in the crime. This classification does not infer any priority or importance to the scene, but is simply a designation of sequence of locations. If a deceased person is at the scene we call it the *death scene*. One of the initial and primary tasks is to determine whether a crime has been committed at the death scene. Every death scene is a potential crime scene. It is important to carefully examine the scene for evidence or unusual circumstances that may indicate the death of the person is other than by natural causes.

Steps of death scene investigation

The deceased is the most valuable piece of potential evidence at any death scene. Hence, a systematic and thorough examination of the deceased should be undertaken at every death scene. Blood spillage or spatter should be noted and will remain after the removal of the body. Weather conditions, location, and poor lighting may mask some faint injuries and trace evidence on the body, therefore the death-scene investigator should document in writing, by sketch, and by photography all information about the body that can be gathered at the scene . The forensic medicine expert should focus on the physical condition of a body at a scene. Without a scene investigation, much initial, valuable body

information can be lost. The following points will serve as a guide.

Pre-planning the death scene investigation

When initially notified, a forensic medicine expert should determine as much information as possible from the caller. Approximate age and gender places a subject in a certain "medical category." An attempt should be made to ascertain if there is any evidence of foul play or if any instruments are available that might have played a role in the subject's death. By gathering these data, a forensic medicine expert is able to anticipate additional information that may be needed upon arrival at a scene.

The first rule in performing a death scene investigation is to make certain that the scene is safe and secure. Usually, this requires police involvement but in some instances, it will require other professionals, such as fire department personnel or utility workers.

The second rule is to not contaminate or disturb the scene. At the very least, death investigators should wear disposable examination gloves and it is also advisable to wear shoe covers and hair nets. Occasionally, full body covering is desirable. When

touching items at a scene, examination gloves should always be worn and care should be taken not to sit on furniture or lean against or brush against walls or furniture.

The death-scene investigator must seek answers to the following questions:

-is trace evidence at the scene consistent with the death having occurred at this location?

-Does the body contain any trace evidence that is unusual for this location, for example, mud on soles of shoes, grass, or seed material embedded in or found on the clothing when the deceased was located inside a building?

-Is the death one that can be attributed to natural causes?

-Are there any external signs of violence? Is there anything amiss or out of the ordinary regarding the scene?

Cooperation among investigators

A successful death investigation, involving more than one individual, requires cooperation and coordination. Any potential conflicts should be worked out. The opportunity to meet at the scene initiates the collegial working relationship between the forensic medicine expert and the detective/investigator, and promotes interagency rapport as both professionals strive to solve the medical mystery of why that particular person died at that particular time, under those particular circumstances. This is not melodrama, just intellectual satisfaction for exploring an extremely important, educational, and fascinating aspect of death investigation. After all, a gunshot wound is a gunshot wound: it is the circumstances behind that gunshot wound that are frequently so compelling and always so instructive about human nature .

Documentation of the scene

All death scenes should be secured and recorded photographically and diagrammatically. If the information to hand, backed by the postmortem, suggests that the death was due to natural causes then the scene should not be processed any further. However, if there are signs at the scene, and other information suggests that the deceased died in suspicious circumstances, and this is reinforced by signs of a struggle or anything unusual, further processing for latent impressions and trace evidence should take place. The four major tasks of documentation are note taking, videography, photography, and sketching. All four are necessary and none is an adequate substitute for another. For example, notes are not substitutes for photography. Documentation, in all its various forms, begins with the initial involvement of the investigator. The documentation never stops; it may slow down, but the need for documentation remains constant. Death scene documentation will be discussed below in the sequence it should follow at a death scene. The systematic process presented will maintain the organized nature of scientific death scene investigation.

MEDICO-LEGAL INVESTIGATION OF DEATH

If a death is natural and a doctor can sign a death certificate, this allows the relatives to continue with the process of disposal of the body, whether by burial or cremation. If the death is not natural or if no doctor can complete a death certificate, some other method of investigating and certifying the death must be present. In England and Wales there are approximately 560 000 deaths each year, of which about 435 000 are certified by doctors, but some 55 000 of these cases are only certified after

discussion with the coroner's office. The coroners themselves certify some 122 000 deaths a year and most usually require an autopsy examination before doing so.

The deaths that cannot be certified by a doctor are examined by a variety of legal officers in other countries: coroners, procurators fiscal, medical examiners, magistrates, judges and even police officers. The exact systems of referral, responsibility and investigation differ widely, but the general framework is much the same. The systems are arranged to identify and investigate deaths that are, or might be, unnatural and that might be overtly criminal, suspicious, traumatic or due to poisoning or that might simply be deaths that are unexpected or unexplained.

There is no common law duty for a doctor to report an unnatural death to the coroner, but it would perhaps be a foolish or foolhardy doctor who did not do so. Conversely, the Registrar of Deaths does have a duty to inform the coroner about any death that appears to be unnatural or where the rules about completion of the death certificate have not been complied with.

Following the death of a person who has not been receiving medical supervision and where no doctor was in attendance, the fact of death can be confirmed by nurses, paramedics and other healthcare professionals as well as by doctors. The police will usually investigate the scene and the circumstances of the death and report their findings to the coroner or other legal authority. The coroner, through his officers, will attempt to find a family practitioner to obtain medical details. That family practitioner, if found, may be able to complete the death certificate if he is aware of sufficient natural disease and if the scene and circumstances of the death are not suspicious.

If no family practitioner can be found, or if the practitioner is unwilling to issue a death certificate, the coroner will usually exercise his right to request an autopsy, but in Scotland the ability to perform only an external examination of the body on cases such as this - the so-called 'view and grant'- is well established.

This all-embracing coronial power to order autopsies is not found in other countries, where autopsies are often much more restricted. It is not surprising, therefore, that the autopsy rate varies widely from jurisdiction to jurisdiction; in some cases it is nearly 100 per cent but it may fall as low as 5-10 per cent. Some jurisdictions with low autopsy rates insist on the external examination of the body by a doctor with medico-legal training. Autopsy examinations are not the complete and final answer to every death, but without an internal examination it can be impossible to be certain about the cause and the mechanism of death. It should be remembered that at least 50 per cent of the causes of death given by doctors have been shown to be incorrect by a subsequent autopsy.

In England and Wales, the coroner may take an interest in any body lying within his jurisdiction, whether referred or not. However, most cases are referred to the coroner by doctors, police and members of the public. Deaths may also be referred by the Registrar of Deaths if a death certificate issued by a doctor is unacceptable, which it may be for the following reasons:

- the deceased was not attended in his last illness by the doctor completing the certificate;

- the deceased had not been seen by a doctor either after death or within 14 days prior to death;
- where the cause of death is unknown;
- where death appears to be due to poisoning or to industrial disease;
- where death may have been unnatural or where it may have been caused by violence or neglect or abortion or where it is associated with suspicious circumstances;
- where death occurred during a surgical operation or before recovery from an anesthetic.

Once a death is reported the coroner, if he is satisfied that it is due to natural causes, he can decide not to pursue any further enquiries and to ask the doctor to issue a death certificate. Alternatively, and more commonly, he may order an autopsy and, if this reveals that death was due to natural causes, may issue a certificate to allow for disposal of the body. If the autopsy cannot establish that death was due to natural causes or if there is a public interest in the death, the coroner may hold an inquest - a public inquiry into the death. The modern inquest is severely restricted in its functions and the verdicts it may return. An inquest seeks to answer four questions: who the person is, when and where they died and how they died. The 'who', 'when' and 'where' questions seldom pose a problem; it is the answer to the fourth question - the 'how' - that is often the most difficult.

The coroner can sit with or without a jury, except in some specific cases (e.g. deaths on a rail-track or in a prison) when they must sit with a jury. The coroner's court cannot form any view about either criminal or civil blame for the death. Indeed, some would say that the coroners' system is long overdue for the review that is currently taking place.

A coroner or the jury has a prescribed list of possible verdicts and, although riders or comments may be attached to these verdicts, they must not indicate or imply blame. The commonly used verdicts include:

- Unlawful killing (which includes murder, manslaughter, infanticide, death by dangerous driving etc.);
- Lawful killing (legal use of lethal force by a police officer);
- Accident (misadventure);
- Killed himself/herself (suicide);
- Natural causes;
- Industrial disease;
- Abuse of drugs (dependent or non-dependent);
- Open verdict (where the evidence is insufficient to reach any other verdict).

Control tests.

1. What is the correct definition of the scene of death? It is…

A. a place where murder occurs

B. a place where suicide occurs
C. a place where dead person (body) is found.
D. a place where person is killed
E. all are correct

2. Which methods of the inspection of the scene of crime do you know?
A. objective
B. subjective
C. central
D. all are correct
E. all are wrong

3. Indicate the correct order of the inspection of a dead body at the scene of death at first:
A. Surroundings-position-pose
B. Surroundings–fixation of the position-general description of the body.
C. position-pose-upper clothes
D. upper clothes-changes in the body-evidences
E. evidences-struggle marks-external injuries

4. Choose the correct statement: The inspection of the scene of death refers to
A. a practical activity of a judge
B. a practical activity of an investigator.
C. a practical activity of lawyer
D. a practical activity of a forensic pathologist
E. a practical activity of doctor

5. There are such tasks of a doctor at the scene of death, except:
A. Whether there is a crime?
B. To establish if a person is alive or dead
C. To determine time since death
D. To fix the position and pose of a corpse
E. To find probable marks of struggle or self-defense

6. The following tasks during the inspection must be solved, except:
A. Whether there is a crime?
B. Who is a criminal?
C. When a crime occurs?
D. How long offenders spend at the scene of crime?
E. How they come at the scene of crime?

7. Where should the body's temperature be measured at the scene of death?
A. In axillar region
B. In a mouth
C. In a whisker
D. In a rectum
E. In iliac area

8. The doctor examines the dead driver and establishes that PML completely disappears under the thumb pressure. Estimate postmortem interval.
A. Not more than 8-10 hours.
B. 14-18 hours.

C. 20-24 hours.
D. 30-36 hours.
E. more than 36 hours.

9. During the inspection of the scene of death it is established that PML does not disappear under the thumb pressure but it becomes pale. Indicate the stage of PML development.

A. the 1 phase of hypostasis
B. the 2 phase of hypostasis
C. stage of stasis (diffusion)
D. stage of imbibition
E. stage of blood coagulation

10. Rectal temperature of a dead body during the inspection of the scene of death was 22 ˚C (surroundings - 18˚C). How many hours have elapsed since death ?

A. 3 hours
B. 7 hours
C. 14 hours
D. 18 hours
E. 24 hours

Task.

During the examination of the death scene it was reviled dead body in the room with closed window and door, with clothes on the body: shirt, trousers, underwear, pair of socks. The rectal temperature was 25ºC, ambient - 20ºC.

What is the time of death?

Basic books:

1. DiMaio V. Forensic Pathology, 2nd ed. / V. DiMaio, D. DiMaio // Practical aspects of criminal and forensic investigation, Boca Raton, London, New York, Washington, D.C.: CRC Press, 2001, p.562.

2. Richard Shepherd - Simpson's Forensic Medicine/Twelfth Edition Senior Lecturer in Forensic Medicine Forensic Medicine Unit St George's Medical and Dental School Tooting, London, UK, 2003, p. 198.

3. Longauer A., Bobrov N., Labaj P. Practicing in forensic medicine, Faculty of Medicine, P. J. Safarik University Kosice, Slovak Republic, 2000, p.98.

4. Eckert, William G. Introduction to forensic sciences. / William G. Eckert second editon. - New York: Elsevier, 1992. – P. 385

5. DiMaio V. J. M. Gunshot wounds. Practical aspects of firearms, ballistics, and forensic techniques. Second Edition / Vincent J. M. DiMaio. – CRS Press: New York, - 1999. – 400p.

6. Mykhailychenko B.V. Forensic Medicine : textbook / B.V. Mykhailychenko, A.M. Biliakov, I.G. Savka ; edited by B.V. Mykhailychenko. — 2nd edition. — Kyiv : AUS Medicine Publishing, 2019. — 224 p.

Supplementary literature:

1. Color Atlas of Forensic Medicine and Pathology -Edited by Charles A. Catanese, USA, 2009, p. 424.;
2. Color Atlas of the autopsy / Scott A. – Wagner Boca Raton London New York Washington, 2004, p. 226.

Informational sources:

1. https://www.4tests.com/usmle#StartExam
2. http://www.medicalstudent.com/
3. http://www.thestudentroom.co.uk/wiki/Resources_for_Medical_Students
4. https://quizlet.com
5. http://library.med.utah.edu/WebPath/webpath.html
6. http://www.webpathology.com/
7. https://www.geisingermedicallabs.com/lab/resources.shtml
8. http:// www.umsa.edu.ua
9. http://ukrmed.org.ua
10. http://sudmed-p.ru
11. http:/forens-med.ru
12. Electronic library.

METHODICAL INSTRUCTION FOR STUDENTS*:*

Topic №3. "*Forensic medical examination of sudden and unexpected death. Autopsy.*"

1. Relevance of the topic. A sudden death meets in medico-legal practice relatively often. As often such death comes under obscure circumstances, then law enforcement authorities always have suspicion on violent death that is not accompanied by the expressed external damages of organism. Examination of such cases requires from the medico-legal expert of knowledge of morphological features and pathogeny of a number of diseases that result in the rapid offensive of death. Medico-legal examination of sudden death is difficult, especially in the cases of the unexpressed morphological changes in an organism.

2. Objectives:

- To be acquainted with the features of implementation of medico-legal examination (researches) of dead body in case of sudden death or suspicion on it.
- To know the types of diseases that result in the rapid offensive of death for adults, their etiology, pathogenesis.
- To know internal signs of the rapid offensive of death.
- To know how to code the cause of the sudden death with international classification of death 10th.
- Interpret results of laboratory researches.
- To fill a death certificate.
- Formulate of medico-legal diagnosis in case of sudden death.

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	**Obtained skills**
Therapy	To have knowledge of the clinical forms of the ischemic heart disease.
Anatomy	To have knowledge of structure of the human system of organs.
Histology	To explain histological structure of the human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	**Definition**

Sudden death	death due to rapid complication of the hidden chronic disease which passed with no or minimal symptoms or physiological state (pregnancy).
Coronary artery disease	Coronary stenosis from narrowing of the lumen by atheroma or spasm may lead to chronic ischemia of the muscle supplied by that coronary vessel
Coronary aneurysm	Tear and weakening of the blood vessel walls
Dissecting aneurysm of the aorta	The damage caused by an atheromatous plaque result in the weakening of the aortic media, and a defect in the intima, usually also associated with the plaque, allows blood from the lumen to dissect into this weakened area of media.
Berry aneurysm	is a cerebrovascular disorder in which weakness in the wall of a cerebral artery or vein causes a localized dilation or ballooning of the blood vessel.
Pulmonary embolism	is a blockage of an artery in the lungs by a substance that has traveled from elsewhere (often pelvic or low limbs deep veins) in the body through the bloodstream (embolism)
Ectopic pregnancy	is a complication of pregnancy in which the embryo attaches outside the uterus.
Myocardial infarction	commonly known as a heart attack, occurs when blood flow stops to a part of the heart causing damage to the heart muscle.
Pneumonia	is an inflammatory condition of the lung affecting primarily the microscopic air sacs known as alveoli.
Intracerebral hemorrhage	also known as cerebral bleed, is a type of intracranial bleed that occurs within the brain tissue or ventricles.
Cerebral infarction	is an area of necrotic tissue in the brain resulting from a blockage or narrowing in the arteries supplying blood and oxygen to the brain

4.2. Theoretical questions for the class:

- To know condition for autopsy performing.
- What are the basic methods of the death or crime scene description?
  What is the structure of the death or crime scene description process? Make «Protocol of examination of dead body on the death scene».
- What is the cause of death, manner of death and mechanism of death? Difference between them?
- What are duties and rights of expert, doctor on the death scene?
- How changes after death are classified?

- How to determine the time of death by using changes after death?

4.3. Practical work (tasks) which are done on the class:

- To determine stages of autopsy and aims of it.
- Draw a sketch of the death or crime scene.
- To make full description of the dead body on the death or crime csene.
- Determination changes after death on a dead body.
- To determine time of death by using changes after death and interpret them.

Basic terminological concepts

In countries where deaths have to be officially certified, the responsibility for certification falls either to the doctor who attended the patient during life or one who can reasonably be assumed to know sufficient of the clinical history to give a reasonable assessment of the cause of death. This is an 'honest opinion, fairly given, but many studies have shown that there is a large error rate in death certificates and that in 25-60 per cent of deaths there are significant differences between the clinician's presumption of the cause of death and the lesions or diseases actually displayed at the autopsy.

Unfortunately, it seems that there has been little or no improvement in the problems of certification of death over the years and as a result the raw epidemiological data gathered by national statistical bureau must be treated with some caution. All doctors should take the task of certifying the cause of death very seriously but, regrettably, it is a job usually delegated to the most junior, and least experienced, member of the team. A review of death certification is currently being performed in the UK in the wake of the serial murders of Harold Shipman, a general practitioner in Manchester.

There is a different approach to sudden and unexpected deaths, as these deaths are usually reportable to the authorities for medico-legal investigation. In

England and Wales, doctors should only issue a death certificate if they are satisfied that they know the cause of death and that it is definitely due to natural causes; additionally, they must have either examined the patient (alive) within the previous 14 days or they must have examined the body after death.

The World Health Organization (WHO) definition of a sudden death is within 24 hours of the onset of symptoms, but in forensic practice most sudden deaths occur within minutes or even seconds of the onset of symptoms. Indeed, it is very likely that a death that is delayed by hours will not be referred to the coroner or other medico-legal authority, as a diagnosis may well have been made, and a death certificate can be completed by the attending doctors.

It is crucial to remember that a sudden death is not necessarily unexpected and an unexpected death is not necessarily sudden, but these two facets are often combined.

CAUSES OF SUDDEN AND UNEXPECTED DEATH

When a natural death is very rapid, the cause is almost inevitably cardiovascular. Indeed, if a person collapses and is clinically dead before bystanders can assist, this can only be due to a cardiac event resulting in a cardiac arrest. Virtually no other mode of death operates so quickly. Extra-cardiac causes, even those elsewhere in the cardiovascular system, are rarely so rapidly fatal. Of course, in all such discussions of this nature, 'death' must be defined and, for our present purposes, irreversible cardiac arrest is taken as the criterion of death.

CARDIOVASCULAR SYSTEM

Disease of the heart

Most sudden unexpected deaths (SUDs) are caused by disease of the cardiovascular system. Although there is a huge geographical variation, due to the remarkable differences in the recorded incidence of atherosclerosis, the prime causes of SUD usually lies in the heart itself. The following lesions are the most obvious.

CORONARY ARTERY DISEASE

• Coronary stenosis from narrowing of the lumen by atheroma may lead to chronic ischemia of the muscle supplied by that coronary vessel. If the myocardium becomes ischemic, it may also become electrically unstable and liable to develop arrhythmias. The oxygen requirement of the myocardium is dependent upon the heart rate and so anything that increases the heart rate (exercise, a large meal or a sudden adrenaline response to stress or to anger, fear or other emotion) will lead to an increase in the oxygen requirements. If these cannot be met due to the restriction of the blood flow through the stenotic vessel, the myocardium distal to the stenosis will become ischaemic. There is no need for this ischaemia to produce a myocardial infarct; it just has to be sufficiently severe to initiate fatal arrhythmias and, if the region rendered ischaemic includes one of the pace-making nodes or a major branch of the conducting system, the risk that rhythm abnormalities will develop is greatly increased.

