MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
ODESA NATIONAL MEDICAL UNIVERSITY

Medical Faculty

Department of Internal Medicine #2 with postgraduate training

APPROVED

Vice-rector for scientific and pedagogical work

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«____» September 2024

METHODICAL GUIDE

for independent applicant's work (IAW) in educational discipline

International Faculty, V-th course

Educational discipline: **Internal Medicine**

Theme: **Diagnostics, treatment and prophylaxis of the common pulmonary diseases**

Approved

At the meeting of the Department of Internal Medicine #2 with postgraduate training

Protocol № 1 dated «02» September 2024

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METHODICAL RECOMMENDATIONS
for independent students work (IWS)

Topic: «Diagnostics, treatment and prophylaxis of the common pulmonary diseases» (Topics № № 12-17, number of hours – 8).

Object: To teach students to master the method of examination of patients with respiratory diseases with the selection of the main pulmonological syndromes. To study probable etiological factors, pathogenesis of chronic obstructive pulmonary diseases, their main clinical forms, variants of disease course, differential diagnosis, treatment tactics, determination of prognosis and efficiency of patients.

Students must acquired the following special competencies:
- Communication skills and clinical examination of the patient with major urinary system diseases (SC1).
- Ability to determine the necessary list of clinical, laboratory and instrumental studies and evaluate their results in common pulmonary diseases (SC2).
- Ability to establish a preliminary and clinical diagnosis of common pulmonary diseases (SC3).
- The ability to determine the principles of treatment, the required regime of work/rest and alimentary regime of patients with common pulmonary diseases (SC4).
- Ability to diagnose emergencies in the clinic of common pulmonary diseases (SC5).
- Ability to determine tactics and provide emergency medical care to patients with common pulmonary diseases (SC6).
- Ability to perform medical manipulations in a case of common pulmonary diseases (SC8).

List of basic terms, parameters, characteristics, which the student must study for the lesson:
1. Syndrome of respiratory insufficiency.
2. Syndrome of pulmonary infiltrate.
3. Syndrome of pleural effusion and pneumothorax.
4. Syndrome of Emphysema.
5. Bronchial obstruction syndrome.

Plan

I. Theoretical questions:
1. Basic symptoms of pulmonary pathology
2. Methods of clinical examination in pulmonology
3. Pneumonia: role of laboratory and instrumental methods of examination. Classification. Disease severity estimation. Diagnostical criteria.
4. Chronic obstructive pulmonary disease (COPD): causes, clinical features, diagnosis, classification, modern treatment and rehabilitation of patients.
5. Pneumothorax: classification, diagnosis, treatment. The therapist's role in the management of patients with this pathology.

6. X-ray diagnostic criteria of bronchi and lungs diseases. Radiological roentgenlogy and
semiotics.
7. Diagnostic bronchoscopy: possibilities, indications and contraindications.
8. Role of laboratory tests in pulmonology (general blood count, biochemical blood tests).
9. Usage of MRI and CT in pulmonology: possibilities, indications and contraindications.
10. General biochemical analysis of sputum.
11. Sensitivity determination of microorganisms to antibiotics, antifungal and phages.

II. Content of the topic:

1. Mastering the skills of external respiratory function interpretation (topics 14, 15, 16, 19):

Spirometry – examination of ventilation during quiet and forced breathing, exercises and of pharmacological tests .

Indications:

• Chronic cough
• Pulmonary diseases
• Frequent colds
• Shortness of breath on exertion and during the rest
• Smoking persons over 40 years
• Vasomotor rhinitis
• Adverse conditions (paint, dust, etc.).
• Information about the coughing and shortness of breath in the anamnesis
• Age over 70 years
• Obesity
• Monitoring of patients receiving bronchodilators
• Monitoring of patients with heart failure
• Assessment of the severity of asthma
• Estimation of power efficiency

Contraindications:

• Unstable patient's general condition
• Myocardial infarction
• Unstable stenocardia
• Uncontrolled hypertension
• Pulmonary insufficiency III degree
• Heart failure FC III-IV
• Myocardial infarction
• Preeclampsia
• II half of pregnancy

To prepare for the examination patient should:

• Do not smoke for 2 hours

• Do not use medications containing caffeine - for 8 hours; inhale β2 – agonists short0acting for 6 hours; inhale β2 - agonists long-acting - for 12 hours; a short-acting anticholinergics - 8 hours; long-acting anticholinergics - 36 hours; theophylline and other oral bronchodilators - 24 hours; antihistamines - 48 hours.

Technique of computer spirography
After a short rest patient inhales deeply, then makes forced expiration with the maximal possible effort. Exhalation must continue 6 sec. or more, until the spirometric plateau has been reached. A patient should make 3-8 respiratory attempts. Their number depends on the results of spirometry. Graphic is considered suitable for interpretation if there is no artifacts due to coughing , closing the vocal cords, a premature termination of the respiratory attempt, inadequate effort during exhalation, etc.
Interpretation of the data
Usage of spirometry can set the type of respiratory insufficiency: obstructive, restrictive, mixed.
Obstructive insufficiency occurs due to narrowing of the airways and increase air flow resistance. Obstruction is caused by a spasm of bronchial smooth muscles, inflammatory infiltration of the mucosa, mucosal edema, hyper - and diskreniya, expiratory collapse of the bronchi, congenital or acquired bronchial distortion, neoplasm.
Spirometric obstruction criteria are:
- Decrease in normal FEV1/VC (vital capacity)
- Decreased Tiffno's index (FEV1/FVC)
- VC is normal or slightly reduced
- RLV (residual lung volume) / TLC (total lung capacity) more than 35%
- FRC (functional residual capacity) / TLC 50%
In case of obstruction it is necessary to carry out test with bronchodilatators. After standard spirometry patient receives 400 micrograms (4 puffs) of β2- agonist salbutamol with an interval between breaths at least 30 seconds. In 15-30 minutes spirometric study is repeated. If a patient has FEV1 > 12% (200 mL) a test with bronchodilators is positive and obstruction - reversible.
Restrictive type - a disturbance of ventilation caused by a decrease in the respiratory surface of the lung tissue or it's ability to stretch. There are pulmonary and extrapulmonary causes of restriction. The first group includes pulmonary infiltrates, pulmonary fibrosis, lung resection, atelectasis, hypoplasia, emphysema, pleural diseases. The second one - chest deformations, respiratory muscles pathology, congestion in the lungs, increased intra-abdominal pressure, pain. Criteria of restriction are:
- Proportional reduction in lung volume and capacity
- Decrease in VC without significant restructuring
- Normal or practically normal spyrometric loop "flow - volume ", which is shifted to the right
- Normal Tiffno index

- Decreased proportion of the inspiratory reserve volume and expiratory reserve volume

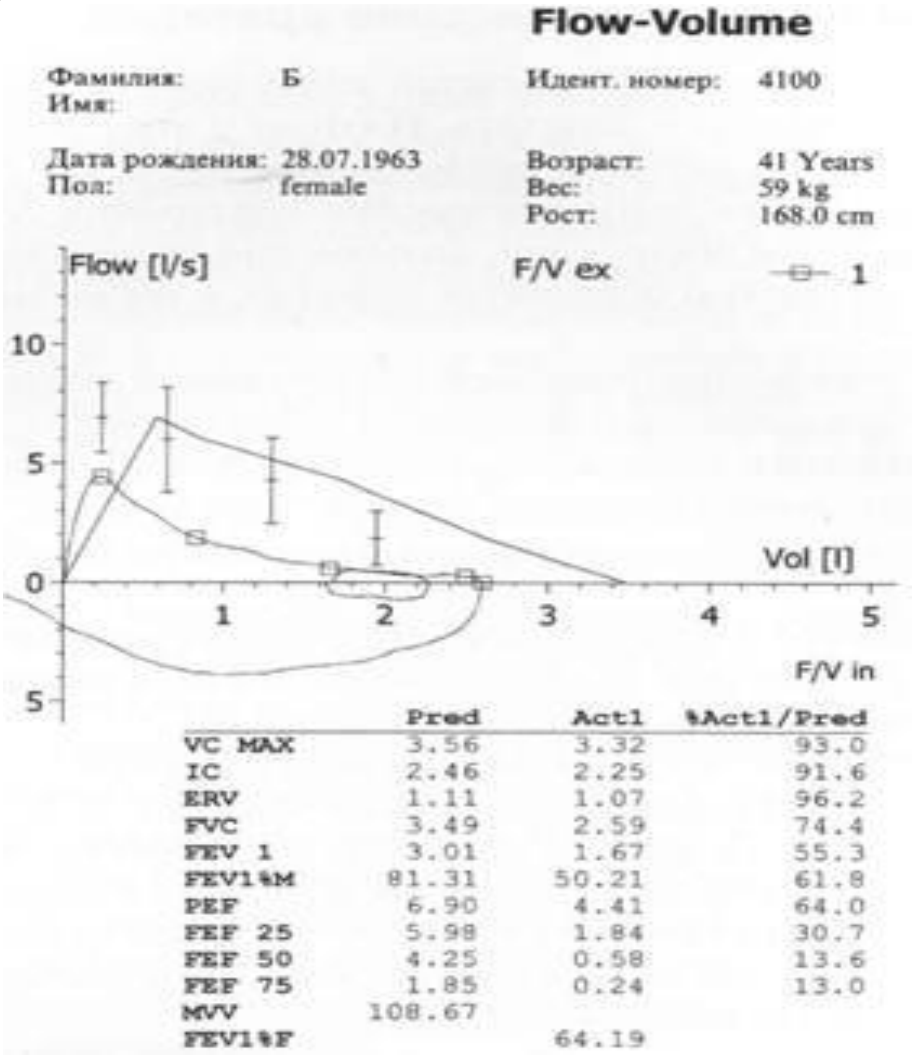
Mixed respiratory insufficiency combines features of restriction and obstruction. It occurs due to airway obstruction and restriction of lung tissue (which stretches or reduces respiratory surface).

Clinical examples

Task 1. Patient M., 52 years, complains of shortness of breath, persistent cough with a small amount of clear sputum. Anamnesis: the patient smokes for 20 years, cough disturbs him for 10-15 years, shortness of breath - 1 year.

Objectively: a respiration rate 18 per min. Percussion: box sound. Auscultation - breathing weakened. X-ray: bilateral symmetric increased transparency of the lung tissue. Results of computer spirography: see below.

Estimate the results of the study. What diseases could cause ventilatory insufficiency?



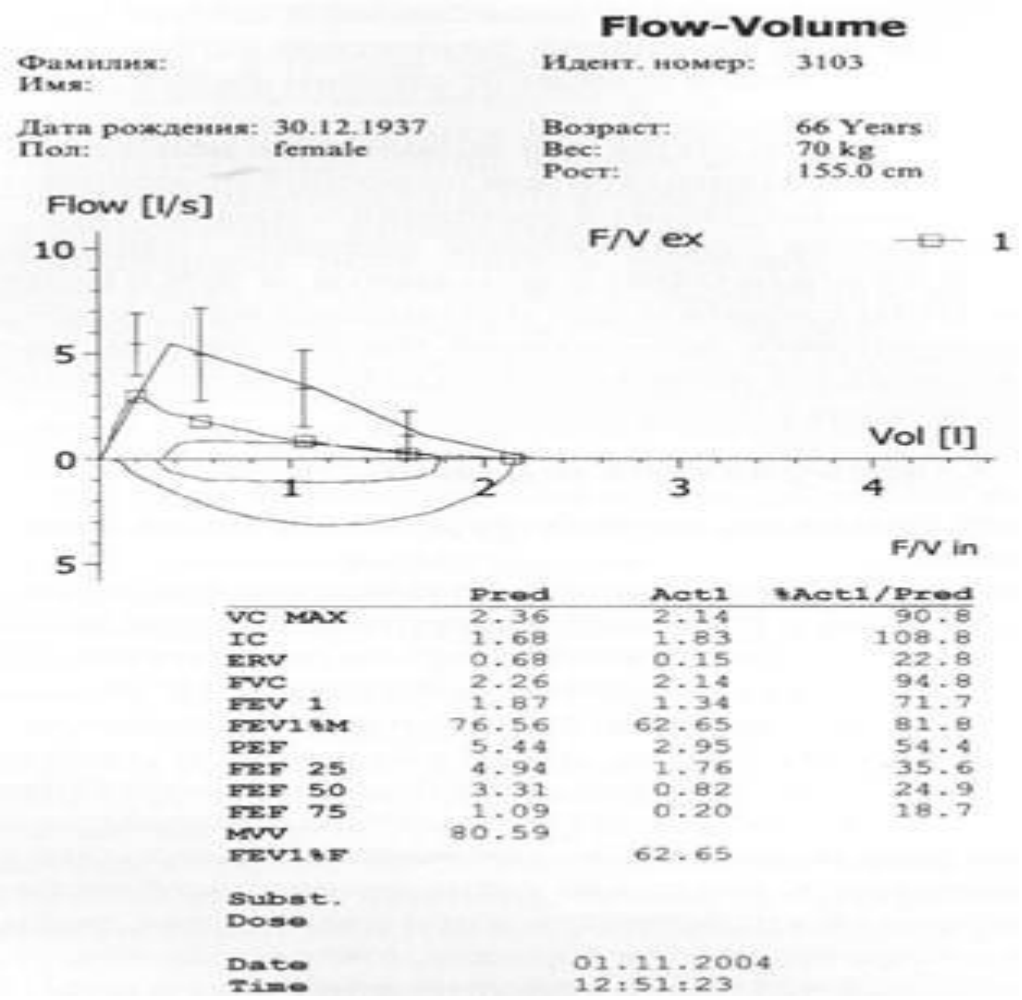
	Pred	Act1	%Act1/Pred
VC MAX	3.56	3.32	93.0
IC	2.46	2.25	91.6
ERV	1.11	1.07	96.2
FVC	3.49	2.59	74.4
FEV 1	3.01	1.67	55.3
FEV1%M	81.31	50.21	61.8
PEF	6.90	4.41	64.0
FEF 25	5.98	1.84	30.7
FEF 50	4.25	0.58	13.6
FEF 75	1.85	0.24	13.0
MVV	108.67		
FEV1%F		64.19	

