GUIDELINES TO THE PRACTICAL LESSONS
for 3rd-year students of medical faculty

Module 2
SURGICAL INFECTION. NECROSIS. FUNDAMENTALS OF CLINICAL ONCOLOGY.
SUPERVISION OF SURGICAL PATIENTS
Thematical module 8
SUPERVISION OF SURGICAL PATIENTS
Topics 14-16
Methods of examination of surgical patients

Academic discipline:
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3-rd year medical faculty
Speciality: 7.110101 - "Medicine"
7.110104 - "Pediatrics"
7.110105 - "Medical prophylaxis"
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1. BACKGROUND.

Methods of examination of the patient are essential for the diagnosis of surgical diseases. Doctor’s knowledge of patient examination methods plays an important role not only for the timely and correct diagnosis, but also for the corresponding effect on treatment, prognosis and recovery of the patient.

In the writings of Hippocrates, mankind had received the first systematized perennial experience in medicine. Hippocrates paid attention to the general appearance, facial expression, posture, shape of the chest, the state of the abdominal wall, skin and mucous membranes, tongue, body temperature. Sleep, breathing, digestion, heart rate and excretions (sweat, urine, sputum) were assessed.

With the development of science and technology, methods of examination of surgical patients were improved, hardware and instrumental techniques came to help doctors and increase educational options.

Future physicians need to know and possess the practical skills to carry out subjective and objective examination of the patient, assess the laboratory parameters, determine the need and scope for additional methods.

Learning and mastering the topic: "Methods of examination of surgical patients" is very important for the further development of the future doctor, putting the diagnosis of disease promptly, determine treatment strategy and the final recovery of the patient.

2. DURATION: 4 hours.

3. STUDY OBJECTIVE.

Know (theoretical questions):
- the value of methods of examination of the surgical patient, including subjective, objective examination, laboratory tests, biochemical and additional examinations for the diagnosis of the disease and its differentiation from other types of pathology;
- the place and role of case history of the patient (in-patient medical record) as important medical, statistical, scientific and legal documents, which reflects the patient's stay from the stage of diagnosis to the components of conservative medical and surgical treatment with the assessment of its results and further recommendations before discharge from hospital.

Be able to:
- conduct a subjective examination at the bedside with the identification of the dominant complaints related to main disease and minor complaints of the patient, collect the history of the disease (Anamnesis morbi) from its first manifestations to hospitalization to a surgical department, including the previous treatment (if applicable) with evaluation of its effectiveness;
- collect the history of patient’s life (Anamnesis vitae) with evaluation of features that might be relevant to the disease (heredity, professional features, habits etc.);
- perform the systemic physical examination of the patient (Status praesens objectivus) using the methods of percussion, palpation, auscultation (skin, subcutaneous tissue, superficial lymph nodes, muscular, skeletal, respiratory, urinary and cardiovascular systems, organs of the abdomen);
- perform the inspection of the the pathological site (Status localis) with visual and palpation and, if necessary, by other means alongside with analytical assessment of local manifestations of the pathological process;
- define the algorithm and analytically evaluate the results of the general clinical and laboratory biochemical tests;
- select and implement the necessary additional examination techniques (hardware and instrumental) with interpretation of the results;
- establish and formulate a diagnosis of the disease using the generalized data analysis of subjective and objective examination and evaluation of laboratory measurements and additional methods of examination;
- carry out differential diagnosis with other similar diseases;
- define a plan of patient care, including drug therapy and surgical treatment methods;
- textually present the examination of the patient in case history.

**Practical skills:**
- learn the techniques of subjective and objective examination of the patient with regard to surgical disease;
- learn to evaluate the results of clinical, laboratory and biochemical examinations;
- learn to build the algorithm of disease diagnosis with optimal choice of necessary methods of additional examination.

4. **BASIC KNOWLEDGE, SKILLS NECESSARY FOR STUDYING THE TOPIC (INTERDISCIPLINARY INTEGRATION)**

<table>
<thead>
<tr>
<th>Previous disciplines</th>
<th>Received skills</th>
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<tbody>
<tr>
<td>1. Normal and topographical anatomy</td>
<td>Know topographic anatomical features of the body structure.</td>
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<tr>
<td>2. Pathophysiology</td>
<td>Be oriented in impaired functions at the basis of the results of the examinations.</td>
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<td>3. Internal medicine</td>
<td>Collect the anamnesis, perform examination, palpation, percussion, auscultation.</td>
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<td>4. Roentgenology</td>
<td>Read radiological images.</td>
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5. **TIPS FOR STUDENTS.**
   Emphasize (reveal) the value of the topic for further study of the discipline and professional activity of doctor in order to create motivation for targeted training. Acquaint students with specific goals and lesson plan.

   After familiarizing of students with specific goals and lesson plan, the teacher organizes the standardized control of initial level of students' knowledge: written tests, oral interview, explanation complicated issues, practical training with the patient.

5.1. **CONTENT OF THE TOPIC CLASSES. SUBJECTIVE EXAMINATION**

**Patient’s complaints:**
What bothers the patient, why did he/she seek help. In case of patient’s severe condition or unconsciousness, this information is obtained from accompanying persons (relatives, friends).