• Complications of atheromatous plaques may worsen the coronary stenosis and subsequent myocardial ischaemia. Bleeding may occur into a plaque and this can be seen as subintimal haemorrhage at autopsy. Sudden expansion of the plaque may lead to rupture, which may also occur if the plaque ulcerates. When a plaque ruptures, the extruded cholesterol, fat and fibrous debris will be washed downstream in the coronary artery and impact distally, often causing multiple mini-infarcts. The endothelial cap of a ruptured plaque may act as a flap valve within the vessel and cause a complete obstruction.

• An atheromatous plaque is a site for the development of mural thrombus, which will further reduce the vessel lumen without necessarily fully blocking the vessel.

• Coronary thrombosis is commonly over-diagnosed by clinicians as a cause of sudden death, and less than one-third of sudden cardiac deaths reveal macroscopic or microscopic evidence of coronary thrombus at autopsy. The simple stenosis and the

complications of atheroma are both sufficient to cause death and much more common. However, coronary thrombosis is still a frequent finding at autopsy and it will be associated with an area of myocardial infarct, providing there has been a sufficiently long period of survival for the macroscopic changes of infarction to develop.

• Myocardial infarction occurs when there is severe stenosis or complete occlusion of a coronary artery so that the blood supply is insufficient to maintain the oxygenation of the myocardium. However, if there is adequate collateral circulation, blood can still reach the myocardium by other routes. The fatal effects of an infarct may appear at any time after the muscle has become ischaemic.

• The area of muscle damaged by a myocardial infarction is further weakened by the process of cellular death and the inflammatory response to these necrotic cells. The area of the myocardial infarct is weakest between 3 days and 1 week after the clinical onset of the infarct and it is at this time that the weakened area of myocardium may rupture and cause sudden death from a haemoperi- cardium and cardiac tamponade. The rupture occasionally occurs through the interventricular septum, resulting in a left-right shunt. If a papillary muscle is infarcted, it may rupture, which will allow part of the mitral valve to prolapse, which may be associated with sudden death or may present as a sudden onset of valve insufficiency.

• An infarct heals by fibrosis, and fibrotic plaques in the wall of the ventricle or septum may interfere with physical or electrical cardiac function. Cardiac aneurysms may form at sites of infarction; they may calcify and they may rupture.

• Physical lesions in the cardiac conducting system have been studied intensively in recent years, especially in relation to sudden death. Many different abnormalities have been found, varying from extensive fibrosis to haemorrhage, tumours and infective lesions. It may be difficult to determine if such lesions are the cause of the fatal arrhythmia or merely an incidental finding, but in the absence of any other abnormality, it is reasonable to conclude that they were a significant factor in causing the death.

HYPERTENSIVE HEART DISEASE

This condition may lead to sudden cardiac death from left ventricular hypertrophy. The upper limit of normal heart weight is about 400 g (although this depends greatly on the body size and weight) and this may increase to 600 g or more, reflecting the increased thickness of the left ventricle. However, blood can only flow through the coronary arterioles during diastole because they are compressed during systole. At rest, when diastole is relatively long, the whole of the myocardium can be adequately perfused, but if the heart rate increases, diastolic time is reduced and the perfusion of the sub- endocardial cells is reduced. These cells become unstable and irritable and may produce arrhythmias and fibrillation. Atheroma is often associated with hypertension so that the enlarged heart may also be deprived of a normal blood flow in the major coronary vessels by the presence of atheromatous plaques and their complications.

AORTIC STENOSIS

Aortic stenosis is a disease that classically affects males over the age of 60 years with tricuspid aortic valves, but which may also be seen in younger people who have acongenital bicuspid aortic valve. The myocar- dial hypertrophy is similar to hypertension and it leads to left ventricular hypertrophy, which may, in some cases, produce heart weights of over 700 g.

In aortic stenosis, the perfusion problem is worsened by the narrow valve, which results in a lower pressure at the coronary ostia and hence in the coronary arteries. Sudden death is common in these patients.

SENILE MYOCARDIAL DEGENERATION

Senescence is a well-accepted concept in all animals, and few humans survive beyond 90-100 years. The cause of a sudden death in these elderly individuals can be very difficult to determine. The senile heart is small, the surface vessels are tortuous and the myocardium is soft and brown due to accumulated lipofuscins in the cells.

PRIMARY MYOCARDIAL DISEASE

These are much less common than the degenerative conditions described above and they commonly affect a significantly younger age group. Myocarditis occurs in many infective diseases, such as diphtheria and virus infections, including influenza, but the clinical complications and sudden death associated with the infection may occur some days or even weeks after the main clinical symptoms. Care must be taken in interpreting the histological appearances of small foci of myocarditis because isolated collections of lymphocytes may be identified in the myocardium of young adults who have died suddenly from trauma, suggesting that these foci are simply incidental findings. These foci used to be known as 'isolated Fiedler's myocarditis'. Other infective and inflammatory processes can also involve the myocardium, including disseminated sarcoidosis.

A more definite group of intrinsic cardiac diseases is the 'cardiomyopathies'. The initial descriptions referred to cardiomegaly with huge hearts of over 1000 g and asymmetric thickening of the ventricular walls in the hypertrophic, obstructive type of cardiomyopathy (HOCM) or dilatation of the chambers in congestive cardiomyopathy. Both types of the disease are usually associated with areas of disordered myocardial fibres. Extensive research has now shown that the cardio- myopathies are a much more complex group of primary myocardial diseases, commonly with a genetic background, which often do not show the typical macroscopic appearances described above. Right ventricular cardiomyopathy is now described and is associated with fatty infiltration of the wall of the right ventricle.

Other primary myocardial diseases or conduction defects, many of which are inheritable, are now described and include long QT syndrome, Brugada syndrome and catecholaminergic polymorphic ventricular tachycardia. The autopsy in these cases will be entirely negative but, as DNA techniques improve, diagnosis will be made in the laboratory rather than the mortuary.

Diseases of the arteries

The most common lesion of the arteries themselves that is associated with sudden death is the aneurysm. Several varieties must be considered as they are very commonly found in autopsies on SUDs.

ATHEROMATOUS ANEURYSM OF THE AORTA

These aneurysms are most commonly found in elderly males in the abdominal region of the aorta. They are formed when the elastic component of the aortic wall below an atheromatous plaque is damaged and the blood pressure is able to balloon the weakened wall. The aneurysms may be saccular (expanding to one side) or fusiform (cylindrical). The wall of the aneurysm is commonly calcified and the lumen is commonly lined by old laminated thrombus.

Many aneurysms remain intact and are found as an incidental finding at autopsy, but others eventually rupture. The rupture may be repaired surgically if diagnosed in time, but many individuals die too quickly for any help to be given. Because the aorta lies in the retroperitoneal space, that is where the bleeding is found; it usually lies to one side and may envelope the kidney. Rarely, the aneurysm itself, or the retroperitoneal haematoma, ruptures through the retroperito- neal tissues to cause a haemoperitoneum.

DISSECTING ANEURYSM OF THE AORTA

The damage caused by an atheromatous plaque can also result in the weakening of the aortic media, and a defect in the intima, usually also associated with the plaque, allows blood from the lumen to dissect into this weakened area of media. Once the dissection has started, the pressure of the influx of blood extends the dissection along the aortic wall. The commonest site

of origin of a dissecting aneurysm is in the thoracic aorta and the dissection usually tracks distally towards the abdominal region, sometimes reaching the iliac and even the femoral arteries. In fatal cases, the track may rupture at any point, resulting in haemorrhage into the thorax or abdomen. Alternatively, it can dissect proximally around the arch and into the pericar- dial sac, where it can produce a haemopericardium, cardiac tamponade and sudden death.

Dissecting aneurysms are also seen in association with diseases of the aortic media such as cystic medial degeneration.

Intracranial vascular lesions

Several types of intracranial vascular lesions are important in sudden or unexpected death.

RUPTURED BERRY ANEURYSM

A relatively common cause of sudden collapse and often rapid death of young to middle-aged men and women is a subarachnoid haemorrhage resulting from rupture of a 'congenital' (berry) aneurysm of the basal cerebral arteries either in the circle of Willis itself or in the arteries which supply it. Whether berry aneurysms can be described as 'congenital' depends on the interpretation of the word: strictly speaking, they are not present at birth, but the weakness in the media of the vessel wall (usually at a bifurcation) from which they develop is present at birth. The aneurysms may be a few millimetres in diameter or they may extend to several centimetres; they may be single or multiple and they may be found on one or more arteries.

The aneurysms may be clinically silent or they may leak, producing a severe headache, neck stiffness, unconsciousness and sometimes paralysis or other neurological symptoms. The rupture of a berry aneurysm on the arterial circle of Willis allows blood to flood over the base of the brain or, if the aneurysm is embedded in the brain, into the brain tissue itself. The speed of death can be such that the initial impression is of a cardiac event. It is thought that sudden exposure of the brain- stem to blood under arterial pressure depresses the cardiorespiratory centres in the brainstem.

The role of direct trauma in the rupture of an aneurysm is in dispute. It seems reasonable to suspect that a large, fragile aneurysm on the circle of Willis might be damaged by a substantial head injury; such an aneurysm should be easy to identify at autopsy and so this should not present a diagnostic problem. However, for the more common, small aneurysms situated deeply inside the skull, it seems unlikely that a blow that causes no other cranial or intracranial injury would cause the aneurysm to be selectively ruptured.

There is another cause for subarachnoid haemorrhage that is well known to be associated with trauma to the head and neck following violence or an assault when there is forceful lateral flexion of the neck or rotation of the head. The anatomical course of the vertebral arteries is convoluted and, for much of their course in the neck, they are protected within the lateral foramina of the cervical vertebrae. However, they are more exposed to trauma above the first cervical vertebra, and it has been claimed that most traumatic sub- arachnoid haemorrhages are due to tearing of this extracranial region of a vertebral artery within or adjacent to the first cervical vertebra or between it and the base of the skull. Damage to the vertebral arteries at these sites requires the bleeding to dissect in the wall of the artery as far as the base of the skull and then rupture to cause the subarachnoid haemorrhage. This dissection in the arterial wall can often be identified more easily than the intimal damage that marks the origin of the haemorrhage. There may be bruising on the skin surface of the neck to indicate direct trauma or the bruising may be confined to the deep muscles of the neck, indicating indirect trauma to the neck.

Cerebral haemorrhage

Sudden bleeding into the brain substance is common, usually in old age and in those with significant hypertension, and together with cerebral thrombosis and the resulting infarction, this is the commonest cause of the well-recognized cluster of neurological signs colloquially termed a 'stroke'.

Spontaneous intracerebral haemorrhage is most often found in the external capsule of one hemisphere and arises from rupture of a micro-aneurysm of the lenticulo-striate artery, sometimes called a Charcot- Bouchard aneurysm. The sudden expansion of a haematoma compresses the internal capsule and may destroy some of it, leading to a hemiplegia.

Haemorrhage can also occur in the cerebellum and the mid-brain, possibly as a result of a ruptured aneurysm or other vascular abnormality, although the abnormality may be extremely difficult to identify at autopsy. Death is seldom instantaneous, although it can be extremely rapid following a haemorrhage in the brainstem.

CEREBRAL THROMBOSIS AND INFARCTION

Cerebral thrombosis rarely causes sudden death, as the process of infarction is relatively slow, although the neurological symptoms and signs may have a very rapid onset and be severe.

The term 'cerebrovascular accident' (CVA) is in common usage, both as a clinical diagnosis and as a cause of death. Occasionally, it is misinterpreted by the public, and sometimes also by legal officials, as indicating an unnatural cause of death because of the use of the word 'accident'. To avoid this small risk, it is much more satisfactory, if the exact cause is known, to use the specific term that describes the aetiology - 'cerebral haemorrhage' or 'cerebral infarction' - or, if the aetiology is not known, to use the generic term 'cerebro- vascular lesion'.

RESPIRATORY SYSTEM

The major cause of sudden death within the respiratory organs is again vascular. Pulmonary embolism is very common and, in fact, is the most clinically under-diagnosed cause of death. In almost every case, the source of the emboli is in the leg veins. Tissue trauma, especially where it is associated with immobility or bed rest, is a very common predisposing factor in the development of deep vein thrombosis. Most thromboses remain silent and cause no problems, but a proportion embolize and block pulmonary arteries of varying size. Some produce no lung lesions at all, whereas others produce infarcts that may or may not lead to clinical signs, and a minority (though an appreciable number) block a major vessel and cause death.

About 80 per cent of pulmonary embolism deaths have a predisposing cause such as fractures, tissue trauma, surgical operation, bed rest, forced immobility etc., but the remainder occur unexpectedly in normal, ambulant people who have reported no clinical symptoms. This makes establishing the relationship of death to an injurious event difficult. For the purposes of civil law (where 'the balance of probabilities' is enough), the embolism can often be linked to the trauma, but in a criminal trial in which the higher standard of proof - 'beyond reasonable doubt' - is required, it is much harder to relate fatal pulmonary emboli to the trauma.

Other rare causes of sudden death in the respiratory system include a massive haemoptysis from cavi- tating pulmonary tuberculosis or from a malignant tumour. Rapid (but not sudden) deaths can also occur from fulminating chest infections, especially virulent forms of influenza.

GASTROINTESTINAL SYSTEM

Once again, the causes of sudden death have a vascular component in that very severe bleeding from a gastric or duodenal peptic ulcer can be fatal in a short time, but, more commonly, the bleeding is less torrential and is therefore amenable to medical or surgical treatment. Mesenteric thrombosis and embolism, usually related to aortic or more generalized atheroma, may result in infarction of the gut, but, once again, a rapid but not sudden death is expected if the infarction remains undiagnosed.

Perforation of a peptic ulcer can be fatal in hours if not treated and intestinal infarction due to a strangulated hernia or obstruction due to torsion of the bowel around an area of peritoneal adhesions can also be fulminating and fatal conditions, as can peritonitis arising from diverticular disease or a perforated carcinoma. Many of these conditions present as sudden death in elderly people because they cannot or will not seek assistance at the onset of the symptoms and are then unable to do so as their condition worsens.

DEATHS FROM ASTHMA AND EPILEPSY

In both conditions, death may occur during an attack and the autopsy will reveal specific features to enable a positive diagnosis to be made. However, both of these conditions are also associated with a few sudden and unexpected deaths each year where the specific features of an attack are absent and for which no obvious cause of death can be identified at autopsy.

Even well-controlled epileptic patients may die rapidly and inexplicably; it was once thought that they must have been exhausted from status epilepticus, but this is now not thought to be so. There are some who doubt that these patients are even having a fit when they die because of the lack of pathological features, but many epileptics have fits that leave no pathological signs, rendering this theory unlikely. Epileptics are also at risk from the hazards of all types of accidents during a pre-fit aura (if they have one), while having a fit or immediately afterwards; these hazards include falls, drowning, suffocation and postural asphyxia.

Control test tasks

1. What cardiovascular disease is the most common cause of death

A. coronary atherosclerosis
B. aortal aneurism
C. myocarditis
D. myocardial infarction
E. thromboembolism

2. Mechanism of sudden death in most individuals with coronary artery disease is the sudden onset of ventricular tachycardia which progresses to

A. rupture of the myocardium
B. myocardium infarction
C. ventricular fibrillation
D. aneurism of aorta
E. thromboembolism

3. Which state can lead to hemorrhage into the subarachnoid space?

A. dissecting coronary aneurysm with rupture
B. transitory coronary artery spasm
C. transient ischemic attack
D. coronary atherosclerosis
E. berry aneurysm

4. During autopsy of the male 32-year-old drug edict dissection of the heart reviled that valve between left atrium and left ventricle has fusion of the cusps due to the inflammatory process. What the name of this valve?

A. aortic valve
B. mitral valve
C. truncus pulmonalis valve
D. tricuspid valve
E. venous valve

5. A fulminant form of meningococcemia is presented with Waterhouse-Friderichsen Syndrome wich is:

A. sclerosis of meninges
B. acute hemorrhagic necrosis of adrenals
C. aortic dissection
D. restrictive-obliterative cardiomyopathy
E. pheochromocytoma

Situatioonal tasks

TASK 1.

During the autopsy of the 32-year-old housewife found dead on the kitchen floor, dissection of the heart reviled the heart pale and flabby with lightly dilated chambers with hemorrhages into the thickness of the muscle. 2 weeks ago had viral infection. Microscopically, there are patchy or diffuse areas of necrosis with interstitial inflammation. The inflammation extensive all over the muscle with degeneration and necrosis of muscle fibers. The infiltrate with neutrophils, lymphocytes, plasma cells, and eosinophils.

What is the cause and mechanism of death in the patient?

TASK 2.

On examination of a man aged 63, who died suddenly in the presence of symptoms of respiratory and heart failure, there were revealed the signs of sudden death: diffuse livores mortis, cyanosis of the face, venous congestion of the inner organs; the pericardium was filled with blood, which entered from a slit-like opening of the lateral wall of the left ventricle; irregular blood filling of the cardiac muscle, including the area of rupture; atherosclerosis plaques narrowing the lumens of the coronary arteries up to 75%; numerous plaques with calcinosis and atheromatosis in the intima of the aorta. Alcohol content in the blood was 2.6 promille; other poisons were not revealed.

What is the cause and mechanism of death in the patient?

Basic books:

1. DiMaio V. Forensic Pathology, 2nd ed. / V. DiMaio, D. DiMaio // Practical aspects of criminal and forensic investigation, Boca Raton, London, New York, Washington, D.C.: CRC Press, 2001, p.562.

2. Richard Shepherd - Simpson's Forensic Medicine/Twelfth Edition Senior Lecturer in Forensic Medicine Forensic Medicine Unit St George's Medical and Dental School Tooting, London, UK, 2003, p. 198.

3. Longauer A., Bobrov N., Labaj P. Practicing in forensic medicine, Faculty of Medicine, P. J. Safarik University Kosice, Slovak Republic, 2000, p.98.

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6. Mykhailychenko B.V. Forensic Medicine : textbook / B.V. Mykhailychenko, A.M. Biliakov, I.G. Savka ; edited by B.V. Mykhailychenko. — 2nd edition. — Kyiv : AUS Medicine Publishing, 2019. — 224 p.

Supplementary literature:

1. Color Atlas of Forensic Medicine and Pathology -Edited by Charles A. Catanese, USA, 2009, p. 424.;

2. Color Atlas of the autopsy / Scott A. – Wagner Boca Raton London New York Washington, 2004, p. 226.

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METHODICAL INSTRUCTION FOR STUDENTS
Topic №4. " Forensic medical examination of the corpse of newborn. Infanticide due to commission and omission."

1. Relevance of the topic: The category of bodies that are subject to forensic examination, and the corpses belong to newborns and fetuses. In many cases they are found on wasteland, in cellars, ditches, rubbish pits. In addition, they can be found buried in the ground, in the drifts of snow, the rivers, and more. In such cases, have always unknown. Because there is a suspicion of violent death of infants. A forensic medical examination of such bodies is different from the examination of corpses of adults. You need to know these features and be able to address issues that arise in the investigation. Also need to know the reasons and principles of medico-legal examination of new-born cadavers. To realize the importance of forensic expertise in provision evidence of infanticide crime.

