Ministry of Health of Ukraine
Poltava State Medical University
Department of phthisiology

Lecture: THE DIAGNOSTICS OF TUBERCULOSIS

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Lecture plan

Definition of the concept of diagnosis

The methods diagnosis of the TB:

- Clinical
- Bacteriological
- Molecular - genetic
- Histological
- Tuberculin (immunological)
- X-ray
- Instrumental
- Formulation of the diagnosis of TB
- Conclusion

Good treats is that, who is good diagnoses" - Hipocrat

The diagnostics it is a difficult process of clinical thinking, in which a doctor defined of the etiologic and pathogenetic features of the development illness and for the reason can to formulate of the exact and evidential diagnosis on the basis of clinical manifestation of illness, a results objective examination, laboratory, bacteriological (bacterioscopy and cultural) investigation, histological, instrumental and other methods of inspection sick.

- In the basis of diagnostics of tuberculosis are such investigation:
- **clinical** inspection of patient
- **etiology diagnostics** (a backterioscopy and cultural methods and molecular-genetic detect of the MBT)
- **x-ray** (radiological) examination
* **tuberculin testes**
- **histological diagnostics**

- **CLINICAL DIAGNOSTICS** of pulmonary TB are characteristics by:
- intoxication syndrome,
- bronchi-lung-pleural syndrome
- without symptoms motion

- **Intoxication syndrome**
- it is increasing of tº, fatigability, anorexia
- a loss of the mass of body to the cachexy
- often night perspire, may be profuse

- **Bronchi-lung-pleural syndrome consist**
- cough
- hemoptysis, haemorrhage (bleeding)
- pain in a chest
- shortness of breath

- **A cough** is protective reflex, for moving away from the respiratory tracts of different irritants. Many respiratory infections are accompanied by irritation of cough receptors.
- **Arc of cough reflex:**
- Cough receptors → eisodic (afferent) nerves → cough center (medulla oblongata of brain) → efferente nerves → respiratory muscles.
- Cough receptors are located on the back wall of pharynx – larynx – trachea - parts bifurcations of trachea - parts division of large and partial bronchial tubes and bronchial spurs
- **Presence of cough during 2 weeks and more the patient must be examination on TB.**

- At TB cough may be dry or moistly. Often tubercular patient produce of sputum.
- **Sputum** has mucopurelent character (compoused of both mucus and pus), without smell, about 50-200 ml during twenty-four hours in depend of the clinical form of TB
- A haemoptysis is bloodstreaks in sputum, or separate blood clots.
- Mostly cough is observed at to cirrhotic TB, fibrotic-cavernous TB, caseous pneumonia, infiltration TB and other forms TB.

- **The shortness of breath** is not characteristic for TB, but it can arise up at the widespread impressions and heavy or chronic forms of TB. More frequent has respiratory abnormality, as a result of pneumosclerosis, loss elasticity of pulmonary tissues and diminishing of the functional surface of lungs.
- **Pain of chest**, as a rule, conditioned by the irritation of pleural nociceptors by subpleural location of TB hearths, infiltration or pleurisy.

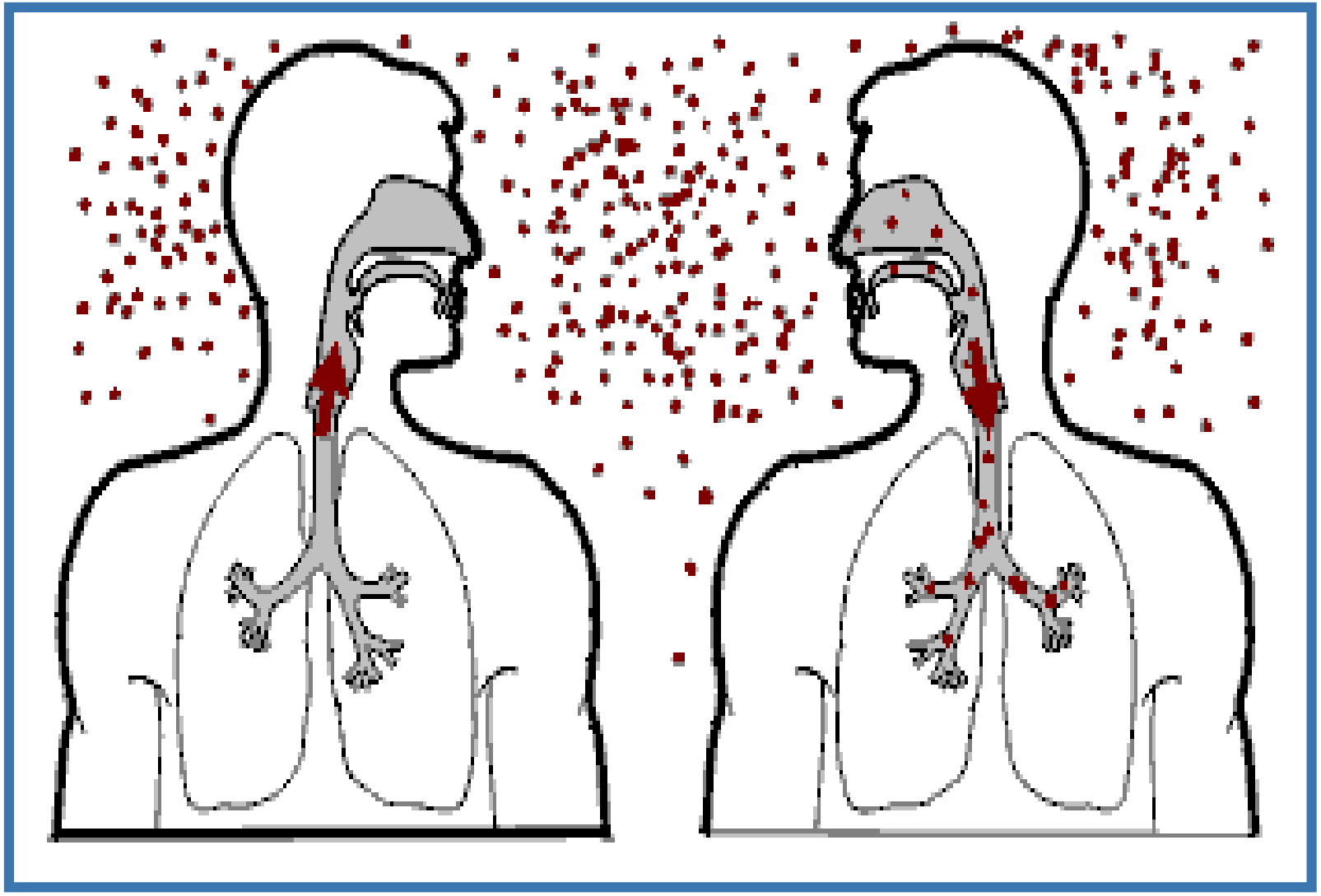
- **INTOXICATION SYNDROME presence** in clinic of many disease are characterize by increase temperature, weakness, asthenia, night perspire, loss weight of body, fatigability, at heavy cases of TB maybe cachexy (named phthisa - phthisik).
- Increase temperature at TB is growing in more frequently very slowly. During of several weeks or months temperature may be subfebril (37,1 – 37,5^{0}C), only in the evening and practical not disturb of ill.

- **BEGINNING OF ILLNESS is** depend from the state of immunology system of organism and can be:
- acute onset of disease (miliary, lobar, caseous pneumonia, pleurisy, infiltration TB)
- subacute begining of disease (dissemination, infiltration, primary TB complex, TB of intrathoracic lymphatic knots) and
- with little or without symptoms of beginin disease (limited or small TB forms - infiltration, focal, tuberculome, round infiltration)

- At all of limited clinical forms TB more frequent observed subfebril tº (37,2-37,5ºC) maybe during a few months and with small symptoms. Often this forms of TB are progressing without symptoms.
- For clinical form TB with acute begining is characteristic increase of tº body to 38-39ºC, weakness, loss of the mass of body, profuse night perspire, the declines of capacity and other.

Epidemiology anamnesis is significant information in diagnostics of tuberculosis.

- It is the substantial factor of diagnostics of TB and includes two important moments:
- 1. presence of contact with a TB patient. Its maybe domestic or professional contact; especially is important domestic contacts, when infecting can to take place repeatedly and many times, it is very dangerous;
- 2. it is a presence illness on tuberculosis in the past.



- **ANAMNESIS OF LIFE**
- The basic condition development of tuberculosis is immunological deficit. Presence of the immune deficit forming factors of **increasing risk of disease on TB**:
- 1. **Medical factors** of **risk** are HIV-infection/AIDS, diabetes mellitus, chronic nonspecific diseases of lungs, digestive tract disease, heavy viral infections (ARVI, flu), congenital immune deficit and toxicomania.
- 2. **Social factors** of **risk** are drug addiction, alcoholism, vagabond, prisoners, emigrants, refugees and poverty.

- **OBJECTIVE INSPECTION** (survey)
- Original appearance of disease maybe
- emaciation
- pallor of skin
- decline the turgor of skin
- asymmetric of the chest (at chronic TB)
- lag of chest in the act of breathing
- enlargement of peripheral lymphatic nodes (especially at primary of TB)

- **PERCUSSION sound** maybe:
- Dulling in lungs (at infiltration, caseous pneumonia, fibrous-cavernous, dissemination tuberculosis);
- Dullness in lungs (at exsudate pleurisy, cirrhotic tuberculosis);
- Tympanic sound (at pneumothorax, emphysema of lungs);
- Small box sound (pneumothorax, caverna magna);
- Without changes of percussion sound