There are major and minor complaints, the sequence of their occurrence and the relationship between them.

Complaints should be classified into groups and fully detailed. Most frequent main complaint is pain. In case of pain, the following should be revealed:

a) its anatomical location, irradiation;
b) stability, intensity (strong, moderate, minor), character (constant, aching, stab-like, cutting, cramping, shooting, dizzy);
c) its connection with the physical or mental exertion, change of body position, movements, food intake, urination and defecation, change of seasons and weather that affect the nature of pain (relief, strengthening).

Complaints should be detailed.

The description of local lesion (wound, swelling, structures etc.), location, size, complaints and symptoms that accompany the lesion (colour change, temperature, pain, discharge etc.).

General condition (malaise, fatigue, vertigo, stage, causes and term of weight loss).

**History of disease (Anamnesis morbi):**
It should be revealed when and how the disease started. For injuries and acute surgical diseases, indicate the date and hour of occurrence. How disease developed (gradually, suddenly), flow of the
disease (progressive, intermittent, stable, regressing). Describe the sequence and interrelationship of changes that arose to reveal the possible causes of the disease. Patients with trauma: specify the mechanism of injury, which and where the aid was provided, what treatment was used and what were the results. The indications for hospitalization, date, hour.

**History of life (Anamnesis vitae):**
Write a brief biography of health in the chronological order, in which area was the patient born, where he/she lived, how did he/she grow, diseases treated, where studied.
The start of menstruations, their cyclicity. Marital status. Number of pregnancies, births, abortions. Health of the spouse and children.
Professional history, presence of professional hazards, conditions of work.
The living conditions. Diseases and injuries: the continuation of disease, treatment efficiency. Use of haemodialysis and plasm transfusions, infusions of serums, use of antibiotics, hormones, local anaesthetics; complications of their usage.
Infectious (diphtheria, hepatitis, malaria, typhoid, HIV, tuberculosis, venereal diseases) and oncological diseases.
Ancestral history: congenital anomalies, malignant tumours, allergic and endocrine diseases, peptic ulcer disease, blood pathology etc. in relatives. Bad habits.

**The patient's condition at the time of observation (Status praesens objectivus):**
The general condition of the patient (good, satisfactory, moderately severe, severe, very severe, terminal).
Consciousness (clear, dull, absent).
Position in bed (active, passive, involuntary). Freely walks, limping, using crutches or a cane.
Face (normal, distressed, mask-like, scared, angry, puffy, face of Hippocrates). Eyes, colour of sclerae, nystagmus, narrowed or dilated pupils, ptosis of eyelids, saddle-like nose. Respiratory movements of the wings of the nose.
The appearance of the patient (age-appropriate, younger or older than actual age).
The structure of the body (correct, defective). The body constitution (asthenic, normostenic, hyperstenic). Body weight, height.
Body temperature: normal, high, low, remitting - daily fluctuations of up to 2°C or more; intermittent - sudden increases to 39-40°C, reducing to normal and repeating after 1-2 days; hectic – sepsis; reverse; wave-like; distorted - in the morning is higher than in the evening; subfebrile.

**OBJECTIVE EXAMINATION OF PATIENTS BY SYSTEMS**

**Skin.** Skin colour (pale pink, pale, cyanotic, grayish, jaundice, presence of pigmentation, spots, their localization). If there is scarring - location, size, mobility, connection with the underlying tissue, pain. Skin turgor, elasticity (high, low, good), exfoliation, hyperkeratosis, ichthyosis. Wounds, sores, their localization, characteristics.

**Subcutaneous tissue.** Developed (moderately, insufficiently, excessively). Distribution (even, uneven, local fat deposits: abdomen, arms, hips, general obesity, weight loss, cachexia). The thickness of the fat layer (skin fold at V-VI ribs on posterior axillary line). Oedema: localization, prevalence, area, conditions of appearance and disappearance.

**Sweating** (normal, reduced, excessive). Hair coverage (male type, female type, hypertrichosis). Hair loss (major, minor, brittle hair).

**Nails** (appearance, spotting, brittleness, elasticity). Visible mucous membranes: nose, conjunctiva, lips, mouth (colour - pink, pale pink, pale, cyanotic, yellow, surface - moist, moderately wet, dry). 

**Tongue** - wet, dry, swollen, lined with white, gray, earthy touch; colour - pink, crimson; look - varnish, cracks, sores.

**Teeth** - dental formula. Tonsils - size, colour, swelling, extending out of the arcs. High and cleft palate. Breath (smell-free, putrid, urine or acetone smell).


Breast. Symmetry, size, shape, skin condition. The nipples and areolae. Breast examination is performed in horizontal and vertical position. Palpation determines the development of fatty tissue, condition of glandules, the presence of infiltrations and tumours (size, location in quadrants, mobility, fusion with surrounding tissues, pain). Depression of nipple, "orange peel" skin, fistulas. Discharge from the nipple (serous, haemorrhagic, mucous etc.).

Lymph nodes: submental, submandibular, cervical - along m. sternocleidomastoideus, occipital, supra- and subclavian, axillary on the outer edge of the breast, elbow, inguinal and mandibular. Location, number, shape, surface (smooth, bumpy), texture (firm, soft, elastic), size, pain, mobility, fusion with each other and surrounding tissues, skin colour over them.