2. Objectives:

- to define the differences between infanticide, neonaticide and homicide
- to know the reasons of newborn cadavers examination
- to specify issues during newborn body examination
- to know possible causes of fetus and newborn death
- to identify signs of a newborn
- to assess maturity of a fetus and newborn
- to calculate fetal (gestational) age
- to identify signs of extrauterine life and to assess its duration
- to determine fetal viability

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	**Obtained skills**
Medical low	To have knowledge of duties and rights of expert, doctor on the death scene. To be acquainted with The Criminal Code and Constitution of Ukraine.
Anatomy	To have knowledge of structure of the human body and organs. To know features anatomy of the fetus body and blood circulation.
Histology	To explain histological structure of the human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	**Definition**
Caput succedaneum	edema and bleeding in the soft tissues of the scalp, which appears physiologically during the birth process.

Cephalhematoma	bleeding under the periosteum of skull bones: it appears in cases of obstetrical traumas or instrumental delivery.
Child care after birth	involves washing, dressing and feeding a newborn.
Filicide	killing of a child by a parent.
Flotation (hydrostatic) test (docimasy or hydrostasy)	ntiate stillborn lungs from those of infants who had breathed; it involves placing the lungs and/or gastrointestinal tract in water.
Infanticide	deliberate killing of a child in the first year of life by either act or omission.
Maturity	born physical development at birth in physiological term
Neonaticide	born child, committed during the birth or immediately after it by his mother, who was in a state of physical or mental disorder with discernment decrease caused by birth.
New born	d not more than 24 hours after birth (medico-legal point of view).
Stillborn	ath in the utenis.
Vernix caseosa	stance that is normally adherent to the skin of a fetus.
Viability	of an infant to independent existence without any special medical care.

4.2. Theoretical questions for the class:

- What are questions have to decide medical examiner during examination?
- What are the signs of the newborn?
- What are the differences between infanticide, neonaticide and homicide?
- How to calculate fetal (gestational) age?
- What are the signs of extrauterine life and how to assess its duration?
- How to determine fetal viability?

4.3. Practical work (tasks) which are done on the class:

- To identify signs of a newborn
- To perform flotation tests
- To assess maturity of a fetus and newborn
- To calculate fetal (gestational) age
- To identify signs of extrauterine life and to assess its duration

- To determine fetal viability
- To identify causes of newborn death

Block of information

The great majority of child murders occurs in the first two years of life. In the most cases the murder of a child is its parent. There are also natural cases of still-birth.

Still-birth

➔ The still-born child is a child of more than 28 weeks' gestational age which after being completely expelled from the mother, did not breathe or show any signs of life.

The circumstances of still-birth are that the child may die before onset of labour, after onset of labour or during the process of birth itself. The still-born child is:

- discolored (pinkish-brown or red)
- with desquamation of the skin
- with soft and slimy tissues
- with over-riding skull plates
- with partial collapse of the head.

As babies who are stillborn have never 'lived' in the legal sense, they cannot 'die' and so a death certificate cannot be issued.

Infanticide

- Infanticide is a form of homicide commonly defined as the deliberate killing of a child occuring in the first year of its life.
- Filicide is general term for killing of a child by its parent (both mother and father.
- Neonaticide is the deliberate killing of a new-born child within 24 hours of its birth by its mother. The killing must take place during a very limited period (not later than after the first feeding and swaddling of the infant). But if the fetus dies before actual birth, these cases are not included in the term of neonaticide, and of course, if the fetus died *in utero* and it undergoes maceration, that obviously is not neonaticide.

The medico-legal questions in that cases are:

1. Was the child fully matured?
2. Was the child born alive?
3. Did the child survive after birth?
4. The identity of the body.
5. What was the cause of death?
6. How long has the body been dead?

THE ESTIMATION OF MATURITY OF A NEWBORN BABY OR FETUS

It may be necessary to estimate the length of gestation from the body of a baby or fetus in relation to an abortion, stillbirth or alleged infanticide. Two very rough 'rule of thumb' formulae for estimating maturity are:

1. up to the twentieth week, the length of the fetus in centimetres is the square of the age in months (Haase's rule);
2. after the twentieth week, the length of the fetus in centimetres equals five times the age in months.

There is considerable variation in any of the measured parameters due to sex, race, nutrition and individual variation, but it is possible to form a reasonable estimate of the maturity of a fetus by using the brief notes that follow.

4 weeks 1.25 cm, showing limb buds, enveloped in villous chorion.

12 weeks 9 cm long, nails formed on digits, placenta well formed, lanugo all over body.

20 weeks 18-25 cm, weight 350-450 g, hair on head.

24 weeks 30 cm crown-heel, vernix on skin.

28 weeks 35 cm crown-heel, 25 cm crown-rump,
weight 900-1400 g.

32 weeks 40 cm crown-heel, weight 1500-2000 g.

36 weeks 45 cm crown-heel, weight 2200 g.

40 weeks 48-52 cm crown-heel, 28-32 cm crown- (full term) rump, 33-38 cm head circumference, lanugo now absent or present only over shoulders, head hair up to 2-3 cm long, testes palpable in scrotum/vulval labia close vaginal opening, dark meconium in large intestine.

Development can also be assessed using the ossification centres and the histological appearances of the major organs (Fig. 1). Specialist anthropological and paediatric textbooks should be consulted for further details of any of these methods.

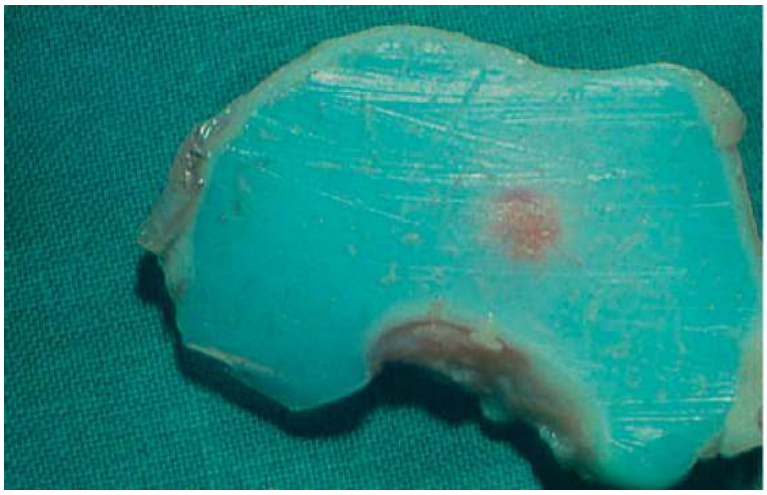

Figure 1 Cross-section of the lower end of the femur showing the ossification center.

In relation to legal medicine, neonaticide must be considered in different countries:

- ❖ as a type of homicide
- ❖ as a murder in peculiar circumstances (woman's disturbance by the effects of childbirth or
- ❖ lactation)
- ❖ as a committed manslaughter.
- ➔ *Mostly the punishment for mother who tailed her new-born infant is somewhat slighter than in the case of "usual" homicide.*

Physical abuse of children (true child abuse)

Legal medicine classifies these cases as "child or baby battering" and "non-accidental injury". The main characteristics of these cases are:

- they are very common
- there is a various threshold between legitimate parental punishment
- they are mostly non-fatal:
  - ✓ 60 % recure
  - ✓ 1 0 % end in death
  - ✓ many cases end in permanent damage (neurological defects from brain injury)
- the murder commonly is a single episode of deliberate killing
- fatal child abuse is a culmination of repeated injury
- manual violence in most cases is proved (the exceptions exist)
- the incidence in any age, but mostly under two years of age
- sexual abuse is usually observed in an older groups of children

- statistically most risk in the "lower middle social classes":
  - ✓ no association with material deprivation
  - ✓ often only one child in a family!
- the most common physical lesions are on the skin and skeleton. *"The skin and bones tell a story that the child is either too young or too frightened to tell"* (a medical proverb).

The characteristics of injuries

1. Bruising; - the cardinal sign (always suspicion in children younger than walking age and requires a satisfactory explanation):
   - ❖ bruising around the large joints (uppper arms, forearms, wrists, ankles, knees as the signs of gripping by adult)
   - ❖ bruises on the face ("black eye"), ears, bps, neck, lateral thorax, abdomen, buttocks, thighs are suspicious if the doctor reveals:
     - o finger-tip discoid marks of different ages (by colour changes)
     - o skip marks r pinch marks
     - o knuckle punch marks
     - o instrument marks (belts, straps, canes, pieces of wood, electric flex etc.)
2. Skeletal lesions (the full skeletal survey to be required!):
   - ❖ fresh fractures (skull, limbs, ribs in one line)
   - ❖ evidence of previous damage (callus formation, subperiostal calcification of haematomata)
3. Eyes and mouth injuries:
   - ✦ eyes: vitreous haemorrhage, dislocated lens, detached retina (ophthalmoscopy!)
   - ✦ lips: bruised or abraded, lacerated by contact with the tooth edges (as a sequel of blows to the face)
   - ✦ mouth: torn frenulum inside the upper lip, tangential blow across the mouth, a feeding bottle rammed between lip and gum.
4. Head injuries (most frequent cause of death):
   - ✦ subdural haematoma. The mechanism is:
     - ➢ direct impact (see fig. 81)
     - ➢ vigorous violent shaking (heavy and unsupported head, "shaken baby syndrome")
     - ➢ skull fracture (haematoma under the scalp) as a result of:
       - ♦ throw against a hard surface (floor)
       - ➢ punch, heavy slap
       - ➢ cerebral oedema
       - ➢ diffuse axonal damage.
2. Visceral injuries:
   - ■ gut crash

- mesentery laceration
- liver and spleen rupture
- kidney decapsulation
- urinary bladder rupture.

3. Other lesions:

burns, scalds on the skin; the instruments are: hot iron, hot water, burning cigarette

Control tests:

1. What is stillbirth?

A. sudden infant death syndrome
B. when a mother kills her child during its first year of life
C. when baby was born dead
D. child died due to omission or commission
E. deliver a live child

2. What is gestational age?

A. age of a pregnancy in weeks
B. amount of days that newborn is living
C. age of the mother
D. period of delivery in hours
E. period when women can become pregnant

3. What is infanticide?

A. when baby was born dead
B. when a mother kills her child during its first year of life
C. sudden infant death syndrome
D. child died due to suicide
E. deliver a live child

4. Act of omission means everything except for:

A. swaddle the baby
B. tying and cutting the cord
C. clearing the air passages of mucus
D. keeping the baby warm and fed.
E. head injuries

5. All signs indicates on stillbirth except for:

A. negative flotation tests
B inflated lungs
C. absents of gastric contents in stomach.
D. no air in stomach on x-ray examination
E. no inflammatory ring of the umbilical cord

6. All the following signs indicate on separate existence of infant except for:

A. positive flotation tests
B. inflated lungs
C. milk in the stomach
D. lanugo over the shoulders, around the ears
E. umbilical cord with inflammatory ring of reddening

7. Gestation age could be estimated based on:

A. state of umbilical cord
B. histological examination of the lungs
C. ossification center examination
D. vernix caseosa on the skin
E. crown-hill length measurement

Keys: 1-C; 2-A; 3-B; 4-E; 5-B; 6-D; 7-E

TASK 1.

On examination of a female baby corpse externaly: weight is 2350g, crown–heel 42cm, umbilical cord is soft, moist, gelatinous, thick 1,8cm without inflammatory ring of reddening, vulval labia doesn't close vaginal opening, lanugo all over the body. Autopsy reviled collapsed lungs, no air in stomach on x-ray examination, flotation tests are negative, ossification centre is 0.4 cm in the lower epiphysis of the femur. What conclusion can be made about maturity and gestation age?

TASK 2

On examination of a male baby corpse it was reviled, that body weight is 3540g, and the rown–heel is 48 cm. Nucleus of ossification is 0.5 cm are in the lower epiphysis of the femur, the head circumference is 35 cm, the chest circumference is 33 cm. Umbilical ring is on the middle distance between the pubis and breastbone edge; from here there extends a succulent moist umbilical cord 13.5 cm long with obliquely ending. The skin is covered with vernix and in streaks of blood; the testicles are in the scrotum; the nails on fingers protrude beyond the fingertips, but on the toes reach the toe-tips. Pulmonary and gastrointestinal flotation tests are positive.

What conclusion can be made about viability, maturity and gestation age?

Basic books:

1. Padure A. Infanticide. Neonaticide. Medico-legal examination of newborn cadavers / Andrei Padure, Anatolii Bondarev. – Chisenau: CEP Medicina, 2015. – 28p.
2. DiMaio V. Forensic Pathology, 2nd ed. / V. DiMaio, D. DiMaio // Practical aspects of criminal and forensic investigation, Boca Raton, London, New York, Washington, D.C.: CRC Press, 2001, p.562.
3. Richard Shepherd - Simpson's Forensic Medicine/Twelfth Edition Senior Lecturer in Forensic Medicine Forensic Medicine Unit St George's Medical and Dental School Tooting, London, UK, 2003, p. 198.
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Supplementary literature:

1. Color Atlas of Forensic Medicine and Pathology -Edited by Charles A. Catanese, USA, 2009, p. 424.;
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METHODICAL INSTRUCTION FOR STUDENTS

Topic №5. "Forensic medical (dental) examination of establishing the severity of injuries, health status and age."

1. Relevance of the topic. Practical activity of investigator (detective) is actually associated with cases of violence when different injuries occur in victims. To investigate such crimes, a forensic medical expert should know specific questions: traumatic objects are used for the crime, time of injuries, mechanism of their infliction etc. Besides, one of the most important problems for an investigator is determination of degree of the severity. Forensic examination for the determination of severity degree can be fulfilled not only for victims (living or dead persons), but for medical documents (patient card's, ambulatory card's, another medical documentation) too. This helps an investigator to resolve a case. Forensic conclusion in cases of the violence is necessary for both investigation and law procedure because it also establishes also punishment for an accused side. Therefore any doctor should know how to determine severity degree and how to draw an expert's conclusion ("Forensic Report") in cases of crimes against human health and life. That's why the topic is so actual for medical students.

2. Objectives:

- To describe injuries on the body of the victim according to the methodology.
- To teach students to methodology and features of realization of medico-legal examination of victims, defendants and other persons .
- To determinate the degree of the severity of injuries .
- To know how to determine severity degree in victims and according to medical documentation.
- To know structure of forensic medical report (expert conclusion).
- To draw forensic conclusion.

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	**Obtained skills**
Internal medicine	To have knowledge of conditional lines on the chest, abdomen and another anatomical regions
Anatomy	To have knowledge about anatomical regions of the human body and their parts, sides to know the structure of the human system of organs.
Histology	To explain histological structure of the skin and other human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	Definition
Injury	signifies a disorder of anatomic structure (continuity) or physiological function of human tissues or organs caused by the action of different environmental factors (mechanical, physical, chemical etc.).
Damages, dangerous for life.	his is such damages, which ourselves on oneself threaten to victim life in moment of its infliction, or which attached to usual their flowing (without assignment of medicare) expire whether can result in death.
Abrasion	is a wound caused by superficial damage to the skin, no deeper than the epidermis.
Contusion, bruise	injury in which capillaries and sometimes venules are damaged by trauma, allowing blood to seep, hemorrhage, or extravasate into the surrounding interstitial tissues.
Hematoma	is a localized collection of blood outside the blood vessels, due to either disease or trauma including injury or surgery and may involve blood continuing to seep from broken capillaries.
Wound (laceration, incision)	is a type of injury which happens relatively quickly in which skin is torn, cut, or punctured (an open wound), or where blunt force trauma causes a contusion (a closed wound).
A bone fracture	is a medical condition in which there is a damage in the continuity of the bone.
The accused person	is a person that in the order set by a law is instituted criminal proceedings against at presence of sufficient evidences about a feasance by him crimes.
Victim	is a person that as a result of crime a moral, physical or property damage is inflicted.

4.2. Theoretical questions for the class:

- How to describe injuries according to the methodology?
- What are the specialties of forensic-medical examination both on alive persons and case materials?
- What are the scheme and contents of «Expert's Conclusion» in cases of determination of severity degree?

- What are the forensic criteria and sings of the severe, moderate and simple injuries.

4.3. Practical work (tasks) which are done on the class:

- Describe injuries during examination.
- Carry out interrogation and inspection of the victim.
- Fill in the «Expert's Conclusion» with the received data.
- Determine severity degree of any injury.
- Make medicolegal conclusions in cases of forensic evaluation of severity degree.

Block of information

Examination of the victims, suspected or accused (alive) persons are objects of forensic-medical examination and take the second place after autopsies (dead body examination) according to work time and importance in expert practice of general profile. Forensic-medical examination of living persons is usually carried out by expert of forensic-medical examination bureau. According to Criminal Procedural Code as an expert it can be appointed any specialist, if it has necessary knowledge, then for taking of forensic-medical examination can be entangled doctor. Negligence and insufficient education of doctor during examination can bring serious mistakes and false forensic conclusion, which is unacceptable.

The necessity in examination of living persons in some cases is a result of demands of the criminal legislation. Specifically, in article 76of CFC of Ukraine provided for **obligatory** examination destination: "…2) for establishment of damages heaviness and kind of bodily injury …". Exclusive of straight law direction, examination can be taken for determination of mechanism and remoteness of damages formation, object, by which a trauma was caused, levels of steady capacity loss, in case of self-damages, members mutilation, etc.

Solving of the counted questions is impossible without other evidence sources, because it is needed a special medical knowledge. If investigator or judge even have such knowledge, they can't use it for deductions because of incompatibility of their forensic position with forensic expert position an thay can directly or indirectly be interested in results of the colclusion (examination).

Solving of some questions, can't be realized personally by forensic-medical expert or doctor, as a specialists in some medical field (radiologist, traumatologist, gynecologist etc.) For example, in cases of cranial-cerebral trauma estimation has to be made with participation of the neuropathologist or neurosurgeon, vision organ trauma with participation of the ophthalmologist etc.

Both corpse examination and examination of living persons, are realized by **passing a court resolution**. Forensic-medical examination cannot

be taken for requests of private persons, establishments, organizations, honour law-courts etc.

Examination of living persons is carried out in forensic-medical establishment or in doctor's cabinet. Drawing up a conclusion only according to data of medical documents (hospital or ambulatory cards, additional clinical studies (MRI, KT, analysis etc.), information from the trauma center, etc.) is made in cases of the urgent necessity of the expert conclusion, if it is difficult to examine victim or suspected person, temporally impossible for medical reasons, when from moment of the trauma it has been a long time.

Among all examination cases of living persons examination of the severity of the injuries takes place more often and composes 90 %, especially with determination of the injuries properties and their severity.

Personnel damage is not only medical, but also legal. From the point of view of criminal law, bodily harm is criminal, intentional, without the intention to take life, injuring one's health by another person. It can be called by an action (for example, blow as a result of a blow, a burn) or inaction of a suspect person (for example, unintentional prescribing by a doctor inappropriate medication which caused severe consequences).

A corporal damage is concept not only medical, but juridical. From point of view of criminal law an injury is criminal, intentional or unintentional, without intention to take a life, infliction of harm to health by one person to another person. It can be made by action (e.g., striking with blunt object, infliction of burns) or inaction of accused or suspected person (e.g., inappropriate assignment of medicare by doctor caused severe consequences).

