

PULMONARY IMAGING

Methods of radiological research of lung

Primary method of research of lung is chest radiograph. The chest radiograph is the examination you will be requesting and observing with the greatest frequency. In addition, it is the examination that you will most likely be reviewing alone. Chest radiographs account for more than half of all the examinations performed in any radiology practice. Chest radiograph certainly, it is shown at clinical suspicion on illness lung, at a trauma of a thorax and a polytrauma, at patients with not clear reason of a fever, at oncological diseases.

Radiography it is happens survey and aim. Survey pictures, as a rule, should be carried out in two projections - direct and lateral (the researched side to the cartridge).

Tomography. The given technique is the following stage in radiological inspection. The longitudinal (conventional) direct tomography is more often is carried out. The median cut is carried out at a level of half of thickness of a thorax; the middle of front -back diameter at the adult is equal - 9-12 cm. The forward cut on 2 cm is closer from median in front and a back cut on 2 cm from the end / tail from median. On the median tomogram shadows neither forward will not come to light, nor back departments of ribs, "stumps" of ribs will be visible only; on the forward tomogram forward departments of ribs, and on the back tomogram will be well visible back departments of ribs, on the contrary, will be visible and there will be no display of forward departments of ribs. Usually to these basic attributes most simply it is possible to identify topographical cuts lung. The longitudinal tomography is applied for:

- Estimations of major airways;
- Specifications of structure of pathological formation (disintegration, calcification);
- Revealing tumor unit on a background obstructive changes;
- Visualization of the increased lymph nodes in lungs and mediastinum.

CT. The computerized tomography provides the diagnostic information unattainable by other methods. CT it is applied for:

- Revealing the pathological changes latent pleural exudation of not clear nature;
- Estimations piecemeal dissemination and diffusive interstitial defects lung;
- Differentiations of solid and liquid formations in lung;
- Revealing focal defects in the size up to 15 mm;
- Revealing larger focuses of defect with an adverse arrangement for diagnostics or weak increase of density;
- Visualization of pathological formations mediastinum;
- Estimations of intrachest lymph nodes. At CT lymph nodes of roots lung by the size, since 10 mm (are visualized at a conventional tomography - not less than 20 mm). At the size 1 cm they it there is less are regarded as normal; from 1 up to 1,5 cm - as suspicious; larger - as definitely pathological;
- Decisions of the same questions, as at a conventional tomography;
- In case of possible surgical or radiotherapy treatment;
- At nondiagnostic with radiograph and conventional tomography .

Fluoroscopy. Its advantage in reception of the image in a mode of real time, an estimation of movement of structures of a thorax, multiaxial research that provides adequate spatial orientation and a choice of an optimum projection for aim pictures. Besides under the control fluoroscopy punctures and other manipulations on bodies of a thorax are carried out.

Fluorography. As screening a method of visualization lung the photoradiography is supplemented full-frame format radiography in not clear cases, at absence of positive dynamics{*changes*} within 10-14 days or in all cases of the revealed pathological changes and at

the negative data missing with a clinical picture. At children the photoradiography is not applied because of higher, than at radiography dose.

Bronchography. The method of contrast research of a bronchial tree refers to bronchography. Contrast substance for bronchography is oil-soluble agents (propylidone). At bronchography can be used and water-soluble X-ray contrast means.

Introduction of contrast substance in tracheobronchial a tree is made by different ways. Most the wide circulation was received with methods with use catheter - through nose catheterization bronchial tubes under local anesthesia and bronchography with narcosis. After introduction of contrast substance in tracheobronchial a tree serial pictures are made in view of sequence staining bronchial system.

As a result of development bronchoscopy, based on fiber optics, diagnostic value bronchography has decreased. For the majority of patients necessity for carrying out bronchography arises only when bronchoscopy does not give satisfactory results.

Angiopneumography - a technique of contrast research of vessels of a small circle of blood circulation. It is used selective angiopneumography is more often, consisting in introduction radiographic contrast catheter in cubital a vein with subsequent its carrying out through the right cavities of heart it is selective to the left or right trunk pulmonary arteries. The following investigation phase is introduction of 70 % of a water solution of contrast substance of 15-20 ml under pressure and carrying out of serial pictures. Indications for this method are diseases pulmonary vessels: embolism, arteriovenous aneurysms, varicose expansion pulmonary veins, etc.

Radionuclid researches of organs of breath

Methods radionuclid diagnostics are directed on studying of three main physiological processes making a basis of external breath: alveolar ventilation, alveolar-capillary diffusion and a capillary blood-groove (perfusion) systems pulmonary arteries. Now the applied medicine has no more informative methods of registration regional a blood-groove and ventilation in lung.

For such realization of researches use two basic kinds RPP: radioactive gases and radioactive particles.

Regional ventilation. Use radioactive gas ^{133}Xe . $T_{1/2}$ biol. - 1 mine. $T_{1/2}$ phys. - 5,27 days. γ -, β - rays. Studying of alveolar ventilation and a capillary blood-groove with application ^{133}Xe is carried out on multidetector scintillation devices or the gamma-camera.

Radiopulmonography (radiopneumography)

At intratrachea introduction ^{133}Xe it is distributed on various zones lung according to a level of ventilation of these zones. Pathological processes in lung which conduct to local or diffusive to infringement of ventilation reduce quantity of the gas acting in struck departments. It is registered with the help of the radiodiagnostic equipment. External registration of γ -radiation xenon allows to receive graphic record of a level of ventilation and a blood-groove in any set site lung.

The patient inhales ^{133}Xe , at approach of a plateau makes a deep breath and an exhalation (maximum). Right after exhalation carry out 2-nd stage: intravenously enter isotonic solution NaCl of which it is dissolved ^{133}Xe which diffuse in alveoluses and exhausts.

1. For an estimation regional ventilation define the following parameters: a) vital capacity lung in %; \bar{b}) the common capacity lung in %, b) residual volume lung; time partial ejection the indicator: $45 \pm 3,7$ with.

2. For an estimation of an arterial blood-groove define: a) height of amplitude; \bar{b}) time partial ejection the indicator.

Intrapulmonic dynamics ^{133}Xe depends on a degree of participation of alveoluses in external breath and from permeability of a alveolar-capillary membrane.