On examination of the spine, physiological changes, abnormal curvatures (lordosis, kyphosis, scoliosis, hump) are checked. Scope of active moves. Palpation - condition of the spinous processes, a symptom of "reins", the load on the spine axis.

Examination of the extremities. When inspected from front and back - position, shape, pathological composition, the presence of scars, tumours, muscle atrophy. Joints - configuration (thickening, swelling, fluctuation), scope of moves (active, passive, limited, excessive), tenderness. Palpation (local temperature, pain, crepitus). Measuring the circumference of the limb segment. Superficial veins. Measurement of pulse on accessible arteries in symmetric locations.

Peripheral vessels should be examined for pulse (rhythm, filling, rate), condition of vascular wall. Examination is conducted by tips of II-III-IV fingers placed along the artery.

Points to control peripheral arterial pulse:
Radial artery (a. radialis) is palpated on the radial side of m. flexor carpi radialis 2-3 cm proximally to the radio-carpal joint.
Femoral artery (a. femoralis) - on the verge of inner and middle third of inguinal ligament, below it in Scarp’s triangle in the area of the oval fossa.
Popliteal artery (a. poplitea) is found deep in popliteal fossa in knee bent at an angle of 120° between the tendons of thigh flexor.
Rear foot artery (a. dorsalis pedis) - between long thumb extensor (m. extensor halluscis longus) and common extensor of the fingers (m. extensor digitorum communis), respectively - between I-II metatarsal bones.
Posterior tibial artery (a. tibialis posterior) - between posterior-inferior margin of inner bone and Achilles’ tendon.

Superficial venous system. System of great saphenous vein (v. saphena magna) is located on anterolateral internal surface of the tibia and on the inside of the thigh; system of small saphenous vein (v. saphena parva) - on external rear surface of the tibia to the popliteal fossa or anterior thigh.

Respiratory system. Shape of the chest (conical, barrel-like, cylindrical, funnel-like, "chicken" chest etc.). Symmetry of supraclavicular and subclavian hollows, intercostal spaces, epigastric angle deformation. Position of scapulas (adjacent to the chest or not). Type of breathing (thoracic, abdominal, mixed). Participation of both halves of the chest in breathing. The rhythm of breathing, frequency per minute. Condition of intercostal spaces during a deep breath (retraction, bulging).
Palpation causes pain, subcutaneous emphysema is seen, crepitus, voice trembling (unchanged, weakened, strengthened), swelling, infiltration, lateral and longitudinal exertion.


Auscultation is performed at symmetric sites, comparatively. Determine the nature of the respiratory sounds (vesicular, bronchial, amphoric, mixed, harsh, weakened, absent). Wheezing (dry, wet: small-, medium- and large-vesicle), crepitation, pleural friction noise. Bronchophony, voice trembling.
The cardiovascular system. Determine the pulse at both sides on the following arteries: radial, temporal, carotid, brachial, femoral, subclavian, retrocrural, dorsoplantar, rate per min., rhythm, tension (satisfactory, hard, soft), filling (satisfactory, weak, thready), characteristics of arterial trunks (density of the walls, the presence of dilations, visible pulsation). Arterial pressure (minimum, maximum, pulse). Venous pressure.

The presence of varicose veins on the chest, anterior abdominal wall, level of dilation - "head of Medusa". Dilatation of superficial veins of lower extremities. Examination of the area of heart. Apical, cardiac impulse, its strength, location. Pulsation in epigastrium (heart, aorta, liver), jugular fossa (aorta, carotid artery, vein). Determine the limits of absolute and relative cardiac dullness by percussion. Auscultation: heart tones (distinct, dull, accented, split). Gallop rhythm. Noises and their relation to cardiac phase (systolic, pre-systolic, diastolic). Strength (sharp, weak), length (long, short). Changes in the nature of noise due to change of body position. Pericardial noise. Changes in the nature of noise due to change of position. Functional tests: orthostatic; with physical exertion; with breath cease; Schtange’s probe – ask patient to hold his/her breath after deep inhalation followed by exhalation: the work of the heart is considered to be good if the patient can hold his/her breath for 40 seconds or more; satisfactory - 35-30 seconds; at a delay of less than 20 seconds, the heart function is defined and unsatisfactory, operation under general anaesthesia is contraindicated.