From medical point of view the injury is called as violation of anatomic integrity or physiological function of tissue or organs of the human organism caused by action various factors of external environment (mechanical, physical, chemical, etc.), which lead to harm to health or death.

According to criminal code of Ukraine (further - CC of Ukraine) the bodily injury subdivide on GRIEVOUS (a. 101), MODERATE (a. 102) and SIMPLE (a. 106). Among last the followed types are defined: 1) simple bodily injury with short-term health disorder 2) light bodily injury without short-term health disorder.

In medicine all of bodily injury subdivide on abrasion, bruises, wounds, dislocations, fractures, cracks, tearing, squashing, tearing off, fragmentation of the body, traumatic toxicosis, burns (thermal, chemical), hypothermia, electrocusion, etc. This is the medical classification of bodily injury.

GRIEVOUS INJURIES

For article 121 of The Criminal Code of Ukraine grievous injuries (punishment according to CC with imprisonment for a term of five to eight years), which may be described by one or more from its six forensic criterions:

1. life-threatening injuries at the infliction moment;
2. the loss of any body organ or loss of its functions
3. action that has caused mental illness;
4. injuries that has caused health disorder attended with a persisting loss of health not less than one-third of working capability;

5. injuries that has caused abortion of the pregnancy;
6. injuries that has caused irreparable facial disfigurement.

Let consider these criterions (signs) separately.

Life-threatening injuries-

– without medical assistance, with their usual course, end or can end with death;
– in the clinical course at different times causing life-threatening states;

Prevention of death caused by the provision of medical care should not be taken into account when assessing the threat to life of such injuries.

A life-threatening condition that develops in the course of the clinical course of the injury, regardless of the time passed after its infliction, must be with him in a *direct causal relationship*.

Life-threatening injuries include:

1) any damage that caused at least one of the following life-threatening states:
   - severe shock;
   - acute or massive blood loss;
   - deep coma;
   - acute renal or hepatic failure;
   - acute heart or respiratory failure;
   - fat or gas embolism;
   - hormonal dysfunction.
2) injuries that penetrate the cranial cavity, including without damage to the brain;
3) open and closed fractures of the bones of the cranial vault and the base of the skull, with the exception of the bones of the facial skeleton and isolated fracture solely the outer plate of the cranial vault;
4) severe brain contusion with both compression and without compression of the brain, a brain contusion with moderate severity in the presence of symptoms of damage to the brainstem region;
5) isolated intracranial hemorrhages in the presence of life-threatening states;
6) closed spinal cord injuries in the cervical region;
7) injuries that penetrate into the spinal canal, including without damaging the spinal cord and its meninges;
8) dislocations, fracture-dislocations and fractures of the bodies or both arcs of the cervical vertebrae, unilateral fractures of the arcs of I or II cervical vertebrae, as well as fractures of the dentate process of the 2nd cervical vertebrae, including without dysfunction of the spinal cord;
9) fracture or fracture-dislocation of one or more thoracic or lumbar vertebrae with dysfunction spinal cord;
10) injuries with disruption of the all layers of the pharynx, larynx, trachea, main bronchi, esophagus;

11) injuries of the chest, with penetration of the cavity of the pleura, the pericardial cavity or the mediastinal tissue, including without damaging the internal organs;
12) injuries to the abdomen, which penetrate the cavity of the peritoneum, including without damaging the internal organs; open injuries of internal organs located in the retroperitoneum (kidneys, adrenal glands, pancreas) and in the pelvic cavity (bladder, uterus, ovaries, prostate, upper and middle rectum, membranous part of the urethra).

Diagnostic laparotomy, if there are no lesions of the abdominal cavity organs, in determining of the severity of injuries are not taken into account.

13) open fractures of the diaphysis of humerus, femoral and tibia;
14) injuries of the aorta, carotid (general, internal, external arteries), subclavian, brachial, iliac, femoral, popliteal arteries or their veins;
15) thermal burns of the III-IV degrees with an area of affection of more than 15% of the body surface; burns of the III degrees more than 20% of the body surface; burns of the II degrees more than 30% of the body surface;

Not life-threatening injuries but related to *GRIEVOUS* according to the outcomes and consequences: the loss of any organ, including one eye, lung, kidney, eggs, hands, feet, or loss of body of its functions.

a) **injury of the blind eye**, leading to its removal, is evaluated depending on the duration of the health disorder;
b) **loss of the hand or leg:** separation from the trunk of the entire arm or leg, and amputation at a level no lower than the elbow or knee joints; all other cases should be considered as a loss of a part of the limb and be evaluated on the basis of persistent disability;
c) **loss of vision:** complete persistent blindness in both eyes or a condition where there is a decrease in vision to counting the fingers at a distance of two meters and less / visual acuity in both eyes 0.04 and lower;
d) **loss of hearing**: full persistent deafness on both ears or such an irreversible condition, when the victim does not hear speaking at a distance of three to five centimeters from the auricle;
e) **loss of language (speech):** loss of the ability to express one's thoughts in terms of sounds that are understandable to others;
f) **reproductive capacity:** the loss of the capacity for copulation or loss of fertility, conception and childbirth / delivery;

Mental disease: injury is classified as severe only when it determines the development of a mental illness, regardless of its duration and degree of curability. The diagnosis of mental illness and the causal relationship between injury and developed mental disease, is established by psychiatric examination.

Health disorder attended with a persisting loss of not less than one-third of working capability:

– any violation of the normal functioning of the body, or a painful process that is directly caused by bodily harm;
– irreversible loss of function that is not completely restored;

Abortion of the pregnancy

Injury that lead to the termination of pregnancy, regardless of its term, refers to GREIVIUS if there is direct causal relationship between this damage and the termination of pregnancy.

Permanent disfigurement of face

A forensic expert does not qualify injuries of the face as a disfigurement, since this concept is not medical (it is judicial). It determines the type of damage, its features and the mechanism of formation, determines whether this damage is reparable or irreparable.

Reparability: significant decrease of the pathological changes (scar, deformation, mismanagement etc.), do not heal with time or cannot be removed with non-surgical means. Damage to the face is considered irreparable, when surgical intervention (cosmetic surgery) is necessary to eliminate pathological changes.

MODERATE DEGREE(MEDIUM) OF SEVERITY

For article 122 of The Criminal Code of Ukraine grievous injuries (punishment according to CC with *imprisonment for a term of three to five years.)*

1) not life-threatening;
2) not result in the consequences provided for by Article 121 of Criminal Code;
3) caused a lasting health disorder;
4) significant and persisting loss of not less than one-third of working capability.

Lasting health disorder: long term illness should be considered to be more than 3 weeks / more than 21 days.

Working capability loss not less than one-third: should be considered to loss of general working capacity from 10% to 33%.

SIMPLE DEGREE OF SEVERITY (minor bodily injury)

For article 125 of The Criminal Code of Ukraine:

Intended minor bodily injury:

(shall be punishable by a fine up to 50 tax-free minimum incomes, or community service for a term up to 200 hours, or correctional labor for a term up to one year)

Intended minor bodily injury that caused a short-term health disorder or insignificant loss of working capability:

(shall be punishable by community service for a term of 50 to 200 hours, or correctional labor for a term up to one year, or arrest for a term up to six months, or restraint of liberty for a term up to two years)

Short-term health disorder, meaning:

– a health disorder lasting more than six days, but not more than three weeks (21 days).

Insignificant loss of working capability, meaning:

– stable loss of general working capacity less than 10%.

Battery and torture

Battery does not constitute a special kind of injury. They are characterized by causing multiple strikes. If there are injuries after the drubbing on the body of the victim, they are evaluated for severity, based on the usual signs. If the beatings did not leave behind any objective traces, the forensic expert marks the complaints of the victim, indicates that the objective signs of damage are not revealed and does not establish the severity of bodily injuries.

Torture is the actions consisting in repeated or prolonged infliction of pain (pinching, flogging, tasks of numerous but small damages with blunt or sharp-pricking objects, the action of thermal factors and other similar actions.)

A forensic expert does not qualify damage as causing torture, because this is not within his competence (it is court`s). In such cases, the forensic expert must determine presents, character, localization, the amount of damage, the simultaneity or the time of their formation, the characteristics of the injured objects, the mechanism of their action, and the severity of the damage.

Test evaluation and situational tasks.

1. Choose the correct definition - an injury is

A. any bruise
B. any wound
C. disorder of anatomical structure or physiological function of human tissues or organs caused by the action of external forse
D. any anatomical disorder
E. any assault

2. Which kinds of severity do you know?

A. simple (mild), moderate and grievous
B. moderate and severe
C. only severe
D. simple (mild) and severe
E. contusion, scratch, incision

3. Which juridical criteria of grievous injuries do you know?

A. dangerous for life
B. which entailed loss of organ
C. which entailed steady loss of working capacity more than 33%
D. which entailed irreparable face disfigure
E. all these criteria

4. Find an injury dangerous for life at the moment of its infliction:

A. a penetrative wound into the thoracic cavity
B. an incised wound of the arm
C. a fracture of the nasal bones
D. a contusion of the brain
E. a firearm injury of the extremity

5. Choose the correct juridical criterion of moderate severity:
A. injuries threatening life
B. any firearm wounds
C. any injuries caused by the action of sharp objects
D. injuries which entail temporary loss of working capacity more than 3 weeks
E. all cases of sexual crimes

6. Which injury can be classified as moderate severity?
A. open fracture of the skull
B. rupture of the spleen
C. great internal bleeding
D. closed fracture of the radii
E. abrasion of the face

7. Simple (mild) severity means such damage which entails:
A. temporary loss of working capacity more than 3 weeks
B. temporary loss of working capacity less than 3 weeks
C. steady loss of working capacity more than 33%
D. steady loss of working capacity less than 33%
E. without loss of working capacity

8. During road accident V. received an opened fracture of right tibia. Indicate degree of severity.
A. severe
B. moderate
C. simple
D. its impossible to establish
E. no enough of data

9. Lady S. was beaten by her husband. As a result of this incident some bruises and abrasions on her body were formed. Forensic pathologist examined her and considered that injuries were:
A. dangerous for life
B. simple
C. moderate
D. grievous (severe)
E. very moderate

10. A soldier accidentally shot his friend with a carbine. A trauma was lethal. Some hours later a forensic pathologist investigated the body in an autopsy room and found a penetrative firearm wound of the head. Which severity of the damage did forensic pathologist determine?
A. moderate
B. simple

C. no simple
D. threaten to victim
E. grievous (severe)

Situatioonal tasks

TASK

In the moment of fight C. was inflicted blow by the rib of palm in the area of larynx. C. became pale and fell down on ground. He was given first-aid in the othorinolaringological department of hospital. Data from hospital chart: consciousness is absent, adinamical. Skin is pale, covered by sticky sweat. A pulse is threadlike, weak, 120 beats per min, blood pressure is 60/0 mm Hg. Performed PSR, successfully. At an inspection found out the break of cricoid. Discharged on 10th day».

To define and ground the degree of weight of bodily harms.

Basic Books.

1. DiMaio V. Forensic Pathology, 2nd ed. / V. DiMaio, D. DiMaio // Practical aspects of criminal and forensic investigation, Boca Raton, London, New York, Washington, D.C.: CRC Press, 2001, p.562.

2. Richard Shepherd - Simpson's Forensic Medicine/Twelfth Edition Senior Lecturer in Forensic Medicine Forensic Medicine Unit St George's Medical and Dental School Tooting, London, UK, 2003, p. 198.

3. Longauer A., Bobrov N., Labaj P. Practicing in forensic medicine, Faculty of Medicine, P. J. Safarik University Kosice, Slovak Republic, 2000, p.98.

4. Eckert, William G. Introduction to forensic sciences. / William G. Eckert second editon. - New York: Elsevier, 1992. – P. 385

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Supplementary Literature:

1. Color Atlas of Forensic Medicine and Pathology -Edited by Charles A. Catanese, USA, 2009, p. 424.

2. Color Atlas of the autopsy / Scott A. – Wagner Boca Raton London New York Washington, 2004, p. 226.

Informational resources:

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2. http://www.medicalstudent.com/
3. http://www.thestudentroom.co.uk/wiki/Resources_for_Medical_Students
4. https://quizlet.com
5. http://library.med.utah.edu/WebPath/webpath.html
6. http://www.webpathology.com/
7. https://www.geisingermedicallabs.com/lab/resources.shtml
8. http:// www.umsa.edu.ua
9. http://ukrmed.org.ua
10. http://sudmed-p.ru
11. http:/forens-med.ru
12. Electronic library.

METHODICAL INSTRUCTION FOR STUDENTS

Topic №6. "General information about poisons, mechanism of action and the basis of forensic medical diagnosis of poisoning. Forensic medical diagnosis of alcohol intoxication. Forensic medical examination of injury due to the action of high and low temperature. Forensic medical examination of injury due to action of electricity."

1. Relevance of the topic. The use of different poisons and alcohol in population is widespread enough. Determination of presence of poison in the organism of man appears important for diagnostics of degree of intoxication. Examination of poisoning is most often executed in connection with different offences. Such examinations meet in practice of medico-legal experts during the inspection of victims, defendants and other persons. Except it, the use of poisons and alcohol can be cause of death or to be complication of ordinary cardiovascular diseases and thus lead to sudden death.

2. Objectives:

- To define the ways of the poison entering into the human body.
- To explain the ways of the metabolization an excretion of the chemicals.
- To know the mechanism of action of poison on the organism of human.
- To know the methodology of collection of the tissue for toxicological analysis.
- To set the fact of poisoning and alcoholic intoxication and diagnose death from poisoning by an alcohol.
- To know the general groups of chemicals (poisons) that can lead to death

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	**Obtained skills**
Pharmacology	To know ways of the entering of the different chemical substances into the human organism; ways of the metabolization and excretion.
Chemistry	To know properties of the different chemical substances and their types of interactions
Anatomy	To have knowledge of structure of the human system of organs.
Histology	To explain histological structure of the human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	**Definition**

Toxicology	is a discipline, overlapping with biology, chemistry, pharmacology, medicine, and nursing, that involves the study of the adverse effects of chemical substances on living organisms[1] and the practice of diagnosing and treating exposures to toxins and toxicants.
Poison	substances that cause disturbances in organisms, usually by chemical reaction or other activity on the molecular scale, when an organism absorbs a sufficient quantity.
Pharmacodynamics	is the study of the biochemical and physiologic effects of drugs (especially pharmaceutical drugs).
Pharmacokinetics	is a branch of pharmacology dedicated to determining the fate of substances administered to a living organism.
A way of administration	in pharmacology and toxicology is the path by which a drug, fluid, poison, or other substance is taken into the body.
Side or adverse effect	is an effect, whether therapeutic, that is secondary to the one intended; although the term is predominantly employed to describe adverse effects, it can also apply to beneficial, but unintended, consequences of the use of a drug.
Synergic drug interaction	is the creation of a whole that is greater than the simple sum of its parts.
Antagonistic drug interaction	chemical impede the normal function of a system. They function to invert the effects of other molecules.
Vitreous body	is the clear gel that fills the space between the lens and the retina of the eyeball of humans and other vertebrates.
Alcohol dehydrogenases (ADH)	a group of dehydrogenase enzymes that occur in many organisms and facilitate the interconversion between alcohols and aldehydes or ketones with the reduction of nicotinamide adenine dinucleotide
Acetaldehyde dehydrogenases	dehydrogenase enzymes which catalyze the conversion of acetaldehyde into acetic acid.

4.2. Theoretical questions for the class:

- What is the classification of poisons?
- What are the ways of the poison entering into the human body?
- How poisons are metabolized in the human organism?
- What is the mechanism of action of poison on the human organism?
- What are the chemicals (poisons) that can lead to death?

4.3. Practical work (tasks) which are done on the class:

- To know signs on that diagnose the fact of poisoning and alcoholic intoxication, that determine the degree of alcoholic intoxication.

- To know morphological changes that it maybe to find out during autopsy in case of death from poisoning.
- To know the methodology of collection of the tissue for toxicological analysis.
- Code cause of death using ICD-10 during poisoning.

Block of information

✓ Poison is any substance, which being entered to the organism in relatively small amount may cause its chemical damaging, pathologic condition and even a death.

✓ Poisoning (from the general point of view) is a damage to the tissues by any chemical agent. Poisons biologically are of two main groups:

♦ Quantitative poisons. Any substance can act as a poison in a sufficient and increased quantity (therapeutic agents or remedy in excess of the prescribed dose or even a water has been drunk in a huge amount). For such a substances, especially for drugs, exists a proportion, which is called "RISK - BENEFIT" ratio (relation between the THERAPEUTIC EFFECT and the TOXICITY). For hard drugs this ratio is poor.

♦ Qualitative poisons. They are harmful in such small doses and have no treating effect (for example: cyanides, mercury, pesticides).

Clinical toxicology cases of poisoning have a certain occurrence - 1 in each 7 admissions to hospital (14 - 15 %). In that cases it is necessary to do these steps:

✦ to collect data of history of case
✦ to learn and observe physical signs
✦ to perform analysis of body fluids and tissues (urine, blood, stomach content). Poisoning from the point of view of forensic doctor may be of three types:

3. Accidental poisoning - most common.
4. Suicidal poisoning (suicidal gesture) - common.
5. Homicidal poisoning - rare.

<u>Accidental poisoning</u>

✦ individual (a child is eating medicinal tablets in mistake for sweets, a drunken person is drinking a pesticide or ethylene glycol anti-freeze from a beer-bottle in mistake for beer)
✦ faulty gas-appliances (CO, lack of oxygen)
✦ agriculture (paraquat, organophosphorus compounds [parathion])
✦ mass industrial disasters (contaminated cooking oil in Spain, dioxin gas in Italy and India, blastfurnace gas in East Slovakian Ironwork [11 victims]).

Suicidal poisoning

✦ mostly appears in advanced communities
✦ easy obtaining of toxic drugs and agricultural products
✦ decreased using of corrosive agents (acids, alkalis) - painful!

Homicidal poisoning

✦ the cases are rare (traditional weapons are arsenic and cyanide) but:

- new intention: immobilization instead killing of the victim for robbing (using benzodiazepines or narcotic analgetics mixed with alcoholic and non-alcoholic drinks)
- the newest intentions:
    - euthanasia (the death as a will of patient)
    - legal punishment (the fatal dose of hard somniferous drug intravenously instead shooting down or hanging).

The toxic and fatal dose

There are several questions concerning the estimation of a total dose of poisoning agent:

1. How long between taking the drug and death?
2. What is the absorption rate?
3. What is the detoxification rate?
4. Is that rate constant?
5. Is the drug completely absorbed?
6. Does the drug diffuse uniformly (variation between aqueous and lipoid body solubility)?