Spirogram to task 1. The patient M., 52 years old

Answer:

1. Lung ventilation dysfunction, obstructive type (decreased FEV1, index Tiffno).
2. Asthma, chronic obstructive pulmonary disease, intrathoracic tumor.

Task 2. A woman, 43 years old was diagnosed rheumatoid arthritis. For a long time used non-steroid anti-inflammatory drugs, glucocorticoids. The disease is often aggravated, soon appeared dyspnea, fatigue, nonproductive cough. Examination of the chest - excursion of the diaphragm is normal on both sides, auscultation - dry bilateral wheezing in the lower parts of the lung . Pathological changes in other organs and systems were not found. X-ray: increased pulmonary pattern due to interstitial component, roots widened. Results of computer spirography: see below. What is the cause of dyspnoea in this patient? Determine the type of ventilation disorder.



	Pred	Act1	%Act1/Pred
VC MAX	2.36	2.14	90.8
IC	1.68	1.83	108.8
ERV	0.68	0.15	22.8
FVC	2.26	2.14	94.8
FEV 1	1.87	1.34	71.7
FEV1%M	76.56	62.65	81.8
PEF	5.44	2.95	54.4
FEF 25	4.94	1.76	35.6
FEF 50	3.31	0.82	24.9
FEF 75	1.09	0.20	18.7
MVV	80.59		
FEV1%F		62.65	
Subst.			
Dose			
Date		01.11.2004	
Time		12:51:23	

Spirogram to task 2. The patient A., 43 years old

Answer:
Interstitial pulmonary fibrosis. Restrictive ventilation disorder (TLC and vital capacity are decreased, normal index Tiffno).

2. Mastering the skills of X-ray interpretation in patients with respiratory disorders. Analysis and interpretation of radiographs - topics 14-19

Describing the X-ray, it is necessary to estimate:

• Quality of X-ray
• Condition of soft tissue and bones
• The state of pulmonary tissue
• The roots of the lungs
• The position of the diaphragm
• Cardio - vascular shadow

Requirements to an X-ray quality:

• Name, age of the patient, the date of the examination
• There must be no scratches, artifacts, images of foreign objects
• The sternum should be fully displayed
• If the position of the patient is correct sterno-clavicular joints are placed symmetrically to the median line of the vertebrae
• The thoracic vertebrae shouldn't been visualized

There are 5 basic radiographic densities, which appear on x-rays as various shades of black and white (materials of low density appear darker than objects of high density):
-black lungs (air)
-dark grey subcutaneous tissue (fat)
-light grey heart and blood vessels (soft tissue)
-off white clavicle and ribs (bone)
-bright white (metal jewellery or right and left labels)

Therefore, structures or objects can be detected on chest x-rays if they are located next to structures of different densities (i.e. white/grey heart border against a black aerated lung field). In the situation of pneumonia in which the consolidated areas of the lung(s) become more dense and similar to the density of the heart, the contrast between the densities of the two organs is lost resulting in the heart border being obscured.

Chest x-rays are usually taken during inspiration but expiratory ones are useful in suspected pneumothorax and bronchial obstructions with air trapping (i.e. inhaled foreign body in a child). When asked to interpret an x-ray, it is important that one should start by commenting on: the name and birth date of the patient whose x-ray you are presenting; the type of x-ray (PA or lateral etc.); and when it was taken. For example one could state, "This is a PA film taken on 11/02/01 of JB who was born on the 21/03/99". All of this general information can usually be found on the upper left hand corner of the x-ray film. Then place the x-ray film on a light box and take 2-3 steps back to get a proper view of the radiograph. Consultants are often very quick to pick up on one of the most commonly made mistakes by students, which is to peer at the x-ray too closely. Next a comment should be made on the technical quality of the x-ray such as:

- ensuring the patient is centred on the film such that both lung apices and costophrenic angles are captured; the term used is "well centred".
- ensuring that there is no rotation by checking that the spinous processes lie midway between the medial ends of the clavicles; the term used is "not rotated", or "is rotated to the right/left".

- ensuring adequate penetration by checking that the vertebral bodies are just visible at the lower border of cardiac shadow. If they are too visible, it indicates an over penetrated film which results in missing low-density lesions. If the vertebral bodies are not visible (representing an under penetration), the lung fields appear falsely white. The degree of penetration is important when comparing serial x-rays used to monitor the patients progress and response to therapy.

THE SYSTEMATIC APPROACH TO CHEST X-RAY

The proposed system for looking at a radiograph of the chest involves remembering part of the alphabet:

A-airway
B-bone
C-cardiac
D-diaphragm
E&F-equal (lung) fields
G-gastric bubble
H-hilum (and mediastinum)

AIRWAY

- Look at the trachea and its branches: check the site, size, shape, and shadow.
- Is it patent, or narrowed indicating stenosis or edema? Is it central? (in children it should be straight but in adults it can deviate to the right due the aortic arch)

BONE

- Look at and compare the bony structures paying attention to site, size, shape, shadows and borders: (clavicles, ribs, scapulae, thoracic vertebrae, and humeri).
- Any fractures? Using a pointer follow along the smooth edges of each bone looking for an interruption of the smooth line.
- Any lytic lesions? Look for discrete darker areas or a change in bone density.
- Any bony deformity? (rachitic rosary at the costo-chondral joints seen in rickets)
- Any extra? (cervical ribs)
- Any missing bones? (absent vertebral arches in spina bifida occulta)
- Look for lateral deviations of the vertebrae in scoliosis.

CARDIAC

- Take note of the cardiac site, size, shape, shadows and borders.

Site: is it located on the right or left?
Size: is it less than half the transthoracic diameter? (i.e. is the largest diameter of the heart less than half the largest diameter of the thorax)
Shape: is it ovoid with the apex pointing to the left?
Shadows: any change in density?
Borders: is it clear or well defined?
-unclear right border suggest middle lobe consolidation.
-unclear left border suggest lingular lobe consolidation.

DIAPHRAGM

- Look at the outline of the diaphragm; it should be clear and smooth.
- Right hemidiaphragm should be higher (2-3cm) than the left:

highest point on the right should be in the middle of the right lung field.
highest point on left should be slightly lateral to the middle of the left lung field.
deviation may indicate pneumothorax.
- Are the costophrenic angles well defined?
-whiteness immediately above the diaphragm indicates pleural effusion or consolidation.
-the presence of fluid will produce a meniscus (Meniscus Sign) or a concave upper border
- Is there air below each hemidiaphragm indicating bowel perforation?
- Is the diaphragm below the anterior end of the 6th rib on the right? If so, this indicates hyperinflation.
EQUAL (lung) FIELDS
- Divide lung fields into zones: upper, middle, and lower zones
-upper: from the apex to 2nd costal cartilage
-middle: between 2nd and 4th costal cartilage
-lower: between 4th and 6th costal cartilage
- Look for equal radiolucency (or blackness due to air filling) between the left and the right lungs zones.
- Look for any discrete or generalized grey/white shadows (described as opacity/patchy shadows)
- The horizontal fissure on the right, divides the upper and middle lobes: from the hilum to the 6th rib at the axillary line
- Look for vascular markings: indicating pulmonary hypertension pruning
- More specifically look for:
Air bronchograms are visible air-filled bronchi, out-lined by surrounding consolidation.
-Bat's wing distribution describes one of two patterns of consolidation (the other pattern being lobar);
refers to the bilateral opacification spreading from the hilar regions into the lungs (sparing the peripheral lung areas) signifying extensive alveolar disease. The causes of bat's wing are: pulmonary edema in heart failure, fluid overload, hypoproteinemia, blood transfusion reaction, and others.
-Reversed bat's wing distribution are alveolar opacification in the peripheral lung fields with sparing of the central areas seen in fat embolism 1-2 days following a bone fracture.
-Kerley A, B, and C lines which are fine lines running through the lungs representing thickened connective tissue septae seen in intersitial pulmonary
edema.
Kerley A lines are found in the upper lobes.
Kerley B lines are short (1-2 cm) horizontal line in the lower lobes.
Kerley C lines are diffusively distributed through the entire lung.
These Kerley lines may be associated with cardiac enlargement and pleural effusions.

Clinical examples

Task 3.

Patient K., 58 years old. Complains on dyspnoea on exertion, dry cough (especially in the morning), which is accompanied by small amount of purulent sputum. Anamnesis: patient smokes about 40 years, a long time worked as a house painter. Objectively: the patient has slight cyanosis of the face and lips. Thoracic form reminds "barrel". Percussion - box sound, lower bounds are shifted down. Auscultation: weakened vesicular breathing, dry wheezing, which increase during forced breathing. RR - 22/min. Heart borders widened to the right, tones are muted, rhythmic. HR-78bmin, BP-140/90 mm Hg. Examination of other organs and systems revealed no pathology. The patient was made X-ray (see figure to task 3). Give him the interpretation and form a preliminary diagnosis.

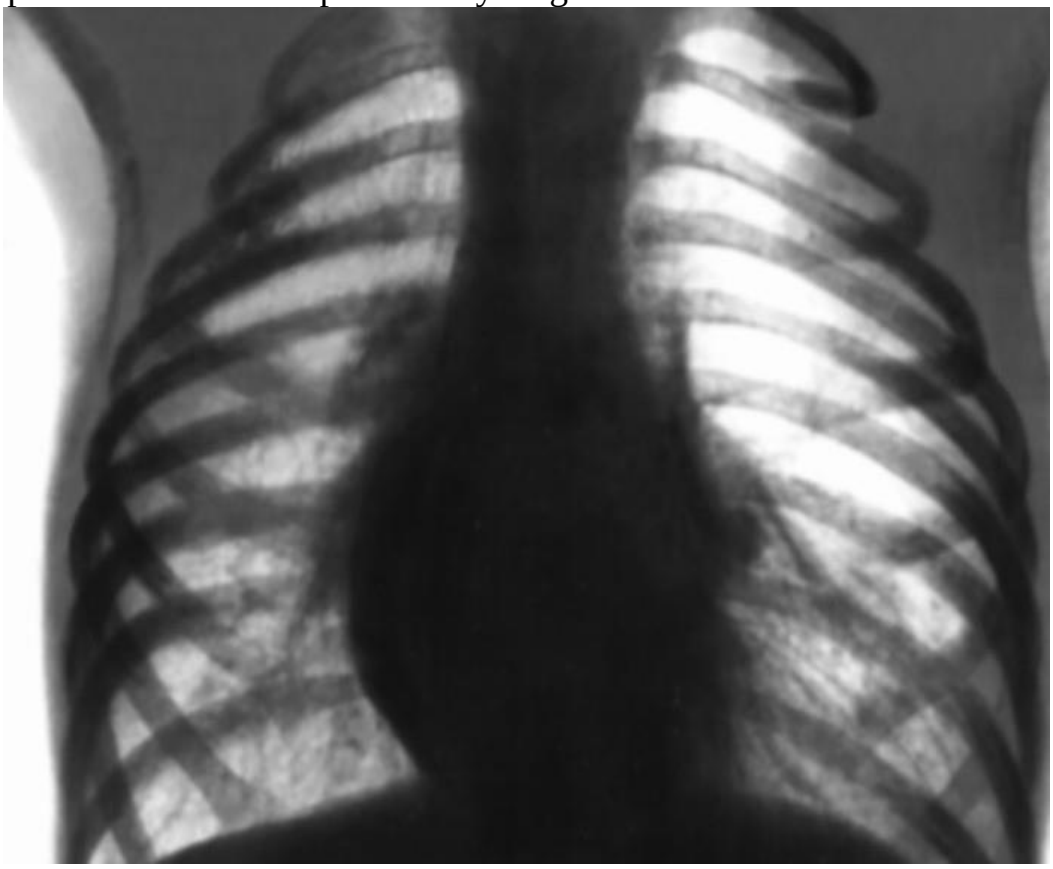


Figure to task 3. X-ray of patient K., 58 years

Answers.