Examination of the abdomen and the abdominal cavity is performed in the horizontal and vertical positions of the body. During examination, presence of scars on the skin of the anterior abdominal wall (location, shape, size, condition) is marked. The shape of the abdomen (oval, rounded, retracted, convex, bloating, protrusion of certain parts). Visible peristalsis. Participation of the anterior abdominal wall in breathing act, pain or during cough. Superficial comparative palpation begins in the left iliac area. Evaluate the condition of the abdominal walls, their resistance, muscle protection (partial, only during palpation, constant). Resistance in different areas, painfulness and their localization. The presence of tumours, infiltrations, Blumberg’s symptom. Condition of umbilical, inguinal and femoral rings. Diastasis of straight muscles of the abdomen. Deep methodical sliding palpation method. Sigmoid colon (location, shape, consistency, mobility, tenderness, rumbling). Caecum, ascending, descending and transverse colon – by the same parameters. The presence of tumour infiltration. Deep sliding palpation of the epigastric area evaluates the stomach: the lower limit (palpation, percussion, auscultation+percussion, “clapping” noise), pain (limited, diffuse), visible peristalsis during palpation. The examination of liver begins with inspection of right upper quadrant. Palpation – peculiarities of liver edge (soft, hard, dense, sharp, blunt, rounded, rough, gibbous, smooth). Evaluation of the liver is performed by the method of M.G. Kurlov. Gall bladder – in healthy persons, is not defined by palpation. Pain at the point Kehr. Pancreas (pain, infiltrations). Spleen - by palpation: size, texture (soft, dense), surface (smooth, bumpy, painful). Definition of limits by percussion. Determination of fluid in the abdomen when tapped. Percussion - dull sound in case of a tumour or fluid, tympanitis – in case of free gas collection in the abdominal cavity, inflated intestine loops. Auscultation - presence of intestinal sounds (number, location, intensity). Inspection of anus and rectum is done in dressing room. Presence of external haemorrhoids, prolapse of rectal mucosa, warts, fistulas, fissures, ulcers is checked. Tonus of the sphincter, condition of the mucosa and prostate (size, texture) are examined by finger. If necessary, examination of rectum is conducted using rectal mirror of sigmoscope. Specify the method of rectal examination (in the knee-elbow position, on the back, standing, lying on the side).

External genitalia, the shape and size of the scrotum, elasticity of the skin, oedema, presence of testicles, their size, density, pain. Accessories of testicles, their size, tenderness. Spermatic cord (presence of varicose veins, relation to the external inguinal ring, examination by finger). Symptom of "cough impulse".

Examination of the kidneys - palpation is performed in the supine and standing position of the patient (localization, mobility, size), surface (smooth, bumpy), pain. Tenderness of costovertebral

The endocrine system. Inspection of the front of the neck. Palpation of the thyroid gland (diffuse or nodal enlargement), dislocation during swallowing, exo- or endophthalm, other findings.

The nervous system. Pupils: condition (dilated, narrowed, symmetrical, asymmetrical), reaction to light (direct, synchronous). Sensitivity of the skin (hyper-, hypo-, anaesthesia), areas of impaired sensitivity, dermographism (red, white, stable, unstable). Pain when pressing the peripheral nerves. Paresis, paralysis, hyperkinesis.

Reflexes (pupillary, conjunctival, knee, of Achilles’ tendons, muscle stiffness of the neck, Kernig’s symptom). Organs of sense, sight, hearing, smell, touch, language.

SITE OF DISEASE (Locus morbi)

Local status is paid the maximum attention while examining the surgical patients. In a detailed examination of the site of the disease, localization is determined according to the conventional anatomical terminology (part of the neck, face, chest, abdominal wall, cavity, extremities). A sequence must be followed during the examination: inspection, palpation, percussion, auscultation. Inspection. Describe the position of the organ, its shape, colour of skin above, presence of skin folds, normal skin lines. Direction of body axis, comparison of symmetrical parts of the body and even organs, the presence of vascular pattern. Describe the nature of the disease, the skin around the focus (unchanged, maceration, oedema, hyperaemia, infiltration etc.), changes of soft tissues around the focus (haemorrhage, infiltration etc.), determine which tissues are affected, if any – describe the granulation tissue (colour, surface, character, quantity, bleeding, superpositions and pellicles), presence of necrotic tissues and foreign bodies. Specify the size of the pathological focus in centimeters. Presence, amount and character of discharge.

Active and passive motion: range of moves, angle of motion of the joints, degree of limitation of moves, pain during moves. Palpation: specify the position, shape, area of oedema, texture, pain, mobility, muscle tonus, presence of compression marks on the skin, local temperature. Presence of softenings, fluctuations, crepitation, pathological pulsation. Describe the regional lymph nodes.

Percussion: character of sound - high, blunt, box-like, location and boundaries of blunting, dislocation on changing the body position or organs. If puncture was performed, describe the obtained content.

Auscultation: presence of cardiac tones, their loudness and rhythm, character of pulmonary noises, presence of intestinal noises, noises over large vessels.

Let us describe the method of local status in the following categories of patients: Contusion (bruise - contusio).

Local tissue damage as a result of injury is called a contusion. It is distinguished by pain, swelling and a bluish colour, which are the greater, the more small blood vessels are damaged. In case of concussion, attention should be paid to concomitant neurological and vascular disorders. After contusion, often a loss of motor function and sensitivity is observed. Damage (contusion) of artery may lead to the rupture of intima and peripheral circulatory disorders. Haemarthrosis during contusion and rupture of ligaments of large joints.

Fractures, sprains: inspect the injured area, palpation, percussion, auscultation, measure the volume, length of limb, assess the muscle strength and function. While examining, pay attention to the main symptoms of trauma:

a) forced position of the limb;
b) deformation of the joint area, swelling;
c) shift of the axis of the peripheral part of the joint (side, angled, rotary);
d) intensive pain;
e) change of limb length, abnormal mobility, crepitus;
f) spring fixation;
g) significant limitation of moves in the joint.
In the sprain of joints, connection between two bones is impaired. One articular surface is shifted in relation to the second, causing a deformation of the joint. Sprains develop only due to synchronous rupture of ligaments and the joint capsule. The main symptoms: pain, swelling, unusual position of limbs and spring fixation.