➔ *Different people have a wide range of individual sensitivity or resistance to a given substance with variation from time to time. It is inevitable to build large computer databases in toxicology laboratories.*

The doctor's duty in suspected poisoning

The main task is the management of the situation in the most effective way. The steps are:

1. Early recognizing the possibility of poisoning.
2. Instituting primary treatment, if the victim is alive.
3. Identifying and retaining any drugs or possible poisons.
4. In the case of death: full co-operation with the police in the investigation :
    - pick up data of full medical and psychiatric history
    - to estimate the schedule of drugs prescribed in the recent past

Main signs for the recognition of poisoning:

- sudden vomiting and / or diarrhea, changes of eye pupils, skin and mouth corrosions
- unexplained coma
- knowledge of a depressive illness in the past
- rapid onset of a neurological or gastrointestinal illness (occupational exposition to chemicals)

The collection and storage of samples for toxicological analysis

"Establishing continuity of evidence" means to ensure full identification. The doctor must do these things:

3. Venipuncture with placing the blood into an appropriate tube.
4. Labeling of the tube with:
    - patient's name
    - address (hospital number)

- date and time of taking blood
- doctor's signature

3. Taking the biological samples for toxicological investigation.
4. Labeling of the plastic bag or box for transport.
5. Medical notes (time and nature of the sample, the name of the person to whom it was given). Samples required for toxicological analysis:

- BLOOD in such amounts:
  - 15 ml in a plain tube
  - 5 - 10 ml in a tube containing an anticoagulant
  - 5 ml in sodium fluoride tube for alcohol estimation.
- URINE -20 - 30 ml (with no preservatives)
- VOMIT AND STOMACH CONTENTS placed in glass screw-topped jars, plastic tubes or containers
  - ➔ *At autopsy some laboratories request the stomach wall (for investigation of adhering tablet debris)*
- FAECES - 20 - 30 g in suspected heavy metal poisoning (arsenic, osmium, mercury, lead)
- LIVER, OTHER ORGANS AND FLUIDS:
  - liver: at least 100 g placed in a clean container
  - bile
  - kidney (a half of organ is enough)
  - lung (solvent abuse) placed in an impervious bag to avoid escape of toxic vapor
  - vitreous body of the eyeball
  - putreous fluid, living maggots in the case of advanced putrefaction and devastation of the body by maggots (to the glass screw-topped jars).
- HAIR AND NAIL CLIPPINGS are available to prove antimony, arsenic or thallium intoxication for many years after death. Neutron-activation analysis of hairs is to be done to determine the time of poison administration.
  - ➔ *A void contamination of taking samples!*

Main methods of toxicological investigation:

1. Screening (qualitative) methods:
   - express-methods with indicative papers and solutions
   - method of fluorescence polarization immunoassay
   - qualitative chemical reactions.
2. Semiquantitative methods:
   - thin-layer chromatography
   - densitometry.
3. Quantitative methods
   - gas chromatography (GC)
   - high performance liquid chromatography (HPLC)
   - mass spectrometry (MS)

On results the judicial-toxicological analysis of blood determine the degree of alcoholic intoxication. Such reference chart is thus recommended for determination of degree of alcoholic intoxication :

- less 0,3% about is absence of influence of alcohol
- 0,3-0,5%oh is insignificant influence of alcohol
- 0,5-1,55%oh is weak intoxication
- 1,5-2,5%oh is intoxication of middle degree
- 2,5-3,0%oh is strong intoxication
- 3,0-5,0%oh is the heavy poisoning by an alcohol, death can come
- 5,0-6,0%oh is the mortal poisoning.

These criteria were offered for determination of degree of alcoholic intoxication at living persons. However, they are used and at research of dead bodies. Thus apply such formulation the «indicated concentration of ethyl spirit in blood of dead body could answer in the time of life... degrees of intoxication».

Control test tasks

1. Which are a groups of poisons biologically?
   A. Quantitative poisons
   B. Accumulative poisons
   C. Qualitative poisons
   D. Liver poisons
   E. Antidotes
2. What is “risk - benefit" ratio?
   A. detoxification rate
   B. biological half-life
   C. range of individual sensitivity or resistance
   D. relation between the therapeutic effect and the toxicity and their doses
   E. variation between aqueous and lipoid body solubility.
3. Which of the following is not used in methyl alcohol poisoning :
   A. Gastric lavage
   B. Dialysis
   C. Ethyl alcohol
   D. High doses of vitamin B12
   E. Nothing from the above
4. Which compound is belong to carboxyhemoglobin ?
   A. O_2+Hb
   B. CO_2+Hb
   C. CO+Hb
   D. NO+Hb
   E. Fe+Hb
5. Pinky red postmortem lividity (hypostasis) is seen in:
   A. Aniline
   B. CO
   C. Phosphorous
   D. Hydro cyanide

E. Alcohol

6. At autopsy the cyanide poisoning case will show the following features except:
   A. Characteristic bitter lemon smell
   B. Congested organs
   C. The skin may be pinkish or cherry red in color
   D. Erosion and hemorrhages in esophagus and stomach
   E. Nothing from the above
7. A man working as a pest killer comes to OPD with pain abdomen garlic odor in breath and transverse lines on nails. Most likely the person is having:
   A. Arsenic poisoning
   B. Lead poisoning
   C. Mercury poisoning
   D. Cadmium poisoning
   E. Alcohol poisoning
8. Extremely narrow pupil of the eyes indicates on
   A. Arsenic poisoning
   B. CO poisoning
   C. Mercury poisoning
   D. Cadmium poisoning
   E. Opioids poisoning
9. How does alcohol metabolize in the human organism?
   A. Mostly transforms in liver
   B. Mostly eliminates with urine
   C. Mostly eliminates with exhaled air
   D. Mostly eliminates with sweat
   E. Eliminates equally by all ways
10. What is passage of poison across the wall of the stomach and small intestine into the bloodstream:
   A. absorption
   B. excretion
   C. elimination
   D. metabolization
   E. exhalation

CASE FILE TASK

A man was get out from seat of fire. Skin, cloth and hair are burnt, crunchy with carbonization, gray and black color. During internal examination reviled: soft tissues pinky and red color, soot on the surface of the mucosa of the tongue, nasal passages, trachea, larinx. Subpleural and subepicardial dotted hemorrhages. No injury. Toxicology: carboxyhemoglobin in blood – 34%; alcohol in blood – 5,1%.

Determine cause of death. Explain the answer.

Basic books:

1. DiMaio V. Forensic Pathology, 2nd ed. / V. DiMaio, D. DiMaio // Practical aspects of criminal and forensic investigation, Boca Raton, London, New York, Washington, D.C.: CRC Press, 2001, p.562.

2. Richard Shepherd - Simpson's Forensic Medicine/Twelfth Edition Senior Lecturer in Forensic Medicine Forensic Medicine Unit St George's Medical and Dental School Tooting, London, UK, 2003, p. 198.

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10. http://sudmed-p.ru
11. http:/forens-med.ru
12. Electronic library.

METHODOLOGICAL INSTRUCTION FOR STUDENTS*:*

Topic №7. "General questions of forensic traumatology. Blunt force trauma. Forensic justification for mechanism of injury and the cause of death from the effects of blunt objects. Injuries of the oral mucosa and teeth. Injuries caused by teeth. Fractures of the facial bones. Falls from height (katatrauma*).*"

1. Relevance of the topic. Forensic examination of injuries caused by blunt and sharp object is an important section of forensic medical traumatology, since such injuries are the most widespread. They can occur in every day life activities, sports activities, in criminal actions (in cases of crimes against human life). Such real situations can result in death frequently. Forensic examination is required in all these cases where specific medicolegal questions such as cause of death, type of traumatic instrument, mechanism of it's action, time of injury etc., must be solved. That is why any physician or forensic expert should know perfectly a morphological properties of injuries caused by the blunt and sharp objects and to be able to investigate and to describe correctly in a medical documents. Generally answers to these questions help to police officers in a crime detection.

2. Objectives:

- To define terms of a trauma, traumatism.
- To classify a types of the blunt objects.
- To determine injuries of the soft tissues caused by blunt objects.
- To know forensic significance of abrasions, bruises, scratches, contusions, wounds.
- To interpret general and typical signs of wounds caused by blunt instruments.
- To define internal injuries and bone fractures inflicted by blunt objects.
- To classify a types of the sharp objects.
- To define general (typical) signs of wounds caused by a sharp instruments.
- To make forensic diagnostics of an incised wounds.
- To know typical signs of wounds caused by stabbing instruments (single- and double-bladed, thrust weapon with verges and without verges).
- To define morphological features of chopped injuries. Variants of the axe action to a human body.

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	**Obtained skills**
Physics	To have knowledge of Newton's laws of motion, types of the deformation
Anatomy	To have knowledge of structure of the human body and organs.
Histology	To explain histological structure of the human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	Definition
Abrasion	is a wound caused by superficial damage to the skin, no deeper than the epidermis.
Contusion, bruise	is a type of hematoma of tissue, in which capillaries and sometimes venules are damaged by trauma, allowing blood to seep, hemorrhage, or extravasate into the surrounding interstitial tissues.
Laceration	is a type of injury which happens relatively quickly in which skin is torn, cut, or punctured (an open wound)
Bone fracture	is a medical condition in which there is a damage in the continuity of the bone.
"tramline" or "railway line"	bruise caused by a blow from a linear object. This pattern occurs because the major stretching and shearing of the skin occur at the edges of contact and not directly beneath the center of the object, which is simply compressed.
Hematoma	is a localized collection of blood outside the blood vessels, due to either disease or trauma including injury or surgery and may involve blood continuing to seep from broken capillaries.
Trauma	is injury or damage to a biological organism caused by external harmful factors (physical, mechanical, chemical, biological)
"Bridges" of tissue, "bridging fibers"	is incomplete separation of the stronger elements, such as blood vessels and nerves, so that when one looks into the depth of the laceration due to different components of soft tissue have different strengths

4.2. Theoretical questions for the class:

- What is modern forensic classification of blunt and sharp objects.
- What is the definition of the terms of a trauma, traumatism.
- What are the injuries of the soft tissues caused by blunt objects.
- What is the mechanism and morphogenesis of the injuries caused by blunt force and in cases of falling from height.
- What are the general and typical signs of the wounds inflicted by blunt objects.
- What is the mechanism and morphogenesis of injuries inflicted by sharp objects.
- What are the specific and typical signs of wounds caused by sharp instruments.

4.3. Practical work (tasks) which are done on the class:

1. Describe wounds caused by action of blunt and sharp objects.
2. Determine a kind of traumatic blunt and sharp objects according to definite morphological features of the wounds.
3. Make up complete forensic conclusions in cases of violence when different blunt or sharp instruments were used.
4. To make a correct scheme of wounds description in initial medical documents.

Block of information

Blunt force trauma –an injury produced by a blunt object striking the body or impact of the body against a blunt object or surface.

Blunt object when an object, usually without a sharp or cutting edge, impacts the body or the body impacts the object.

Wounds of **Blunt force trauma** indicate:

- Fact of trauma;
- Number of impacts;
- Shape and size of injuring object;
- Direction of injuring action;
- Strength of injuring action;
- Remoteness of injury;
- Was a person alive when injury was inflicting.

The severity, extent, and appearance of the injury produced by blunt trauma is determined by:

1. **Nature of the weapon** (*A weapon with a flat surface, such as a board, diffuses the energy over a broader area, resulting in a less severe injury than one caused by a narrow object, such as a pipe, delivered with the same amount of energy. A weapon, which is easily deformed or broken upon impact, will deliver less energy to the impacted surface.*)
2. **Amount of body surface over which the force is delivered**. (*The greater the area over which the force is delivered, the less severe the wound, as the force is dissipated. A blow delivered to a rounded portion of the body (i.e., head) will cause a more severe injury than one delivered to a flat surface (i.e., the back), where a larger area of contact leads to a dispersion of the force.)*
3. **Amount of force delivered to the body by the blow.**
4. **Time over which the force is delivered**. (*In general, if the period of time over which a force is delivered is* increased, *a less severe injury will result than if the same force was delivered in a* shorter *period of time.)*
5. **Region of body impacted by the blow.**

Types of injury

- Abrasions
- Contusions
- Lacerations
- Fractures of the skeletal system.

An abrasion is the most superficial type of injury and affects only the epidermis.

A skin injury caused by scraping off of superficial skin due to friction against a rough surface.

(As the epidermis does not contain blood vessels, abrasions should not bleed, but the folded nature of the junction between the dermis and the epidermis and the presence of loops of blood vessels in the dermal folds will mean that deep abrasions have a typical punctate or spotty appearance)

- Anternortem abrasions appear reddish-brown, red, dark red,
- in contrast to postmortem abrasions, which usually appear yellow and/or translucent, due to a lack of blood flow, so cold parchmented abrasion (*Postmortem insect bites, caused by ant or cockroach activity after death, can mimic true abrasions, and are often misinterpreted as such by inexperienced physicians and law enforcement personnel*

Abrasions are usually caused by tangential glancing impacts but they can also be caused by crushing of the skin when the force is applied vertically down onto the skin.

The size, shape and type of abrasion depend upon the nature of the surface of the object which contacts the skin, its shape and the angle at which contact is made.

(Contact with the squared corner of an object may well result in a linear abrasion, whereas contact with a side of the same object will cause a larger area of abrasion.)

The direction of the causative force can be identified by inspecting the wound – with a hand lens if necessary – and identifying the torn fragments of the epidermis which are pushed towards the furthest (distal) end of the abrasion.

If one end of a wound has margins with raised skin, for example, the force originated from the opposite side.

(a portion of the skin scraped free may remain attached to the body, at the edge of an abrasion, thus indicating the direction in which the scrape occurred.)

Types of abrasions:

1. Scrape (or brush) abrasions caused by a scraping-type of injury.

(*May denude the epithelial layer only or extend deep into the dermis. Examples include linear abrasions, or scratches, sliding abrasions seen on lower extremities of pedestrian struck by motor vehicle, dragging abrasions (may be ante- or postmortem*).)

2. Brush burn abrasion (*is a term commonly used to describe a scraping injury over a large area of the body, such as the back; such injuries, when dry, may be very firm, even though no true "scab" is present*)

3. Impact (pressure) abrasions (*are caused when the force is delivered perpendicular to the skin, so that the skin is crushed by the force, usually over a bony prominence. Impact abrasions may occur as a body collapses to the ground, or is thrown against a flat surface, at the time of death (perimortem), or immediately after death (postmortem*)).

4. A patterned abrasion

Crush abrasions are important because they retain the pattern of the causative object. (is a variation of the impact abrasion, where the pattern of the object, or pattern of an intermediary object such as clothing, is imprinted on the skin underlying the point of impact.)

- Patterned injuries should be photographed from various angles, and directly with a scale, for size comparison, in the picture. (*Diagrams and sketches can be extremely useful and, if possible, scaled photographs should be taken. Many different objects have been identified in this way: car radiator grills, the tread of escalator steps, plaited whips and the lines from floor tiles*.)
- The use of alternative light sources, such as UV light, may reveal, in some cases, patterned injuries not readily apparent with visible light.

CONTUSIONS

Is the rupture of a blood vessel and the leakage of blood from the site of rupture into the surrounding tissues.

(*Bruising is most commonly seen in the skin, but it can also occur in the deeper tissues, including muscle and internal organs*.)

The extent of the damage to the blood vessels is proportionate to the force applied: in general terms, the greater the force, the more blood vessels are damaged, the greater the leakage of blood and the bigger the bruise.

(The blood leaks into the tissues along the fascial planes and so a bruise will not reliably reproduce the object which caused it and, as a bruise ages, the spread of the blood and so the relationship between the size and shape of the bruise and the causative object reduce.)

But sometimes bruises can reproduce the nature of the object that caused them.

(Once outside the confines of the blood vessel, blood is considered by the tissues to be foreign and they immediately begin to degrade and remove it. This degradation results in the color change of a bruise that is so well known.)

A contusion changes color as hemoglobin undergoes degradation. The color progresses from blue or red, to red-blue, to green, to brown, and finally yellow. These

color changes, however, may appear out of order and may overlap. There is no way to know how long each color stage lasts. Occasionally a recent contusion has a brown tinge. The color of the edge of a bruise usually is the best indicator of age, the oldest color being at the edge.

In general terms, a bruise will initially be blue/dark blue/purple (depending on the amount of blood within the tissues) and it will then change to brown to green to yellow as the hemoglobin passes through various stages of degradation.

(The speed of these changes is variable and it is not possible to use the color changes as a 'clock' or 'timetable' of the bruise. Even in one individual, two bruises inflicted at the same time may differ in their appearances during resolution.)

As a very broad rule of thumb, a small bruises in a fit young adult will resolve in about 1 week. Research in the 1980s showed that if yellow was identified, the bruise was over 18 hours old, whereas if no yellow could be seen, the bruise could not be reliably aged.

It is essential to remember that the skin from Asians, Africans and blacks has a layer of melanin pigment of varying intensity. This will reduce the visibility of a bruise and will mask the color changes that occur.

(In the examination of a living victim with dark skin, a bruise may only be identified by palpation. Pathologically, it is possible to identify bruising by dissection and inspection of the undersurface of the skin.)

Although bruises do not reflect with any accuracy the object causing them, but there are some particular patterns that indicate the type of weapon used.

One such pattern is the 'tramline' or 'railway line' bruise caused by a blow from a linear object.

This pattern occurs because the major stretching and shearing of the skin occur at the edges of contact and not directly beneath the centre of the object, which is simply compressed. Impact by a hard ball produces concentric rings of bruising for similar reasons.

The patterns of bruises are extremely important: a row of oval or round bruises may be due to impact by the knuckles in a punch; groups of small oval or round bruises are also indicative of fingertip pressure as in gripping and there is sometimes a single, larger, thumb bruise on the opposite side of the limb. Fingertip bruises on the neck or along the jaw line are commonly seen in manual strangulation.

Lacerations are the result of a blunt force overstretching the skin and the result is a split, which usually passes through the full thickness of the skin.

(A laceration is deep and will bleed.)

Lacerations are most common where the skin can be compressed between the applied force and underlying bone (i.e. over the scalp, face, elbows, knees, shins etc).

(They are rare (unless severe force has been applied) over the soft, fleshy areas of the body such as the buttocks, breasts and abdomen.)

Because the skin is composed of many different tissues, some of the more resilient tissues will not be damaged by the forces that split the weaker tissues. These most resilient tissues are often nerves, the small fibrous bands of the fascial planes and, sometimes, at the base of the laceration, the occasional medium-sized elastic blood vessels. These fibers arch across the defect in the skin and are referred to as 'bridging fibers'.

When the force applied to the skin is more tangential, as in the rolling or grinding action of a vehicle wheel, the laceration may be horizontal and result in a large area of separation of skin from the underlying tissues. This can be termed 'flaying'.

(The margins of a laceration are always ragged; however, if a thin regular object inflicts an injury over a bony area of the body, the wound caused may look very sharply defined and can be mistaken for an incised injury. Careful inspection of the margins will reveal some crushing and bruising, and examination of the inner surfaces of the wound will reveal the presence of bridging fibers. The laceration may reflect the object causing it if that object is straight, but this wound is a poor reproducer in other circumstances.)

SKELETAL FRACTURES DUE TO BLUNT FORCE TRAUMA

Bone fractures are caused by *direct* and *indirect* trauma.

1. Direct trauma is subdivided into three types, depending on the amount of force applied and the size of the area impacted:

- *focal* (tapping) fracture:
  - produced by small force striking a small area:
  - usually transverse;
  - in regions where two bones lie adjacent to each other, usually only one bone is fractured.
- crush fracture—produced by a great force striking a large area:
  - usually comminuted;
  - usually accompanied by soft tissue injury.
- penetrating fracture:
  - produced by a great force striking a small area (i.e., gunshot wound).