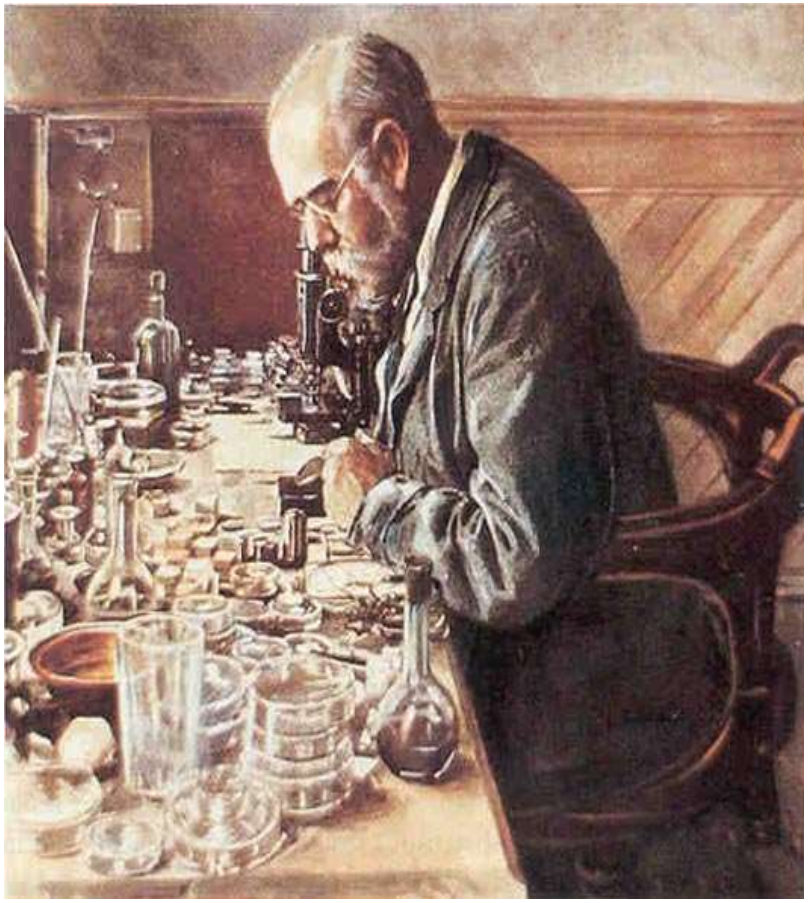
- At **AUSCULTATION** may to hear
- weakening breath noises
- hard or bronchial breathing (at cirrhotic tuberculosis);
- amphoric breath sound (at giant cavity);
- dry rales;
- moist rales may be small vesicular, medium vesicular and large vesicular.
- Often tuberculosis development without changes of the breath noises (tuberculome in the phase of stability; rounded infiltration; focal TB)

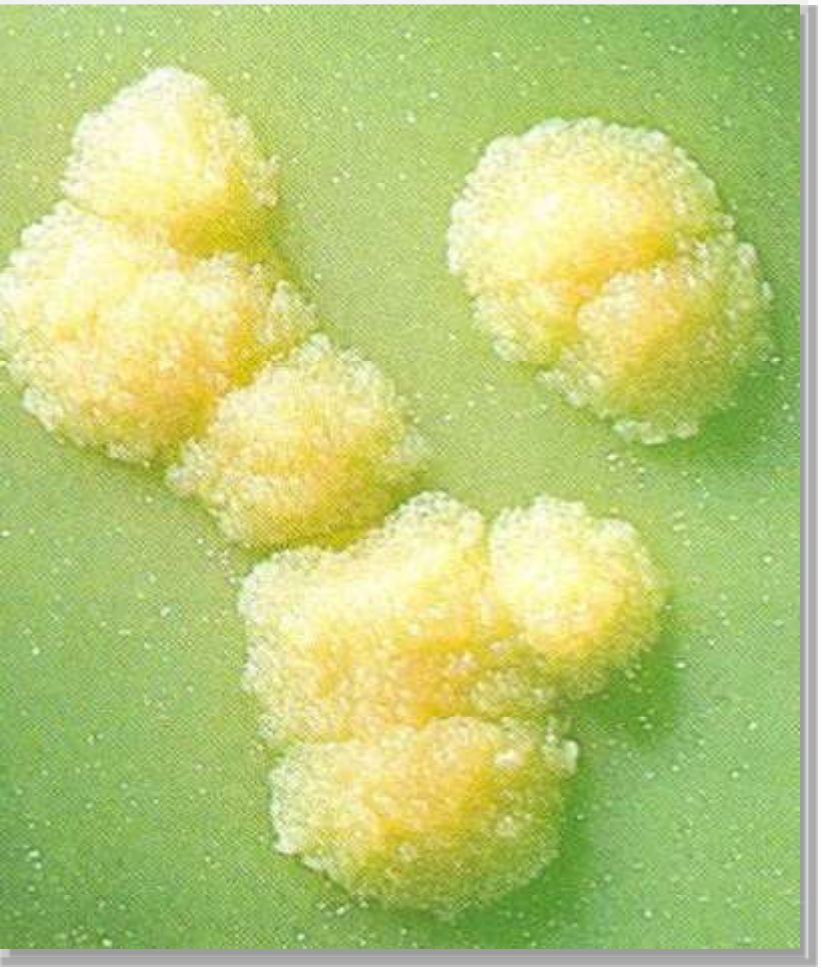
- **LABORATORY DIAGNOSTICS**

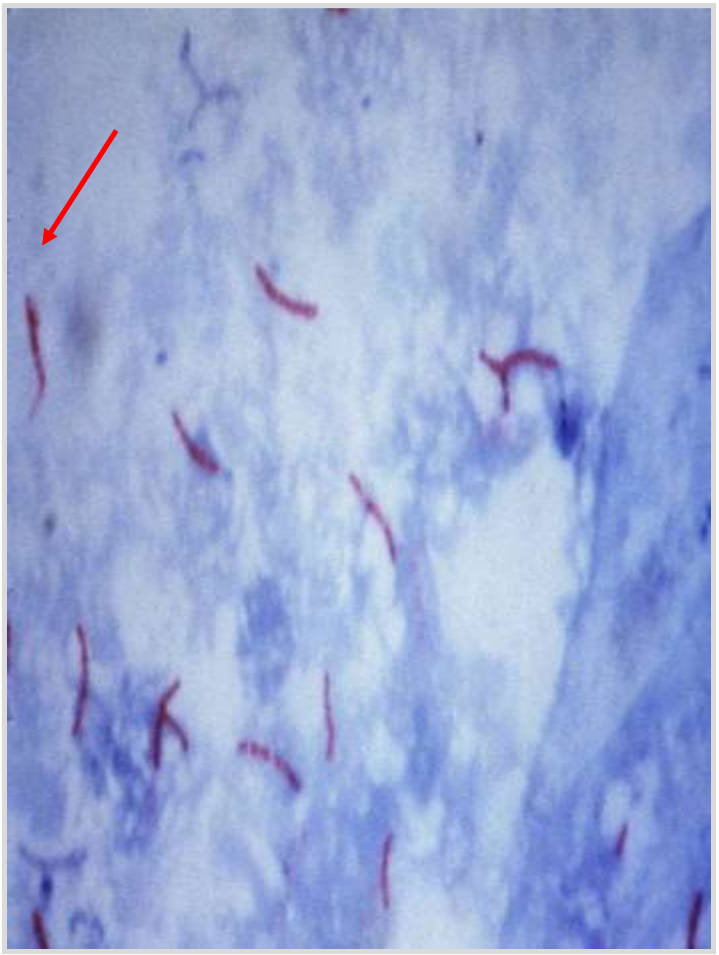
The laboratories serve play major role in the diagnosis and management of tuberculosis – to detect presence of MBT in sputum and other biological materials.

The laboratory identification of MBT consists of the following methods:

- **1)** sputum collection and processing;
- **2)** microscopic (bacterioscopic) identification of MBT in biological material or tissues;
- **3)** culture techniques;
- **4)** drug susceptibility (resistent MBT) testing;







You see colonies of MBT growth, they look like mulberries, bumpy, yellowish in color.

- **5)** performance of new molecular-genetic methods of MBT identification, including polymerase chain reaction (PChR)
- Xpert Mtb/RIF®(Ultra)
- Xpert Mtb/XDR or HAIN LPA

- **Collection of sputum with MBT** performs in specially equipped medical institutions or in ambulatory services. The collected specimens immediately send for laboratory examination.

- **The risk of infection is very high when the patient coughs, therefore specimens of sputum must be collected in specially prepared room.** Special sputum containers must be used. They must be rigid to avoid crushing in transit and possess a wide-mouthed screw top hermetically scalable cover to prevent desiccation and to minimize risk contamination by leakage sputum.

- **Additional procedures for detection MBT in biological material.**
- **Bronchial flush waters.** To obtain bronchial flush waters, first anesthesia is performed of the upper airways. Physiological solution (15-20 ml) warmed up to 37oC is administered with a larynx syringe. This procedure will increase secretion from the bronchial mucosa. The patient will cough up the flush water.

- The flush water collected in a sterile flask and sent for bacterioscopy and cultural examination for MBT.
- The method of bacterioscopy of bronchial flush waters and especially the cultural method increases the possibility of MBT detection up to 11-20%.

Gastric flush water usually used among children who swallowing sputum at cough, and for those adults, who have poor amount of sputum.

- The method is not difficult and gives rather a high percentage of detection of MBT not only with lung tuberculosis, but also with tuberculosis of other organs (skin, bones, joints etc.).
- For reception of gastric flush waters, the patient in the morning should drink a glass of water. Then through a gastric tube, the stomach fluids collect in sterile flasks. The fluid is then centrifuge treated and conduct bacterioscopic and cultural examination on MBT of precipitate.

- **Examination of cerebrospinal fluid.**
- At suspicion of tubercular meningitis it is necessary to make a cerebrospinal fluid analysis as early as possible. When the cerebrospinal fluid is obtaines, attention should be paid to the degree of pressure in the cerebrospinal canal. The liquid flowing by a continuous jet under the large pressure is indicates an increased intracranial pressure. If the liquid expectorates by large often drops, it is a sign of normal pressure, and in the case of rare small drops – about a lowered pressure or about some obstruction cerebrospinal canal.

- Cerebrospinal fluid for examination is placed in two sterile tubes. One tube is placed in a cold environment and after 12-24 hours film is formed on the surface of the liquor. The film analyze on MBT. Liquor collected in the second tube using for the biochemical and cytological examinations

- **Bronchoscopy.** When other methods have failed to give a proper diagnosis, it is possible to collect bronchial material by a trap specimen through a bronchoscope. **Biopsy** for histological examined of the bronchial tissues may sometimes show typical changes of tuberculosis.
- **Pleural fluid.** MBT may occasionally be seen in centrifuged pleural fluid, but may find only by cultural method. The larger the amount of fluid cultured are the more likely to obtain a positive result.

Pleural biopsy can be useful when there is pleural effusion. But it needs a special biopsy needle (Abrams punch) and trained personal for exact histology diagnosis.

- **Lung biopsy.** Only experienced surgeon should use this method. A diagnosis may be made by histology or by finding MBT in the sectional biopsy material.
- All named methods diagnostics of TB are additional.
- The basic methods of diagnosis TB are etiological (detection MBT bacterioscopic and cultural methods) and histological.

- **Bacterioscopy method revealing of MBT.** The simplest and fast method of detection **MBT** used for over 100 years – the carbol-fuchsin methods **of Ziehl–Neelsen’s**. The fundamental principles of this method relate to the ability of the cell wall to absorb carbol-fuchsin dye. The mycobacterial cell walls absorbing the red carbol-fuchsin are becoming so impregnated, that they resist decolorization even with a potent hydrochloric acid-ethanol solution. So, when the slide is counter stained with methylene blue, the MBT appear as red rods on the blue background.

- Since 1989 **fluorescent microscopy** used for revealing of MBT in biological material. The stain in this technology is auramine-rhodamine. The mycobacteria absorb this agent and resist decolorization with acid-alcohol, however, the auramine-rhodamine-stained bacilli fluorescents when excited in UV light.
- The mycobacteria appear as bright yellow rods against on black background in the UV system.