1. This is a posterior-anterior chest x-ray. It is well centred, with no rotation. There are no bony abnormalities noted. The heart is enlarged to the right. The cardiac borders are clear and well defined. The chest is hyperinflated and the costophrenic angles are sharp. Both lung fields are equal in radiolucency with enhanced vascular markings. The paratracheal lines are thickened. In the mediastinum, the outlines on the right (for the azygous vein, right hilum, and right atrium) and on the left (for the aortic arch, left hilum, and left ventricle) are clear and well defined.
2. Probable diagnosis: Chronic obstructive pulmonary disease.

Task 4.

Patient D., 42 years. Complaints of wheezing attacks of dry cough that occurs in dusty places and after contact with pets. These symptoms disturb a woman for 22 years. A few weeks ago attacks became more frequent, disturb woman at night and in the morning, accompanied by a small amount of viscous transparent sputum. Objectively: patient is sitting with her hands resting on the knees, breathing sharply with prolonged exhalation, at a distance dry wheezing are heard. Cyanosis is general and diffused. Thoracic form reminds "barrel". Percussion - box sound, lower bounds are shifted down. Auscultation - hard breathing with prolonged expiration, dry wheezing. RR-24/min. The patient was made X-ray (see figure to task 4). Give him the interpretation and form a preliminary diagnosis.

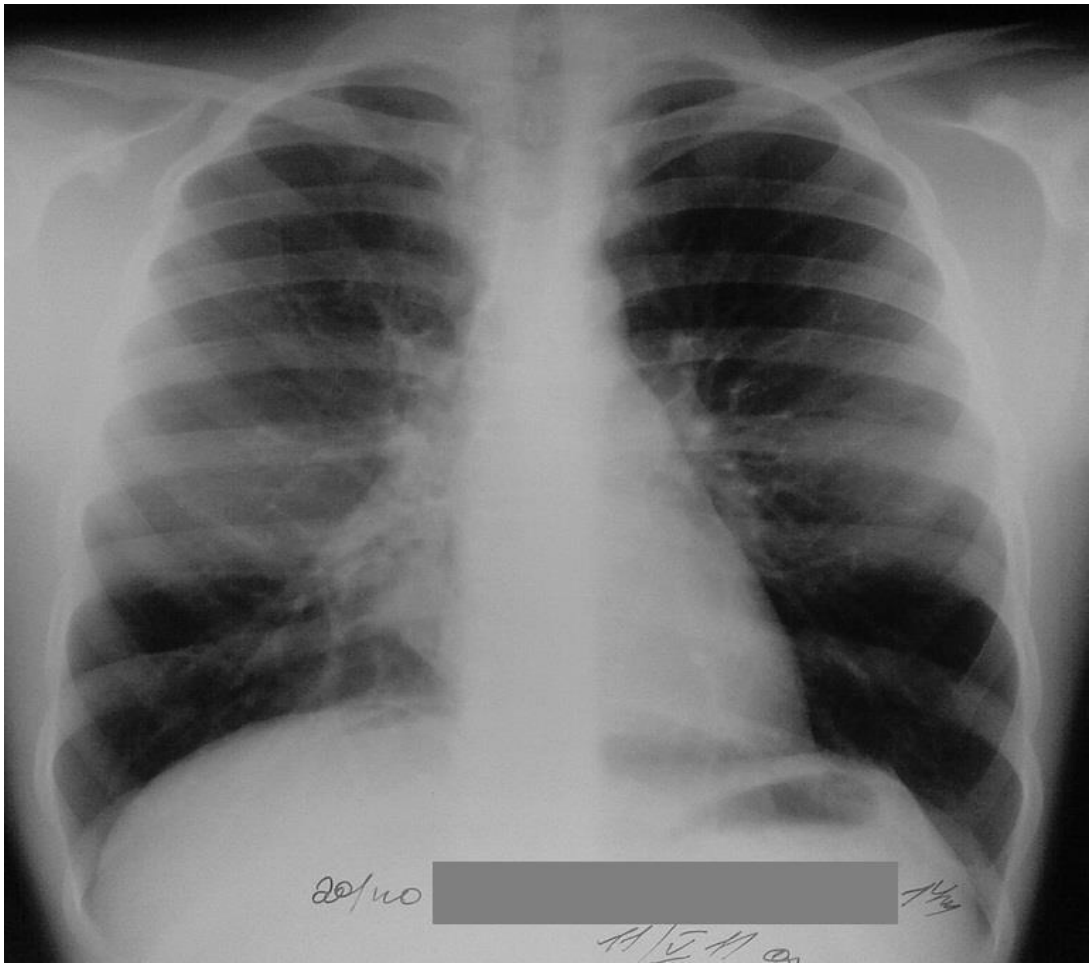


Figure to task 4. X-ray of patient D., 42 years

Answers:

1. This is a posterior-anterior chest x-ray. It is well centred, with no rotation. There are no bony abnormalities noted. Intercostals are enlarged. Both lung fields are equal in radiolucency with weakened vascular markings. The chest is hyperinflated and the costophrenic angles are sharp. The paratracheal lines are thickened. The diaphragm is shifted down. The heart is not enlarged.

2. Persistent asthma, moderate severity, exacerbation.

Task 5.

Patient S., 36 years old. Complaints of pain in the right side of the chest, worsed when breathing and cough, cough with red sputum (approximately 30 ml per day), shortness of breath, fatigue, fever. Anamnesis: fell ill 3 days ago, when the body temperature rises to 40C, appeared pain in the right side of the chest when breathing, dry cough. The next day there sputum became red, appeared shortness of breath, increased general fatigue. Objectively: redness of the cheeks, more at the left, herpetic eruption on the lips and nose wings. RR-32/min. The right half of the chest lags behind in the act of breathing. In the lower parts of right lung voice trembling is enhanced, dull sound on percussion. Auscultation of this site - bronchial breathing, the pleural rub, reinforced bronhophony. The patient was made X-ray (see figure). Give him the interpretation and form a preliminary diagnosis.

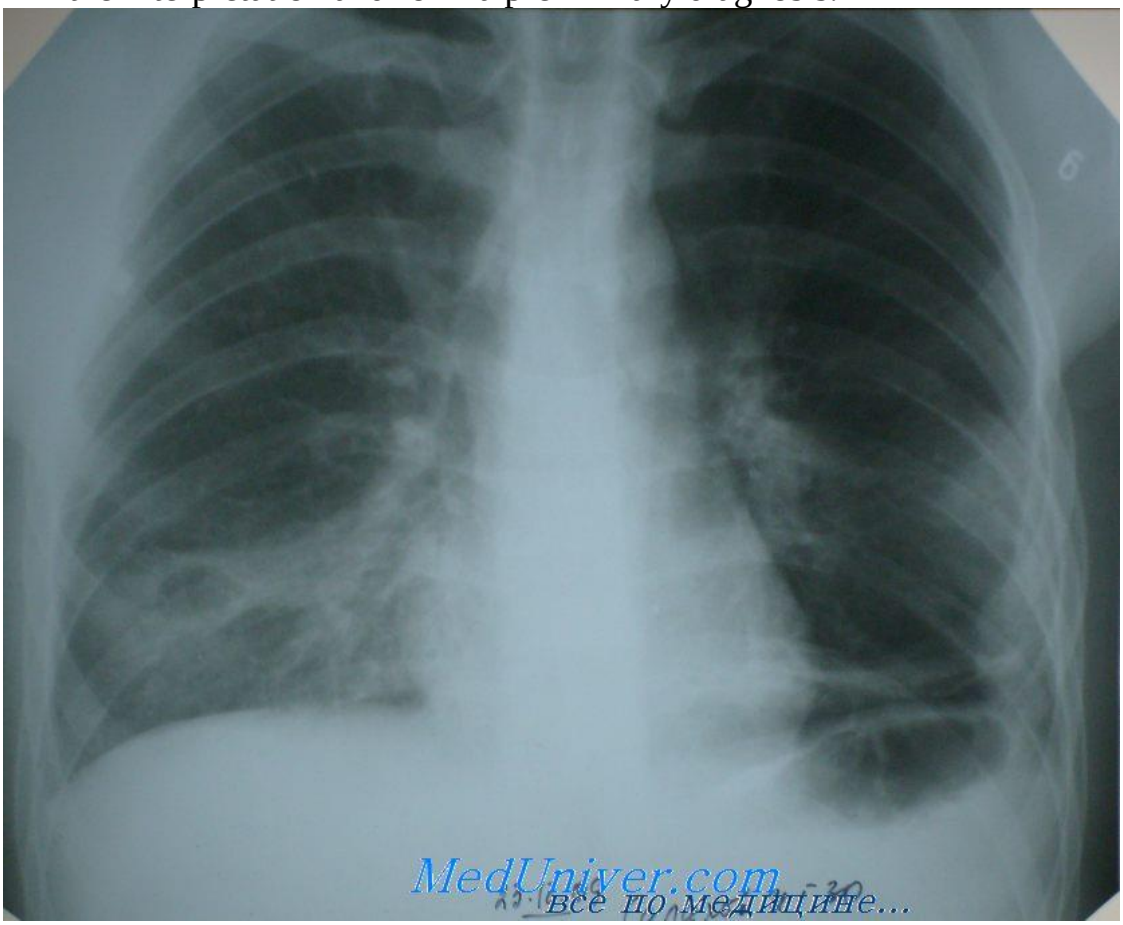


Figure to task 5. X-ray of patient S., 36 years

Answers.

1. This is a chest film. Although the patient is centred with both lung apices and costophrenic angles being captured, some of the bony structures are not
visible due to poor reproduction. Since the medial ends of the clavicle cannot be seen, the rotation cannot be assessed. The trachea is patent and deviated to the right, as is the heart. The cardiac size and shape are normal but there is a difference in the

radiolucency on either side of the vertebral column (darker or less dense on the right). The cardiac borders are well defined on the left but indistinct on the right. The right hemidiaphragm is also indistinguishable with blunting of the costophrenic angle, consistent with a pleural effusion. There is a white region (consolidation), containing discrete dark patches (air) along the right cardiac border, and extending to the right costophrenic angle. This is distorting the out-
lines of the azygous vein, right hilum, and right atrium. On the left, the outlines for the aortic arch, left hilum, and left ventricle are clear. This x-ray demonstrates one of the possible complications of staphylococcal pneumonia, a pneumatocele. This is a right lower lobe, not middle lobe pneumonia, since the right cardiac border is still visible.
2. Pneumonia III group, moderate severity, with localization in a right lower lobe. PI II.on the left but indistinct on the right. The right hemidiaphragm is also indistinguishable with blunting of the costophrenic angle, consistent with a pleural effusion. There is a white region (consolidation), containing discrete dark patches (air) along the right cardiac border, and extending to the right costophrenic angle. This is distorting the out-
lines of the azygous vein, right hilum, and right atrium. On the left, the outlines for the aortic arch, left hilum, and left ventricle are clear. This x-ray demonstrates one of the possible complications of staphylococcal pneumonia, a pneumatocele. This is a right lower lobe, not middle lobe pneumonia, since the right cardiac border is still visible.
2. Pneumonia III group, moderate severity, with localization in a right lower lobe. PI II.