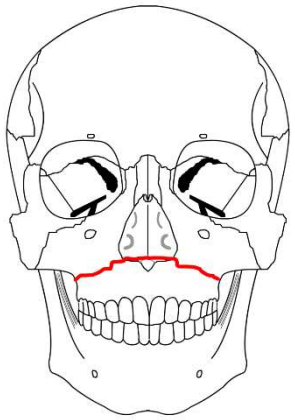
2.Indirect trauma is produced by a force acting at a location removed from the fracture site.

Subdivided into (6) categories:

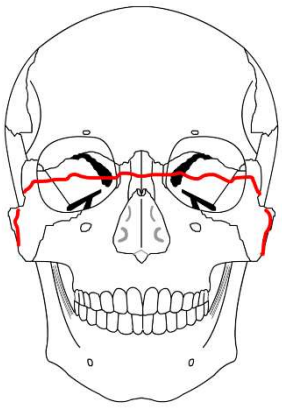
1) traction fracture – bone pulled apart;

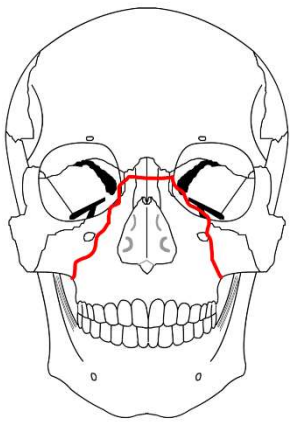
2) angulation fracture – bone is bent until it snaps; usually a transverse fracture is produced;
3) rotational fracture – bone is twisted, producing a spiral fracture;
4) vertical compression fracture – produce, oblique fracture of the v body of long bones; in the femur, this produces a T-shaped fracture at the distal end of the bone;
5) angulation and compression fractures are usually curved, not transverse;
6) angulation, rotation, and compression fractures.

A Le Fort fracture of the skull is a classic transfacial fracture of the midface, involving the maxillary bone and surrounding structures in either a horizontal, pyramidal or transverse direction. The hallmark of Lefort fractures is traumatic pterygomaxillary separation, which signifies fractures between the pterygoid plates, horseshoe shaped bony protuberances which extend from the inferior margin of the maxilla, and the maxillary sinuses. Continuity of this structure is a keystone for stability of the midface, involvement of which impacts surgical management of trauma victims, as it requires fixation to a horizontal bar of the frontal bone. The pterygoid plates lie posterior to the upper dental row, or alveolar ridge, when viewing the face from an anterior view. The fractures are named after French surgeon *René Le Fort* (1869–1951), who discovered the fracture patterns by examining crush injuries in cadavers.



LeFort I fracture





Le Fort I fracture (horizo n as y result from a force of injury directed low on the maxillary alveolar rim, or upper dental row, in a downward direction. The key component of these fractures, in addition to pterygoid plate involvement, is involvement of the lateral bony margin of the nasal opening. They also involve the medial and lateral buttresses, or walls, of the maxillary sinus, traveling through the face just above the alveolar ridge of the upper dental row. At the midline, the inferior nasal septum is involved. Historically, it has also been referred to as a Guérin fracture, although this name is less commonly used in practice.

Le Fort II fracture (pyramidal) may result from a blow to the lower or mid maxillary area. The key component of these fractures beyond the pterygoid plate fractures is involvement of inferior orbital rim. When viewed from the front, the fracture is classically shaped like a pyramid. It extends from the nasal bridge at or below the nasofrontal suture through the superior medial wall of the maxilla, inferolaterally through the lacrimal bones which contain the tear ducts, and inferior orbital floor through or near the infraorbital foramen.

Le Fort III fracture (transverse), otherwise known as craniofacial dissociation, may follow impact to the nasal bridge or upper maxilla. The salient feature of these fractures, beyond pterygoid plate involvement, is that they invariably involve the zygomatic arch, or cheek bone. These fractures begin at the nasofrontal and frontomaxillary sutures and extend posteriorly along the medial wall of the orbit, through the nasolacrimal groove and ethmoid air cells. The sphenoid is thickened posteriorly, limiting fracture extension into the optic canal. Instead, the fracture continues along the orbital floor and infraorbital fissure, continuing through the lateral orbital wall to the zygomaticofrontal junction and zygomatic arch. Within the nose, the fracture extends through the base of the perpendicular plate of the ethmoid air cells, the vomer, which are both part of the nasal septum. As with the other fractures, it also involves the junction of the pterygoids with the maxillary sinuses. CSF rhinorrhea, or leakage of the nutrient laden fluid that bathes the brain, is more commonly seen with these injuries due to ethmoid air cell disruption, as the air cells are located immediately beneath the skull base.

Bitemarks

Definition of a Bitemark

Cutaneous bitemarks represent patterned injuries in skin produced by teeth. Those of forensic significance most often accompany violent crimes such as homicide, sexual assault, child abuse, domestic violence, and battery. Bitemarks can also be inflicted by animals, most notably dogs and cats.

Significance

Each human dentition is unique, differing even in identical twins. Its imprint in skin can show this individualization. Accordingly, perpetrator identification is possible. For this reason, bitemarks have been referred to as “dental fingerprints”. The analogy is superfluous. Bitemarks seldom mark with the rubber stamp accuracy expected with fingerprints. Yet, in some ways bitemarks are more valuable. Fingerprints found at a scene indicate only that a suspect was there. They do not imply criminal activity or a time relationship to the crime. Bitemarks suggest an altercation between the victim and perpetrator, and their temporal coincidence to a crime can be determined. Even in cases where a biter cannot be identified, the mere presence of a bitemark supports the allegation that sexual assault or child abuse has occurred. When a suspect claims that intercourse was consensual or when the sole caretaker of a child alleges that the fall was accidental, the presence of a bitemark suggests otherwise.

Control test tasks

1. To the factors of outward environment, that can operate on an organism and cause damages, take:

A. Biological
B. Physical
C. Psychoemotional influences
D. Chemical
E. Medicinal facilities and gaseous substances

2. All of the following are true statements regarding injuries, except:

A. It is harm caused illegally to a person regarding body, mind, reputation or property
B. Physically violent injuries are mechanical injuries
C. All injuries are wounds but all wounds are not injuries
D. Disorder of anatomic structure of human tissues or organs caused by the action of different environmental factors (mechanical, physical, chemical etc.).
E. It entails health disorder or death.

3. Effusion of blood in the tissues due to violence is:

A. Wound
B. Abrasion
C. Scratch
D. All are false
E. Bruise

4. Bruise of eyelids, which extend to the check or even lower may be due to the remote effect of:

A. Fracture of nasal bone
B. Meningitis
C. Fracture of the base of anterior cranial fossa
D. Fracture of the base of medium cranial fossa
E. Fracture of the base of posterior cranial fossa

5. During healing process in bruise, livid red color appears:

A. Before greenish
B. After greenish
C. Before bluish black
D. After yellowish
E. Before yellowish

6. What injuries are firstly bright red and then change to yellow with no bluish or green:

A. Petechial hemorrhages
B. Incised wounds
C. Grazes

D. Subconjunctival hemorrhages
E. Contusions

7. Suicidal bruises are rare because of:
A. More penalty to the person to be involved
B. More pain
C. More skill required to produce it
D. All are true
E. All are false

8. All are true about postmortem bruise, except:
A. No color changes
B. No clotting of blood in the tissues
C. No swelling of tissue
D. Cannot be produced 2 hours after death at any part of the body
E. All are false

9. A dead body was found on the street. Forensic autopsy was done later and revealed a linear fracture of the occipital bone and contusion of the brain. Try to determine the cause of death:
A. Falling down from a height (pedestrian`s falling).
B. Collision of a moving car with a man.
C. Compression between automobiles.
D. Trauma made by wheels of a car.
E. Falling from an automobile

10. Which one of the following is an incorrect statement about incised wounds:
A. There are caused by sharp edges or cutting weapons
B. There are broader than edge of weapon causing it
C. Margins are usually everted
D. Their length is more than depth
E. They have no any slight cuts and notches in the ends

11. The common suicidal incised wound is:
A. On the back of the left index finger
B. On the back of the right index finger
C. On the back of the left foot
D. On the anterior side of the left arm
E. On the back of the right foot

12. The most typical wound with a false change is:
A. Incised wound
B. Abraded wound
C. Lacerated wound
D. Contused wound
E. Chopped wound

13. All the statements are true about postmortem wounds except:
A. Signs of blood spurting on the body

B. The edges are inverted
C. The edges do not gape
D. No inflammation
E. No blood spurting

14. A wound with oval margins can be produced by:
A. A knife
B. A file
C. Long pointed conical weapon
D. A dagger
E. A nail

1 – A,B,D; 2-C; 3 - E; 4 - C; 5 - C; 6 - D; 7 – D; 8 – B; 9 – A; 10-E; 11 - D; 12 - A; 13 - A; 14 - C;

Situational tasks

TASK 1.

During medico-legal research of dead body of deceased man, 49 years old, found out such damages. On the front surface of the left thigh in the his middle third on height of a 72 cm from a foot there is a scratch of the uneven oval shape, sizes is 5x7 cm, covered by a scab that is located higher than level of surrounded skin with decorticating on periphery of scratch. On a right knee there is the rounded bruise 4x3cm in size. green-yellow color on periphery.

Task.

To define the remoteness of infliction of damages.

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METHODICAL INSTRUCTION FOR STUDENTS*:*

Topic №8. "*Sharp force trauma.*"

1. Relevance of the topic. Forensic examination of injuries caused by sharp object is an important section of forensic medical traumatology, since such injuries are the most widespread. They can occur in every day life activities, sports activities, in criminal actions (in cases of crimes against human life). Such real situations can result in death frequently. Forensic examination is required in all these cases where specific medicolegal questions such as cause of death, type of traumatic instrument, mechanism of it's action, time of injury etc., must be solved. That is why any physician or forensic expert should know perfectly a morphological properties of injuries caused by the sharp objects and to be able to investigate and to describe correctly in a medical documents. Generally answers to these questions help to police officers in a crime detection.

2. Objectives:

- To classify a types of the sharp objects.
- To determine injuries of the soft tissues caused by sharp objects.
- To interpret general and typical signs of wounds caused by sharp instruments.
- To define internal injuries and bone fractures inflicted by sharp objects.
- To classify a types of the sharp objects.
- To define general (typical) signs of wounds caused by a sharp instruments.
- To make forensic diagnostics of an incised wounds.
- To know typical signs of wounds caused by stabbing instruments (single- and double-bladed, thrust weapon with verges and without verges).
- To define morphological features of chopped injuries. Variants of the axe action to a human body.

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	**Obtained skills**
Physics	To have knowledge of Newton's laws of motion, types of the deformation
Anatomy	To have knowledge of structure of the human body and organs.
Histology	To explain histological structure of the human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	**Definition**

Stab wounds	are produced by pointed instruments. Most are homicidal. In stab wounds, the depth of the wound track in the body exceeds its length in the skin.
Incised wounds	are produced by sharp-edged weapons or instruments. A knife is the classical example of a weapon used to inflict an incised wound, though, in fact, any instrument with a sharp edge can do so e.g., a piece of glass, metal, or paper.
Chop wounds	are produced by heavy instruments with a cutting edge, e.g., axes, machetes, and meat cleavers.
Langer's lines	are a pattern of elastic fibers in the dermis of the skin, which is approximately the same from individual to individual.
Y- or L-shaped wound	a knife might produce this type of wound in case if it`s withdrawn from the body, it may be twisted or the person stabbed may move.
"hesitation" stab wounds, "hesitation marks"	multiple suicidal stab or incised wounds vary in size and depth around or next to the usually only one or two "final" stab wounds going into an internal organ.
"Bitemark"	in skin produced by teeth. Each human dentition is unique, differing even in identical twins. Its imprint in skin can show this individualization.

4.2. Theoretical questions for the class:

- What is modern forensic classification of sharp objects.
- What is the definition of the terms of a trauma, traumatism.
- What are the injuries of the soft tissues caused by sharp objects.
- What is the mechanism and morphogenesis of the injuries caused by sharp force.
- What are the general and typical signs of the wounds inflicted by sharp objects.
- What is the mechanism and morphogenesis of injuries inflicted by sharp objects.
- What are the specific and typical signs of wounds caused by sharp instruments.

4.3. Practical work (tasks) which are done on the class:

1. Describe wounds caused by action of sharp objects.
2. Determine a kind of traumatic sharp objects according to definite morphological features of the wounds.
3. Make up complete forensic conclusions in cases of violence when different sharp instruments were used.
4. To make a correct scheme of wounds description in initial medical documents.

SHARP FORCE TRAUMA

By definition, these are wounds produced by a pointed instrument (i.e. knife, ice pick), in which the depth of penetration into the body is greater than the length of the wound on the skin. Stab wounds, therefore, consist of an outer, visible skin wound (external component) and a deeper, inner wound (internal component).

2. A distinguishing characteristic of stab wounds is the absence of "bridging tissue" in the depth of the wound.

If connecting tissue strands are present in the base of the wound, it is more likely the wound was produced by a blow with a blunt object, and not a stab with a sharp-edged implement, as the latter would cut through, not tear, the tissue. Therefore, the terms laceration and stab wound (or cut) should never be used interchangeably.

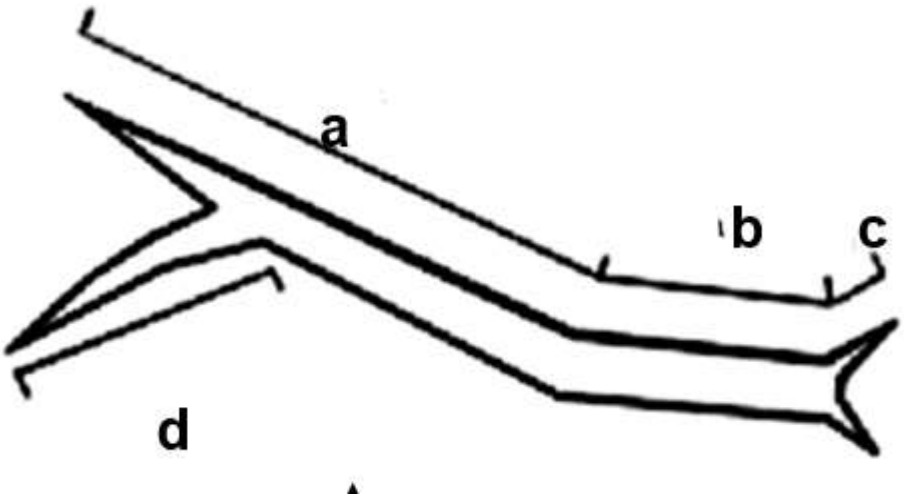
Straight wound edges, instead uneven edge blunt force wounds.

Sharp wound ends (V-shaped margin), instead blunt edges blunt force wounds

3. A knife is the most common weapon used to produce a stab wound. Other instruments which can cause stab wounds are ice picks, scissors, forks, pencils or pens, screwdrivers, knitting needles, or any similar device with a relatively pointed end capable of penetrating the skin.

The size and shape of a stab wound on the skin (external component) is dependent upon:

1. shape of the weapon:
2. sharp weapon tends to produce a regular, linear wound without abraded margins;
3. the external skin wound produced by a *single-edged* weapon should have a squared-off or blunted margin (produced by the dull edge, or back of the blade) and a V-shaped margin (produced by the sharp edge of the blade);
4. both margins of the external skin wound produced by a *double- edged* weapon should appear V-shaped
5. movement of the blade within the wound, or movement of the individual stabbed as the blade is withdrawn from the body. In either case, the resulting wound may be Y or L-shaped;
6. scissors tend to produce linear wounds if closed, but paired perforations if open;
7. a Phillips screwdriver may produce a circular wound with four equally spaced cuts or abrasions;
8. A serrated knife may leave a saw-tooth cut on the body, if the blade of the knife encounters the skin at an oblique or shallow angle;
9. The angle of thrust;



part a formed with sharp edge of the blade;

part b formed with bevel knife while knife immersion

part c formed with the dull edge, or back of the blade

part d as the blade is withdrawn from the body.

3. The state of tension or relaxation of the skin stabbed;

i. Langer's lines. Bundles of collagen and elastic fibers in the dermal layer of the skin are mostly arranged in parallel rows. The direction of these rows is referred to as the lines of cleavage, or Langer's lines.

In the extremities, these lines tend to run longitudinally; in the neck and trunk, these lines tend to run circumferentially.

a. if a stab wound is made parallel to the lines of cleavage, the wound will tend to be narrow, slit-like, or thin;

b. if a stab wound is made perpendicular to the lines of cleavage, the fibers in the skin will tend to pull the edges of the wound apart, causing an open, gaping wound;

c. if a stab wound is made diagonally across the lines of cleavage, a curved or semi-lunar wound may result.

The length of the wound in the skin (external component) may be equal to, greater than, or less than the width of the knife blade. The depth of the stab wound (internal component) may be equal to, less than, or greater than the length of the knife blade.

A patterned skin abrasion or contusion may be produced by the guard of the knife contacting the skin if the weapon is driven into the body with

great force. The guard on a knife is a separate piece of metal which is perpendicularly attached to the blade, between the blade and the handle, which keeps the hand away from the blade while cutting.

Single-edged weapons may produce skin wounds in which both ends are squared-off or blunted, if the weapon has been driven in up to the guard. This happens because in most knives, a short section of the blade (ricasso) immediately in front of the guard is unsharpened on both edges.

If the knife or stabbing weapon encounters bone, the tip of the weapon may break off and remain in the body. For this reason, victims stabbed multiple times, or having stab wounds into bone, should be radiographed prior to autopsy. If the x-rays reveal a fragment of metal retained within the body, this fragment should be recovered in the same fashion as a bullet, taking care to preserve any toolmarks that may be present, as it is possible to match the metal fragment found at autopsy with the weapon.

Stab wounds may be homicidal, suicidal, or accidental:

- in suicidal stabbings:
- the wounds are usually multiple and to the mid or left anterior chest, with most of the wounds superficial or barely breaking the skin ("hesitation wounds");

"Hesitation" marks or wounds may be present, and are commonly found in association with incised wounds of the wrists or neck. These are very superficial cuts, usually multiple, parallel to each other, and found in association with a deeper, fatal incised wound of the neck or wrist.

1. the stab wounds do not usually go through the clothing, consistent with the individual pushing aside or pulling up the clothing prior to stabbing him/herself;
2. stab wounds to the neck or head do occur occasionally, but these are much less common than those to the chest; suicidal stab wounds to the abdomen are very rare;
3. in homicidal stabbings:
4. multiple wounds are usually present, with most penetrating deep into the body;
5. most fatal chest wounds involve injury to the heart or aorta. A stab wound to the heart that severs the left anterior descending artery can cause rapid death;

Accidental stabbings:

- an occur, but are very rare;
- usually involve an individual being impaled after an accidental fall onto a sharp or pointed object, or by a moving sharp object striking the individual.

Defense stab wounds

- occur usually to the hands, extensor or ulnar aspects of the forearm, or backs of the upper arms of an assault victim. These wounds are produced as the victim attempts to defend him/herself from the assailant.
- defense wounds are rarely fatal by themselves.

- defense wounds of the lower extremities can also occur, but are much less common than those of the upper extremities. These wounds result from the victim being assaulted while lying down, usually face up, as he/she kicks at the assailant.

INCISED WOUNDS

An incised wound is defined as a wound produced by a sharp-edged weapon or instrument, which is longer on the skin than it is deep. In other words, the length of the wound on the outer aspect of the body (external component) is greater than the depth of the wound track within the body (internal component).