- **Cultural method** of revealing MBT consists in following: after prescribes special treatment, sputum or another material amass in special container, cultivates by 3% solution of acid during 30 min, then centrifugation of material and sown on a nutritive medium.
- More often hard egg Lewenstein-Yensen”s medium is used. 20 and more microbial bodies in 1 ml of material is enough for revealing MBT. The first colonies MBT appear on the 15-30-th day of cultivation.

You see the culture method of detecting MBT by inoculation on Jensen-Levenshtein’s solid nutrient medium.

- The negative result is given only in 2 months after sowing. The advantage of this method: allows to define vitality of MBT, their virulence, group (acid resistant and atypical) MBT and resistance to antymicobacterial drugs. The quantitative assessment of bacterial excretion is made: miserly - up to 10 colonies, moderate – from 11 to 50 and massive – more then 50 colonies on a nutritive medium.

- **Molecular-genetic diagnostic methods.** Deciphered MBT genome has opened unlimited prospects in development of the genetic-molecular tests, including the study and revealing of MBT and its diagnostics in the host. The classical methods used for detection of MBT presence in host, such as bacterioscopy, cultural, cytological are rather effective, but differ in either their insufficient sensitivity or duration of revealing MBT. Development and the perfection of molecular-diagnostic methods have opened new prospects for **fast revealing MBT** in clinical samples.

- **Polymerase chain reaction (PCR)** entails amplification of characteristic fragments of bacillary DNA that found in diagnostic specimens. This test used for detection of MBT in sputum or identification of species that are growing in culture medium. The PCR allows to carry out MBT identification in a diagnostic material within 5-6 hours (including processing of a material) and has high specificity and sensitivity (in a range from 1-10 MBT cells in a biological sample).
- Lately deployment the radio-nuclide **system BACTEC** is used for the rapid exposure of МБТ, when material is cultivated in the liquid nutritive medium of BACTEC, where as a source of carbon is used by marked C14 palmitic acid. At the positive results of growth МБТ expose aerophare research on 7-10th days. If in 14-21th day of growth МБТ does not find a result consider as negative.

- **Resistent of MBT**
- **The drug resistant microorganisms** are capable to multiply in such concentrations of the drug in the nutritive medium, which has bacteriostatic or bactericidal effect.
- **Genomic analysis of the MBT sensitivity to drugs.** The genetic loci of resistance mutations to isoniazid, rifampin, ethambutol, streptomycin, and the fluoroquinolones identified. Based on this type of methodology, molecular-biological techniques are rapidly improved and offer quick identification of the drug sensitivity of the MBT.

- Select primary resistance, acquired, monoresistance, combined, multiresistance and enlarged.
- **Primary resistance** of МБТ is resistance to one or a few anti tubercular preparations, appear at an initial inspection.
- Primary resistant is firmness of МБТ to one or greater amount of anti tubercular preparations for patients, which before them did not treat oneself these drugs.

- **Acquired (secondary) resistance** is firmness of МБТ to antitubercular drugs, which was formed in a process or after the course of chemotherapy.
- The presence of acquired resistance is suspected for patients which have in anamnesis data about treatment antitubercular drugs during 1 month or anymore, here at first it was known that at the beginning of therapy this stamm of МБТ was sensible to antitubercular drugs.
- **Monoresistance.** The stamms of МБТ are resistance only to one from five antitubercular drugs of the first row (rifampicin, isoniasid, etambutol, pirasinamid, streptomycin)
- **Poliresistance** (combination resistance) is firmness of МБТ to any two and more antitubercular drus without simultaneous resistence to isoniasid and rifampicin

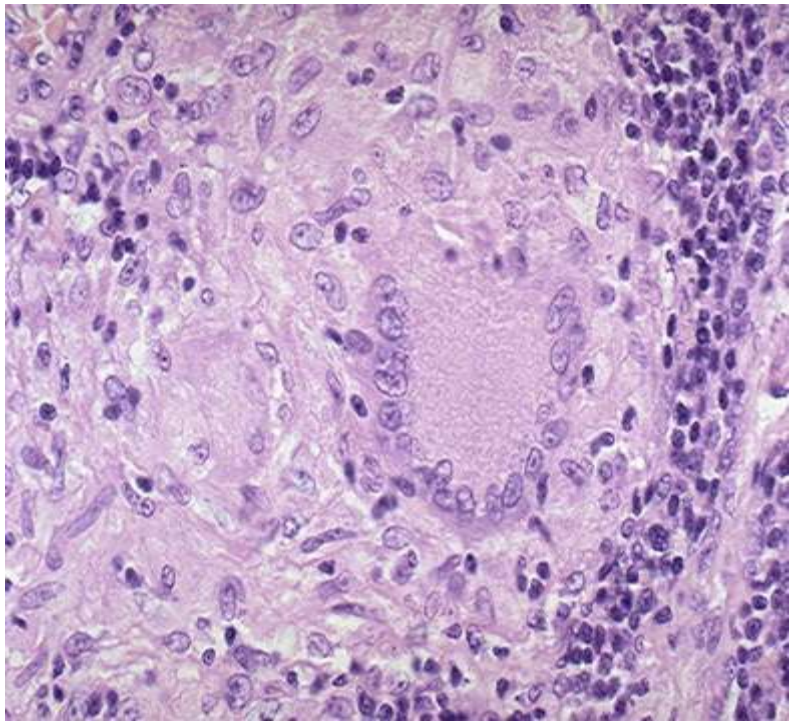
- **Combined resistance** was determination, as combination primary and acquired resistance of MBT (WHO).
- Plural (**multiresistent**) it is drugs resistence of МБТ to the action of isoniasid and rifampicin simultaneously, with a presence and without firmness to any other antitubercular preparations.

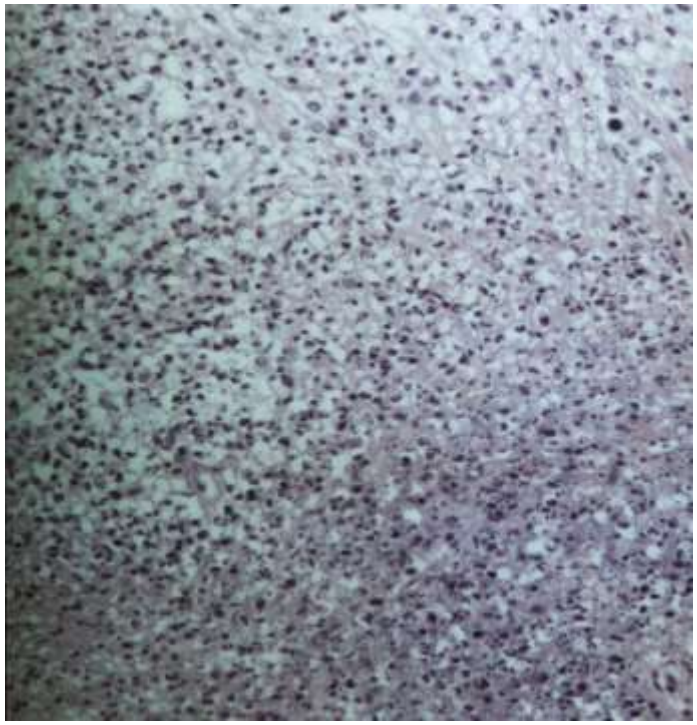
- **BLOOD AND URINE ANALYSIS.** Red blood elements, as a rule, do not suffer serious changes in tuberculosis. Only after acute blood loss (lung or intestines) can be anemia. The small downturn of hemoglobin is markedly increased in chronic forms of fibrotic-cavernous tuberculosis. One of the parameters indicating activity of tubercular process is the ESR (erythrocyte sedimentation rate, reaction). Raised ESR reflecting presence intoxication and only demonstrates activity and volume of an ongoing fresh process, but also the volume of a chronic process, especially the fibrotic-cavernous TB.

White cells of blood have a more sensitive reaction to tubercular process: moderately leucosytosis, lymphopenia, eosynopenia, but often this sings are normal.

- **The analysis of urine.** Excretion of urine in tubercular patients usually is normal. Pathological changes could be revealed at intoxication, in tubercular infection of kidneys or in urinary tract. Signs of amyloidosis can be detected among patients with purulent chronic forms of lung and bones tuberculosis.

- **Histological diagnosis** of ТБ is based on specificity of tissue changes, which show up tubercular granuloms, consisting of caseous in a center, epithelioid cells, giant multinuclear cells of Pirogov-Langhans", and on periphery have a small billow from lymphoid and plasmatic cells. At confluence of ТВ granuloms arise tubercles, measuring with millet grain. They arise up in any organ and to looks of semitransparent knots with clear contours and rather yellow caseous center. МБТ are find in the hystological preparations of tissues at coloring on Zyegl-Nilssen's.