Task 6.

Patient A., 23 years old. On admission complained of dyspnea, fever, heaviness in the right chest, general weakness. Fell ill a week ago. In the beginning there was a dry cough , stabbing pain in the right side of the chest when breathing, which enhanced with a deep breath, coughing, sweating, headaches, body temperature rose to 37.7^0 C. Used aspirin without effect. After 2 days, there was shortness of breath, the temperature rose to 38.3^0 C. In the examination doctor found moderate cyanosis, increase in volume of the right half of the chest with the smoothness of intercostal spaces, the lag of the right half of the chest in breathing. BR - 35/min. Right below the angle of the scapula voice trembling is not registered. Percussion of the chest revealed zone of blunt sound with arcuate upper boundary, which is determined by the highest point of the right posterior axillary line. Auscultation of the site: breathing is not heard, above that place was registered bronchial tone. The presence of what syndromes can be set at the patient? Give interpretation of x-ray.

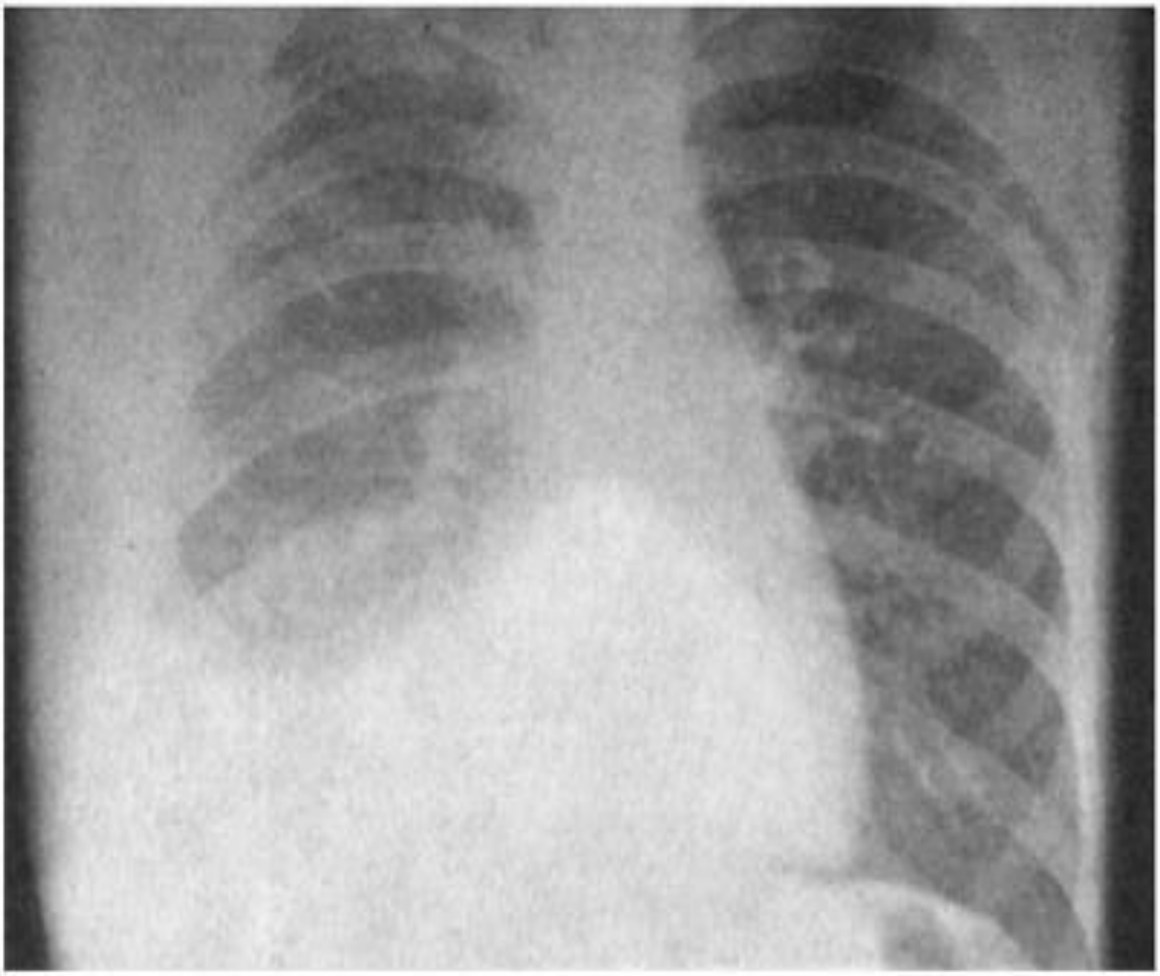


Figure to task 6. X-ray of patient A., 23 years

Answers:

Congestion fluid syndrome in the pleural cavity (shortness of breath, a feeling of heaviness in the chest on the affected side, intercostal spaces on that side widened).
This is a posterior-anterior chest x-ray. Bone deformations are not determined. A pulmonary structure on the left side enhanced due to an interstitial component.
On the right is the intensive homogeneous shading with a slanting high bound to the IV rib. Both lung fields are equal in radiolucency with enchanced vascular markings. Sinus on the left is free, on the right - filled by an exsudate. The roots of lungs are extended on either side. Cardiac shade is displaced to the left.

Task 7.

Patient B., 32 years, complains on pains in the left half of thorax at the deep breathing and cough, that diminish at lying on the left side. It is known from anamnesis, that a week ago he caught a "cold", treated himself with some antibiotics, antipyretics. Examination: the state is stable, lies on the left side. The left half of thorax falls behind in the act of breathing. Percussion - pulmonary sound. At an auscultation: weakened vesicular breathing, crepitation; on the right – enhanced vesicular breathing. BR - 21/min. Give interpretation of x-ray.

Figure to task 7. X-ray of patient B., 32 years

Answers:
This is a posterior-anterior chest x-ray. Bone deformations are not determined. A pulmonary structure on the left side enhanced due to an interstitial component.

Task 8.
Patient D., 28 years. Complaints about the discharge of large amounts of purulent sputum with odors (up to 250 ml per day). Sputum departs in the morning and in the lateral position. Also he has sweating and fever to 38^0C. The patient fell ill about a month ago, when there was a small cough with sputum, fever, sweating, pain in the right side. About 10 days ago while coughing allocated a large amount of smelling sputum (500 ml), which made the patient consult a doctor. Objective examination: Right on the mid-axillary line at the level of VI-VII intercostal space voice tremor is enhanced; percussion - tympanic sound on with some metallic tone. Above the projection of tympanic sound is heard amphoric breath, crepitation. Patients underwent X-ray examination of the lungs, the data of which are shown below. Give it the interpretation.

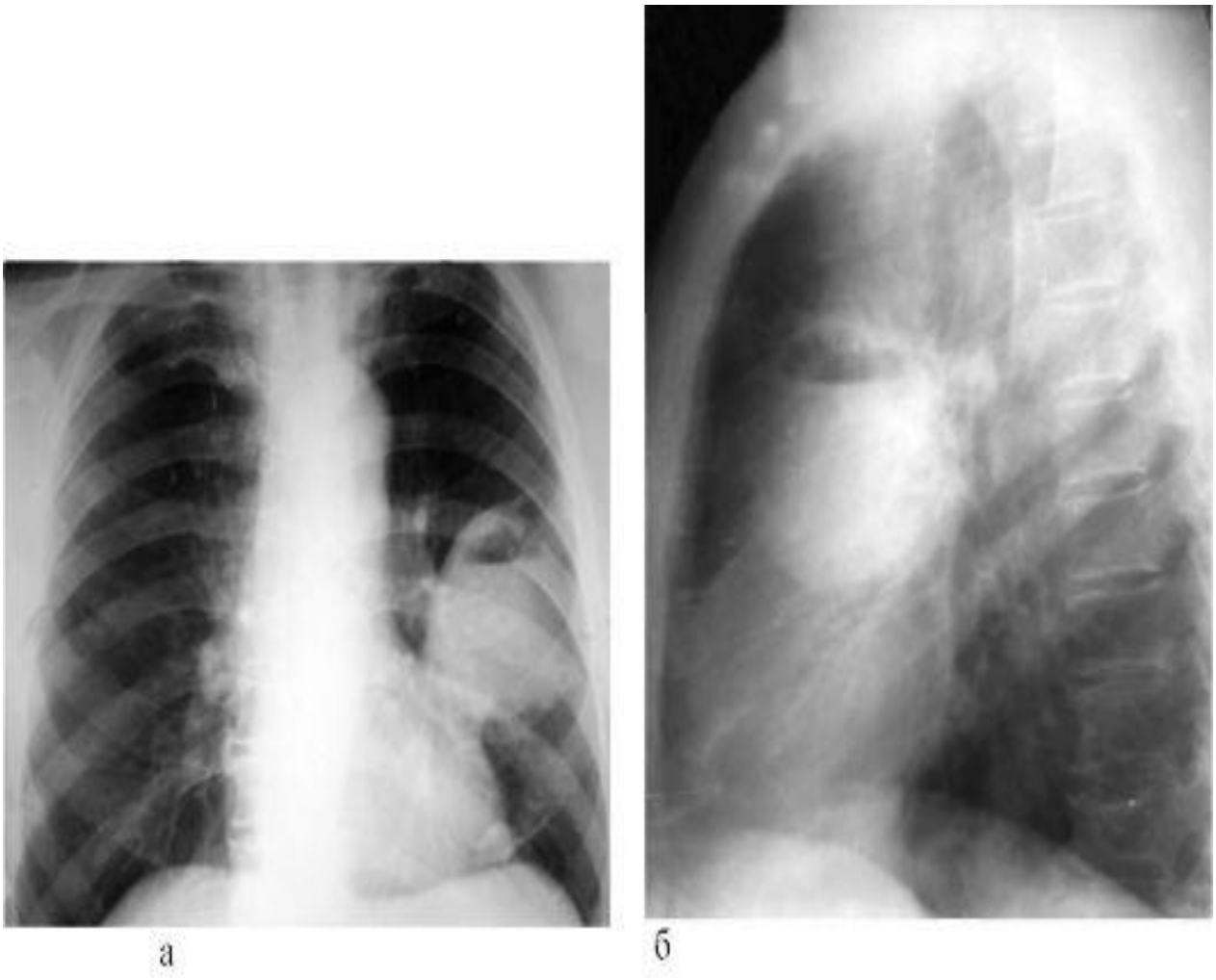


Figure to task 8. X-ray of patient D., 28 years old.

Answer.
On x-ray in the direct projection bone deformations are not defined. Pulmonary tissue enhanced by interstitial component. In the projection of the middle lobe of the left lung is determined rounded annular shadow, 6.5-7 cm in diameter, with smooth contours and fuzzy horizontal liquid level. The size and position of cardio - vascular shadow is not changed.

5.2.1. Mastering the skills of bronchography interpretation. - Topics № 16, 18.
The main indications for bronchography are:
• Bronchiectasis
• Abnormalities of the bronchial system
• Suspected neoplastic process in the bronchi
Bronchography can detect two types of changes. Reversible radiological symptoms of bronchial inflammation are caused by mucosal edema, hyperplasia of mucous glands and hypersecretion. In these cases, radiographs visualized numerous clippings fill the bronchi contrast agent, the jaggedness of their contours, fragmented filling etc.

Irreversible radiological signs indicate organic changes in the morphology of the bronchi and have important diagnostic value. These changes include:
1. Filling defects of large and small bronchi ("stump" of the bronchi), due, for example, a cancer with endobronchial growth.
2. Severe bronchial walls jaggedness indicates usually a chronic inflammation with hypertrophy of goblet cells and mucous glands, ductal extension in which numb contrast agent .
3. Bronchiectasis and transverse shadows of medium bronchi. It is due to atrophy of the mucosa and bulging of the bronchial cartilage.
Normal bronchography is characterized:
- Bronchi have correct structure;
- Right main bronchus is shorter, wider and has a vertical movement, and the left - longer, narrower and passes more horizontal;
- All bronchi have normal width;
- Width of the bronchi gradually narrows;
- Absence of shadows or cavities filled with contrast;
- Absence of bronchoconstriction.
How to evaluate abnormal formations?
After detection of pathological formation in images, the doctor uses the standard scheme:
- The situation of the lungs, bronchi, ribs and vertebrae;
- Number of units;
- Shape: round, oval, irregular;
- Dimensions: normally the highest and lowest measured diameter (in the case of a stenosis - width and length);
- The intensity of the shadows on the radiograph gives an indication of the density of pathological formation;
- Figure: focus can be uniform or have inside any structure;
- Contours: clear or fuzzy;
- Edge: smooth or rough;
- Offset: Does focus changes its position in the process of respiration?
After evaluating the features and comparing them with the symptoms, results of other studies, the doctor can put a diagnosis.