The height of amplitude is directly proportional to quantity radionuclid, and, hence, and weight of blood. The important parameter is the period partial ejection, describing speed gaseous

exchange processes between blood, pulmonary vasculature and atmospheric air. This parameter, on the average, makes 8-10 with. The important parameter ventilation (percentage of volume of ventilation to regional to a blood-groove in identical sites lung).

Perfusion scintigraphy lung. It is applied to studying pulmonary a blood-groove, mainly, with the purpose of diagnostics (thrombo)embolism pulmonary arteries. It is used RPP - ^{99m}Tc - the macrounit of human whey. The principle of a method consists in time blockade of an insignificant part pulmonary capillaries. In some hours after an injection albuminous particles collapse enzyme blood and macrophages. Infringements of a capillary blood-groove are accompanied by change of normal accumulation $\text{P}\Phi\text{II}$ in lung.

PET (positron emission tomograf) - the best way of revealing of prevalence of a cancer lung. Research is carried out with - 18-fluorineglucose. Application of a method restrains in its high cost.

Role MRI in diagnostics of diseases of organs of breath

Application MRI is limited, mainly, to visualization of pathological formations mediastinum and roots lung, defeats of a chest wall, revealing and the characteristic of diseases of large vessels of a chest cavity, especially aortas. Clinical value MPT pulmonary parenchyma is insignificant.

Role of ultrasonic in diagnostics of diseases of organs of breath

This method has the limited value in diagnostics of the majority of diseases of bodies of a thorax (except for illnesses of cardiovascular system). With its help it is possible to receive the information concerning the formations adjoining with a thorax or prisoners in it, about a pleural cavity (a liquid and dense formations and a diaphragm (about movement and the form), and also about the formations which are settling down in certain departments mediastinum (for example, about thymus iron).

The analysis of the chest radiograph

(chest radiograph, systematic interpretative approach).

For a systematic evaluation, a chest radiograph should first be looked at from a technical viewpoint. Rotation: assess the distance from the medial ends of the clavicles and anterior ends of the ribs to the centre of the vertebral bodies, which should be equidistant.

Inspiration: adequate inspiration is identified by the appearance of six anterior ribs above the hemidiaphragm, whereas eight or more visible ribs suggest hyperinflation. Four ribs or fewer are seen in hypoaeration. The anterior ribs are more reliable in children as the dome of the diaphragm is anterior. Penetration: intervertebral disc spaces should be visible through the cardiac shadow, and central pulmonary vessels also easily seen, in the presence of adequate penetration. Outlines of structures should be well-defined. There should be a systematic approach to examination of the findings on a chest radiograph, to ensure that possible pathology is not overlooked. The ribs of the radiograph are inspected. This includes the abdomen, neck and shoulders. The position of any tubes of catheters is noted. The shape of the thorax is inspected, and checked for symmetry. The soft tissues of the chest wall and the bony thorax are evaluated. The contours of the hemidiaphragms, mediastinum, heart and pleura are inspected.

Then the structures within the mediastinum are assessed individually: the trachea and major bronchi, the great vessels, the thymus and the locations of lymph nodes. The size of the heart and pulmonary vessels is evaluated, and the contribution to the cardiac contour by individual chambers is assessed. The spine and paraspinal structures are probably best evaluated at this time also.

The pulmonary parenchyma is then surveyed, paying particular attention to areas obscured by other structures, that is, the retrocardiac region, the lung apices, and below the dome of the diaphragm.

It should be begun with an estimation of technical qualities of a picture. The radiograph should capture completely a thorax from tops lung up to a diaphragm and rib- diaphragmatic sine. Symmetric position sternal the ends clavicle in relation to ribs of were outlined bodies (or awned shoots) top chest vertebra testifies to correctness of installation of the patient during carrying out of the X-ray film.

At correctly picked up specifications (force of a current, a voltage, an exposition) on the chest film should be visible bodies three or four top vertebra, and other chest vertebra only slightly are outlined as a continuous shadow on mediastinum.

The chest film should be enough contrast - a median shadow, area of an arrangement of a liver should be white, and pulmonary fields - dark, with the distinct image pulmonary figure. Outlines of a diaphragm, the top of ribs, hearts should be precise.

After an estimation of technical qualities of a picture it is necessary to pass to the roentgen-anatomica to an estimation of a thorax. In a forward survey picture lung the image of a thorax and bodies of a chest cavity turns out. The greatest on the area a place occupy in pictures lung, forming so-called pulmonary fields - right and left. First of all, it is necessary to distinguish the right side of a thorax from left. For this purpose it is necessary to pay attention to a shadow of heart: at the healthy person 1/3 these shadows settle down to the right of an average line, and 2/3 - at the left. Besides in the top part left pulmonary fields the shadow of an arch of an aorta acts, in the field of its transition in a descending aorta.

The relation of a diameter of a thorax to distance between lateralis ribs of roots at chest children 2/1, at adults - 3/1. Root departments are covered in the greater degree, than at adults.

The diaphragm limits from below pulmonary fields to a dome-shaped shadow. In the central part it settles down most highly, and, falling from top to bottom, forms external costodiaphragmatic slopes (sine). An average level of an arrangement of a diaphragm - the sixth edge (a forward department) which as though crosses a diaphragm in the center. The right slope of a diaphragm on 1-1,5 cm settles down above, than left.

Some muscles and soft tissues of a chest wall are projected on a background pulmonary fields. It is necessary to take into account, that downturn of a transparency pulmonary fields can be caused by stratification sternocleidomastoid, the big and small pectoral muscles, wide muscles of a back, mammary gland and mammilla.

On the direct film such bone elements, as ribs and clavicle are visible. Ribs are projected on a background transparent pulmonary fields in quantity of 9-10 pairs from both sides. It is necessary to distinguish back and forward pieces of ribs. Back pieces of ribs already forward, give more intensive shadows and have close vertebra a short bend upwards, and then are directed from top to down and on the outside. Forward pieces of ribs settle down back pieces below corresponding to them and are directed outside and from above inside and downwards; the forward ends of ribs pass in costal cartilages which do not give a shadow on films at children and young people. Since age of 18-20 years, are found out insular ossification cartilaginous, (gristly) parts of the first edge; the next years ossify costal cartilages of other ribs. On direct films of a thorax the bone structure of ribs is distinctly visible. It is necessary to mean an opportunity of a bone pathology. At correct installation of the patient clavicle cross a forward piece of the first edge and a back piece of the fourth that is an exact reference point for digital definition of all below and above the located pieces of ribs. Practical value has readout of forward pieces of ribs since on them it is accepted to locate both anatomic substrata, and the centers of pathological formations.