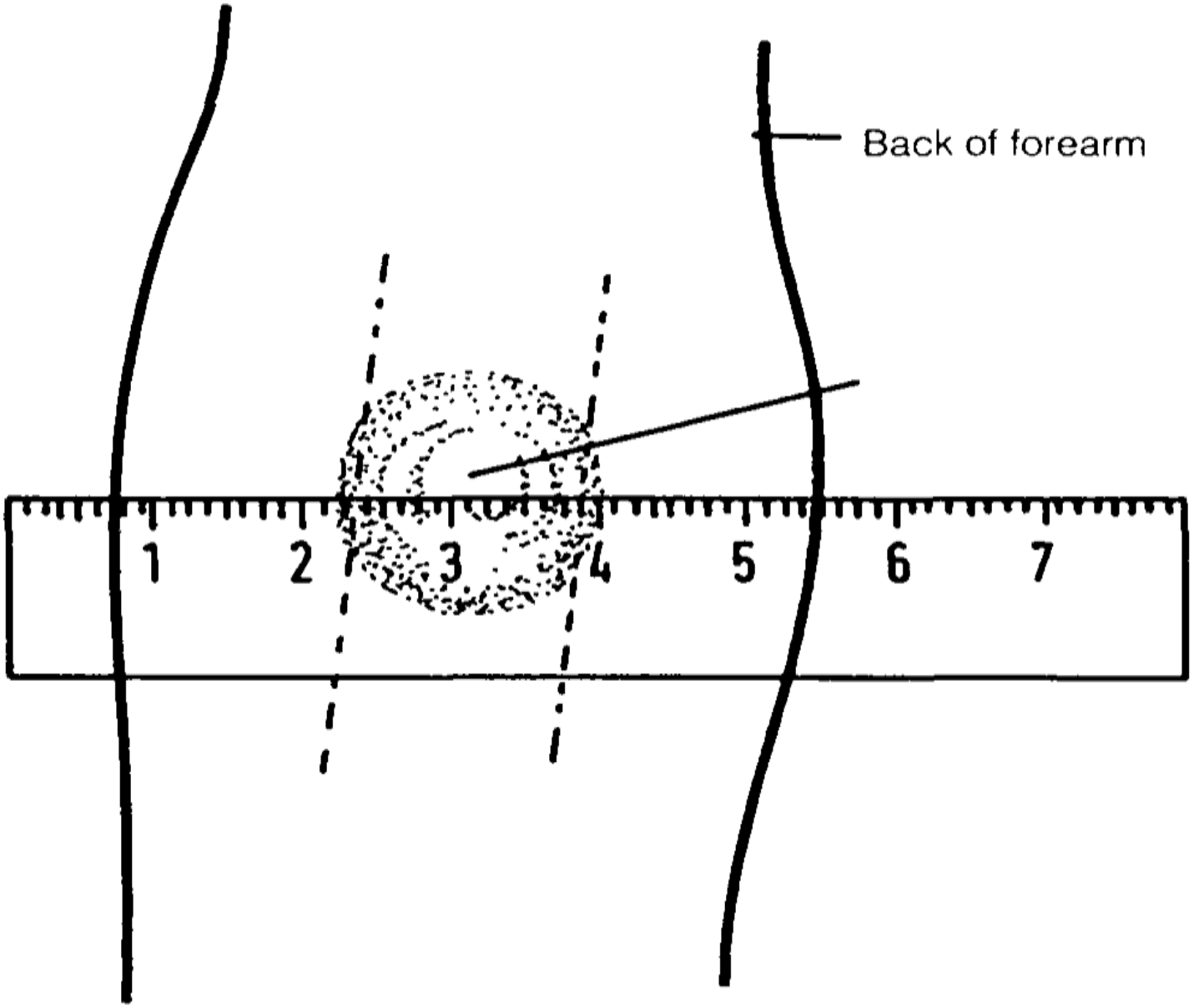
In the photomicrograph, you see a specific granuloma, which is characterized by caseous necrosis in the center, surrounded by a layer of epithelioid cells, and then a layer of giant multinucleated Pirogov-Langhans cells. Such a granuloma can only be caused by tuberulosis. Therefore, it is a 100% diagnostic criterion for TB. In patients with AIDS/TB, granulomas in the tissues are not formed due to immunodeficiency.

- **Tuberculin diagnostic** is determination of sensitiveness of organism to the tuberculin with the aim of establishment of infecting of МБТ and diagnostics of ТВ.
- Koch was first who got a tuberculin in1890. His tuberculin composed from nutritive medium (99%) and derivations vital functions of МБТ (1%). It had non specific action. In present time tuberculin of Koch”s is not used.

- In 1934 in Austria F. Seibert growing the culture of МБТ on a without protein medium. After filtration his got cleared derivations vital functions MBT. It is **tuberculin,** which was named - Purified of protein derivat (PPD) - hapten, having specific action.
- The further improvement of technology of clearing of preparation allowed WHO in 1952 to confirm the tuberculin of PPD as an international standard of the cleared tuberculin. The industrial production of tuberculin was begun in 1954. Thereafter tuberculin is used in detection infected by MBT and diagnostics of tuberculosis.

- In the basis of tuberculin reactions is a **hypersensitivenes of slowly type**, which is formed by T-cells immunity and expose at introduction of tuberculin.
- Today in most countries of world used the endermic tuberculin test of Mantoux from 2TU PPD and provocative subcutaneous tuberculin test of Koch”s.
- The test of Mantoux makes: preliminary on the internal surface of middle third of forearm the area of skin clearances by 70% ethyl spirit.
- Thin needle entered in the skin in parallel to her surface. At introduction of needle to the skin infuses exactly 0,1 ml of solution of tuberculin, it is one dose which contains 2TU PPD.
- At a correct technique in a skin forming a papula appears as a lemon crust by a size a 5-7 mm in the diameter.

- Valuing of the reaction of skin in test Mantoux makes after 72 hours. The reaction may be:
- 1) negative is absence of infiltration (papule) and hyperemia or other reaction (sign 0 -1 mm);
- 2) doubtful is a presence a papule by a size 2-4 mm or only hyperemia of any size;
- 3) positive is a presence a papule by a size 5 mm and anymore.
- Positive reactions on a tuberculin after the sizes of papule in a diameter divide:
- on small intensities is a size of infiltration a 5 - 9 mm;
- middle intensities are a 10 -14 mm;
- expressed - a 15 -17 mm;
- Superfluity is inadequately reaction for children and teenagers take into account reaction with the diameter of papule a 18 mm and anymore, in adults are 21 mm and anymore, and also vesicular or necrotic reactions, lymphagitis and lymphadenitis.


Back of forearm
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- **CLINICAL valuation of test Mantoux:**
- At negative reaction diagnosis anerg. Anergy may be positive it is anergy in health patients without infected and negative anergy it is immune deficite in patients with heavy clinical form TB
- Doubtful reaction it is defect of technical implementation. Test must be repeat after 1-2 weeks.
- A positive reaction is a papule a 5-17 mm is estimate as a normergy, when immunological system is normal.
- A superfluity positive reaction are a papula more then 17 mm, vesicle, necrosis, lymphangitis, lymphadenitis. Diagnoses a hyperergy is inadequate reactivity, which is testimony of presence active TB and requires realization of treatment with correction immunological reactivity.

- **Aims performing of the tuberculin test Mantoux**:
- 1. An exposure of groups of the increased risk of diseases on tuberculosis, which children and teenagers behave to:
- 1.1. initially infected of МБТ;
- 1.2. patient is infected МВТ if having hyperergic reactions on tuberculin;
- 1.3. patient is infected if in test Mantoux papule increased on a 6 mm and anymore during of year;
- 2. Selection of contingents for revaccination against of tuberculosis.
- 3. Determination of infected and risk of infection of population with the aim of analysis of epidemiology situation on tuberculosis.

- **Tuberculin a test of Koch** is a provocative hypodermic test in which tuberculin in a dose 20 TU PPD enter under a skin in a subscapular area. Testimonies for realization test of Koch is doubtful activity of tubercular changes, absence of possibility to conduct bacteriological or histological diagnostics, provocation of intensifying with the aim of differential diagnostics of pathological process. The valuation of a result of test Koch" are conducting on a general, focal and local reactions.
- A general reaction shows up the symptoms of intoxication is worsening of feel, fervescence, which is measured each 2 hours during a 72 hours.
-

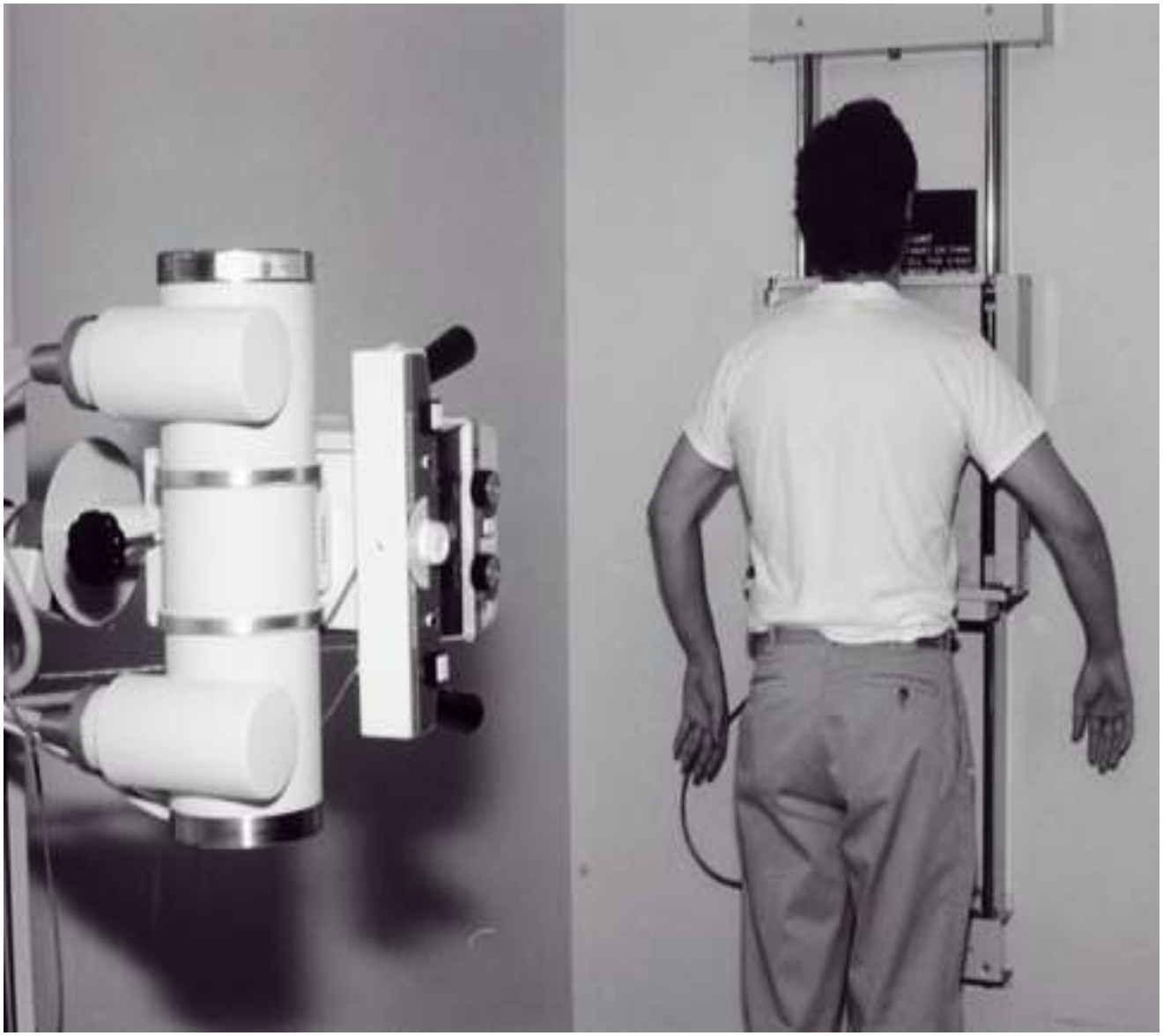
- A focal reaction is displays of intensifying of inflammation in the place of pathological process (foci in lung, staggered joints and others like that).
- A local reaction is forming of papule (infiltration) in the place subcutaneous of introduction of tuberculin.
- A presence of the positive reactions after introduction of tuberculin is confirmation of specificity (TB) of pathological process.

- **X-RAY DIAGNOSTICS OF TB –** is not specific, but is very impotents in diagnostic of TB.

On the diagnostics of lung tuberculosis most frequently are applied the following X-ray methods:

1) radioscopy;
2) radiography;
3) tomography;
4) fluorography
5) computer tomography.

Tuberculosis in x-ray picture are shadows such as foci, infiltration and ring-like.