Task 9.
Patient K., 27 years old complains of persistent cough with a small amount of muco-purulent sputum. From history case we know that in childhood she was often sick with colds, cough bothering her from 7-8 years and maximum severity it acquires in the morning after waking up. In objective examination any pathological changes were not found. A chest x-ray showed no pathological changes. Thus the patient was directed to bronchography, the results of which are shown below. Interpret the data.
Answer.

At simultaneous bilateral bronchography with contrasting lower lobes of the lungs, bronchi of the right lung have no pathological changes. Lower lobe of the left lung is reduced, the cylindrical bronchiectasis are determined.

Figure to task 9. Bronhogramma of patient T., 23 years

5.3. Mastering the skills of bronchial endoscopy interpretation. Topics 14, 16, 18

Bronchoscopy is a test to view the airways and diagnose lung disease. It may also be used during the treatment of some lung conditions.

A bronchoscopy may be performed for diagnostic and/or therapeutic reasons.

Diagnostic indications may include, but are not limited to, the following:

- Tumors or bronchial cancer
- Airway obstructions and/or strictures (narrowed areas)
- Inflammation and infections such as tuberculosis, pneumonia, or fungal or parasitic lung infections
- Interstitial pulmonary disease
- Persistent cough or hemoptysis
- Abnormal chest X-rays
- Biopsy of tissue or collection of other specimens, such as sputum
- Vocal cord paralysis

- Bronchoalveolar lavage, or BAL (instilling fluid through the bronchoscope to aid in the diagnosis of certain lung disorders)

Therapeutic uses of bronchoscopy may include, but are not limited to, the following:

- Removal of secretions, blood, mucus plugs, or polyps (growths) to clear airways
- Control of bleeding in the bronchi
- Removal of foreign objects or other obstructions
- Laser therapy or brachytherapy (radiation treatment) for bronchial tumors
- Stent placement (a device used to keep the airway open)
- Drainage of an abscess, or a collection of pus

There may be other reasons for your doctor to recommend a bronchoscopy.

Risks of the procedure

As with any invasive procedure, complications may occur. Complications related to bronchoscopy may include, but are not limited to, the following:

- Bleeding
- Infection
- Bronchial perforation
- Bronchospasm and/or laryngospasm, an irritation of the airways and/or vocal cords
- Pneumothorax. Air becomes trapped in the pleural space causing the lung to collapse.

Contraindications for bronchoscopy may include severe tracheal stenosis and pulmonary hypertension. Patients with hypercapnia and/or severe shortness of breath may require intubation prior to the procedure, so that oxygen can be delivered directly into the lungs while the bronchoscope is in place.

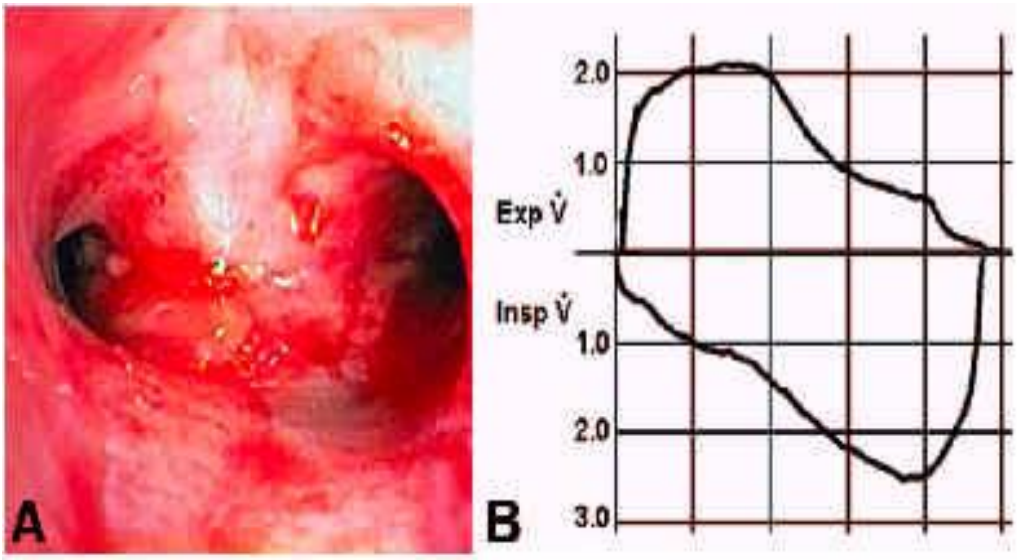
There may be other risks depending on your specific medical condition. Be sure to discuss any concerns with your doctor prior to the procedure.

Severe coughing and/or gagging may interfere with a bronchoscopy.

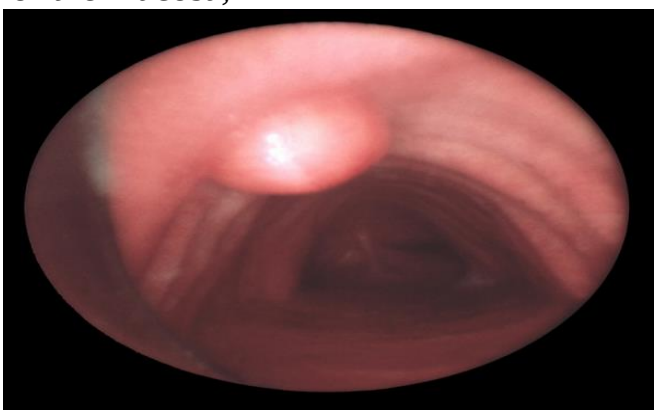
Endoscopic inspection of tracheo - bronchial tree includes examination of the position and the division of the bronchi, and the morphological and functional changes caused by the pathological process.

Among the morphological characters, the most common include:

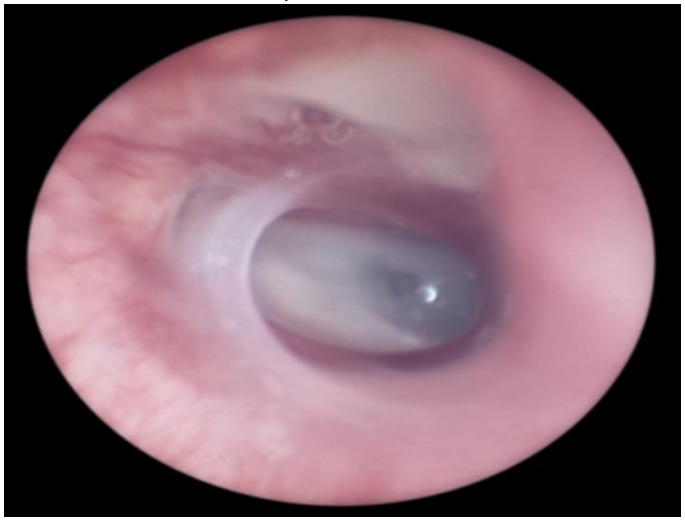
- Congestion and swelling of the mucous membrane of the trachea and bronchi;



- Diffuse or localized fibrinous raids, erosions and ulcers;
- A tumor infiltration of the mucosa;

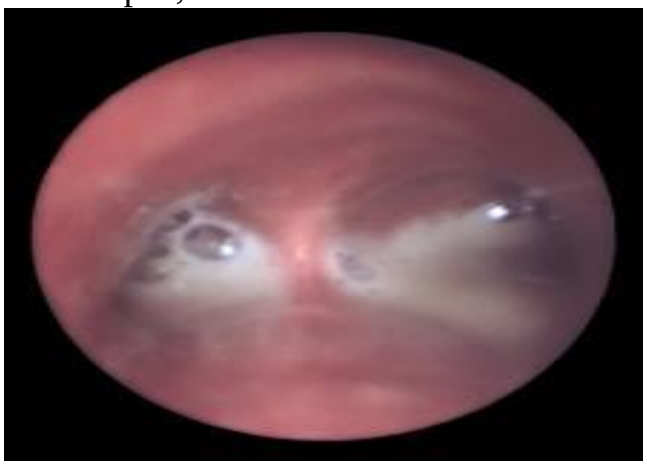


- Deformation and bronchoconstriction;



- The presence of foreign body in the bronchus;

- Discharge from the bronchi pus, etc.



Anatomical changes detected during bronchoscopy, do not independent of the type of anesthesia. The latter only to a certain extent affect the availability of some examination of the bronchi.

The next step is to review endoscopy tracheal bifurcation. Estimate location of the carina, the shape and angle of the carina, its mobility.

Extension, flattening deformation of karina is the presence of metastases in the lymph nodes bifurcation. However, this can only be when all of the signs are present. Expansion and flattening of the carina can be observed in the norm, especially in hypersthenics, or be caused by the angular displacement of the main bronchus with upper lobe atelectasis.

Preparation of material for histological study is one of the most important moments of bronchoscopy. Diagnostic findings on bronchoscopic biopsy are able to get confirmation of the diagnosis before surgery. Therefore, bronchoscopic biopsy is considered the final method in the differential diagnosis of lung tumors. Weak side of bronchoscopic biopsy remain its limited accessibility of various departments of the bronchial tree.

3. Mastering skills laboratory researches analyzing (the general analysis of blood, the general protein and protein fractions, coagulogram, the general and

microbiological research of a sputum, the general and microbiological research of pleural liquid). Topics 14-19.

Task 10.

Patient D., 24 years. Complaints on pains in the left half of the thorax, amplifying at breath and at cough, cough with allocation of sputum (about 30 ml per day), shortening of breath, fatigue, high temperature. Anamnesis: he ached a week ago when body temperature increased to 38^0C, appeared pains in the left half of a thorax at breath, dry cough. Next day there was a purulent sputum, dyspnoe, the general fatigue. Data of objective research: the giperemiya of cheeks, is more at the left, herpetic rash on lips and nose wings. BR - 28/min. The left half of a thorax lags behind in the breath act. In the right lung the voice trembling is strengthened, weakened sound at percussion. At auskultation of this site - the bronchial breath, the strengthened bronkhofoniya. General analysis of blood: Er.-4,2 T/l, Hb-130 g/l, L.-$12x10^9$ l, ESR-20 mm/h. Biochemical analysis of blood: the general protein - 80 g/l, albumine 55 g/l, γ-globulins- 28%. At microscopic research of a sputum: mucous, "rusty" coloring, flavourless. There is a small amount of erythrocytes, cages of an alveolar epithelium, leukocytes and crystals of hematoidine. Estimate results of the received researches and give them clinical interpretation.

Answers:

1. Clinically the patient has such syndromes: the general intoxication (fever, fast fatigue), respiratory insufficiency (short wind), a syndrome of focal defeat of pulmonary tissue (the strengthened voice trembling, weakened sound at percussion, the strengthened bronkhofoniya).
2. The general analysis of blood (leikocytosis, ESR increased) and biochemical research (increase of level of the general protein, albumine, gamma globulins) are signs of system inflammatory answer activation.
3. Presence at sputum of alveolar macrophages testifies inflammatory process activation in a pulmonary parenchyma, a small amount of erythrocytes - of the increased permeability.
4. Probable diagnosis: focal pneumonia.

Task 11.

The patient E., 19 years old. Complaints of dry wheezing cough attacks that occur at night and early morning. These symptoms disturb a woman for 10 years. Recently, frequent attacks, accompanied by the release at the end of a small amount of viscous transparent sputum. These objective research: the patient is sitting in bed, her hands resting on the knees, breathing with prolonged exhalation sharply, at a distance of dry wheezing are heard. Pronounced diffuse cyanosis. Thorax is “barrel”; Percussion - over the lung is determined by the box sound. Mobility of the lower edge of the lungs on both sides sharply limited. Auscultation - hard breathing with prolonged exhalation, a variety of dry wheezing. BR - 24/min. Blood count: Er.-4,0 T/L, Hb-115 g/l, L.–$7x10^9$/L, ESR-10 mm/h, banded cells-2%, segmented-50%, Eos.-10%, Limph.-20%, Mon.4%. Sputum analysis: glassy, transparent, viscous, odorless and

colorless. On microscopic examination revealed: a large number of eosinophils, Charcot-Leyden's crystals, Kurshman's spiral, bronchial epithelial cells. Evaluate the results obtained by research and give them a clinical interpretation.