**Burns**: square of burned surface is counted by the rule of "nines", "palm" method of V.M.Postnikova, H.D.Vilyavyna. Diagnosis: thermal burn (chemical, radiation, electric burn). Within the development of burn disease, following stages are distinguished: (I stage - burn shock, II stage - acute toxaemia, III stage - septicotoxaemia, IV stage - reconvalescence).

**Frostbite**: Location, degree (I - skin lesions - reversible circulation disorders, cyanosis or marble colour; II - necrosis of superficial layers of skin to Malpighian, formation of vesicles with clear content; III - necrosis of all layers of the skin and underlying tissues, formation of vesicles with haemorrhagic content, IV - necrosis of soft tissues and bone).

Period should be indicated: latent (pre-reactive) and reactive. A reliable verification of the degree of frostbite is possible only within 5-7 days after freezing.

**Wounds**: examination should be carried out in the dressing room. Following should be indicated: the character of injury, location, size, shape, direction, edges, walls, bottom of the wound, exudation, phase of the wound process, status of regional lymph nodes, severity of infection, condition of circulatory and nervous regulation, function of the damaged organ.

**Surgical infection**: Acute inflammatory processes are characterized by major classic signs of inflammation:
- **Rubor** - redness, caused by dilation of capillaries under the influence of humoral and neurogenical factors.
- **Tumour** - swelling; caused by local oedema.
- **Calor** - local increase of temperature due to hyperaemia.
- **Dolor** - pain: occurs due to mechanical stretching, as a result of influence of bacterial toxins and humoral inflammatory mediators, such as histamine, serotonin.
- **Functio laesa** - functional disorders are not cardinal symptoms and in many cases are absent. Attention is paid to location, size, thermal reaction, presence of lymphangitis and lymphadenitis, the overall body’s reaction.

In case of **abscess** - a softening in the center of infiltration, due to the release of tissue fluid and lymphocytes, which manifests as fluctuation. For example: in the area of the upper outer quadrant of the left buttock, an infiltrate sized 18*10 cm is seen, painful on palpation, hyperthermia and hyperaemia of the skin with transition zone to normally coloured skin, fluctuation.

**Phlegmon** - inflammation spreads diffusely, without the formation of capsule, has no clear limits, infiltration of neighboring tissues.

**Mastitis** - localization (right, left), quadrant (upper, lower medial and lateral upper and lower), subcutaneous, intramammary, retromammary, galactophoritis; size, phase of inflammation (serous, acute infiltrative, abscess, phlegmon, gangrenous, chronic infiltrative).

When describing tumours, pay attention to their growth speed, topographic location, size, shape (flat, hilly, mixed structure), consistence (elastic, rocky, etc.). Mobility. Regional lymph nodes. For description of ulcers, pay special attention to the edges (rough, fringed etc.) and granulation tissue. Necrosis - localization, depth of lesion, spread.

**PRELIMINARY DIAGNOSIS**

To put and justify the preliminary diagnosis, it is necessary thoroughly analyze the major complaints of the patient, clinical history, physical examination (main symptoms obtained during inspection, palpation, percussion, auscultation). During analysis of obtained information, one should group the symptoms, identify the leading syndrome, which should be compared with previous. If syndromes coincide and manifestations of the disease - with those typical to known illnesses, form the preliminary diagnosis. In order to put the final diagnosis, additional methods of examination of the patient should be used.
LABORATORY AND BIOCHEMICAL METHODS

General clinical laboratory methods include:
- complete blood count (haemoglobin, number of red blood cells, white blood cells, white blood formula, erythrocyte sedimentation rate, colour index);
- urinalysis (colour, transparency, specific weight, pH reaction, presence of epithelium, protein, cylinders, white blood cells, red blood cells).

Biochemical methods include:
- blood glucose;
- blood group, Rh factor;
- proteins (their fractions);
- electrolytes;
- liver and kidney function tests (bilirubin and its fractions, transaminases, lipoproteins, cholesterol, urea, creatinine, residual nitrogen);
- blood coagulation (prothrombin index, recalcification time, clotting time by the Lee-White, β-naphthole test, total fibrinogen).

RADIOLOGICAL METHODS

X-rays were discovered on November 8, 1895 by Wilhelm Conrad Roentgen.

X-ray method – is a way of studying the structure and function of various organs and systems based on qualitative and quantitative analysis of the X-ray beam that has passed through the human body. When passing through the human body, X-ray beam’s intensity decreases. Human body is a heterogeneous environment, as in different organs radiation is absorbed differently, due to uneven thickness and density of the tissues. In case of equal thickness, radiation is mainly absorbed by bone tissue, almost 2 times less of it is absorbed by parenchymal organs and none in the gas in the lungs, stomach, intestines. Thus, the more organ absorbs the radiation, the more intense is its shadow on the film, and on the contrary, the more X-rays pass through the body, the clearer will be the image.