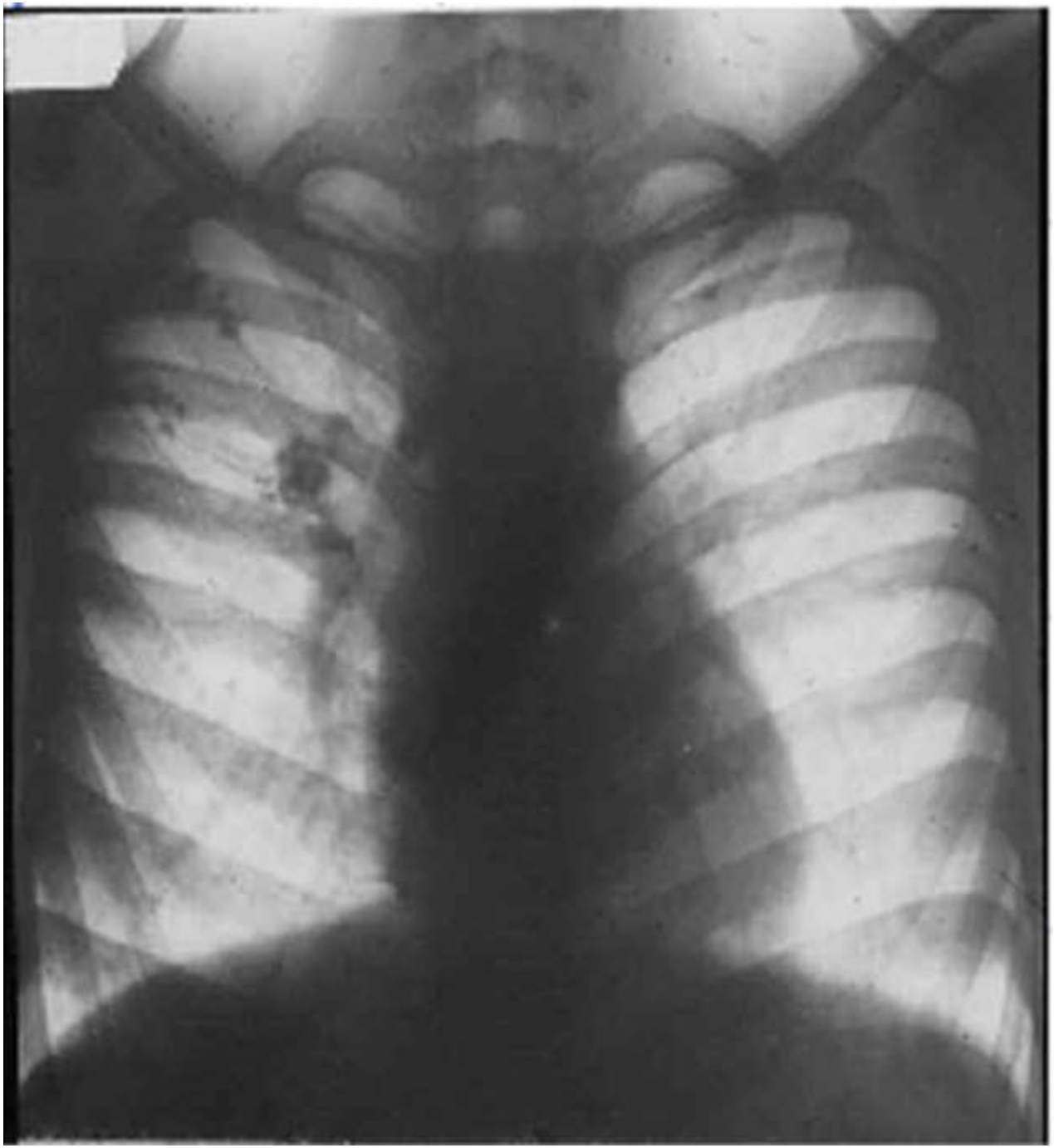
- They are a characterized:
- the **quantity** of a shadow can be single or multiple;
- **size** – small, average, large;
- **form** – rounded, oval, polygonal, linear and irregular;
- the **contours** of shadows can be precise (legible) and indistinct (ilegible);
- the **intensity** of shadows maybe weak, average (middle), high;
- **structure** – homogeneous or non-homogeneous.
- **Localizations** of the shadows are indicated according lobes or segments of lungs.

- **The changes of lung picture are:**
  1) rodsimilar and 2) net character.
  The lung picture appear as linear shadows going in parallel or of a «fanlike» arrangement of the lung vessels.
  Net like lung shadows are defined by intertwine linear shadows. These shadows can be of various width, from 1-2 up to 5-6 mm. Often they merge in wide strips, especially in roots areas of lungs. Their contours may be precise or dim. The intensity is average or high.

Large or fine loops are formed at a net like arrangement of shadows.

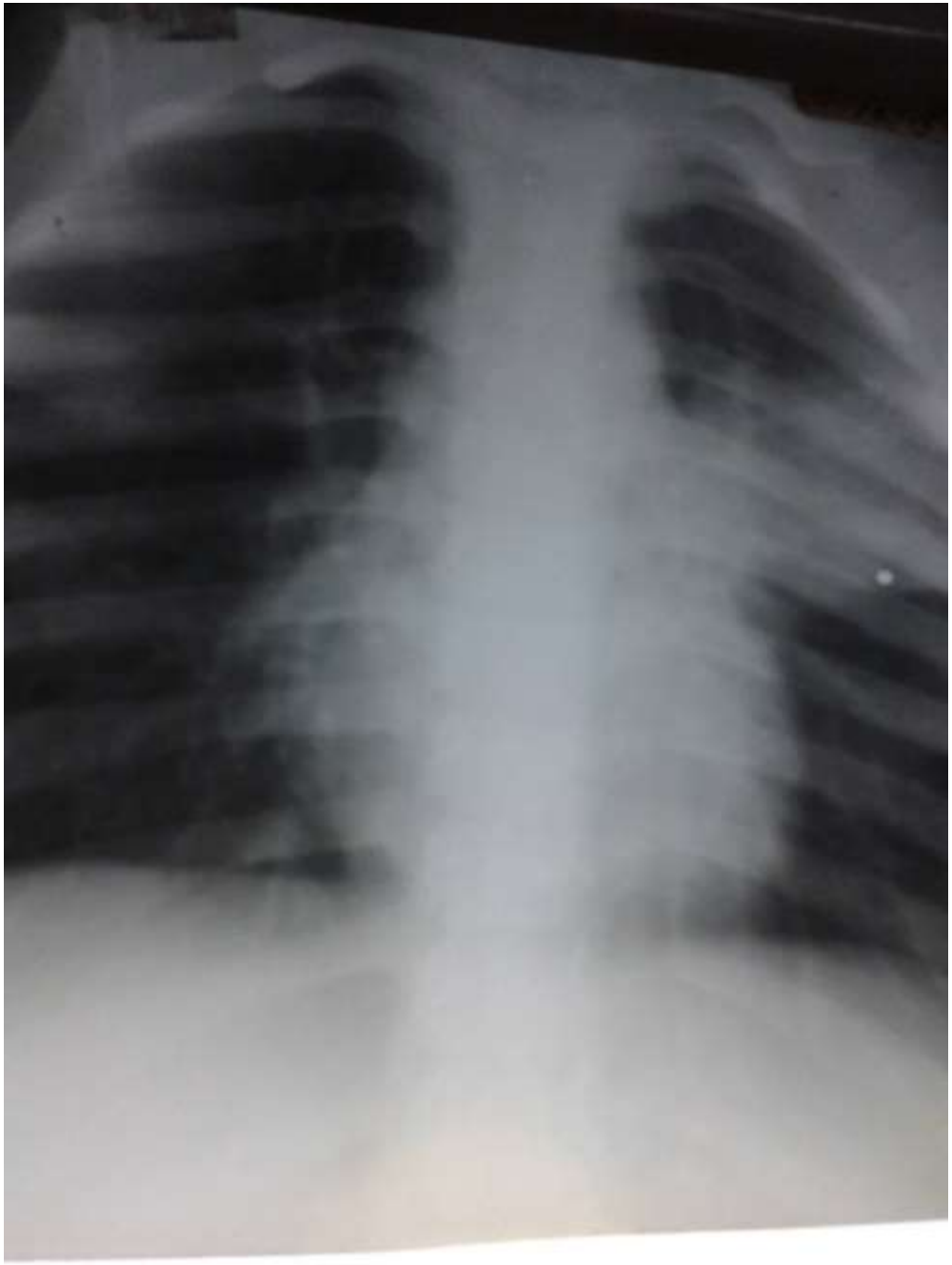
- **Rod-like and net-like** changes in the lung picture reflect inflammatory processes, the scar and the fibrous changes in lymph vessels or in interlobular connective tissue. Usually for inflammatory process (lymphangitis) are typical large width, indistinct contours and average intensity of linear shadows.
- For fibrotic and the scars are typical shadows of minor width, clear contours and high intensity. However, it is not an obligatory attributes. Repeated radiographic examinations are needed in order to distinguish fresh changes or the old in the connective tissue of lung. The fresh changes are decrease at recovering or increase at progressing during on the course of treatment, but old ones remain of stable.