Answers.

1. The patient has respiratory distress syndrome (orthopnea, cyanosis, tachypnea).
2. In the analysis of blood - eosinophilia, other parameters were normal.
3. Sputum: eosinophilia with Charcot-Leyden's crystals and Kurshman's spiral is pathognomonic sign of asthma.
4. Probable diagnosis - asthma.

Task 12.

Patient M., 52 years, complaining of shortness of breath, persistent cough with a small amount of morning purulent sputum. From history we know that the patient smokes for 20 years, cough worried for 10-15 years, shortness of breath - 1 year. Objectively: RR-21 per min. "Box" sound in percussion, auscultation - breathing weakened. X-ray: bilateral symmetric increase transparency of the lung tissue. General blood count: Er.-6.0T/L, Hb- 162 g/l , L.–9x10^9/L, ESR-10 mm/h, banded cells-5%, segmented-50%, Eos.-0%, Bas.-0%, Limph.-20%, Mon.-4%. Biochemistry of blood: total protein-55 g/l, albumin-40 g/l, γ- globulin-28%. Laboratory examination of sputum: mucous, odorless. On microscopic examination found: 5-6 leukocytes in sight, cylindrical bronchial epithelial cells in large numbers, often clusters. Evaluate the results obtained by research and provide them with clinical interpretation.

Answer:

1. The patient has respiratory distress syndrome (cough, tachypnea), emphysematous syndrome (box sound with percussion, respiratory depression).
2. In the X-ray examination found emphysema (bilateral symmetric increase transparency of the lung tissue) .
3. In the general analysis of blood: possible signs of low partial pressure in the blood (polycythemia, an increase in hemoglobin concentration). The biochemical blood test - hypoproteinemia.
4. Bronchial epithelial cells in sputum, their degeneration - degeneration and metaplasia of the reactive nature - a sign of chronic nonspecific lung diseases. Slight leukocytosis indicates inflammation in the bronchi.

A preliminary diagnosis - chronic obstructive pulmonary disease.

Task 13.

Patient K., 58 years old. Complaints on dyspnea on exertion, dry cough attacks (especially in the morning), which are accompanied by the release of a small amount of purulent sputum, fever to 37.4^{0}C. From history we know that the patient smokes about 40 years. Objectively: the patient has moderate cyanosis of the face and lips. Thorax is "barrel", percussion - box sound, light lower bounds are shifted downward. Auscultation - weakened vesicular breathing, scattered dry wheezing, which

intensified during forced breathing. BR - 22/min. Heart borders extended to the right, muted tones, rhythmic. HR-78 bpm, BP-140/90 mmHg. Other organs and systems revealed no pathology. Laboratory examination of sputum: mucous, odorless. On microscopic examination found: 7-10 leukocytes in sight, cylindrical bronchial epithelial cells in large numbers, often clusters. Antibiogram: found 1.staph.aureus 10^8KOE, 2. Non-gemolitic Streptococcus 10^6KOE.

Ampicillinum	Slightly sensitive	Slightly sensitive
Levomicetinum	Non-sensitive	Slightly sensitive
Amikacinum	Slightly sensitive	Sensitive
Gatiphloxacinum	Sensitive	Sensitive
Cephoperazon	Sensitive	Sensitive
Cefepim	Non-sensitive	Slightly sensitive
Levophloxacinum	Slightly sensitive	Non-sensitive
Cefotaxim	Slightly sensitive	Slightly sensitive

Evaluate the results obtained by research and provide them with clinical interpretation.

Answers.

1. The patient has respiratory insufficiency syndrome (tachypnoea, dyspnoea, cyanosis of the face and lips), intoxication syndrome (hyperthermia).
2. On survey - signs of emphysema (barrel chest, percussion - box sound, light lower bounds are shifted downward. Auscultation - weakened vesicular breathing), bronchial obstruction (dry wheezing, which intensified during forced breathing).
3. Syndrome of bronchial tissue injury (Sputum: 7 - 10 leukocytes in of view cylindrical bronchial epithelial cells in large quantities).
4. According to the microbiological examination of sputum - the most likely causative agent is Staph. aureus.

The most likely diagnosis - chronic obstructive pulmonary disease. Patient should prescribe antibiotics (gatifloxacin or ceftazidime).

Task 13.

The patient, aged 38, is hospitalized. Complaints of fever, shortness of breath, pain and a feeling of heaviness in the chest on the right, a dry cough, general weakness, headache, sleep disturbance. Considers herself sick for 2 weeks, deterioration occurred in the last 2 days: increased shortness of breath, the temperature rose to 39^0C, with chills and sweat. In the surrounding area caters adequately. Objectively: a clear conscience, a serious condition, the patient lies on his right side. Skin clean, pale, moist, cyanosis nasolabial triangle. RR 24 per min, the right side of the chest behind in the act of breathing. Percussion below the fifth rib on the rear surface of the thorax defined stupidity. Auscultation of breath right not available. Pulse 90 bpm. BP-120/70 mm Hg. Radiologically - right below the fifth rib with intense darkening superior oblique boundary offset to the left mediastinum. Performed pleural puncture.

With its X-ray examination gave the following data: serous fluid, transparent, yellowish, specific gravity 1018, 4% of protein (40g/l), positive Rivalt's test, a large number of leukocytes. Bacteriological examination revealed Streptococcus pneumonia (10^{10}KOE), which is sensitive to amoxicillin, levofloxacin, cefoperazone.

Figure to task 13. X-ray before pleural puncture

Evaluate the results of microscopic examination of pleural fluid and establish a preliminary diagnosis.

Answers.

1. The resulting liquid is an inflammatory origin (exudates), as there is a large amount of protein, leukocytes, positive Rivalt's test.
2. The patient has following syndromes: intoxication (fever, headache, sleep disturbance), respiratory failure (dyspnoea, tachypnoea, cyanosis of nasolabial triangle, the lag of the right half of the chest in breathing), a syndrome of accumulation of fluid in the pleural cavity (percussion below the third ribs on the rear surface of the thorax defined stupidity, auscultation breath right not performed). X-ray examination showed signs of accumulation of fluid in the pleural cavity, pleural puncture exudates obtained.

Probable diagnosis - Pneumonia of the lower lobe of the right lung, clinical group II, pleural effusion caused by streptococcus pneumonia. For the treatment of antibiotic therapy is necessary to choose one of the drugs to which sensitive specified pathogen (Amoxicillin, levofloxacin, Cefoperazone).

3.1 Describe sequential algorithm of diagnostic and therapeutic pleural puncture with the interpretation of pleural fluid analysis (total analysis, fluid abnormal cells). Topics 17, 18.

Pleural puncture is a diagnostic and therapeutic method used to evacuate material from the pleural space (air, liquid-transudate, exudate, blood, pus, lymph). It is performed in order to diagnose the origin of the accumulated foreign content in the pleural space, and if it is a large amount to remove it so as to improve the function of the lungs.

The patient does not require any special preparation to perform this intervention. The method is uncomfortable but only slightly painful. During the procedure a pleural needle biopsy can also be taken. The patient is usually in a sitting position or lying down. The procedure is performed as a blind pleural puncture or using imaging - X-ray, ultrasound or CT chest (pleural puncture guided), thus establishing the boundaries of content to be evacuated.

After disinfection of the chest the field that will be the site of the puncture, and administering local anesthesia, this intervention is carried out using special sterile needles or special disposable sets. The places where the punctures are performed are different and depend on what the nature of the content is to be evacuated. Complications are rare, but possible, and they are bleeding in the puncture injury and pleural and lung tissue.

If it is a diagnostic puncture, the resulting content is sent for biochemical, microbiological, serological and cytological analysis.

There are no absolute contraindications for thoracentesis. *Relative contraindications include the following:*

- High risk of bleeding (hemorrhagic diathesis)
- Portal hypertension with pleural vena varicosity
- Severity condition of the patient.

Indications:

Percutaneous pleural effusion aspiration is carried out:

To investigate the cause of pleural effusion*:*

- The British Thoracic Society (BTS) guidelines suggest that pleural aspiration should be reserved for the investigation of unilateral exudative pleural effusions. It should not be carried out if a unilateral or bilateral transudative effusion is suspected, unless there are atypical features or there is failure of response to therapy.

As symptom relief for breathlessness:

- Urgent decompression of the pleural space may be required to alleviate respiratory distress.
- Repeated 'tapping' of fluid may be useful in palliative care. However, there is a high recurrence rate if pleurodesis (intrapleural instillation of a sclerosant) is not carried out simultaneously.

Relative contra-indications to pleural effusion aspiration

- Very small volume of fluid
- hemorrhagic diathesis
- Anticoagulant therapy
- Mechanical ventilation (increased likelihood of tension pneumothorax or bronchopleural fistula if the lung is punctured)
- Cutaneous disease over the proposed skin puncture site

Procedure:

Thoracentesis can be safely done at the patient's bedside or in an outpatient setting. Presence and location of pleural fluid are verified by physical examination (chest percussion) and usually by imaging techniques. Ultrasonography, CT, or both may be useful if chest x-rays are equivocal, if prior thoracentesis attempts were unsuccessful, or if the fluid is loculated. The clinician doing the procedure usually uses bedside ultrasonography to localize the effusion and confirm that it is free flowing. Use of ultrasonography increases success rates and decreases complications.

Thoracentesis is best done with the patient sitting upright and leaning slightly forward with arms supported. Recumbent or supine thoracentesis (eg, in a ventilated patient) is possible but best done with ultrasound or CT guidance. Only unstable patients and patients at high risk of decompensation due to complications require monitoring (eg, pulse oximetry, ECG).

Under sterile conditions, 1-2% lidocaine is injected with a 25-gauge needle to anesthetize the skin. A larger (20- or 22-gauge) needle with anesthetic is then inserted at the upper border of the rib one intercostal space below the fluid level in the midscapular line. The needle is advanced with periodic aspiration (to avoid inadvertent insertion into a blood vessel and intravascular injection), and anesthetic is injected at progressively deeper levels. The most painful level after the skin is the parietal pleura, which should be infiltrated the most. The needle is then advanced beyond the parietal pleura until pleural fluid is aspirated, at which point the depth of the needle should be noted. A large-bore (16- to 19-gauge) thoracentesis needle-catheter device is then attached to a 3-way stopcock, which is connected to a 30- to 50-mL syringe and tubing that drains into a container. The thoracentesis needle is passed through the skin and subcutaneous tissue along the upper border of the rib into the effusion at about the same depth noted during anesthesia. The catheter is inserted through the needle, and the needle is withdrawn to decrease the risk of pneumothorax.

Pleural fluid can then be aspirated and, with a turn of the stopcock, collected in tubes or bags for further evaluation. Traditional guidelines have stated that fluid should be removed in stages not to exceed 1.5 L/day because hypotension and pulmonary edema may occur with removal of >1.5 L of fluid at one time or with rapid evacuation of the pleural space using a vacuum or suction bottle. However, there is little evidence that re-expansion pulmonary edema is related to volume of pleural fluid removal, and therefore it may be reasonable for very experienced operators to completely drain effusions in one procedure. When large volumes of fluid must be removed, blood pressure should be monitored continuously and thoracentesis should

be stopped if the patient develops chest pain, or if pleural manometry is being used, if the pleural pressure falls below negative 20 cm H_2O.
It has been standard practice to obtain a chest x-ray after thoracentesis to rule out pneumothorax, document the extent of fluid removal, and view lung fields previously obscured by fluid, but evidence suggests that routine chest x-ray is not necessary in asymptomatic patients.
Coughing is common as the lung re-expands; it does not signify pneumothorax. If the pleural process is inflammatory, pleuritic pain, an audible pleural rub, or both may develop as fluid is removed because of approximation of inflamed visceral and parietal pleura. When substantial volumes of fluid are removed from the pleural space, the plunger on the syringe should be released periodically during aspiration. If the fluid in the syringe is drawn back into the pleural space when negative pressure on the syringe is decreased, pleural pressure may be too negative, and the lung may be restricted from re-expanding because of enveloping adhesions or tumor.
Complications include:

- Pneumothorax
- Hemoptysis due to lung puncture
- Re-expansion pulmonary edema or hypotension (uncommon, and probably not related to the volume of fluid removed)
- Hemothorax due to damage to intercostal vessels
- Puncture of the spleen or liver
- Vasovagal syncope

Bloody fluid that does not clot in a collecting tube indicates that blood in the pleural space was not iatrogenic, because free blood in the pleural space rapidly defibrinates.