Shadows of roots lung are various also. The root left lung is latent by a part behind the image of heart, but its top border is always precisely designated by a wide shadow of the left branch pulmonary arteries. The root right lung, as a rule, has no so clear top border. Roots lung on roentgenograms is an image right and left pulmonary arteries with all its branchings. Not changed lymph nodes and walls of large bronchial tubes are not part of the shadow image of a root lung. Roots lung form on each side mediastinum slantwise the located shadows which are coming nearer on a configuration to a point on the right and a half moon at the left. On the right the shadow of a root is separated from a median shadow by a transparent strip (≈ 1 cm), representing a projection of the basic and right lower-lobe bronchial tube; at the left the root usually to a greater or lesser extent

is closed by a shadow of heart. The arrangement of the top border of roots lung is defined by a level the largest vascular trunks (a level II intercostal). The top border of the left root is located above. The width of a root of the adult person changes from 1,5 up to 2,5 cm, and, the left root is always wider, than right. The external contour of a shadow of a root is rectilinear or is slightly concave. Camber or polycyclicity of a contour of a root testifies to a pathology. Roots lung are subdivided into the head, a body and a tail part. The head settles down at a level cartilaginous (gristly) parts of 2 ribs, a body - between 2 and 3 ribs, and caudal a part - from 3 ribs from top to bottom up to 4-th rib. Roots lung are better for studying on the shadow picture received at height of a deep breath and it is better in position of the patient standing. In norm a root structure, i.e. the shadow of it is non-uniform because of its projective stratification on pulmonary an artery of vascular branches departing from it, and also cross-section of bronchial tubes.

At children of younger age root departments lung are covered with an intimate shadow in the greater degree, than at more senior children and at adults. Roots lung are covered with cross-section located heart and wide thymus.

The median shadow is a symbol of mediastinum, a chest department of a backbone and a breast bone. However at research of the patient in a direct projection the median shadow is, first of all, a cardiovascular shadow since other formations are not represented outside a cardiovascular bunch. In mediastinum the same as and in roots lung, lymph nodes settle down. Having rather small size, they are not visible at radiological research. But at the same time, the radiological method possesses the leading part in recognition pathologically changed (increased, calcified) intrachest lymph nodes.

On a background transparent pulmonary fields the bound shadows being display of blood vessels lung - arteries and veins are defined laminate shadows. Bronchial tubes and connective-tissue layers in norm are not visible. Elements pulmonary figure are traced during 3/4 pulmonary fields, in external departments of it they are not visible. Shadows of vessels are more intensive and are large in medial sites. On a course or at the ends separate laminate shadows are visible small roundish or oval dense shadows. Their diameter usually corresponds to width of those laminate shadows pulmonary figure on which they accumulate or with which come to an end; near to a root they the largest. Roundish or oval shadows are display of axial or slanting section of vessels, as against a longitudinal projection at laminate the image of vessels.

In the top part of a thorax the right contour of a median shadow goes along a right edge of a shadow of a backbone, but below the contour of a median shadow as an arch acts in right pulmonary a field, settling down on 1-1,5 cm on the outside from a right edge of a shadow of a backbone. As to the left contour of a median shadow it goes considerably more to the left of edge of a shadow of a backbone. Its site most acting to the left is on 1,5-2 cm in(side) from left half-claviculae lines.

Lobes right lung are projected on a forward chest wall as follows: the upper lobe occupies space from a top up to a forward department of IV rib, middle- from IV up to VI ribs, lower - from a level of back department IV-V of ribs up to a diaphragm. At the left the upper lobe settles down from a top up to a forward department of VI rib, lower - from a level of back department III-IV of ribs up to a diaphragm.

Simplifies localization of pathological processes in lung research in a lateral projection. In the beginning in a lateral picture find the highest point of a dome of a diaphragm. From it through a shadow of the middle of a root carry out a direct line before its crossing with the image of a backbone. This line corresponds to a slanting interlobe crack and separates the lower lobe from left lung and from upper and middle in right lung.

The trachea shares on two main bronchial tubes - right and left. It is considered to be them bronchial tubes of the first order. The main bronchial tubes give rise to lobe bronchial tubes, i.e. bronchial tubes of the second order (on the right allocate still an intermediate bronchial tube, not designating its order). Lobe bronchial tubes are divided on bronchial tubes of the third order which

have received the name of segmentary bronchial tubes. Besides a bronchial tube, each segment has also an independent segmentary artery. It enters into a segment together with a bronchial tube. The upper lung lobe will consist of three segments: 1 - apical, 2 - posterior, 3 - anterior. The middle lobe will consist of two segments (4-5). Right lung: 4 - external, 5 - internal segments. Left lung: 4 segment - upper uvular and 5 segment - lower uvular. The lowest lobe lung on the right will consist of 5 segments: 6 - superior, 7 - medial basal, 8 - anterior basal, 9 - lateral basal, 10 - posterior basal. In left lung quite often allocate only 9 segments. (7 is absent).

The basic radiological syndromes at diseases and damages lung.

As the pathology is diverse pulmonary, its radiological attributes manage to be laid in nine basic syndromes:

1. Total or subtotal a shadow of pulmonary fields.
2. The limited a shadow of pulmonary fields.
3. A round a shadow in pulmonary field.
4. Ring-shaped a shadow in pulmonary a field.
5. The nodular dissemination.
6. Diffusive dissemination.
7. A pathology pulmonary figure.
8. A pathology of a root lung and bronchial lymph nodes.
9. An extensive enlightenment pulmonary fields.

Full to characterize each shadow on the film, it is necessary to know the following of eight attributes of a shadow:

1. Position of a shadow.
2. Number of shadows.
3. The form of a shadow.
4. The sizes of a shadow.
5. Intensity of a shadow.
6. Figure shadows (structure).
7. Contours of a shadow.
8. Removable shadows.

First seven attributes estimate under roentgenograms, and the eighth (removable) - mainly at fluoroscopy.

Numerous pathological processes in lung cause changes their transparency.