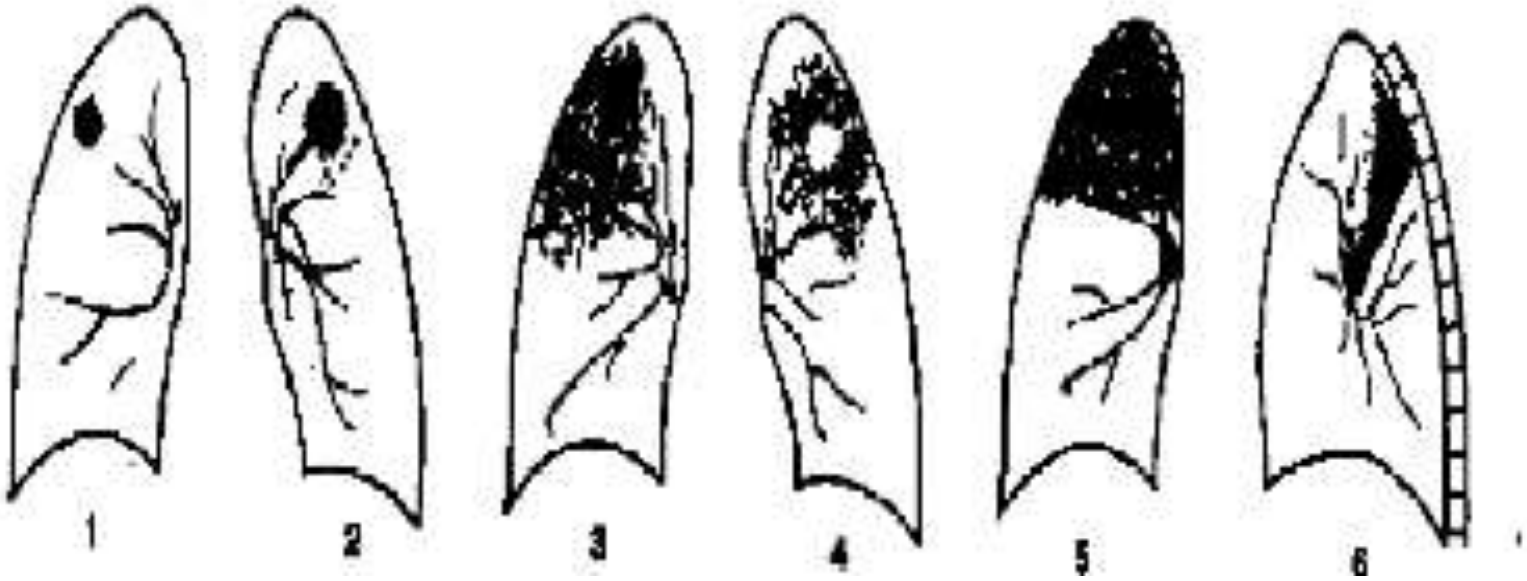
- **Foci shadows** are the most often display of lung tuberculosis. They are defined as spots of size from 2 mm to up 10 mm in diameter. They can be single, but more often multiple.
- According to their sizes, the foci are divided into three groups: small – 2-4 mm, average size – up to 5-7 mm and large – up to 10 mm.
- The form of the focal shadows can be rounding, polygonal, irregular and wrong.
- Contours can be precise or dim. Linear shadows are visible, rod-like, departing from a contour of the focus into surrounding lung parenchyma.
- The intensity of the focal shadows could be weak, when it corresponds to the intensity of a longitudinal shadow of a vessel, average intencity is corresponding to the intensity of transverse shadow of a vessel, high intensity is corresponds to intensity of a rib or shadow of mediastinum.



- **The structure of the focal shadows** can be homogeneous and non-homogenous. The non-homogenous structure is observed usually at their irregular condensation and calcification, and at presence of disintegration.
- At irregular condensation and calcifications of the focal intensity of its shadow will be various in different parts; the intensity of an average degree settles down closely to the site of the large intensity. The disintegration is defined as enlightenment with a precise inside contour.

- **The infiltration** shadow are shadows with the size more than 1,0 cm in diameter.
- Mainly infiltrations are single.
- Their forms could be round, oval, and irregular. Large infiltrations usually occupy segments or lobe and usually repeat the form of the lung subunit.
- Round infiltrative shadow, according to their sizes are divided into small - to 2 cm, medium – up to 3 cm and large 4 cm and more.

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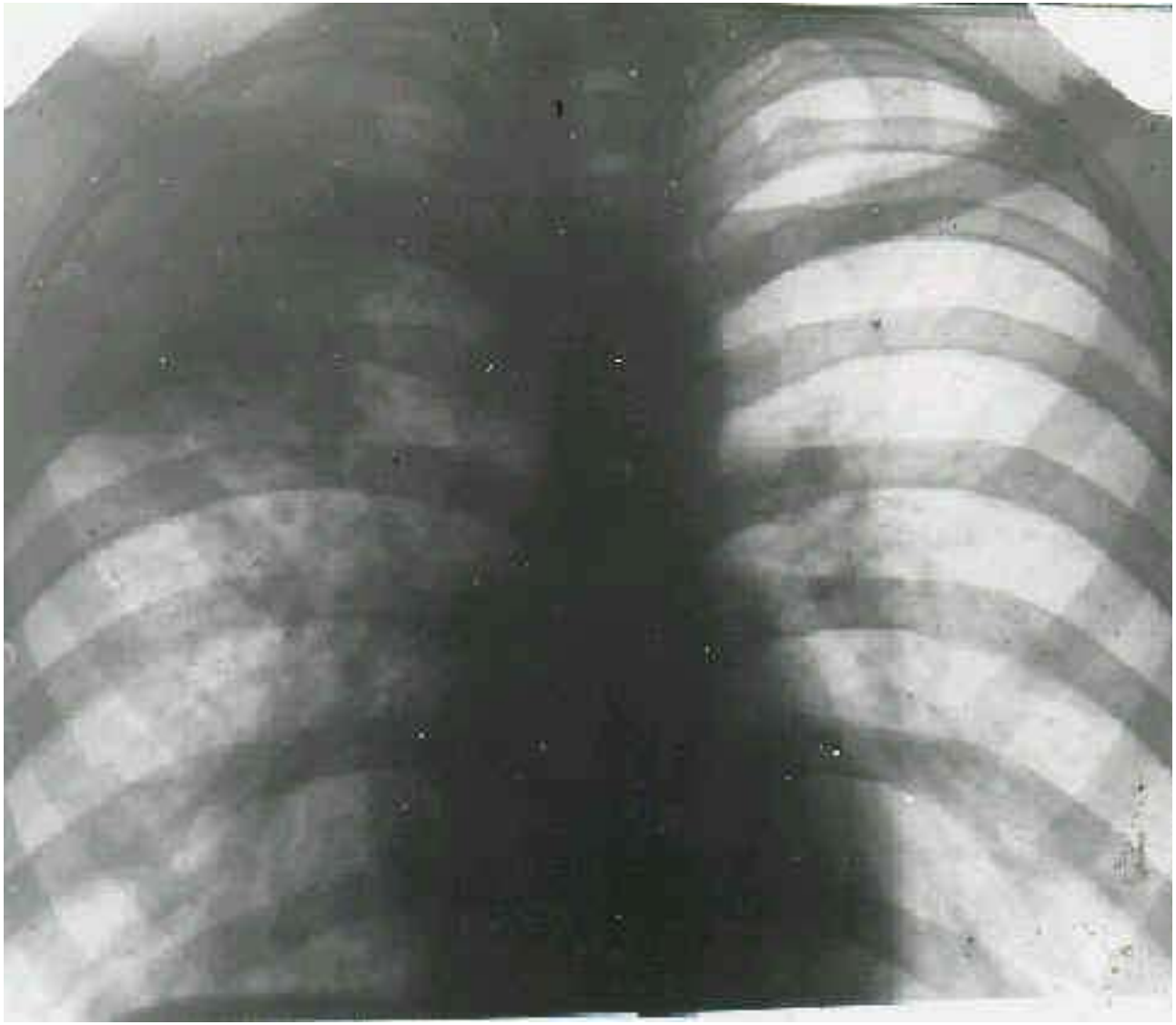
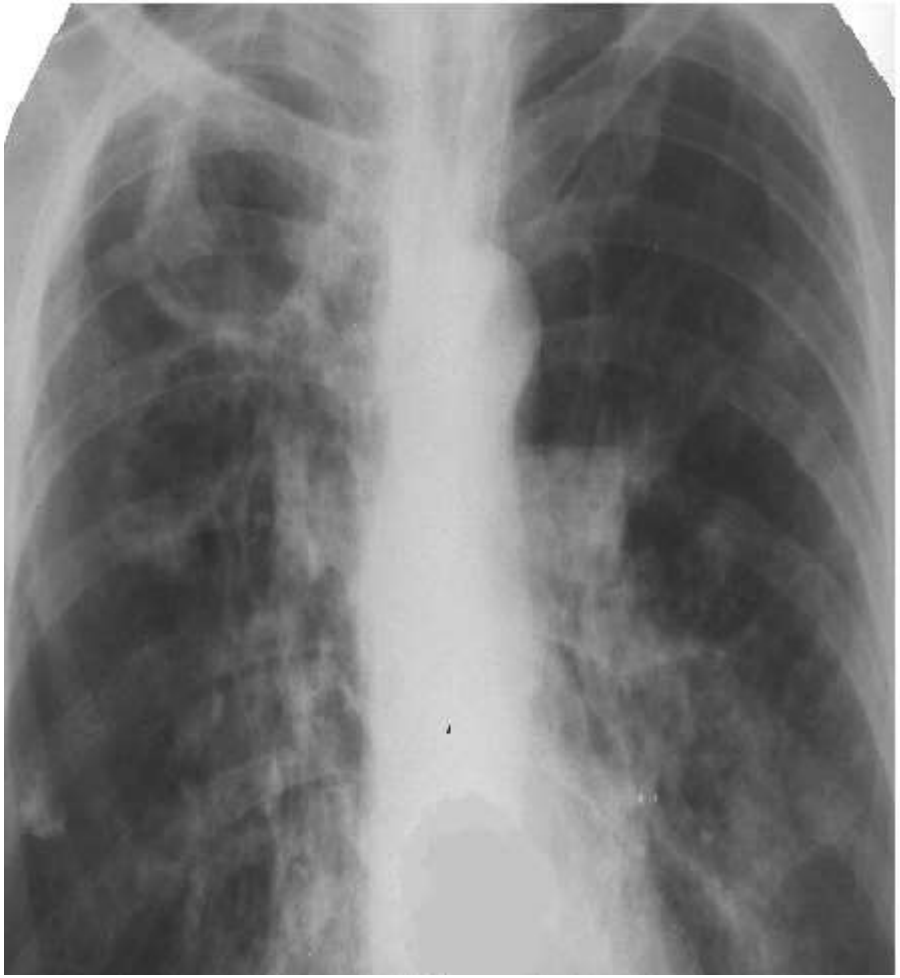


- Their contours are more often precise, the intensity is medium or high and structure is more often non-homogenous
- **The structure of the infiltration shadow** can be homogeneous and non-homogenous. The non-homogenous structure is observed usually at presence in their of the destruction. The destruction is defined as enlightenment in shadow with a precise inside contour or as cavity.

- **Tubercular cavities it is closed ring-like shadows.** They may be classified under three types**:**
  1) forming (acute);
  2) fresh cavity;
  3) old cavity.
- X-ray diagnosis of all kinds of cavities is based on detection of two attributes:
  1) presence of closed ring-like shadow of various form and size;
  2) internal contour of a cavity never repeats its outer contour.
- **The acute (forming) cavity** is defined by enlightened irregular and distinct inlet contours. A forming cavity is localized as a rule eccentrically in the area of draining bronchus.



- **The fresh cavity** is a round ring-like shadow with smooth thin fibrous wall, which develops more slowly within an area of tubercular infiltration. The width of the cavity wall is various, usually to 2 mm. The fresh cavities could be with rounded, smooth and thin-walled. If the fresh cavity arises among old tubercular changes (scars, fibrotic focuses), its form can be extended and even irregular.
- Characteristic sign of fresh cavities is the presence of two wide pair strips, going from its bottom part to the lung root. The strips are the indurated wall of draining bronchus caused by inflammation.