The sample #1 of a general analysis of the pleural fluid.
Serous fluid, transparent, yellowish, specific gravity 1018, 4% of protein (40 g/l), Rivalt's test is positive. In sight of a large number of white blood cells. As evidenced by these data?

Answer. Given the high specific gravity (1018), 4% of protein presence, positive Rivalt's test and a large number of white blood cells on microscopic examination. It can be assumed that the liquid under investigation has an inflammatory character. That is, is the exudate. Example of a disease in which such a situation might occur - pneumonia.

The sample #2 of pleural fluid with abnormal cells.
Haemorrhagic fluid, transparent, specific gravity 1007, 1.5% of protein (15g/l), Rivalt's test is negative. On microscopic examination revealed accumulations of sediment erythrocytes and Berezovsky – Sternberg's cells. Give the interpretation of the data obtained.

Answer. This fluid contains a small amount of protein sample Rivalta negative, indicating that the non-inflammatory nature obtained punctate, so it is transudate . Detection by microscopic examination of cells Berezovsky - Sternberg is pathogenic for Hodgkin's disease. Evidence of tumor process in the pleural cavity is a hemorrhagic nature of the liquid, which is due to its content of erythrocytes.

4. Algorithm of emergency care in acute respiratory failure (ARF).

The risks of oxygen therapy are oxygen toxicity and carbon dioxide narcosis. Pulmonary oxygen toxicity rarely occurs when a fractional concentration of oxygen in inspired gas ($F_I O_2$) lower than 0.6 is used; therefore, an attempt to lower the inspired oxygen concentration to this level should be made in critically ill patients.

Carbon dioxide narcosis occasionally occurs when some patients with hypercapnia are given oxygen to breathe. Arterial carbon dioxide tension ($P_a CO_2$) increases sharply and progressively with severe respiratory acidosis, somnolence, and coma. The mechanism is primarily the reversal of pulmonary vasoconstriction and the increase in dead space ventilation.

Hypoxemia is the major immediate threat to organ function. After the patient's hypoxemia is corrected and the ventilatory and hemodynamic status have stabilized, every attempt should be made to identify and correct the underlying pathophysiologic process that led to respiratory failure in the first place. The specific treatment depends on the etiology of respiratory failure.

Patients generally are prescribed bed rest during early phases of respiratory failure management. However, ambulation as soon as possible helps ventilate atelectatic areas of the lung.

Consultation with a pulmonary specialist and an intensivist are often required. Patients with acute respiratory failure or exacerbations of chronic respiratory failure need to be admitted to the intensive care unit for ventilatory support.

The first objective in the management of respiratory failure is to reverse and/or prevent tissue hypoxia. Hypercapnia unaccompanied by hypoxemia generally is well tolerated and probably is not a threat to organ function unless accompanied by severe acidosis. Many experts believe that hypercapnia should be tolerated until the arterial blood pH falls below 7.2. Appropriate management of the underlying disease obviously is an important component in the management of respiratory failure.

A patient with acute respiratory failure generally should be admitted to a respiratory care unit or intensive care unit (ICU). Most patients with chronic respiratory failure can be treated at home with oxygen supplementation and/or ventilatory assist devices along with therapy for their underlying disease.

Extracorporeal membrane oxygenation (ECMO) may be more effective than conventional management for patients with severe but potentially reversible respiratory failure.

Peek et al found that survival without severe disability was significantly higher in patients who were transferred to a single specialized center for consideration of ECMO. In a randomized, controlled trial in 180 patients either with a Murray lung injury score of 3.0 or higher or with uncompensated hypercapnia and a pH lower than

7.20 despite optimal conventional treatment, 36.7% of patients in the ECMO arm had died or were severely disabled 6 months after randomization, compared with 52.9% of patients in the conventional treatment arm.

Although average total costs were more than twice as high for ECMO than for conventional care in this study, lifetime quality-adjusted life-years (QALYs) gained were 10.75 for the ECMO group and 7.31 for the conventional group.[7]

Assurance of an adequate airway is vital in a patient with acute respiratory distress. The most common indication for endotracheal intubation is respiratory failure. Endotracheal intubation serves as an interface between the patient and the ventilator. Another indication is airway protection in patients with altered mental status.

Once the airway is secured, attention is turned toward correcting the underlying hypoxemia, the most life-threatening facet of acute respiratory failure. The goal is to assure adequate oxygen delivery to tissues, generally achieved with an arterial oxygen tension ($P_a O_2$) of 60 mm Hg or an arterial oxygen saturation ($S_a O_2$) greater than 90%. Supplemental oxygen is administered via nasal prongs or face mask; however, in patients with severe hypoxemia, intubation and mechanical ventilation are often required.

Coexistent hypercapnia and respiratory acidosis may have to be addressed. This is done by correcting the underlying cause or providing ventilatory assistance.

Mechanical ventilation is used for 2 essential reasons: (1) to increase $P_a O_2$ and (2) to lower $P_a CO_2$. Mechanical ventilation also rests the respiratory muscles and is an appropriate therapy for respiratory muscle fatigue.

The use of mechanical ventilation during the polio epidemics of the 1950s was the impetus that led to the development of the discipline of critical care medicine. Before the mid-1950s, negative-pressure ventilation with the use of iron lungs was the predominant method of ventilatory support. Currently, virtually all mechanical ventilatory support for acute respiratory failure is provided by positive-pressure ventilation. Nevertheless, negative-pressure ventilation still is used occasionally in patients with chronic respiratory failure.

Types of mechanical ventilation:

Over the years, mechanical ventilators have evolved from simple pressure-cycled machines to sophisticated microprocessor-controlled systems. The following is a brief overview of the basic principles of their use.

Positive-pressure versus negative-pressure ventilation

For air to enter the lungs, a pressure gradient must exist between the airway and the alveoli. This can be accomplished either by raising pressure at the airway (positive-pressure ventilation) or by lowering pressure at the level of the alveolus (negative-pressure ventilation).

The iron lung or tank ventilator is the most common type of negative-pressure ventilator used in the past. These ventilators work by creating subatmospheric pressure around the chest, thereby lowering pleural and alveolar pressure and facilitating flow of air into the patient’s lungs. These ventilators are bulky and poorly tolerated and are not suitable for use in modern critical care units. Positive-pressure

ventilation can be achieved via an endotracheal or tracheostomy tube or noninvasively through a nasal mask or face mask.

Controlled versus patient-initiated ventilation

Ventilatory assistance can be controlled or patient-initiated. In controlled ventilation, the ventilator delivers assistance independent of the patient's own spontaneous inspiratory efforts. In contrast, during patient-initiated ventilation, the ventilator delivers assistance in response to the patient's own inspiratory efforts. The patient's inspiratory efforts can be sensed either by pressure or flow-triggering mechanisms.

Pressure-targeted versus volume-targeted ventilation

During positive-pressure ventilation, either pressure or volume may be set as the independent variable.

In volume-targeted (or volume preset) ventilation, tidal volume is the independent variable set by the physician or respiratory therapist, and airway pressure is the dependent variable. In this type of ventilation, airway pressure is a function of the set tidal volume and inspiratory flow rate, the patient's respiratory mechanics (compliance and resistance), and the patient's respiratory muscle activity.

In pressure-targeted (or pressure preset) ventilation, airway pressure is the independent variable, and tidal volume is the dependent variable. The tidal volume during pressure-targeted ventilation is a complex function of inspiratory time, the patient's respiratory mechanics, and the patient's own respiratory muscle activity.

Endotracheal intubation

Mechanical ventilation requires an interface between the patient and the ventilator. In the past, this invariably occurred through an endotracheal or tracheostomy tube, but there is a growing trend toward noninvasive ventilation, which can be accomplished by the use of either a full face mask (covering both the nose and mouth) or a nasal mask (see Noninvasive Ventilatory Support).[8] Care of an endotracheal tube includes correct placement of the tube, maintenance of proper cuff pressure, and suctioning to maintain a patent airway.

After intubation, the position of the tube in the airway (rather than the esophagus) should be confirmed by auscultation of the chest and, ideally, by a carbon dioxide detector. As a general rule, the endotracheal tube should be inserted to an average depth of 23 cm in men and 21 cm in women (measured at the incisor). Confirming proper placement of the endotracheal tube with a chest radiograph is recommended.

The tube should be secured to prevent accidental extubation or migration into the mainstem bronchus, and the endotracheal tube cuff pressure should be monitored periodically. The pressure in the cuff generally should not exceed 25 mm Hg.

Endotracheal suctioning can be accomplished via either open-circuit or closed-circuit suction catheters. Routine suctioning is not recommended, because suctioning may be associated with a variety of complications, including desaturation, arrhythmias, bronchospasm, severe coughing, and introduction of secretions into the lower respiratory tract.

Ventilator modes

Pressure support ventilation (PSV) can be categorized as patient-initiated, pressure-targeted ventilation. With PSV, ventilatory assistance occurs only in response to the patient's spontaneous inspiratory efforts. With each inspiratory effort, the ventilator raises airway pressure by a preset amount. When the inspiratory flow rate decays to a minimal level or to a percentage of initial inspiratory flow (eg, 25% of peak flow), inspiration is terminated.

During PSV, patients are free to choose their own respiratory rate; inspiratory time, inspiratory flow rate, and tidal volume are determined, in part, by the patient's respiratory efforts. This mode of ventilation should not be used in patients with unstable ventilatory drive, and care must be exercised when the patient's respiratory mechanics are changing because of bronchospasm, secretions, or varying levels of auto–positive end-expiratory pressure (auto-PEEP).

Intermittent mandatory ventilation (IMV) is a mode whereby mandatory breaths are delivered at a set frequency, tidal volume, and inspiratory flow rate. However, the patient can breathe spontaneously between the machine-delivered breaths.

Most modern ventilators are capable of synchronized IMV (SIMV), whereby the ventilator attempts to deliver the mandatory breaths in synchrony with the patient's own inspiratory efforts. In essence, the ventilator allows the patient an opportunity to breathe. If the patient makes an inspiratory effort during a window of time determined by the IMV rate, the ventilator delivers a mandatory breath in response to the patient's inspiratory effort. However, if no inspiratory effort is detected by the ventilator, a time-triggered breath is delivered.

Compared with standard IMV, SIMV may improve patient comfort and may limit dynamic hyperinflation, which may occur when a preset breath is delivered immediately after the patient's spontaneous inspiratory effort (ie, before exhalation).

In assist-control ventilation, patients receive a fixed tidal volume and inspiratory flow rate with each inspiratory effort, regardless of their respiratory rate. However, a backup rate is selected that guarantees that the patient receives a minimum number of breaths per minute. If the patient's respiratory rate falls below the backup rate, the ventilator delivers the number of breaths necessary to reach that rate; such breaths are delivered independent of any inspiratory effort by the patient.

In volume-control mode, respiratory rate, tidal volume, and inspiratory flow rate (or inspiratory time) are fixed. This mode is used most often in heavily sedated or paralyzed patients.

In pressure-control mode, as contrasted with volume-control mode, airway pressure is raised by a set amount at a fixed number of times per minute. The physician or respiratory therapist also sets the inspiratory-to-expiratory (I:E) ratio or the inspiratory time. This mode is used most often in heavily sedated or paralyzed patients.

Pressure-control inverse-ratio ventilation (PCIRV) is a variation of simple pressure-control ventilation. In this mode, inspiration is set to be longer than expiration. The I:E ratio should rarely, if ever, exceed 3:1.

Triggering mechanisms

In patient-initiated (assisted) ventilation, the ventilator must sense the patient's inspiratory effort in order to deliver assistance. Ventilator triggering may be based on a change in either pressure or flow.

With pressure triggering, the ventilator is set to detect a certain change in pressure. The ventilator is triggered whenever airway pressure drops by the set amount. For example, in a patient on no positive end-expiratory pressure (PEEP) with a trigger sensitivity set at 1 cm H_2O, a breath is triggered whenever airway pressure falls below –1 cm H_2O. In a patient on 5 cm H_2O PEEP with the same trigger sensitivity, a breath is triggered whenever airway pressure falls below +4 cm H_2O.