X-ray radiography – is the method of radiologic examination, when a fixed X-ray image of the object is projected onto a solid carrier (film, paper, screen). Snapshot of the body (head, pelvis, abdomen etc.) is called “plain” and the method – “plain X-radiography”. X-ray study of separate organ or parts of the body is called “target” and the method – “target X-radiography”.

Radioscopy (roentgenoscopy) – is a technique of X-ray study, in which images of objects are seen moving live on the screen getting during the study process. In this case, the patient’s body can be positioned as needed for the most exact diagnosis, although it increases exposure to radiation. Artificial contrasting of organs is used to obtain a differential image of tissues that consume about the same energy. With this aim, substances that absorb X-rays more or, vice versa, less than soft tissues, are injected, and thus create sufficient contrast with the organs of interest. Substances that absorb radiation more than soft tissue, are called X-ray-positive (being manufactured from heavy elements - barium or iodine). As X-ray-negative contrast agents, some gases are used - nitrous oxide, carbon dioxide. There are two fundamentally different ways of contrasting: first - direct mechanical injection of contrast agent into the cavity (stomach – orally, intestine - by enema, blood vessels); second method is based on the ability of organs to absorb contrast agent from the blood, concentrate and release it (urinary system and biliary tract).

Methods of contrasting research study of vessels are called angiography. A contrasting substance is injected into the studied vessel through a puncture or catheter and an X-ray film is made. Depending on what part of the vascular system is contrasted, there are arteriography, venography (phlebography) and lymphography. Water-soluble iodine contrast agents are used for this purpose. Methods of contrasting study of the gallbladder and bile ducts - cholecystography (oral): the evening before the study, the patient takes iodine hepatotropic drug (Bilihnost). It is
absorbed in the intestine, captured from the blood by the liver cells and then excreted into the bile. Overnight, the drug is concentrated in the gallbladder and in the morning, plain X-ray images of the organ are made. The normal gallbladder on cholecystogram is defined as elongated oval shade, tapering upwards, having even clear outline. Measures - 6-10*2-4 cm. Shadow of gallbladder is homogeneous, gradually increasing in the caudal direction. Due to the development of ultrasonography, clinical value of this method had significantly decreased. Currently, the main indication is to determine whether lithotripsy is needed.

Cholegraphy (intravenous cholecystocholangiography): hepatotropic iodine-containing contrast agent is injected slowly. The drug is captured by hepatocytes and excreted into bile. In 5-7 minutes, the pictures gradually show first shadows of the bile ducts and then the gall bladder. The main value of the study is functional and morphological data about the biliary system. Cholangiography is a group of X-ray methods (percutaneous transhepatic cholangiography, endoscopic retrograde cholangiopancreatography - ERCP) of examination of the bile ducts after direct injection of the contrast agent into their lumen.

Percutaneous transhepatic cholangiography (when ERCP is unavailable) is performed under ultrasound-controlled percutaneous puncture of dilated bile ducts or gallbladder, contrast agent is injected and films are made.

Endoscopic retrograde cholangiopancreaticography: contrast is injected into large duodenal papilla under control of endoscope. Main purpose – study the biliary tract in patients with obstructive jaundice.

Irrigoscopy - method of X-ray examination of rectum and colon with the introduction of contrast agent into them. Irrigoscopy helps to obtain information about the morphological changes of the colon. Irrigoscopy often is a crucial method for diagnosing tumours and diverticula of the colon. Double-contrast method increases the diagnostic value of irrigoscopy.

Under X-ray control, the colon is gradually filled with radiopaque suspension, then plain and targeted images and all its parts in various positions of the patient are made (tight filling phase). After evacuation of radiopaque suspensions, the relief of gut mucosa is evaluated (emptying phase). At the final stage of irrigoscopy, especially if colon tumour is suspected, the study is carried out on the dosed filling of colon with air using Bobrov’s apparatus (double contrasting).

Computed tomography is the most sensitive and informative method of X-ray study and is a layered X-ray, based on computer reconstruction of image obtained with circular scanning of an object by narrow X-rays. Inventors A.Kormak and H.Hausfield were awarded in 1979 by the Nobel Prize. A narrow beam of X-rays scans the human body in a circular manner. On the other side of the patient, a system of sensors is installed (the number may reach several thousands), each of which converts radiant energy into electrical signals. After amplification, these signals form a digital code that is transferred to the computer memory.

ADDITIONAL (HARDWARE) AND INSTRUMENTAL STUDY METHODS

Ultrasonic methods.

Ultrasound is a medical imaging method that was adopted over 40 years ago. Currently, medicine can no longer exist without this method of diagnostics. Areas of usage of ultrasound in medicine are extremely broad. For diagnostic purposes, it is used to detect diseases of the abdomen, kidneys, pelvis, thyroid gland, breast, lymphatic system, heart, blood vessels, in obstetric and paediatric practice.