- **The old cavity** is defined as ring-like shadow with thick-walled, oval or irregular form, with precise internal and external contours formed as a result of chronic process. Its wall width usually reaches several millimeters, with high intensity. The multiple linear and rod-like densities of fibrosis are found around the shadow of the cavity. Frequently the walls of draining bronchus are visible, but these shadows are thinner and more intensive, than in fresh cavity.
- The described attributes of different of cavities are relative. They meet in significant percentage of cases, but not necessarily in all. Therefore, the possibility to make a final conclusion about freshness or chronic of a cavity can be done only after dynamic supervision.

- Statistically more frequently the lesions of secondary lung tuberculosis localize in I, II, VI segment and sometimes in X.
- Upper and dorsal area of lungs, subclavicular area are the favorite locations of fresh tubercular lesions.
- Supraclavicular areas and upper parts of lungs are specific for locations of the old tubercular lesions.

- **The artifacts or defects** on radiographs are named shadows or enlightenments caused by technical errors and which do not connected with the shadows of body tissues.
- The linear white strips can be simply scratches, round transparent stain or smudges maybe consequence of hit on the not shown film of a fixative substance.
- The branch-like or, similar figure of lightning black shadows arise at the electrostatic discharge as a result friction between films.

- **Techniques of description of the X-ray lung shadows**.
- At the investigation of the lung's X-ray it is convenient to use the consecutive order of their description.
- **1. Localization** of process. Indicate distribution on lobes and segments.
  2. Number, quantity of shadows. Indicate single or multiple.
  3. Form. Specify rounded, oval, polygonal, linear and irregular.
  4. **The size of a shadIndicateow**. Specify small, average, and large.
  5. The intensity. Indicate weak, average and high.
  6. The structure of a shadow: spotty and linear, homogeneous or non-homogenous (with destructions).
  7. The contours. Indicate distinct and indistinct
  8. Displayness. Indicate a position deviation of lung structures from their normal arrangement.
  9. Background of surrounding lung tissue.

- **Radiographic classification of tubercular lesions in lungs.**
- In order to have a common ground of clinical understanding, the following classification is used mostly in **English literature** to denote the degree of pulmonary involvement. From the x-ray standpoint the essential features of this classification are as follows: **Extent of pulmonary lesions: 1. Minimal.** Slight lesions without demonstrable excavation confined to a small part of one or both lungs. The total extent of the lesions, regardless of distribution, shall not exceed the equivalent of the volume of lung tissue, which lies above the second chondrosternal junction and the spine of the fourth or the fifth thoracic vertebra body on one side.

- **2. Moderately advanced.** One or both lungs may be involved, but the total extent of the lesions should not exceed the following limits.

2.1. Slight disseminated changes that may extend through not more than the volume of one lung, or the equivalent of this in both lungs.

2.2. Dense and confluent changes that may extend through not more than the equivalent of one-third the volume of one lung.

2.3. Any gradation within the above limits.

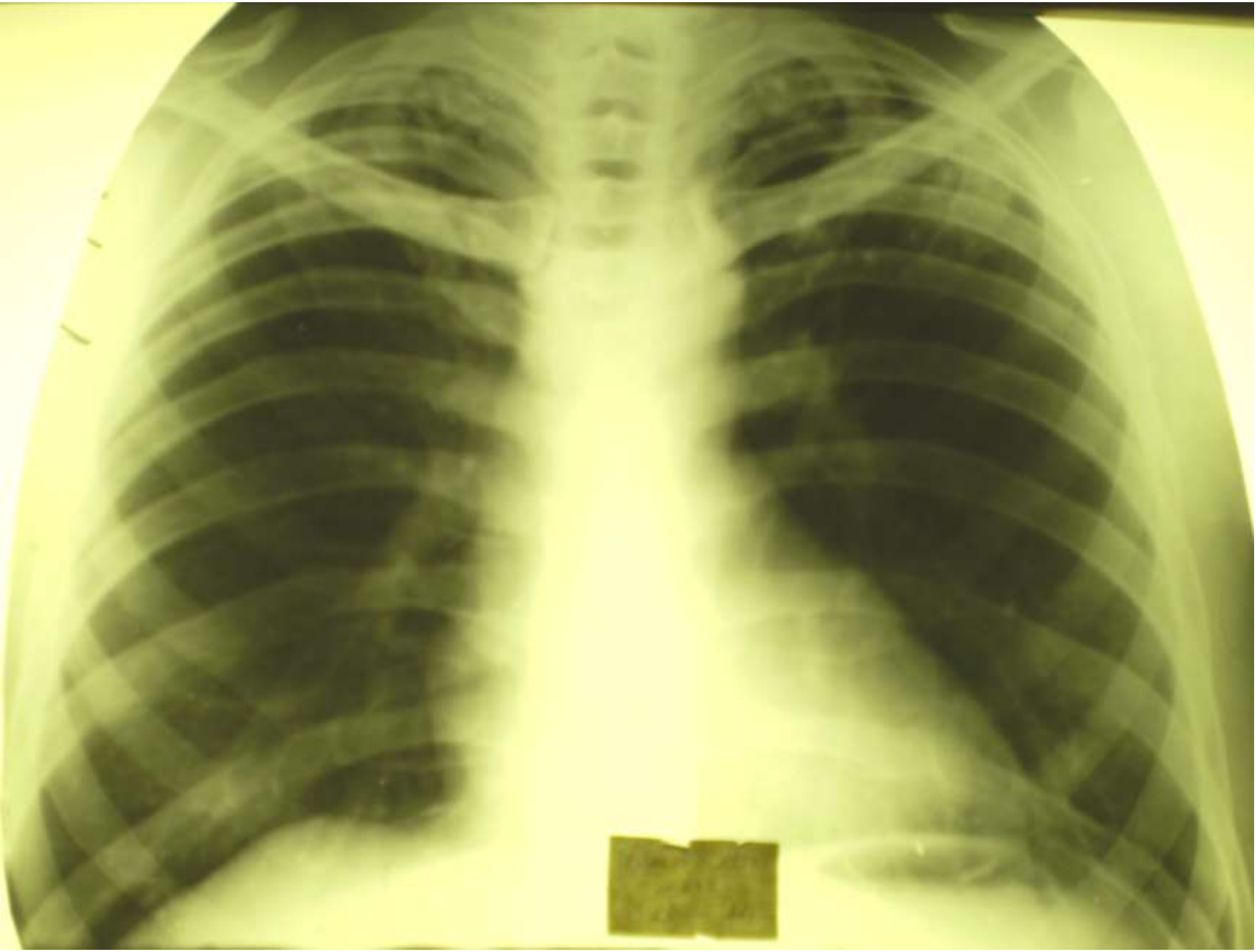
2.4. Total diameter of cavities, if present, should not to exceed 4 cm.

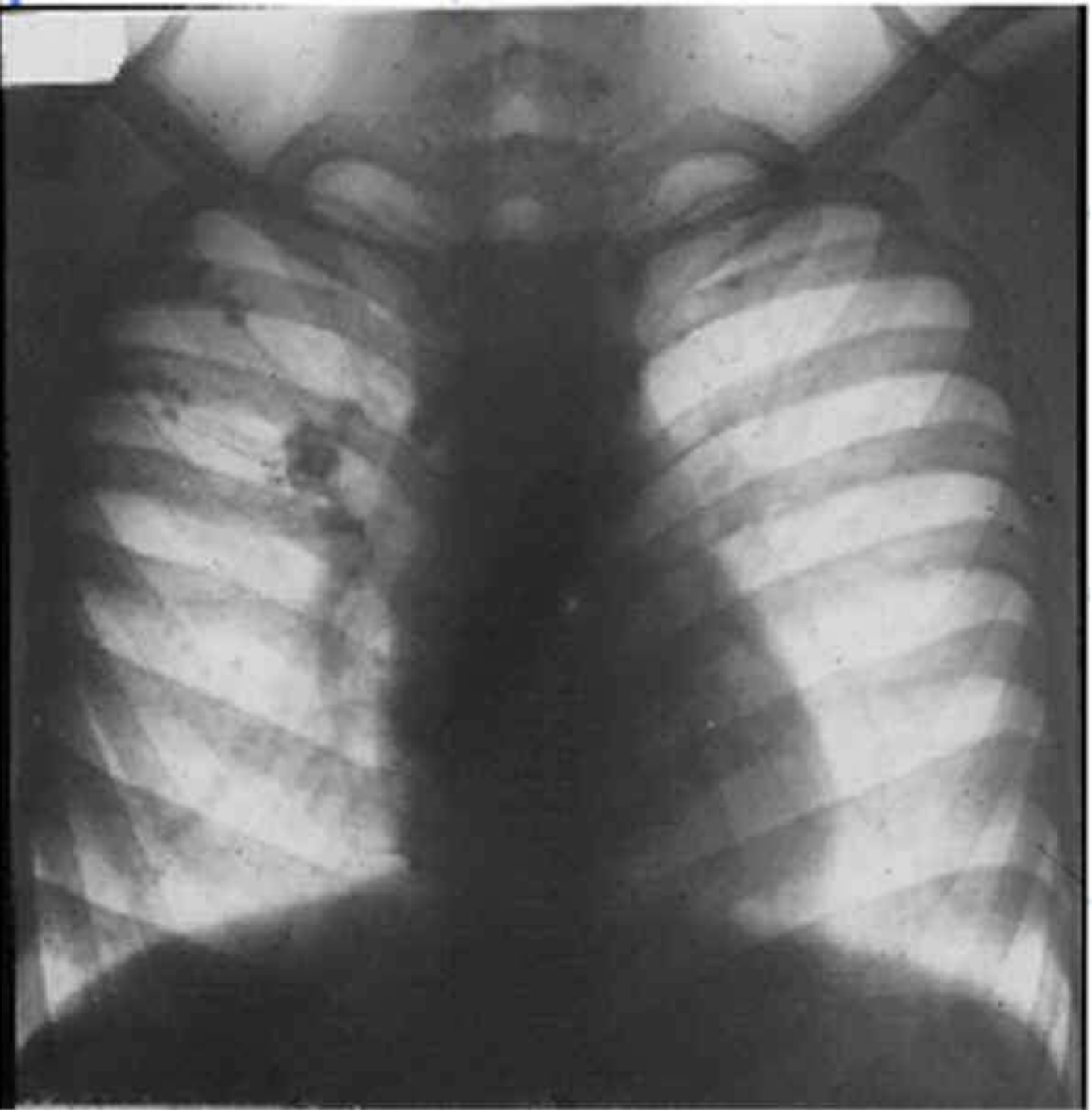
3. Far advanced. Lesions more extensive than moderately advanced.