Total or subtotal a shadow of pulmonary fields. In cases seepage pulmonary tissues, growth of unit of a tumour, a congestion of a liquid, airless sites lung. Extensive (a total or subtotal shadow) give atelectasis lung, a pneumonia of all lung, total exudative a pleurisy, a cirrhosis lung, diaphragmatic a hernia. If mediastinum it is displaced aside, opposite to shadow, is the expressed pathological process in a pleural cavity. If the shadow is homogeneous, at the patient a congestion of a liquid in a pleural cavity if it is inhomogeneous - that diaphragmatic a hernia. At displacement mediastinum aside defeats the pneumosclerosis, atelectasis, a condition after pneumonectomy is possible. At atelectasis a shadow homogeneous, and at a pneumosclerosis non-uniform. At a pneumonia mediastinum it is not displaced. Confidently the congestion of a liquid is distinguished at ultrasonic and CT.

The limited shadow in lung corresponds to defeat of a lobe of lung, one or several segments, exudativ and encapsulated to a pleurisy, diaphragmatic to a hernia, a tumour mediastinum.

Nodular opacities – nodular fine (up to 0,3 cm in diameter), average (up to 0,3 - 0,5 cm), large (0,5 - 1 cm in diameter). In a basis of the nodular is lung defeat acinus (the fine - miliary) or lobules (the large nodular). Nodular opacities frequently are plural (a lobe pneumonia, hematogenic-disseminated a tuberculosis, MTS of malignant tumours, etc.).

In spite of the fact that pathological changes in lung are characterized by a shadow of the uncertain form is more often, meet also vectorially correct form of a shadow (round, ring-shaped, triangular, linear). Spherical formations in lung at research in direct and lateral projections are characterized by a shadow of the round form. Among the diseases giving a round shadow, it is necessary to allocate a peripheral cancer, tubercular infiltration, tuberculoma, MTS of malignant tumours, echinococcus, a tumour mediastinum, benign tumours, etc.

Ring-shaped the shadow in lung corresponds to a cavity in lung, containing air. On X-ray film in direct and lateral projections at fluoroscopy the closed ring is defined. Such form the shadow can be caused by the tubercular cavity, the breaking up cancer tumour, the abscesses, air cyst, cystic bronchiectasis.

Segmentary atelectasis, pneumonias, mediastinum pleurisies, a pulmonary embolus are characterized by shadows of the triangular form. Linear shadows in lung can arise at chronic inflammatory diseases owing to growth of a connecting tissues, at a thickening of a pleura, at some types of stagnation in lung.

On structure of a shadow are homogeneous (homogeneous, unstructured) and non-uniform. Atelectasis, exudative a pleurisy, hydatid cyst, a lobe pneumonia in stages hepatization give a homogeneous shadow. Tumours lung, bronchopneumonia, abscessing pneumonias, chronic pneumonias are characterized by non-uniform shadows.

Intensity of a shadow depends on size of pathological process in lung and from pathomorphology a substratum. The shadow is considered intensive if on its background it is not differentiated not only pulmonary figure, but also shadows of ribs. Shadows of small intensity are characterized by presence pulmonary figure on their background. The shadow of average intensity is deprived pulmonary figure. However on its background shadows of ribs are differentiated.

Contours of a shadow in lung are more often (blurred, fuzzy), dim, gradually passing in normal pulmonary a tissue. It is observed at sharp inflammatory processes. A precise smooth contour have hydatid cyst, festered [suppurated] air cyst, inflammatory process within the limits of one share, which shadow precisely delimit an interlobe crack. A precise smooth contour give tuberculoma, a peripheral cancer lung.

Increase of a transparency lung - meets at a lot of diseases and can be diffusive, bilateral, unilateral or local.

The enlightenment of both pulmonary fields is caused by increase in volume pulmonary tissue at patients emphysema, a bronchial asthma, the chronic bronchitis.

Increase of a transparency of one lung, lobes is caused by infringement of their ventilation (valve corking of a bronchial tube) or pneumothorax; at the last there are no elements pulmonary figure in general. The local symptom of an enlightenment gives air cyst. So-called huge cyst sometimes occupy almost all lung and cause increase of its transparency. Cavities in lung, containing air (the tubercular cavity, the breaking up peripheral cancer, the emptied abscess, bronchiectasia, air in a pleural cavity) cause presence of a local enlightenment.

The characteristic of enlightenments is carried out under the same circuit and sequence, as shadow.

The characteristic on position of a cavity matters for topical diagnostics - the cavity is outside of or inside lung and for differential diagnostics.

The characteristic on number of cavities. Single cavities are characteristic for a chronic abscess lung, a breaking up cancer. Plural cavities are at bronchiectasia, at cavernous a tuberculosis.

In the form of a cavity can be correct, ring forms at the generated tubercular cavity and wrong - at abscesses, bronchiectasia.

The sizes of cavities. It is accepted to divide cavities on fine (diameter of 1,5 cm), average (1,5-5 cm), large (up to 8 cm) and huge (from above 8cm).

Figure (structure) of a cavity. It is necessary to understand a condition of walls, contents of a cavity and surrounding fabric as this definition. Air cavities can be without liquid contents and with a liquid. The horizontal level of a liquid above which air settles down will be defined in the latter case. Such picture, as a rule, happens at the generated abscess lung. Very seldom at a tuberculosis, an abscess and a breaking up cancer in a cavity, except for a liquid, there can be a slice necrotizing and come off from a great bulk pulmonary fabrics - the sequestration. Air cavities without a liquid, as a rule, are at gangliac lung; at a tuberculosis also almost there is no liquid in cavities.

Condition of walls of a cavity. Walls cavernous formations can be as thin-walled capsules, the fibrous, precisely outlined rings or as the expressed inflammatory shaft. If the cavity thin-walled also is precisely outlined on an internal and external contour is, undoubtedly, gangliac process in lung without attributes inflammatory seepage. The wall of a cavity as the outlined ring with more or less wide (fillet; band) testifies about fibrosis it. Inflammatory granulation the shaft around of a cavity is a parameter infiltrative changes pulmonary tissues. At an abscess granulation the shaft is caused by one inflammatory phenomenon, and at a breaking up cancer - both tissues of the kept tumour, and inflammatory perifocal reaction.

External contours of a cavity can be as sharp outlines that testifies to absence inflammatory seepage; at presence of last contours become indistinct, with the tendency to gradual transition in healthy pulmonary a fabric. This attribute is characteristic for a formed, developing cavity of a various origin. At the generated cavity internal and external contours of it become equal and precisely outlined.