Generally, ultrasound is a high-frequency sound wave with a frequency above 20 kHz. In medicine, applicable frequency range is 2-10 mHz. The feature of ultrasound waves is the ability to reflect off the walls of environments that differ from each other in density. Different tissues conduct ultrasound differently and have different characteristics of its reflection. This makes possible to obtain ultrasound images. When returning echoes are reflected to the sensor (a high-tech device that can both generate and receive ultrasonic waves), two-dimensional image of all tissues, which conducted the ultrasonic waves, is reconstructed. The intensity of the reflected
ultrasound signal depends on the initial difference of acoustic impedances at the walls of environments, allowing to get the real-time image of examined organ. Tissues containing air and bones are inaccessible to this method.

In abdominal practice, ultrasound helps to visualize and characterize (size, contours, structure, density) all parenchymal organs (liver, spleen, pancreas, kidneys), fluid-filled hollow organs (gallbladder and ducts), blood vessels, fragments of intestinal loops, free fluid in the abdomen, enlarged lymph nodes, tumour conglomerates, inflamed appendix. Resolution of modern ultrasonic devices is 1-2 mm.

**Endoscopic methods.**

**Endoscopy** – is a research method based on the introduction into the body cavity of special devices equipped by optical and lighting systems and tools for the collection of material - endoscopes. Endoscopes used in modern medicine are divided into flexible and rigid.

Wide clinical usage of flexible endoscopes with fiber optics (fibroendoscopes) began in the 60’s, when the Japanese company "Olympus" and "Machida" began to produce oesophagogastroscopes with fiber optics. Later, fibrocolonoscopes and fibrobronchoscopes appeared.

Modern fibroendoscopes are complex in their construction, the light is transferred by fibers with diameter of tens of microns, they consist of bundles and form a fiber-optic system, covered with a protective material and are fit inside a flexible tube. In fiber-optic tract, light signals are transmitted from the source to the terminal surface (fibers end), creating a set of picture elements. In fiber details, glass fiber is commonly used, the light core of which has a high refractive index and is surrounded by a glass with a lower refractive index. Consequently, at the border of core and outer layer, the light rays undergo complete inner reflection and move only through the light fiber. For image transfer, multiple rigid fibers and bundles of fibers with regular packing are used. At the terminal end, the picture is projected by a lens, and on the source end – it is observed through the eyepiece. Image quality in such devices is determined by the diameter of light cores, their total number and manufacturing excellence. Resolution of modern flexible endoscopes is 2-5 lines per mm up to 15 mm (i.e. we can see the object with a diameter of 1 mm) and 1.5x optical zoom. At the distal end of the endoscope, there is a terminal window of light guide, eyepiece, opening of channels for insertion of instruments, aspiration of fluid and air. Location of optics can be lateral, oblique and terminal. Purpose of endoscope determines its length, external diameter, number of biopsy channels.

**Capsule intestinoscopy** starts with swallowing by patient of a special capsule which has a miniature video camera, processor, system for transmitting information. During passage through the gut, the capsule continuously, at a speed of 2 frames per second, sends a videostream to a semiconductor recording device via system of sensors, attached to the skin of the abdomen. Later, the recording device is connected to a computer, on which the image is processed, viewed on the monitor and printed. The total number of images exceeds 50.000. This method can detect ulcerative lesions of the small intestine, helminthiasis, bleeding from the small intestine or functional disorders of intestinal motility. Modern capsules can be controlled by changing the magnetic field, which is applied to the abdominal wall.

**Colonoscopy** is a method of examination of the mucous membrane of the colon using a flexible colonoscope.

Basic requirements for colonoscope are based on the anatomy of the colon (curves): presence of end optics, ability to control the moving end of the endoscopic device to move inside the gut and pass the anatomical curves under constant visual inspection, sufficient flexibility of the instrument, ability to clean the optical window and evacuate a small amount of intestinal content. All these requirements are met by modern colonoscopes: controlled distal end with the ability to bend in two planes at 160-180° and graded stiffness – i.e. flexibility is adaptable, ensuring minimal formation of
bends, accelerating the introduction to the intestine and minimal trauma. Colonoscopes also have additional features, like the gastroscopes.

**Sigmoidoscopy** is a method of endoscopic examination of the rectum and distal sigmoid colon through inspection of their internal surface with sigmoidoscope introduced through the anus. Sigmoidoscopy - the most common, accurate and reliable method for studying the rectum and lower sigmoid. With sigmoidoscope the doctor can examine the lining of patient’s colon to a depth of 30-35 cm from the anus. Sigmoidoscope (belonging to the group of rigid endoscopes with fiber optics) is a metal tube with built-in lighting system and a special crane. The crane has a tube put on for air inflation. Into the tube, an obturator with rounded ends is inserted. The device is smeared with vaseline oil and inserted into the anal canal to a depth of 5-6 cm. Then, the obturator is pulled out. The eyepiece is set, lighting system is turned on and the tube is inserted to the depth of 25-30 cm. The examination is performed in the elbow-knee position of the patient with back well bent in the lumbar section.

**Diagnostic laparoscopy** - a method of research, when a special endoscope (laparoscope) is introduced into the abdominal cavity through a small incision to directly visualise the pathological process. Laparoscope is a metal tube with a diameter of 10 mm or 5 mm with a complex system of lenses and light guide. It belongs to the rigid endoscopes and is used to transfer images from the cavities of the human body using the rod lens or optics. Laparoscope allows to explore the inside of the abdominal organs to detect pathology: peritoneum, stomach, anterior surface and edge of the liver, gallbladder’s bottom, colon and small intestine, uterus and appendages. Laparoscopes are supplied with sets of instruments, which include stilettos, trocars, optical tubes, insuflator, light source and set of instruments for diagnostics and surgical manipulations.