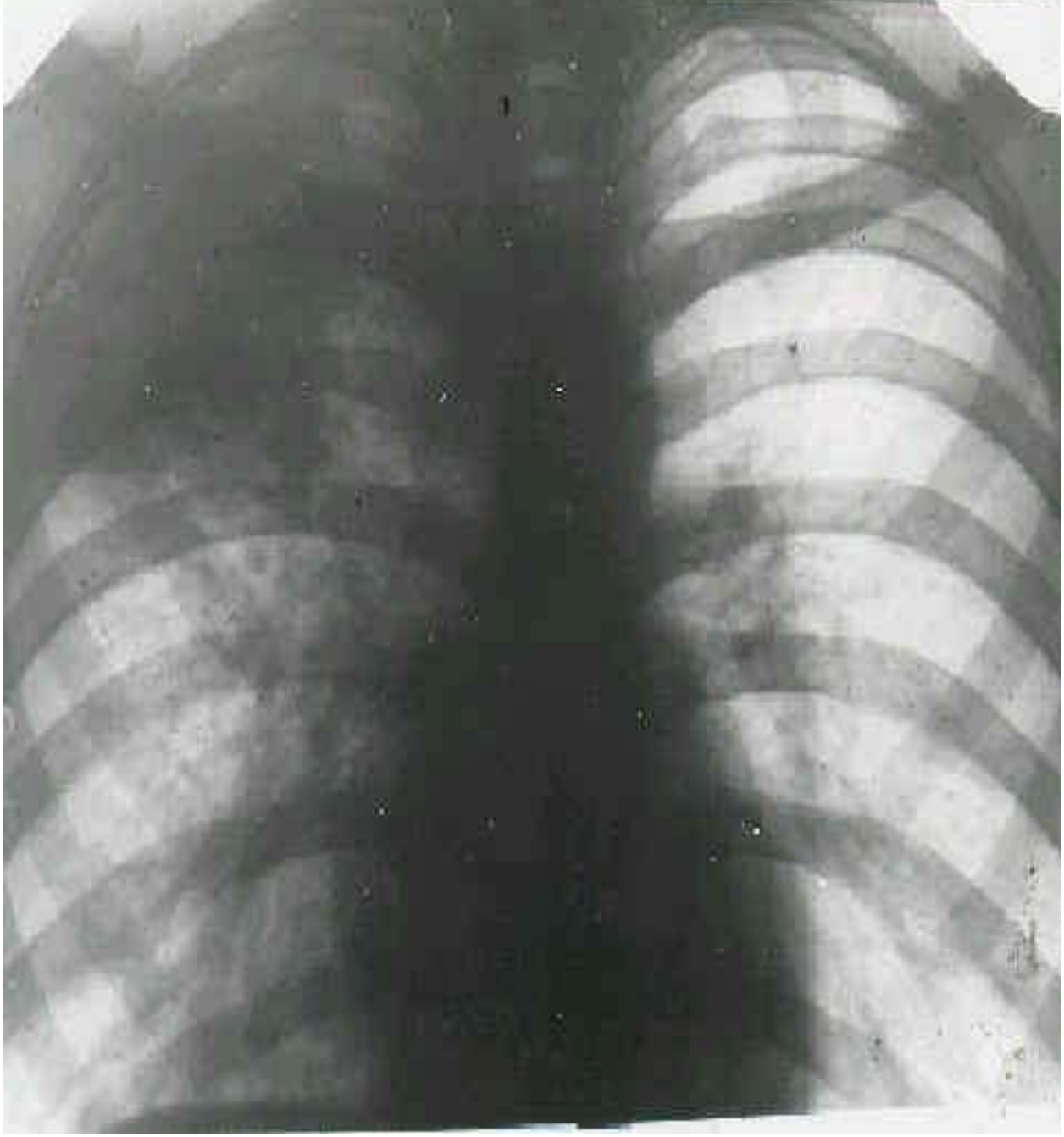
- **Obligatory** inspections at diagnostics of TB of lungs
- Collection of complaints and anamnesis of illness.
- 2th valid for one occasion analysis of sputum by the method of microscopy (colouring by an Zyegl-Nilsen
- 2th valid for one occasion analysis of sputum by the method of sowing (cultural).
- Antibiotycogram (a test is on a sensitiveness MBT to antitubercular preparations of the first row.
- Survey and lateral sciagraphy of OPC and tomography of the areas of lungs.

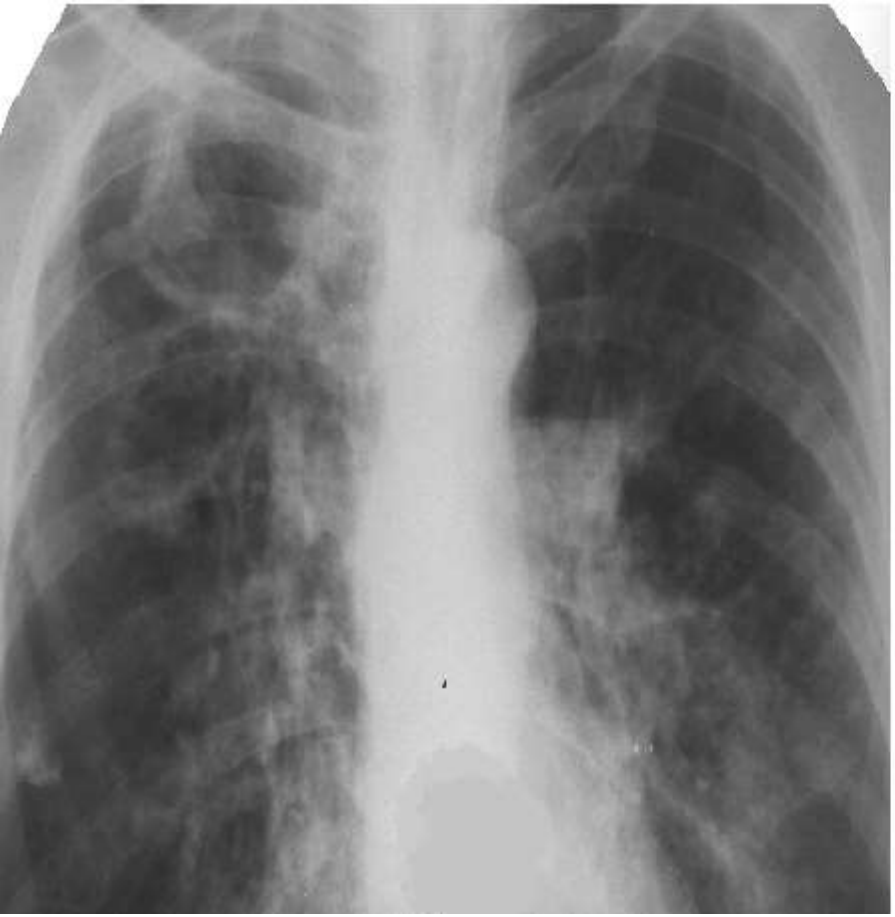
- Additional methods of inspection at diagnostics of TB :
- Computer tomography of OPC.
- Bronchoscopy with the fence of scourages for microscopic and cultural research.
- Transthoracic and transbronchial punction biopsy of lungs tissues and lymphonoduss and histological investigation.
- Thorathiscopy with the biopsy of pleura by the fence of exsudate for microscopic and cultural research on MBT.
- Genetic laboratory methods: tests of amplification of nucleic acids.
- Tuberculin test of Mantoux and test of Koch”s;
- Trial antitubercular therapy.

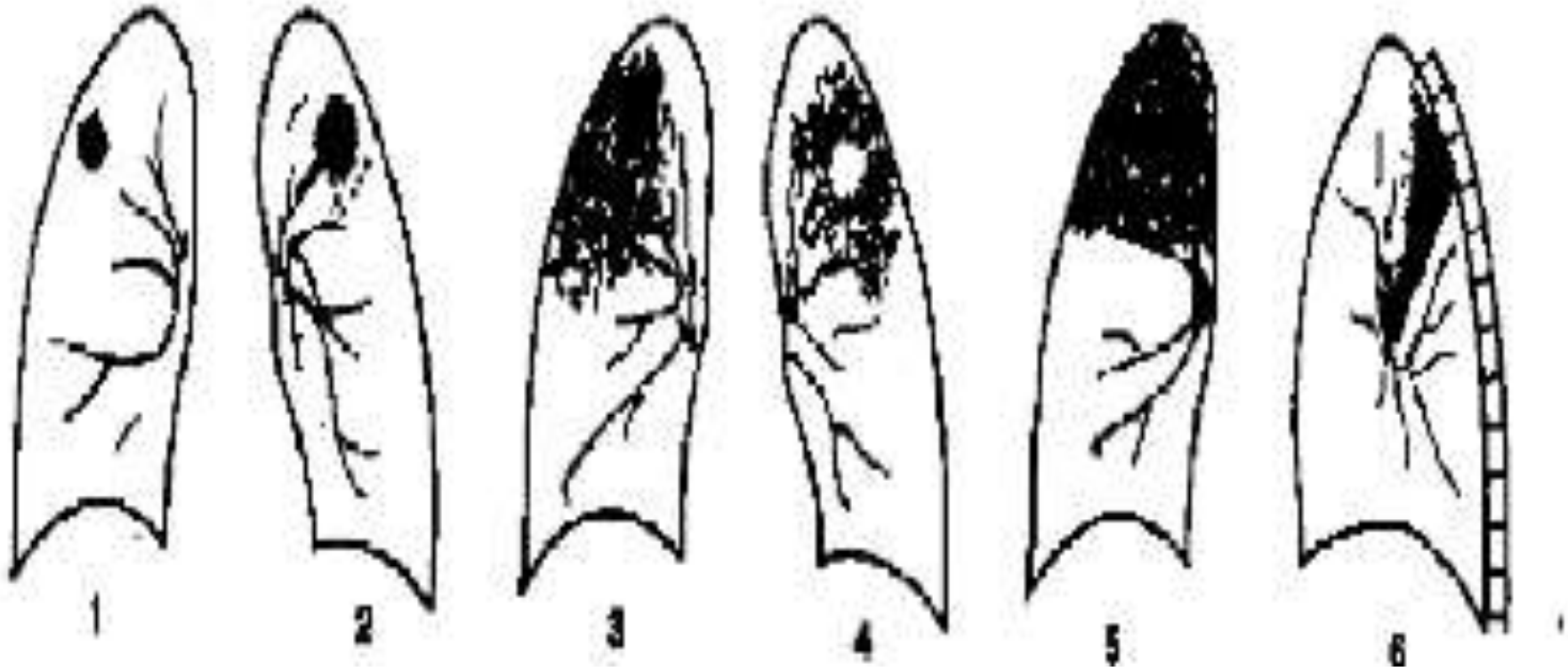
- Criteria of diagnostics of tuberculosis :
- Tuberculosis confirmed МБТ+: signs of tuberculosis of organs and tissues, exposure of MBT by the methods of microscopy or cultural. Tuberculosis unconfirmed МБТ(-) : Signs of tuberculosis of organs and tissues, positive result from application of trial antitubercular therapy regression of pathological changes is in the affected organs and tissues.







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ДЯКУЮ ЗА УВАГУ!