Change pulmonary figure. The majority of diseases lung is accompanied by change pulmonary figure: amplification, pauperization, deformation.

Amplification pulmonary figure is caused by infringement pulmonary a blood-groove, more often, and characterized by increase in number of elements pulmonary figure, more dense network of fine branchings of the pulmonary figure is found out at the got and congenital heart diseases with increased pulmonary a blood-groove, at sharp inflammatory processes.

Pauperization pulmonary figure (reduction of its elements) is observed at emphysema, huge air cyst, at the congenital heart diseases proceeding with reduced pulmonary by a blood-groove (Fallot's tetrad, a stenosis of an aperture pulmonary arteries, etc.).

Amplification and deformation pulmonary figure are caused by growth of a connecting tissue around of vessels, bronchial tubes, interlobular and between acinosis partitions. Such changes pulmonary figure are observed at a chronic pneumonia, a chronic bronchitis, a pneumosclerosis tubercular and not tubercular aetiology, bronchiectasis, etc.

Changes of roots lung. Many diseases lung are accompanied by change of roots lung and, first of all, their expansion. Expansion of a root lung can be unilateral, for example, at sharp inflammations and bilateral. Bilateral expansion of roots lung without change of structure and their position is observed at the increased blood-groove in a small circle of blood circulation at got and some congenital defects. Expansion of roots lung in the given cases is accompanied by amplification pulmonary figure and change of a configuration of heart. Expansion of a root lung is promoted by increase in lymph nodes. Polycyclicity of a contour of the expanded root lung at the adult person testifies to tumoral defeat lymph nodes.

Fibrous and cicatricial changes radically lung result in its expansion, deformation with preservation of structure and amplified clearness of elements, to change of position of a root - pulling up (at fibrous - cavernous a tuberculosis). Fibrous changes of a root lung correspond fibrous changes in lung.

Changes of position and infringement of mobility of a diaphragm.

Diseases lung which are accompanied by reduction of volume lung or shares owing to development of a cirrhosis, fibrothorax a various origin, atelectasis, and also absence of a share or the whole lung as a result of operative intervention, are characterized by high position of a

diaphragm. It is observed also at a relaxation, and a paralysis of a diaphragm. Sometimes high position of a diaphragm is caused by growth of a tumour in subdiaphragmatic organs. Low position of a diaphragm is observed at increase in volume in all lung or its parts (emphysema).

Radiological attributes acute inflammatory processes lung.

Till now there is no uniform classification of acute pneumonias. Many researchers prefer to divide acute pneumonic processes on etiological to a principle.

Pneumococcal a pneumonia. Lung-fever the pneumonia is the most known.

It is characterized by the acute beginning, heavy current, sequence of pathoanatomical changes. The infection which has got in an organism in the aerogenic way at presence of some contributing factors (cooling, overfatigue, etc.), causes defeat of the whole lobe lung or parts of it. In this connection lung-fever a pneumonia frequently name lobar a pneumonia, or pleuropneumonia. Clinically and pathoanatomical the pneumonia is characterized by change of four stages of development.

The stage of inflow, or hyperemia, is accompanied by overflow of a lobe lung blood and expansion of capillaries, a congestion in alveoluses of a serous liquid with presence erythrocytes, leukocytes. Duration of this stage about one day. In this stage of a pneumonia amplification pulmonary figure of the lobe, and by the end of 2-3 day - insignificant downturn of a transparency, expansion of a root lung is marked, the linear shadow of an interlobe pleura is sometimes visible, restriction of mobility of a dome of a diaphragm is marked. The stage hyperemia passes to 2-3 day in a stage red hepatization. Cavities of alveoluses are filled by fibrin with an impurity erythrocytes, leukocytes, alveolar epithelium that results in increase in volume of a lobe, its density.

X-ray film show in a stage red and grey hepatization the intensive shadow according to the struck lobe of lung almost homogeneous character is defined. Intensity of it raises to periphery. The lobe has the usual sizes, a root lung is more often is expanded, the structure of it is lost. And at atelectasis the lobe in sizes decreases. Besides consolidation at lobar pneumonia differs two more features: first, intensity of a shadow in the direction of periphery increases; second, that on its background in medial departments are visible radiolucent a strip of bronchial tubes of large and average caliber (this sign be possible mean as air bronchogram – air bronchogram, visualization of air within normal intrapulmonary bronchi caused by consolidation in adjacent alveoli providing tissue contrast between lucent airways and opaque lung).

Adjacent the pleura is condensed, regarding cases it is found out effusion in a pleural cavity which comes to light in lateroposition on one side better. Radiological distinctions between a stage red and grey hepatization are not present.

The stage of the resolution is characterized by gradual decrease in intensity of a shadow, its fragmentation and reduction in sizes. The shadow of a root still long time remains expanded and not structural. The same it is necessary to tell and about pulmonary figure on a place former hepatization: it remains amplified during 2 - 3 weeks after clinical recovery. Complications, a failure to which number transition in abscessing or a chronic pneumonia with development bronchiectasis concerns, a cirrhosis are possible.

Bronchopneumonia (lobular). The activator of it is pneumococcus. At bronchopneumonia in inflammatory process are involved lobules i.e. in pulmonary tissues appear at various times and consequently stages which pass the pneumonic centers, are not identical (in one centers - a stage of inflow, in others - hepatization, in the third - resolution). As against lobar pneumonia, current of disease less heavy. At radiological research bilateral defeat lung with presence focal the shadows corresponding to the sizes lobules (1,0 cm), with dim contours of small or average intensity is characteristic. The greatest quantity of the centers settles down in the bottom departments lung. On all an extent lung amplification pulmonary figure is marked, roots are expanded, the structure of them is absent. Reaction is quite often observed on the part of a pleura, development exudative a pleurisy is possible. At bronchopneumonia merge of the centers to formation of large focuses of an

inflammation is possible. Bronchopneumonia it can be characterized fine focal by shadows, in a basis defeat acinus lays. Prominent feature bronchopneumonia is fast dynamics focal shadows within the first week, and disappearance of the centers is observed in 10-14 days. In it is the basic difference from a tuberculosis.

Streptococcal and staphylococcal pneumonias. Make about 10 % of all acute pneumonia. The basic contingent - children, including early age and newborns.

Primary staphylococcal and streptococcal pneumonias at adults can clinically proceed on two types.

Unique way to distinguish staphylococcal from a streptococcal pneumonia - the bacteriological analysis.