Incised wounds are usually not fatal. However, fatal incised wounds can occur, which usually involve the neck or arms.

Like stab wounds, incised wounds will lack "bridging tissue" within the depth of the wound.

Sharp-edged weapons produce clean, sharply incised wounds without associated abrasions or contusions of the wound edge. A dull-edged weapon may produce an irregular incised wound with abraded or contused edges.

b. Suicidal incised wounds:

i. are usually to areas of the body accessible to the individual;

ii. as with stab wounds, clothing may be open, or pulled away from the injured area, providing good evidence that the wound is in fact a suicidal one;

iii. fatal incised wounds of the arms (wrists, antecubital fossae) are almost always suicidal, unless the scene clearly indicates an accidental manner of death.

1. The wrist and arm wounds are usually to the anterior (flexor) surface of the wrist or forearm.
2. Right-handed individuals tend to cut the left wrist or forearm, while left-handed persons tend to do the opposite. Occasionally, cuts are present on both arms or wrists.
3. In the investigation of a possible suicide by other means, such as overdose, the pathologist should always carefully inspect the anterior arms and wrists for the presence of superficial linear scars, which may have resulted from a prior suicide attempt.

c. **Accidental incised wounds** are rare, but do occur. The majority of these cases involve glass fragments accidentally injuring a major blood vessel leading to exsanguinations (обескровливание) or air embolus.

d. **Homicidal incised wounds**, when present, are usually associated with multiple stab wounds. Lethal homicidal incised wounds are usually to the neck. If the incised wound is inflicted from the front, the resulting wound is usually short and angled, but occasionally horizontal wounds are seen. An assailant holding a knife in his right hand and slashing at a victim from the front will tend to produce incised wounds of the victim's left neck, and vice versa. Extremely deep incised wounds of the neck can

completely transect the trachea or larynx, and extend to the vertebral column, producing near decapitation. These wounds are almost always inflicted from behind.

e. **"Defensive incised wounds"** usually occur to the upper extremities, as the victim assumes a defensive posture, with his/her upper extremities thrown up between the weapon and their body, or as the victim attempts to grab the offending weapon and encounters the blade of the knife. Therefore, defensive incised wounds should occur on the palms, or the backs of the hands, forearms, or upper arms.

CHOP WOUNDS

Chop wounds are caused by heavy instruments, or weapons, which have at least one sharp, cutting edge. Examples of such weapons include axes, hatchets, meat cleavers, and machetes A chop wound consists of an incised wound with an associated groove or cut in the underlying bone.

1. If the chopping blow is tangential, then a disk-shaped portion of bone or skin and soft tissue may be cut away.

2. Dull-edged chopping weapons (such as a heavy shovel), may cause more crushing than incision of the tissue, and may, therefore, result in a wound more consistent with a laceration than an incised wound.

3. Moving propellers (boat or airplane) may cause severe chop-like wounds.

4. The presence of soft tissue hemorrhage associated with a chop or incised wound is generally considered good evidence the wound occurred prior to death. Prolonged immersion of a body in water can cause hemorrhage initially present in the wound to be leached out, giving the wound a postmortem appearance, and making the determination of its true nature difficult.

Control test tasks

1. To the factors of outward environment, that can operate on an organism and cause damages, take:

A. Biological
B. Physical
C. Psychoemotional influences
D. Chemical
E. Medicinal facilities and gaseous substances

2. All of the following are true statements regarding injuries, except:

A. It is harm caused illegally to a person regarding body, mind, reputation or property
B. Physically violent injuries are mechanical injuries
C. All injuries are wounds but all wounds are not injuries
D. Disorder of anatomic structure of human tissues or organs caused by the action of different environmental factors (mechanical, physical, chemical etc.).
E. It entails health disorder or death.

3. Which one of the following is an incorrect statement about incised wounds:

A. There are caused by sharp edges or cutting weapons

B. There are broader than edge of weapon causing it
C. Margins are usually everted
D. Their length is more than depth
E. They have no any slight cuts and notches in the ends

4. The common suicidal incised wound is:
A. On the back of the left index finger
B. On the back of the right index finger
C. On the back of the left foot
D. On the anterior side of the left arm
E. On the back of the right foot

5. The most typical wound with a false change is:
A. Incised wound
B. Abraded wound
C. Lacerated wound
D. Contused wound
E. Chopped wound

6. All the statements are true about postmortem wounds except:
A. Signs of blood spurting on the body
B. The edges are inverted
C. The edges do not gape
D. No inflammation
E. No blood spurting

7. A wound with oval margins can be produced by:
A. A knife
B. A file
C. Long pointed conical weapon
D. A dagger
E. A nail

Situational tasks

TASK 1.

During medico-legal research of dead body of deceased woman, 50 years old, was found dead in her apartment. After examination of dead body it was revealed that on the front right side of the chest slit-like wound with sharp edge with no bruising or abrasion of the wound margins and no bridging fibers in deep. One point is V-shaped another blunt. Deeper than it is long. Task.

Define diagnosis.

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METHODICAL INSTRUCTION FOR STUDENTS

Topic №10. "Forensic medical examination of mechanical asphyxia. Strangulation. Suffocation. Obstruction. Compression. Forensic medical examination of drowning."

1. Relevance of the topic. Death from a mechanical asphyxia is the frequent type of medico-legal examination of dead body that needs decision of different questions, in particular, establishment of reason of death, mechanism of origin of damages on the body of victim, to the remoteness of their causing and others like that. For their decision certain knowledge that will be studied on this employment are needed.

2. Objectives:

- To define different types of the mechanical asphyxia.
- To know the classical signs of asphyxia.
- To classify and know different types of suffocation.
- To classify and know different types of strangulation.
- To interpret different types of the mechanical asphyxia according to the manner of death
- To interpret different types of the mechanical asphyxia according to the mechanism of death
- To know the classical signs of suffocation.
- To define morphological features of strangulation.

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

Previous disciplines	**Obtained skills**
Physiology	To know processes that provide gas exchange in the human organism and which pathological factor can lead to hypoxia. Types of the hypoxia.
Anatomy	To have knowledge of structure of the human body and organs. Blood circulation of the brain and chest.
Histology	To explain histological structure of the human organs and tissues.
Pathology	To know the morphological manifestations of pathological changes of internal organs and systems of the human body in diseases that often lead to death.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	Definition
Hypoxia	is a condition in which the body or a region of the body is deprived of adequate oxygen supply at the tissue level
Asphyxia	or asphyxiation is a condition of severely deficient supply of oxygen to the body that arises from abnormal breathing.
Petechiae	are pinpoint hemorrhages produced by rupture of small vessels, predominantly small venules.
Suffocation by entrapment	or environmental hazard, asphyxia is caused by inadequate oxygen in the environment
Environmental suffocation	an individual inadvertently enters an area where there is gross deficiency of oxygen
Smothering	is caused by the mechanical obstruction or occlusion of the external airways, i.e., the nose and mouth.
Choking	asphyxia is caused by obstruction within the air passages.
Traumatic asphyxia	occurs when a heavy weight presses down on an individual's chest or upper abdomen, making respiration impossible.
Positional asphyxia	individuals become trapped in restricted spaces, where, because of the position of their bodies, they cannot move out of that area or position.
Strangulation	form of asphyxia characterized by closure of the blood vessels and air passages of the neck as a result of external pressure on the neck.
Hanging	asphyxia is secondary to compression or constriction of the neck structures by a noose or other constricting band tightened by the weight of the body.
Ligature strangulation	the pressure on the neck is applied by a constricting band that is tightened by a force other than the body weight.
Drowning	is defined as respiratory impairment as a result of being in or under a liquid.

4.2. Theoretical questions for the class:

- What is forensic classification of the mechanical asphyxia?
- What are the definitions of the terms of a suffocation, choking, smothering?
- What are the external signs can be found in cases of asphyxia?
- What is the mechanism and pathogenesis of the death in cases of hanging?
- What are the internal signs can be found in cases of asphyxia?
- How to differentiate hanging, ligature strangulation and manual strangulation?
- What is the mechanism and pathogenesis of the death in cases of drowning?

- Forensic medical examination of the dead body in case of traumatic and positional asphyxia.

4.3. Practical work (tasks) which are done on the class:

1. Find and describe classical signs of asphyxia during examination of the dead body.
2. Determine a type of strangulation asphyxia (hanging and ligature strangulation).
3. Make up forensic report in cases of asphyxia death.
4. Formulate a cause, mechanism and manner of death in cases of different types of mechanical asphyxia.
5. Find and describe morphological signs of asphyxia in cases of drowning.

Block of information

Asphyxia is characterized by inadequate oxygenation of tissue. Asphyxial deaths fall into three general categories:

Suffocation
Strangulation
Chemical

SUFFOCATION

In suffocation, asphyxia results from failure of oxygen to reach the blood. There are four types of suffocation:

- Environmental suffocation
- Smothering
- Choking
- Mechanical

2. In ***environmental suffocation***, there is inadequate oxygen in the atmosphere due to environmental conditions.

- There may be an actual reduction of the oxygen, such as might occur in a closed chamber where fungus has depleted the atmosphere of oxygen.
- In other instances, there is displacement of oxygen by carbon dioxide, such as in a silo, or by nitrogen such as occurs in the holds of ships.
- A child who becomes locked in a refrigerator suffocates due to environmental deprivation of oxygen.
- In these types of death, there are no specific autopsy findings. Pete- chiae are not present.

B. Smothering occurs by mechanical obstruction of the nose and mouth.

- Such deaths may be accidental, homicidal or suicidal.
- Examples of accidental deaths are: an infant who becomes wedged between the frame of a crib and the mattress with the face pushed into the mattress;
- The most common form of suicidal smothering involves using a plastic bag secured about the head, a method more common among the elderly.
- An example of homicide by smothering is gagging accomplished by occluding the nose and mouth with duct tape.

This may occur in robberies, burglaries, or kidnappings where the victim is "gagged" to keep them quiet.

2. An example of homicide by smothering is gagging accomplished by occluding the nose and mouth with duct tape. This may occur in robberies, burglaries, or kidnappings where the victim is "gagged" to keep them quiet.

2. More deliberate homicides involve smothering with a pillow or bed clothing; pinching off the nose with fingers and clamping the hand over the mouth. In both instances, the victim is usually a young child.

2. In infants who are smothered:

2.the child will develop bradycardia in approximately 30 seconds and a flat EEG and cessation of respiration in 90 seconds;

2.respiration will not return spontaneously if the smothering is stopped. The child has to be resuscitated.

2. In deaths due to smothering, typically, there are no findings at autopsy. This includes petechiae.

2.In the case of a suicide with a plastic bag, if it is removed by a relative prior to notification of the police and/or the medical examiner, the diagnosis cannot be made.

2.In homicides with pillows and young children, again, there are no findings.

2.If the victim is an adult, and they are conscious and can resist, there may be some bruising of the lips and nose and some scratches. This is especially true if the hands are used to occlude the airway.

*C. **Choking***. In choking, there is blockage of the internal airways.

1. Homicides are rare. Usually they involve cases in which a gag is rammed in the mouth of a burglary or robbery victim in order to keep them quiet.

The assailant does not realize that the victim is going to choke to death. The authors have seen deliberate cases of homicide by choking. In one, a pacifier was rammed into the throat of a young child.

2. Most choking deaths are accidental and involve blockage of the posterior pharynx and larynx by food or foreign objects.

a. In children, the typical object is a small toy, ball, or a piece of hot dog.

b. Accidental choking deaths in adults are usually associated with acute alcohol intoxication, senility or mental retardation.

3. Occasionally death is ascribed to massive aspiration of food. In actuality, this is rarely a cause of death.

a. The finding of food in the airway does not mean the individual choked to death.

b. Agonal aspiration of food occurs in approximately 25% of all deaths irrespective of the cause.

c. Death from massive aspiration of food with obstruction of the airway occurs only when there is severe central nervous system depression such as in an individual who has had a stroke and in whom there is virtual absence of the gag reflex.

4. In choking victims, the only findings at autopsy are obstruction of the airway. There are no typical findings and no petechial of the conjunctivae or sclera.

D. Mechanical (traumatic) asphyxia occurs when pressure on the chest and abdomen restricts respiratory movements and thus inspiration.

- Most such deaths are accidental. Examples are an individual repairing a car when it falls off the jack onto their chest; burial and caveins in sand.
- In cases of mechanical asphyxia, there may be no internal injuries, even when a car has fallen on an individual.
- In positional asphyxia, a form of mechanical asphyxia, a person is trapped in a position such that they cannot breathe or the respiration becomes inadequate.

Examples of this would be an individual suspended upside down for a prolonged period of time.

STRANGULATION

In strangulation, there is occlusion of the blood vessels in the neck secondary to external pressure.

There are three types of strangulation:

- Hanging
- Ligature
- Manual

In all of these, death may be relatively slow, with the formation of the 'classic' asphyxial signs of cyanosis, congestion, edema and petechiae.

Mechanism of death in strangulation cases.

In strangulation deaths, occlusion of the airway usually ***does not*** occur and is ***not*** the mechanism of death. The mechanism of death is cerebral hypoxia secondary to obstruction of the vessels bringing oxygenated blood to the brain.

Two-thirds to three-quarters of the blood supply of the brain is provided by the carotid arteries with the remainder supplied by the vertebral arteries.

An individual cannot survive on the vertebral artery blood supply alone, if there is acute occlusion of both carotid arteries.

The amount of force necessary to compress the carotid arteries is approximately 5 kg. Complete occlusion of these two vessels will produce loss of consciousness in 10 to 15 seconds.

Since only 2.00 kg of pressure is necessary to occlude the jugular veins, and they lie adjacent to the carotids, in virtually every case that the carotids are occluded, the jugular veins are also occluded.

The jugular veins are the principal vessels through which blood drains from the head.

Because of this, when the carotid arteries and jugular veins are occluded, while blood will continue to enter the head from the " vertebral arteries, drainage is inadequate.

Thus, the face will appear cyanotic with numerous petechial of the conjunctivae, sclera and periorbital skin.

In hanging, there is often occlusion of the vertebral arteries as well as the carotids, thus, no significant amount of blood reaches the head. The secondary vertebral venous system, however, still drains blood. Because of this, in hangings, the face often appears pale and petechiae are often not present. The picture presented depends on the degree of suspension.

Hanging.

In hanging, the weight of the body tightens a noose around the neck compressing the vessels of the neck.

✦ Hanging does not have to involve complete suspension of the body. Individuals have hanged themselves standing, sitting and even lying down. The weight of the head (10-12 pounds(5-6kg)) is in fact sufficient to occlude the carotid arteries.

✦ Almost all hangings are suicides. There are occasional accidental hangings with homicides extremely rare.

✦ Nooses are constructed of whatever material is available. Rope, electrical cords, ties, sheets, belts, dog chains are examples.

✦ The noose is typically constructed with a simple slip knot which on V hanging is positioned on the side of the neck.

✦ The noose imparts a furrow to the skin of the neck that has an inverted V-shaped configuration, with the apex of the V indicating the point of suspension. A gap in the furrow is often present at the knot site

- This furrow typically lies above the larynx.
- The appearance of the furrow depends upon the noose. A rope will produce a prominent furrow with the weave pattern imparted to the skin; a strip of soft cloth usually produces a discontinuous pattern of irregular areas of abrasion.

- Typically, the furrow is pale yellow initially and becomes brown on drying. The edges are often congested.
- On viewing the body, the face is usually pale; the tongue protruding and dried out. Mucous drips from the nose.

Only one-quarter of the cases show any evidence of scleral or conjunctival hemorrhage.

Fractures of the hyoid or thyroid are uncommon, being present in only 10 to 15% of the cases.

Hemorrhage is present in the strap muscles in about 20% of the cases.

Fracture of the cervical spine is extremely rare and is usually associated with a hanging involving a drop, in an individual who has underlying disease of the vertebral column such as osteoporosis.

If the individual is completely suspended, there is pooling of the blood in the lower extremities and forearms with the development of petechial due to hydrostatic rupture of the vessels. These punctate hemorrhages are called Tardieu spots.

This is a relatively common manner of homicide used by a man against a woman or a child and it is sometimes associated with a sexual attack.

It is relatively unusual for a man to throttle another man, and women rarely strangle, except as a means of infanticide.

Manual strangulation may be performed by one or both hands, from the front or the back.

The hand or hands may be applied, loosened and reapplied over and over again during the course of an attack, making it extremely difficult to interpret the injuries on the neck.

The external signs are abrasions and bruises on the front and sides of the neck and there are commonly injuries at each side of the laryngeal prominence and just below the jaw line.

The injuries may be much more widespread, even extending onto the upper part of the sternal area.

Typical fingertip bruising may be seen, which consists of disc-shaped or oval-shaped bruises about 0.5–1 cm in size. There may also be linear abrasions or scratches from fingernails. If these are from the assailant, they are commonly vertically orientated. However, victims may also mark their own necks while trying to prise away the strangling fingers; these linear marks commonly lie close to areas of bruising and are often horizontally orientated.

When pressure has been more prolonged, the classic signs of venous obstruction will be seen, with cyanosis, oedema and congestion of the face together with showers of petechiae in the eyes and face and sometimes bleeding from nose and ears.

1. Most men and approximately half of the women have fractures of the hyoid and/or thyroid cartilages.

a. The higher percentage of men with fractures may be due to the fact that male victims tend to be older on an average than the female victims.

b. Usually, fractures of the thyroid and/or hyoid cartilages are not present in young individuals due to the elastic nature of these structures.

c. The larynx is commonly damaged during manual strangulation and the most vulnerable structures are the superior horns of the thyroid cartilage, which may be fractured on one or both sides.

d. The hyoid bone is much less often injured, but when it is injured, one or both of the greater horns may be broken

These fractures of the laryngeal cartilages rarely occur in children or young people as the cartilage is pliable, but the calcification and ossification of increasing age render these cartilages more brittle and vulnerable to trauma.

Diagnosis of a fracture of the hyoid and/or thyroid cartilage is only valid when there is visible hemorrhage around the fracture site. If there is no visible hemorrhage, or the hemorrhage can only be demonstrated microscopically, then this fracture cannot be designated as being antemortem.

2. Rarely, one will have a manual strangulation in which there is neither external or internal evidence of trauma. This occurs when the victim was unconscious at the time they were assaulted and the amount of pressure to the neck was so minimal as not to produce either external or internal injury.

LIGATURE STRANGULATION

- constricting band is tightened around the neck, which usually results in marked congestion and cyanosis and extensive petechiae in the face.

All types of ligature can be used: **rope, wire, string, electric and telephone cable, scarves, stockings, pieces of cloth etc**.

The mark on the neck will usually reflect the material used for the ligature.

If a wire or thin cord was used, the mark will usually be clear-cut and deep with sharply defined edges. If a soft fabric is pulled taut, it will commonly fold into a series of firm ridges or bands that may produce interlacing deeper areas of bruising on the neck of the victim, which can suggest the use of a narrow ligature.

- The ligature mark is a vital piece of evidence, especially when the killer has taken away the actual ligature.
- The mark on the neck may reproduce the pattern of the object, such as spiral or plaited weave, and the width of the mark can sometimes give a clue as to the size of the ligature.
- The mark usually goes around the whole circumference of the neck, but it need not necessarily do so if clothing or hair has become interposed between the ligature and the skin.

- The ligature mark may lie horizontally or at an angle, but, crucially, it will not have a suspension point, which is commonly found in many hangings.