### 5.2. QUESTIONS

1. What are the methods of examination used in the assessment of the surgical patient;
2. Objective and subjective methods for evaluating the clinical condition;
3. Status localis and its importance in the diagnosis of disease;
4. Features of laboratory and biochemical studies in diagnostic program;
5. Features and indications for additional and instrumental examinations;
6. The role and importance of methods of examination of surgical patients for verification of clinical diagnosis;

### 5.3. TESTS FOR SELF-CONTROL

1. **What are the symptoms of the injury of soft tissues of the head ?**
   a) vomiting;
   b) loss of consciousness;
   c) amnesia;
   d) anisocoria;
   e) subcutaneous haematoma.
2. **Typical symptoms of fracture of the cranial vault:**
   a) none;
   b) dizziness, headache;
   c) seizures at the beginning, later - paralysis;
   d) paresis and paralysis;
   e) an increase of temperature and pulse rate.
3. **What symptoms prompt the diagnosis of torticollis ?**
1. Head tilt;  
b) pulling the clavicle up;  
c) shortening of the sternocleidomastoid muscle;  
d) hard muscular cord on palpation;  
e) all the above.  

4. Neck malformations include all except:  
a) torticollis;  
b) cysts of the neck;  
c) submandibular lymphadenitis;  
d) lateral fistula of the neck;  
e) median fistula of the neck.  

5. In closed abdominal trauma without damage to internal organs, the following is/are seen:  
a) haemorrhage on the anterior abdominal wall;  
b) subcutaneous and intermuscular haematomas;  
c) true traumatic hernia;  
d) false traumatic hernia;  
e) all the above.  

6. On palpation of the abdomen in case of traumatic peritonitis, the following is/are seen:  
a) rapid pulse and dry tongue;  
b) tension of the abdominal muscles;  
c) leukocytosis with shift to the left;  
d) positive Blumberg’s symptom;  
e) all the above.  

7. The absence of liver dullness and tympanic sound on percussion below the diaphragm in patients with acute abdominal pain can indicate on:  
a) haemoperitoneum;  
b) right-sided heamothorax;  
c) pneumoperitoneum;  
d) gastrointestinal bleeding;  
e) right-sided pneumothorax.  

8. Is the inspection of the part of the body as the source of pain, sufficient for diagnosis?  
a) yes;  
b) no;  
c) only palpation and percussion;  
d) laboratory data only.  

9. On examination of the abdomen, in case of detection of pathology of the colon, all following methods are used except:  
a) rectoscopy;  
b) sigmoscopy;  
c) irrigoscopy;  
d) scanning;  
e) fibrocolonoscopy.  

10. Shoulder length is measured:  
a) from the blade to the inside of the arm pits;  
b) from the blade to the outer bones of the shoulder;  
c) from the head to the outside shoulder bones of the shoulder;  
d) from the head to the inside shoulder bones of the shoulder;  
e) from the axillary area to the olecranon.  

5.4. SITUATIONAL TASKS FOR SELF-CONTROL.  

1. A 32 years old patient, on a background of overall health, suddenly had experienced a severe pain in the left side of the chest, shortness of breath. Objectively: respiratory rate 30 per min, cyanosis, auxiliary
1. Muscles involved in breathing, chest asymmetry. Above left lung, tympanitis is present, absence of respiratory sounds, diminished voice trembling. What is the most likely diagnosis?

2. Patient P., 48 years old, contacted a surgeon with complaints of pain in the right half of the chest, shortness of breath, cough, dizziness. An hour ago he fell from the motorcycle and hit the right side of the chest to the edge of the pavement. Objectively: skin and visible mucous membranes are pale, consciousness is dull, AP - 90/60 mm Hg, pulse - 100 beats per min. Breathing in the right part of the chest is weakened, percussion - dullness in the lower parts. Which pathological process may be suspected?

3. A patient, 35 years old, was diagnosed with gastrointestinal bleeding, anaemia Hb 90 g/L and the lowered number of red blood cells to 2.7·10^{12}. The general condition of the patient is satisfactory. What further examination would be of most informative value to confirm the diagnosis?

4. A patient, 32 years old, had received an injury of anterior abdominal wall while falling from height at work. Four days after, while lifting a load, he felt a sharp pain in the left hypochondrium, dizziness and in 2 hours time he was hospitalized. Objectively: skin is pale; pulse - 110 per min; AP - 90/50 mm Hg; tongue is dry, clean; abdomen is slightly bloating, soft on palpation, sensitive in the left hypochondrium; tympanitis on percussion over intestines, in the projection of both flanks - a dull sound; auscultation - weakened peristalsis; signs of peritoneal irritation - weakly positive. What injury is the most likely in this case?

5. A patient with a history of peptic ulcer disease had suddenly felt a stab-like epigastric pain, muscle tension of anterior abdominal wall, positive Blumberg’s symptom. Which diagnostic method is the most informative for further diagnosis and treatment strategy?

Література.