The radiological picture strepto -and staphylococcal pneumonias is characterized by presence of plural bilateral inflammatory focuses of the large and average sizes. Outlines of focuses indistinct, intensity of shadows depends on their sizes; the expressed tendency to their merge and the subsequent disintegration is marked. In these cases on a background of shadows of inflammatory focuses there are radiolucent, often be present air-fluid level. Rather fast change of a radiological picture is characteristic. Within 1-2 weeks it is possible to observe occurrence infiltration, their disintegration, transformation of cavities of disintegration in thin-walled cyst with their subsequent reduction (sometimes longer). On one chest film it is possible to find out all stages of development pneumonic, that gives to a radiological picture an original kind. Frequently joins exudative a pleurisy, quite often purulent. The triad of symptoms is characteristic for these pneumonias: consolidation, roundish cavities of disintegration, pleural exudation. Outcomes strepto- and staphylococcal pneumonias are various. Sometimes pulmonary figure long time remains amplified. At separate patients the increase cyst owing to valvular swellings is observed; their break can lead to spontaneous pneumothorax. Shadows of roots lung which extend and homogenize at sharp current of a pneumonia, gradually accept a normal kind. Differential diagnostics carry out with tuberculosis, a chronic pneumonia. Distinctive recognition is helped by fast dynamics of process.

Viral pneumonia. The influenzal (grippe) pneumonia arises more often. The basic clinical displays: pains in a thorax, cough with allocation poor phlegm, general weakness. Temperature in most cases mild pyrexia, (low grade fever) though can sometimes rise up to high figures. The picture of blood is characterized leukopenia, sometimes lymphocytosis. Clinical feature acute interstitial pneumonias is resistance to sulfanilamide and to the majority of antibiotics. Allocate 3 stages of a radiological picture acute interstitial pneumonias: 1) initial, tracheobronchitis, described by amplification of pulmonary figure. A substratum of the specified changes is inflammatory seepage interstitial a tissue located around of bronchial tubes, vessels, acinus, lobule, segments. There is a significant amount of shadows (on unit of the area), and their normal radial orientation disappears. 2) Peribronchitis at which on a background amplified pulmonary figure appear multifocal uptake shadows, is especial in parahilar region and supradiaphragmatic departments, and 3) pneumonic at which multifocal uptake shadows are a basic element of a radiological picture; are possible large low-intensity infiltration with indistinct outlines; pleural effusion is absent. Current interstitia pneumonias long: radiological changes are observed within 3-6-8 weeks and more. At favorable current acute viral pneumonia resolves completely and restored a normal radiological picture. At the delayed current as the residual phenomena condensation of a pleura and sites of a pneumosclerosis can be observed. Quite often the viral pneumonia accepts character chronic. The chronic bronchitis, diffusive a pneumosclerosis develops, appear bronchiectasis.

Dynamics of a radiological picture, the analysis phlegm, immunologic(al) researches help to put the correct diagnosis.

Radiological attributes of chronic nonspecific inflammatory processes in lung

Chronic bronchitis. At a acute inflammation of bronchial tubes radiological research is undertaken not so much with the purpose of recognition of a bronchitis, how many for exception of

other defeats lung, first of all, pneumonia. In lung cases of a acute bronchitis the picture from norm does not differ. At heavy current of a bronchitis amplification pulmonary and root figure is defined. At a chronic bronchitis the following pathological changes can be revealed: 1) a thickening of walls of bronchial tubes and increase in volume of a connecting tissue in lung (pneumosclerosis), and 2) a emphysema lung in a combination to attributes pulmonary hypertension.

The second group of attributes is typical only for diffusive an obstructive bronchitis. Absence of changes on chest film is not the proof of absence of a chronic bronchitis.

The thickening of walls of bronchial tubes is shown as ring-shaped shadows of axial sections of bronchial tubes. Thickness of a ring makes, as a rule, less than 1 mm. At an arrangement of a bronchial tube to in parallel x-ray film or under a small corner to it reinforced walls are allocated as parallel stria ("tram rails"), everyone in width no more than 1 mm. Non-uniformity, roughness of their outlines, excesses. The thickening of walls of bronchial tubes is combined with other changes pulmonary figure, first of all, with attributes diffusive interstitial fibrosis. It is shown in pictures mesh - trabecular by figure and caused by a thickening alveolar and interlobular partitions.

The syndrome emphysema lung and pulmonary hypertension - expansion of a thorax, expansion of large branches pulmonary arteries, pauperization peripheral pulmonary figure, flattening and low position of a diaphragm, a small shadow of heart is much less often defined on chest film.

Chronic nonspecific pneumonia.

Inflammatory process lung, accompanying with irreversible changes of all structures and development it is purulent - necrotic focuses, growth of a connecting tissue, occurrence of the centers of a productive inflammation. Time of transition of acute process in chronic changes from several weeks till 6-7 months. As against a chronic bronchitis, disease does not conduct to total defeat bronchoalveolar tissues, and is limited only to a part lung.

The most constant symptoms is cough with allocation mucopurulent fetid phlegm and hemoptysis. Disease has propensity to progressing. The chronic pneumonia can sometimes occupy the whole lobe or a separate segment or has the form roundish focus of radiodense. Amplification and deformation pulmonary figure and infiltration changes in pulmonary tissues is marked. At the further progressing restriction of a suppuration, a pneumosclerosis, bronchiectasis is found out. With the purpose of exception lung cancer it is necessary for a pneumonia tomographic research, bronchoscopy, cytologic, histologic researches.

Radiological attributes of a tuberculosis of bodies of breath.

Can give any radiological syndrome. In total allocate 12 clinical forms of a tuberculosis. We shall consider most frequently meeting.

Primary tuberculosis. The primary tubercular complex is formed. This combination of specific defeat pulmonary the tissues, usually limited character, and intrachest lymph nodes, mainly regional in relation to localization of the center. A triad: 1) the primary center (infiltration) in pulmonary tissues, regional lymphangitis – laminate a shadow (a vascular path), 2) going to a root (hilar region) and incorporating to a shadow hyperplastic lymph nodes, 3) regional lymphadenitis. Typically, thus, double-polar, a figure of "dumbbell".

Tuberculosis of intrachest lymph nodes. In this case, except for a usual minimum, tomograms are necessary. To the expressed forms of a tuberculosis intrachest lymph nodes concern infiltration and tumor-like bronch(o)adenitis.