There may be scratches and bruises on the neck, which may have been caused when the victim tried to pull off the ligature, or when there had also been attempts at manual strangulation preceding or following the application of a ligature.

CHEMICAL ASPHYXIANTS

These gases prevent the utilization of oxygen at the cellular level. The three most common chemical asphyxiants are

- **carbon monoxide**
- **hydrogen cyanide**
- **hydrogen sulfide**
- Carbon monoxide deaths are usually accidental, though there are a significant number of suicides involving this gas.
- Hydrogen cyanide cases are usually suicidal.
- Hydrogen sulfide cases are virtually all accidental. They involve individuals working in sewer plants and cess pools.

Control test tasks

1. What are the subcategories under suffocation?
   A. Hanging
   B. Ligature
   C. Smothering
   D. Choking
   E. Mechanical asphyxia
2. What are the subcategories under strangulation?
   A. Hanging
   B. Manual
   C. Smothering
   D. Choking
   E. Mechanical asphyxia
3. What are the three categories of asphyxia death?
   A. Homicide
   B. Suffocation
   C. Strangulation
   D. Laceration
   E. Chemical
4. That characteristically for the first stage of asphyxia :
   A. Shortness (inciter and expiration) of breath
   B. Before asphyxial period
   C. Clonic seizures
   D. Falling of BP

E. Increase of BP

5. Mechanism of death in strangulation cases:
   A. cerebral hypoxia due to obstruction of the vessels bringing oxygenated blood to the brain.
   B. occlusion of the airway
   C. emotional shock
   D. seizures
   E. carbon monoxide poisoning
6. Mechanism of death in drowning cases:
   A. cerebral hypoxia due to obstruction of the vessels bringing oxygenated blood to the brain.
   B. occlusion of the airway
   C. emotional shock
   D. seizures
   E. carbon monoxide poisoning

Situational tasks

TASK 1.

During medico-legal research of dead body, 1932, it is discovered: highly on a neck, higher than level of thyroid cartilage located strangulation mark of brown and red color, that goes from a top to bottom and from right to left. A furrow is absent on the back surface of neck, the best expressed on her front surface, where a depth makes a 0,2cm, and width 1,5cm.

Of a postmortem hypostasis intensive, violet color with punctuate hemorrhages, are located on lower limbs. At the limit pressing on it color does not change. Nemperature of the body is 22 ^{0}C, environmental temperature is 21^{0}C. A tip of the tongue is squeezed between foreteeth, dry, has brown and red color. At internal research reviled blood is liquid, dark red, internalss are sanguineous. There are punctulate hemorrhages of dark red color on the surface of lungs and heart.

Task:

1. What is cause of death.
2. To set the remoteness of death.

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12. Electronic library.

Topic №11. "Making of the "Act of the forensic medical examination" ("Forensic Report")."

1. Relevance of the topic. Forensic report is an important part of a preliminary investigation which contains vital information and defines the next steps of an inquiry. This is one of the most important pieces of evidence in the case. So, it is important to make a full, short, thorough report according to the given questions and add important information which was revealed during an examination.

2. Objectives:

- define of the forensic autopsy, the algorithm of the autopsy, crime or death scene examination
- explain the role of the forensic pathologist in the identification of unknown person and identifying the person by the bone remains.
- explain the basic methods of examination of dead body at the crime scene according to the provisions of modern organizational and procedural principles of its conduct.
- analyze the main causes, as well as the study of the conditions that lead to death or health problems in criminal cases, forensic medical examination of people, corpses, physical evidence, the activities of medical personnel.
- explain the methods of inspection of a corpse depending on the conditions, peculiarities of the location of the corpse, and so on.
- to interpret the meaning of the term "identification", the meaning of the methods of forensic criminology, identification, medical documentation for the identification of an unknown person.
- to explain the significance of the methods of forensic forensic expertise, peculiarities of forensic examination of corpses of unknown persons during identification of an unknown person.

3. Basic knowledge skills necessary to study of the topic (interdisciplinary integration):

The names of previous disciplines	Obtained skills
Human anatomy	1. Demonstrate knowledge of the anatomical structure of the body and organs of a person, signs of functioning of the body's systems (cardiovascular, respiratory, nervous)
Normal physiology	2. To determine the morphological manifestations of damage from the action of various factors and pathological changes in the internal organs and systems of the human body in diseases that often lead to death.
Pathological anatomy	3. Compare the stages of the pathanatomical autopsy and assimilate the list of objects of forensic research, compare the differences of pathoanatomy

	from the forensic section.
Pathological physiology	4. Define the concept: clinical death, biological death, terminal states and be able to substantiate them.

4. Tasks for independent work during preparation for the class and on the class.

4.1. The list of the basic terms, concepts, characteristics, which must be learned by student during preparing to the lesson:

Term	Definition
Forensic Medicine	Special multidiscipline science learning and answering the medico-biological questions of low practice during investigation of criminal or civil cases.
Coroner	is an elected and trained person, not obligately a physician, who examines dead bodies and investigates cause and manner of death in medico-legal cases. In many areas of the USA the coroner is also a funeral director.
Cause of death	is the disease or injury that produces the physiological disruption in the body resulting in the death of the individual, e.g., a gunshot wound of the chest.
Mechanism of death	is the physiological derangement due to the cause that results in the death, e.g., hemorrhage.
Manner of death	is how the cause of death came about: natural; accident; suicide; homicide.
ICD-10	a medical classification list by the World Health Organization (WHO). It contains codes for diseases, signs and symptoms, abnormal findings, complaints, social circumstances, and external causes of injury or diseases.
Rigor mortis	its simplest, a temperature-dependent physicochemical change that occurs within muscle cells as a result of lack of oxygen in form of rigidity and stiffness of the muscle.
Post-mortem hypostasis	Discoloration of the skin due to cessation of the circulation and passive settling of red blood cells under the influence of gravity to the blood vessels in lowest areas of the body.

4.2. Theoretical questions for the class:

- What are th basic medico-legal system in the world?
- What is the structure of forensic services in Ukraine?
- What is the cause of death, manner of death and mechanism of death? Difference between them?

- What is the ICD-10. Aims and tasks?
- What is the structure of the forensic medical examination?
- How changes after death are classified?

4.3. Practical work (tasks) which are done on the class:

- Code cause of death using ICD-10.
- Determination changes after death on a dead body.
- "Read" changes after death and interpret them.
- "Read" nommograms.

Topic contents

Forensic Medicine – Special multidiscipline science learning and answering the medico-biological questions of low practice during investigation of criminal or civil cases.

Forensic medicine (synonym: *legal medicine*) is a fundamental and independent part of medicine dealing with the interaction of medical science and practice with the law.

The practice of using the terms **"forensic medicine"** and "**medical jurisprudence**" (*medical law*) has led to considerable confusion as to their correct meaning. These definitions are closely related but somewhat different:

***** Medical jurisprudence (medical law) is that part of law which is concerned with the regulations governing the professional practice of the doctor of medicine.

***** Forensic (or legal) medicine is that part of medical science which is employed by the legal authorities for the solution of legal problems.

Medico-legal systems. The structure of a department of forensic medicine.

There are three main medicolegal systems in the world:

- The coroner system (adopted both in the USA and in the ex-British empire countries).
- The system of medical examiners (adopted in the USA, European. African and Asian countries).
- The system of medico-legal departments (adopted in some European countries).

Coroner - is an elected and trained person, not obligatory a physician, who examines dead bodies and investigates cause and manner of death in medico-legal cases. In many areas of the USA the coroner is also a funeral director.

In the United States the medical investigation of fatal cases is done most often by an elected official of the county known as a coroner. In a few states, however, similar functions are performed by a physician known as the medical examiner who is an appointed officer of the county or municipal government.

The coroner system in England and some states of the USA, this system has its own 800-year history. Originally the coroner *(crowner)* was appointed by the British King to represent the Crown as its magistrate in a certain district. The coroner typically is elected

by popular vote for a term of office which varies from two to four years. The coroner is subordinated to a sheriff.

Medical examiner - is the professional physician who can solve both medical and legal problems concerning cause and manner of death, performs autopsies and advances his medico-legal work because on effect of mcreased specialization.

In the present the working place of medical examiner is the Office of Chief Medical Examiner in big cities of most states in the USA and some countries of Europe (Scotland France), the Office should be opened *nonstop* day and night with a medical examiner on duty always present. The duties of medical examiner are:

- ♦ investigation of the scene of death (together with a police, but independently of policemen)
- ♦ analysis of circumstances of death with taking the names of witnesses
- ♦ issuing the death certificate
- ♦ performing the autopsy and necessary additional examinations
- ♦ preparing the report of case investigation
- ♦ representing as a subpoena witness in a court.

The system of medico-legal departments

The medico-legal service in most European countries is built on the system of Departments of Forensic Medicine. The Department of Forensic Medicine is the basic entity for services in forensic medicine. At the universities, there are Institutes of Forensic Medicine with additional tasks as education and research. These Institutes are often regional centers for toxicology and forensic chemistry as well as for forensic serology, haematology and genetics (because of very expensive equipment and methods).

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Objects of Forensic medicine:

- ▪ Corpse
- ▪ Living persons
- ▪ Evidence
- ▪ Metter of criminal and civil cases.

The main tasks of forensic medicine

1. Autopsies in cases of:

♦ violent deaths

- sudden and unexpected deaths
- *"mors in tabula"*
- death in custody
- death of foreign citizens
- deaths caused by medical malpractice
- exhumation.

2. Clinical seminars and case analyses (regularly with the Departments of Traumatology, Neurosurgery, Intensive Medicine. Emergency Medicine).
3. Medical reports and statements, expert opinions.
4. Forensic toxicology and drug analysis (living and dead persons).
5. Forensic serology, hematology and genetics (examination of blood and other biological materials and DNA profiling for identification).
6. Forensic alcohology (the measurement of alcohol in blood, urine and other biological fluids).
7. Forensic anthropology (identification of decomposed or skeletonized human remains by anthropological methods).
8. The presence at the scene of crime.
9. Participation in mass disasters.
10. Investigation of living persons (examination of wounding, injury and trauma, pregnancy and abortion, sexual offences, abuse of alcohol and drugs of dependence etc.)
11. Pregradual and postgradual education.
12. Scientific research.

CAUSE, MECHANISM AND MANNER OF DEATH

Deaths can be categorized as to cause of death, mechanism and manner.

A. The cause of death is the disease or injury that produces the physiological disruption in the body resulting in the death of the individual, e.g., a gunshot wound of the chest.

B. It should not be confused with the mechanism of death which is the physiological derangement due to the cause that results in the death, e.g., hemorrhage.

C. The manner of death is how the cause of death came about.

2. **Manners of death are:**

a. natural;
b. accident;
c. suicide;
d. homicide;
e. undetermined;

The term "homicide" just means that one individual killed another.

A classification of homicide does not necessarily indicate that a crime has been committed as the term homicide is not synonymous with murder.

Classification of death as murder is done by a Court not a pathologist.

The forensic examination, as opposed to forensic medicine, is a branch of practical medicine, which uses knowledge of forensic medicine to solve questions posed of investigations and court cases regarding illegal activities of life and human health.

Changes after Death

EARLY CHANGES:

- Rigor mortis

(Rigor mortis is, at its simplest, a temperature-dependent physicochemical change that occurs within muscle cells as a result of lack of oxygen. The lack of oxygen means that energy cannot be obtained from glycogen via glucose using oxidative phosphorylation and so adenosine triphosphate (ATP) production from this process ceases and the secondary anoxic process takes over for a short time but, as lactic acid is a by-product of anoxic respiration, the cell cytoplasm becomes increasingly acidic. In the face of low ATP and high acidity, the actin and myosin fibers bind together and form a gel. The outward result of these complex cellular metabolic changes is that the muscles become stiff.)

Rigor develops uniformly throughout the body but it is first detectable in the smaller muscle groups such as those:

- around the eyes and mouth, the jaw, neck – 1-6 hours;
- Limbs 6-12 hours;
- All body 12-24 hours.

(It appears to ‘spread’ down the body from the head to the legs as larger and larger muscle groups are rendered stiff. That it can never provide an accurate assessment of the time of death and in practice should never be used alone. The chemical processes that result in the stiffening of the muscles, in common with all

chemical processes, are affected by temperature: the colder the temperature the slower the reactions and

vice versa. It is also important to be aware of the microenvironment around the body when assessing rigor: a

body lying in front of a fire or in a bath of hot water will develop rigor quickly, whereas rigor will progress

slowly in a body lying outside in winter.)

The passive settling of red blood cells under the influence of gravity to the blood vessels in lowest areas of the body due to cessation of the circulation of blood. It produces a pink or bluish color to these lowest areas.

(Hypostasis is not always seen in a body and it may be absent in the young, the old and the clinically anemic or in those who have died from severe blood loss. It may be masked by dark skin colors, by jaundice or by some dermatological conditions.)

(As most bodies fall down or lie horizontally when dead and most are placed in a supine position, hypostasis

commonly forms on the back, buttocks, thighs, calves and the back of the neck. However, hypostasis occurs only where the superficial blood vessels can be distended by blood and, if the body is lying on a firm surface, the weight of the body will compress those areas of the skin that are in contact with the surface and prevent the filling of the blood vessels.

These compressed areas will remain pale and their pallor will be all the more striking because of the surrounding hypostasis.

This is commonly referred to as blanching. Blanching may also be caused by pressure of clothing or by contact of one area of the body with another.)

There are, however, a few color changes that may act as indicators of possible causes of death: the cherry pink color of carbon monoxide poisoning, the dark red or brick red color associated with cyanide poisoning, and infection by *Clostridium perfringens*, which is said to result in bronze hypostasis.

post-mortem hypostasis
estimate time of death

- *Absence of post-mortem hypostasis - 0-3 hours*
- *Reinstating after 1 min - 3-6 hours*
- *after 3-5 min - 6-12 hours*
- *Become bit pale - 12-24 hours*
- *Does not change - 24 hours and more*

COOLING OF THE BODY AFTER DEATH

The cooling of the body after death can be viewed as a simple physical property of a warm object in a cooler environment.

(Newton's Law of Cooling states that heat will pass from the warmer body to the cooler environment and the temperature of the body will fall. However, a body is not a uniform structure: its temperature will not fall evenly and because each body will lie in its own unique environment, each body will cool at a different speed, depending upon the many factors surrounding it.)

Factors affect the rate of cooling of a body:

- *Mass of the body.*
- *Mass/surface area.*
- *Body temperature at the time of death.*
- *Site of reading of body temperature(s).*
- *Posture of the body – extended or curled into a fetal position.*

- *Clothing – type of material, position on the body – or lack of it.*
- *Obesity – because fat is a good insulator.*
- *Emaciation – lack of muscle bulk allows a body to cool faster.*
- *Environmental temperature.*
- *Winds, draughts, rain, humidity etc.*

Nomograms

1. Connect the points of the scales by a straight line according to the rectal and the ambient temperature. It crosses the diagonal of the nomogram at a special point.
2. Draw a second straight line going through the center of the circle, below left of nomogram, and the intersection of the first line and the diagonal.
3. The second line crosses the semi-circle of the body weight: the time of death can be read off. The second line touches a segment of the outermost semi-circle.

Here can be seen the permissible variation of 95%.

Late Changes

- ***Putrefaction***

(In temperate climates the process is usually first visible to the naked eye at about 3–4 days as an area of green discoloration of the right iliac fossa of the anterior abdominal wall. This change is the result of the extension of the commensal gut bacteria through the bowel wall and into the skin, where they decompose hemoglobin, resulting in the green color. The right iliac fossa is the usual origin as the caecum lies close to
the abdominal wall at this site. This green color is but an external mark of the profound changes that are occurring in the body as the gut bacteria move out of the bowel lumen into the abdominal cavity and the blood vessels. The blood vessels provide an excellent channel through which the bacteria can spread with some ease throughout the body. Their passage is marked by the decomposition of hemoglobin which, when present in the superficial vessels, results in linear branching patterns of brown discoloration of the skin that iscalled ‘marbling or net of putrefaction.)

- ***Mummification***

A body lying in dry conditions, either climatic or in the microenvironment, may desiccate instead of putrefying.

(Mummified tissue is dry and leathery and often brown in color. It is most commonly seen in warm or hot environments such as the dessert and led to thespontaneous mummification of bodies buried in the sand in Egypt.)

- ***Adiopocere***

is a chemical change in the body fat, which is hydrolyzed to a waxy compound not unlike soap.

(The need for water means that this process is most commonly seen in bodies found in wet conditions (i.e. submerged in water or buried in wet ground) but this is not always the case and some bodies from dry vaults have been found to have adiopocere formation, presumably the original body water being sufficient to allow for the hydrolysis of the fat.)

Control tests.

1. What is the correct definition of the scene of death? It is…

A. a place where murder occurs
B. a place where suicide occurs
C. a place where dead person (body) is found.
D. a place where person is killed
E. all are correct

2. Which methods of the inspection of the scene of crime do you know?

A. objective
B. subjective
C. central
D. all are correct
E. all are wrong

3. Indicate the correct order of the inspection of a dead body at the scene of death at first:

A. Surroundings-position-pose
B. Surroundings–fixation of the position-general description of the body.
C. position-pose-upper clothes
D. upper clothes-changes in the body-evidences
E. evidences-struggle marks-external injuries

4. Choose the correct statement: The inspection of the scene of death refers to

A. a practical activity of a judge
B. a practical activity of an investigator.
C. a practical activity of lawyer
D. a practical activity of a forensic pathologist
E. a practical activity of doctor

5. There are such tasks of a doctor at the scene of death, except:

A. Whether there is a crime?
B. To establish if a person is alive or dead
C. To determine time since death
D. To fix the position and pose of a corpse
E. To find probable marks of struggle or self-defense

6. The following tasks during the inspection must be solved, except:

A. Whether there is a crime?
B. Who is a criminal?
C. When a crime occurs?
D. How long offenders spend at the scene of crime?
E. How they come at the scene of crime?

7. Where should the body's temperature be measured at the scene of death?

A. In axillar region
B. In a mouth
C. In a whisker
D. In a rectum
E. In iliac area

8. The doctor examines the dead driver and establishes that PML completely disappears under the thumb pressure. Estimate postmortem interval.

A. Not more than 8-10 hours.
B. 14-18 hours.
C. 20-24 hours.
D. 30-36 hours.
E. more than 36 hours.

9. During the inspection of the scene of death it is established that PML does not disappear under the thumb pressure but it becomes pale. Indicate the stage of PML development.

A. the 1 phase of hypostasis
B. the 2 phase of hypostasis
C. stage of stasis (diffusion)
D. stage of imbibition
E. stage of blood coagulation

10. Rectal temperature of a dead body during the inspection of the scene of death was 22 ˚C (surroundings - 18˚C). How many hours have elapsed since death ?

A. 3 hours
B. 7 hours
C. 14 hours
D. 18 hours
E. 24 hours

1-E; 2 - D; 3 - B; 4 - B; 5 - A; 6 – B; 7 - B ; 8 – A; 9 – C; 10. – B.

Basic books:

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Supplementary literature:

1. Color Atlas of Forensic Medicine and Pathology -Edited by Charles A. Catanese, USA, 2009, p. 424.;
2. Color Atlas of the autopsy / Scott A. – Wagner Boca Raton London New York Washington, 2004, p. 226.

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