Infiltration lymphadenitis. It is characterized by development of inflammatory process outside a capsule of lymph nodes, i.e. in pulmonary parenchyma. Expansion and deformation of roots are marked, the contour indistinct is more often unilateral, the structure is broken.

Tumor-like lymphadenitis. Condensation, deformation, expansion of a shadow of a root with typical changes of the external contour getting polycyclic wavy character.

Indurative the form of lymphadenitis is characterized by development of a fibrous connecting tissue in lymph nodes and presence of the rests specific inflammatory seepage and caseous weights.

Focal a tuberculosis. Plural multifocal uptake shadows of the different density, settling down groups in the top departments lung - in tops and subclavian areas.

Hematogenously disseminated a tuberculosis lung. Dynamics proceeds for a long time - 7-9 months.

Miliary a tuberculosis - symmetric semination in all fields fine identical (1-2 mm) the centers of equal density and sizes.

Subacute - different size and the form, the identical intensity, symmetrically located from both sides multifocal uptake .

Chronic - semination polytypic - different size, the form, density - the locuses distributed on separate sites lung; presence of the expressed pleural stratifications and pulling up of roots up.

Infiltration-pneumonic tuberculosis lung. Infiltration the tuberculosis can proceed acute, clinically to be similar to a flu, a pneumonia, however flash of tubercular process is delayed, in phlegm appear mycobacteria a tuberculosis. Low-intensity, blurred the outlined focus of opacity, is more often than the oval form, located in the top departments lung and connected by linear shadows a path with a root.

Tuberculoma. Represent spherical formations in diameter more than 1 cm. Morphological tuberculoma - focuses caseous the pneumonias of various prescription surrounded connective tissue with a fibrous capsule; isolated large focal a shadow or small focus of intensive irregular-shaped opacity with rough or scalloped, but precise contours (frequently on a background of other tubercular changes: the nodules on a circle, calcificatio, pleural commissures, apical stratifications).

Cavernous a tuberculosis. It is characterized by presence in lung isolated cavities without expressed perifocal infiltration and fibrous changes in pulmonary parenchyma. The initial form can be infiltration the form, focal, disseminated.

Leading symptom of a cavity - a cavity of an enlightenment without a horizontal level of a liquid with clear closed ring-shaped a shadow, clearly outlined internal and external borders and with a shadow drainage a bronchial tube connected to a root, without the expressed attributes of a pneumosclerosis and fibrosisa in surrounding pulmonary parenchyma.

Fibrosis- cavernous a tuberculosis lung. Represents far advance, the most dangerous form of a tuberculosis since patients in most cases are eliminator of bacilli. Clinically this form of a tuberculosis is shown by long and quite often wavy current with change of the period of flash of a tuberculosis by the period of clinical well-being. Radiographic picture: the cavity on a background expressed fibrosisa pulmonary and the surrounding tissue, shown by deformation pulmonary figure, a thorax, narrowing pulmonary fields, displacement of organs mediastinum and presence of pleural commissure is defined. In connection with often aggravations of process pulmonary changes polymorphous.

Pleurisies (more often a tubercular origin, or a malignant tumour). Depending on quantity of a liquid in a picture, there will be intensive, homogeneous, the triangular form a shadow with the top concave and indistinct contour or total opacity. It settles down above a diaphragm and is displaced at change of position of the patient. At development of adhesive process comes encapsulation, exudate loses ability to moving, the shadow gets the special form and localization.

Black-lung disease.

Black-lung disease refers to professional dust fibrosis lung, developing at inhalation and accumulation in pulmonary parenchyma of an inorganic mineral, metal or organic dust. Depending on character of development of pathological process and its distribution, distinguish interstitial, nodular and central forms pneumofibrosis. Disease usually proceeds years, steadily progressing. Alongside with development of a connecting tissue gradually there are sites emphysema.

Radiological attributes of traumatic damages lung.

At a part of victims they are shown already at primary radiological research, however traumatic changes in lung can be found out and through 6-12-24 ч. After a trauma at the increasing phenomena hypoxia. The basic kind of defeat is break parenchyma with a haemorrhage around of a zone of defeat. Most frequently there are following changes.

Intermuscular and hypodermic emphysema owing to penetration of air into soft tissues of a chest wall at break lung and pleuras. Thus are visible light a strip of air in soft tissues.

At a trauma of a thorax can arise pneumothorax. The congestion of gas in a pleural cavity conducts to fall lung on the certain part of its volume. Increase of a transparency of external departments pulmonary fields and absence pulmonary figure is characteristic; the density of a shadow slept lung thus increases. At simultaneous presence in a pleural cavity of air and a liquid it is necessary to make (if the condition of the victim) fluroscopy or radiography in vertical position of the patient or in lateroposition allows. The horizontal level of a liquid formed at it allows to establish the diagnosis. At massive pneumothorax on the chest film displacement of a median shadow in the healthy side is marked.

As radiological display of traumatic damages pulmonary parenchyma is opacity. On the plain radiograph film arises the nodular shadows merging among themselves with primary localization in basal or in radical departments pulmonary of a field. For traumatic changes in lung their fast increase marked at dynamic supervision, and return development within 7-10 day is characteristic. The pneumonia on this background arises, as a rule, not earlier than 3-5 day after a trauma, occurrence new infiltrationob is fixed.

Radiological attributes of tumours lung

Among set of classifications of a cancer lung the wide circulation was received with the classification based on the anatomico -physiological data. The specified classification allocates 5 forms of a cancer lung: 1) central; 2) peripheral; 3) top; 4) mediastinal and 5) miliary carcinomatosis of lung.

Lung cancer, (also called bronchogenic carcinoma), by far the most common fatal malignant neoplasm in men and it has now surpassed breast cancer as the leading cause of cancer death in women.

The radiological appearances of lung cancer depend on the location of the tumour, its spread in the thorax and its histological type. Lung cancer invades locally by endobronchial and transbronchial growth, spreads by way of the lymphatic system to hilar and mediastinal nodes, and also spread through the bloodstream to secondary sites, including other thoracic structures. When the tumour is peripheral, it presents radiographically as a solitary pulmonary nodule or mass. The cardinal signs of central tumours are lung collapse or obstructive pneumonitis of the lung beyond the tumour and the presence of a hilar or parahilar mass, signs which may be seen in isolation or in conjunction with one another. CT, because of its better contrast resolution, will detect smaller lesions and virtually eliminate the problem of the tumour being hidden by normal overlying structures. Both CT and MR play a major role in lung cancer staging. Signs of intrathoracic spread include bone destruction, pleural effusion, hilar and mediastinal lymphadenopathy, lung nodule in the contralateral lung, mediastinal mass, or pleural nodularity or nodular thickening of the interlobular.

The central cancer lung. Clinical symptoms of disease arise at infringement of bronchial passableness, change of drainage function of a bronchial tube. Basically, complaints of the patient are reduced to occurrence of cough, sometimes attack-like, to allocation phlegm with blood, a short wind, the general weakness, undue fatiguability, rise in temperature of a body up to subfebrile figures, loss of weight of a body.

The central cancer develops from epithelium a mucous membrane of large bronchial tubes: main, lobe or segmentary. Growth of a tumour can be directed to a gleam of a bronchial tube

(mainly endobronchial the cancer), is rather seldom observed peribronchial growth of a tumour, outside from a wall of a bronchial tube (mainly exobronchial a cancer).

At endobronchial growth of a cancer tumour in an initial phase of development when the sizes of a tumour are very small, clinically and radiological to establish the diagnosis it is impossible. At increase in its sizes ventilation of a segment or a lobe or segment of lung is broken, that gives the basis to suspect a tumour. There comes the second phase of development of a tumour and the first stage of development bronchostenosis - hypoventilation. At the second stage bronchostenosis can develop valvular emphysema which is characterized by the increased transparency of a segment or a lobe, expansion of intercostal intervals, displacement mediastinum at the forced breath in the healthy side. In process of growth of a tumour there comes full corking of a bronchial tube - infringement of bronchial passableness of the third stage that conducts to development bronchostenosis. At radiological research the atelectasis of segment, a lobe or lung look as a homogeneous intensive shadow, the sizes of them are reduced, intershare borders are concave, the diaphragm is located highly, mediastinum is displaced aside defeats. At carrying out bronchography it is found defects fillings a bronchial tube, in initial stages - roughness, wavy its contour, at full obturation - amputation of a bronchial tube.

On tomograms it is possible to define narrowing of a gleam of a bronchial tube, a shadow of a tumour or breakage of an air column of a bronchial tube at its corking by a tumour.

Outside of bronchial tube growth of cancer. Changes are in hilar zone, its expansion are defined due to unit of a tumour and MTS in lymph nodes, the shadow of a root loses its structure, merging with a median shadow. The contour inverted to pulmonary to a field, radiant, laminate, that testifies to germination of a tumour in surrounding a root pulmonary a tissue. The increase in the sizes of a tumour up to several centimeters in diameter results in narrowing a gleam of a bronchial tube, to infringement of ventilation. Mainly peribronchial growth of a tumour to define it is not possible, as from the very beginning of occurrence it attachment a course of a bronchial tube and vessels. In process of growth of a tumour are formed thick around of bronchial tube and on chest film the rough shadows fanlikely departing from a root in lung parenchyma are defined. On tomograms the uniform thickening of walls of bronchial tubes is defined. At the further growth of a tumour and germination of a wall gleams of bronchial tubes are narrowed, comes hypoventilation. At bronchography extended concentric narrowing bronchial tubes, a thickening of their walls is defined.

The peripheral cancer lung develops from a wall of a fine bronchial tube and more often grows as unit, settling down or under pleura, or on significant distance from a pleura. The most often localization of a peripheral cancer is marked in right lung and the top lobe of both lung.

Clinically peripheral cancer it is long does not prove, as it is located far from large bronchial tubes. In this connection, it is defined radiographically is more often. Clinical displays arise later and are characterized by occurrence of a pain in a breast that is caused by germination of a tumour in a pleura, at its germination in a bronchial tube there is a cough with allocation phlegm, hemoptysis. The peripheral cancer in the beginning of the development forms unit of the small sizes of the polygonal form, nodular in diameter of 3-4 cm; it gets the spherical form. Growth of a tumour slow (but can be and fast). Intensity of a shadow can be various depending on size of unit. The shadow is more often non-uniform, a contour uneven, (hilly, bumpy). Pulmonary figure near to unit of a tumour is usually deformed, that, most likely, is caused by previous chronic inflammatory process. In some cases it is possible to see the path going from a round shadow of a tumour to a root lung, caused lymphangitis or peribronchial and perivascularis by growth of a tumour.

The tomography used at a peripheral cancer finds out knottiness of a shadow of a tumour, the cavity of disintegration helps to reveal drainage a bronchial tube, a condition of lymph nodes of a root lung and mediastinum

Top cancer lung (Pancoast's neoplasm). Clinical displays late. Pains. Radiographically the top cancer is characterized by a shadow which occupy all area of a top lung. The bottom border of a shadow precise, is inverted by camber downwards while other borders are not differentiated. On a background of a shadow usually it is possible to see destruction back pieces of ribs and shoots several vertebra.

Mediastinal the form of a cancer. In a clinical picture the most important is compression a syndrome (vena cava superior, large nervous trunks). There is a puffiness of a neck, the person, feeling compression in the field of a neck and a breast. Primary localization of a tumour in most cases appears not clear, the minimal sizes of a tumour do not allow to define it at radiological research, the early tendency to metastasis in lymph nodes mediastinum however is characteristic.

Leading way of diagnostics of formations mediastinum now is CT and MRI which allows to establish exact localization of formation, its parities with surrounding anatomic structures, and in some cases to give exact enough tissue characteristic of formation (lipoma, cyst).

Radiographically: a picture, characteristic for a tumour mediastinum. Presence of the extensive tissue overlapping a shadow of a root lung on the one hand (increase lymph nodes unilateral), merging with a median shadow. To define the nature increased lymph nodes it happens difficultly since a similar picture give Hodgkin's disease or lymphosarcoma.

MTS in lung.

As a rule, MTS give a round shadow in the x-ray image. They usually plural, but sometimes meet solitary MTS. CT - the most sensitive method of revealing of MTS in lung. It provides confident recognition nodulated with the size up to 3 mm (radiographically > 6 mm); in the field of roots lung a threshold of revealing for CT - 5-6 mm.

Miliary carcinomatosis. The differential diagnosis is difficult. It is necessary to lead the careful analysis phlegm, and sometimes puncture biopsy.