With flow triggering, a continuous flow of gas is sent through the ventilator circuit. In some ventilators, this continuous flow rate may be set by the physician or respiratory therapist, whereas in other ventilators, the continuous flow rate is fixed. A flow sensitivity is selected, and the ventilator senses the patient's inspiratory efforts by detecting a change in flow.

When the patient makes an inspiratory effort, some of the gas that was previously flowing continuously through the circuit is diverted to the patient. The ventilator senses the decrease in flow returning through the circuit, and a breath is triggered. One problem with flow triggering is that automatic triggering sometimes results from leaks in the ventilator circuit.

Positive end-expiratory pressure

By maintaining airway (and hence alveolar) pressure greater than zero, PEEP may recruit atelectatic alveoli and prevent their collapse during the succeeding expiration. PEEP also shifts lung water from the alveoli into the perivascular interstitial space and helps with recruitment of alveoli. However, it does not decrease the total amount of extravascular lung water.

In patients with disorders such as acute respiratory distress syndrome (ARDS) or acute lung injury (ALI), PEEP is applied to recruit atelectatic alveoli, thereby improving oxygenation and allowing a reduction in F_IO_2 to nontoxic levels (< 0.6). Applying PEEP of 3-5 cm H_2O to prevent a decrease in functional residual capacity in patients with normal lungs is a common practice.

In an ARDS Network trial, higher PEEP produced better oxygenation and lung compliance but no benefit to survival, time on ventilator, or nonpulmonary organ dysfunction.[3] Although sufficient PEEP is essential in ventilator management of patients with ARDS, this level varies from patient to patient. Ideal PEEP helps to achieve adequate oxygenation and decrease the requirement for high fractions of inspiratory oxygen without causing any of the harmful effects of PEEP.

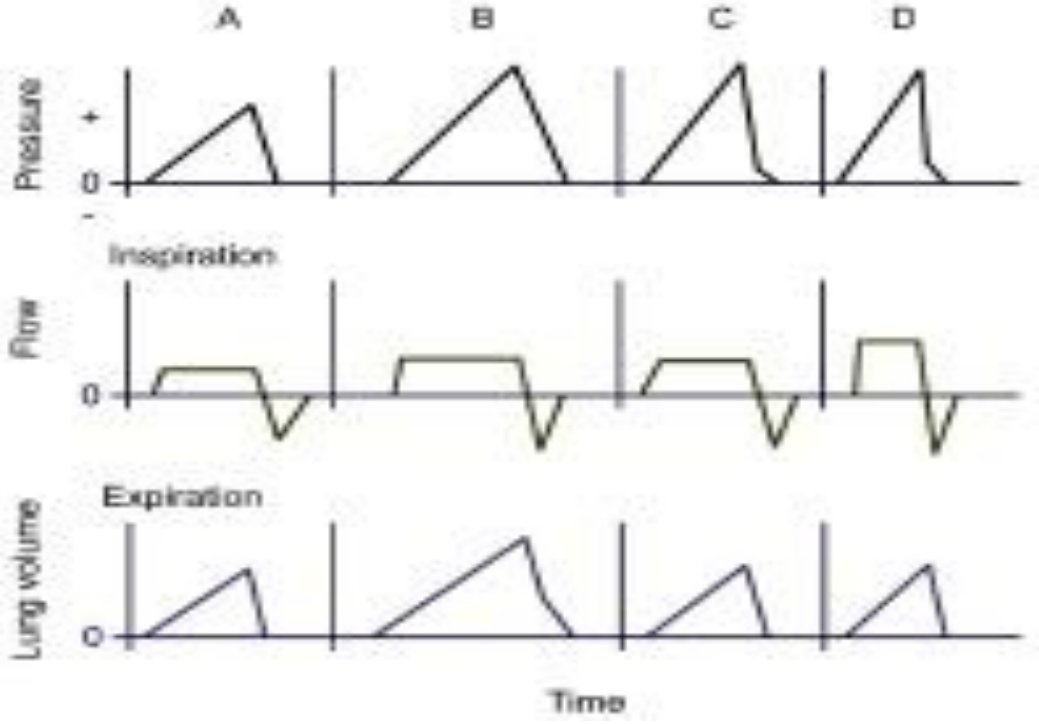
Current evidence does not support routine application of high PEEP strategy in people with ALI or ARDS; however, a study by Briel et al found higher PEEP levels have been associated with improved survival among patients with ARDS.[9]

PEEP causes an increase in intrathoracic pressure, which may decrease venous return and cardiac output, particularly in patients with hypovolemia.

Inspiratory flow

In volume-targeted ventilation, inspiratory flow is a variable that is set by the physician or respiratory therapist. The inspiratory flow rate is selected on the basis of a number of factors, including the patient's inspiratory drive and the underlying disease.

Two flow patterns are used commonly: (1) a constant-flow (ie, square-wave) pattern (see the image below) and (2) a decelerating-flow pattern. With a constant-flow pattern, inspiratory flow is held constant throughout the breath, whereas with a decelerating-flow pattern, flow rises quickly to a maximal value and then decreases progressively throughout the breath.



Wave forms of a volume-targeted ventilator: Pressure, flow, and volume waveforms are shown with square-wave flow pattern. A is baseline, B is increase in tidal volume, C is reduced lung compliance, and D is increase in flow rate. All 3 settings lead to increase in peak airway pressures. Adapted from Spearman CB et al.

In pressure-targeted ventilation, the inspiratory flow rate is a dependent variable that varies as a function of the preset pressure and the patient's own inspiratory effort. Because airway pressure is held constant while alveolar pressure rises during inspiration, the pressure difference between airway and alveoli decreases, leading to a decelerating pattern of inspiratory flow.

Ventilator-associated lung injury

Mechanical ventilation is associated with a variety of insults to the lung.

In the past, physicians focused on barotrauma, including pneumothorax, pneumomediastinum, and subcutaneous and pulmonary interstitial emphysema. The manifestations of barotrauma probably result from excessive alveolar wall stress; excessive airway pressure by itself does not appear to cause barotrauma. In critically ill patients, the manifestations of barotrauma can be subtle. For example, the earliest

sign of pneumothorax in supine patients may be the deep-sulcus sign or a collection of air anteriorly along cardiophrenic angle.

It is now recognized that lung damage indistinguishable from ARDS may be caused by certain patterns of ventilatory support. Early animal experiments showed that mechanical ventilation employing high peak airway pressures and high tidal volume led to pulmonary edema, possibly as a result of direct parenchymal injury and altered microvascular permeability secondary to high peak alveolar pressures. Subsequent work indicates that excessive tidal volumes resulting in alveolar overdistention are the most important factor in ventilator-associated lung injury.

A strategy of using low tidal volumes in patients with ARDS who are on mechanical ventilation has led to a reduced incidence of barotrauma and improved survival rates in clinical trials.

5. Algorithm of emergency care in bronchial asthma. Topic # 15.

Oxygen should be administered to maintain normal saturations. Only those patients with chronic severe asthma and chronic hypercarbia are at risk for increasing hypercarbia with oxygen administration.

It is clear that the mainstays of acute asthma treatment are the b2-agonists**.** They relax bronchial smooth muscle and may inhibit the release of mast cell mediators. There is no apparent therapeutic advantage of parenteral over inhaled b2-agonists. Parenteral treatment consistently increases the incidence of side effects, such as tachycardia, hypokalemia, dysrhythmias, tremor, myocardial ischemia, and lactic acidosis.In contrast to parenteral treatment the heart rate tends to decrease with successful inhalation therapy. In almost all situations inhaled b2 therapy should be given prior to parenteral.

In some severe cases however, there is so little airflow that inhaled therapy does not work. Salbutamol or epinephrine are the most commonly used parenteral b2 agonists Epinephrine may be given as an infusion (2-8 mg/min.), subcutaneously (0.3-0.5 mg q20-30 min.). Salbutamol may given by metered dose inhaler (MDI) with a spacer (4-20 puffs/hour), by wet nebulization (WN) (5-10 mg q 15 min. prn), or intravenously (4 mg/kg load then 0.1-0.2 mg/kg/min. infusion).

Inhaled bronchodilators can be given by WN. MDI with spacers are as effective as WN even if the patient was using MDI prior to admission, and they are cheaper. MDI therapy is inspiration phased so more drug can be deposited in the lung per unit time as compared to WN. Appropriate MDI dosing is 4 - 20 puffs salbutamol per hour.

Considerable drug is wasted with WN as the predominant part of respiration is expiration hence as little as 1% of drug may actually reach the lungs. A large amount of drug (5-10 mg salbutamol) should be therefore be given frequently (q 15-30 min.).Salbutamol may be given continuously by WN although this may increase risk for toxicity.

The optimal delivery technique and appropriate dosing in ventilated patients has not been clearly established as considerable amount of drug is probably lost. If using MDI, use a spacer and increase the dose (6-15 puffs/treatment). Higher doses of WN drug are probably appropriate.

Whether intubated or not, the dosing of b2 agonists should be "titrated to effect" using objective and clinical signs of airflow limitation. Dosing cannot be standardized due to the heterogeneity of the disease process (spasm vs inflammation), and the heterogeneity of individual patients responses (? down regulation of b2 receptors). Overaggressive dosing can cause severe side effects.

Anticholinergic agents, although not first line therapy may be of benefit in mild to moderate asthma, and should be used, in addition to b2 agonists in severe asthma. In the severely obstructed patient drug deposition tends to be in the more proximal airways which is where cholinergic receptors are located. Ipratropium may be given by MDI (4-8 puffs q15 min.) or by WN (0.25-0.5 mg). The maximum effect is probably reached with 0.5 mg, although more may be required in ventilated patients. Glycopyrrolate and atropine both produce bronchodilation if given IV (atropine 20 mg/kg, glycopyrrolate 10 mg/kg), although there is a high incidence of side effects. They may also be nebulized (glycopyrrolate 1.0 mg, atropine 1.2-2.0 mg) which diminishes the incidence of side effects, particularly with glycopyrrolate.

Corticosteroids are invaluable in acute asthma but take 6-12 hours to show an effect - so give early! Methylprednisolone has less mineralocorticoid activity and is cheaper than hydrocortisone. Dexamethasone is cheaper again. Doses shown to be effective are 10-15 mg/kg/day of hydrocortisone or its equivalent (120-180 mg methylprednisolone/day, i.e. 40mg q6h). There may be slight improvements with 125 mg q6-8h. Smaller doses may be as effective although firm data is not available. There is no role for inhaled steroids during an acute severe asthma attack.

Aminophylline is second line therapy. It is a weak bronchodilator, has a low therapeutic index, and a high incidence of potentially serious side effects. A recent meta analysis and several subsequent studies have not shown significant improvement in PFT's when aminophylline is added to conventional treatment (b2 agents plus steroids). Although it has little additive bronchodilatory effect, its other possible actions including increased diaphragm contractility, diuresis, mucociliary clearance, and antiinflammatory action may offer some benefit. If other first line therapy has been unsuccessfully tried, some clinicians will add aminophylline (loading dose of 3-6 mg/kg, infusion of 0.2-0.9 mg/kg/hr).

Emergency Drug Doses

SALBUTAMOL
· MDI-SPACER 4-20 puffs/hour
· NEBULIZED 5-10 mg q15 min prn
· IV 4 ucg/kg load and 0.1-0.2 ucg/kg/min.

IPRATROPIUM
· MDI-SPACER 4-20 puffs/hour
· NEBULIZED 500 ucg q30-60 min. prn

CORTICOSTEROIDS
· Methylprednisolone 40-125 mg q6-8h
· Hydrocortisone 500 mg iv

AMINOPHYLLINE
· iv 3-6 mg/kg load and 0.2-0.9 mg/kg/hr infusion

Indicative card for self-study student for writing history case:

Main tasks	Insrtructions
1	**2**
Using the scheme of history case to write a survey of the patient with pulmonologyical pathology	- History of case contains a brief description of all the necessary sections, with detailed description and analysis of broncho - pulmonary system and diseases which are pathogenetically associated with them. - Before formulating the preliminary diagnosis student should identify and describe syndromes. - While examination student should not only describe the method of investigation, but also tell expected changes. - Treatment should be in the stationary form (Regime - I, II, III, IV, V), a diet, treatment according to the following scheme: I / O purposes, / assignment, oral, etc., local, physiotherapy, drug issued in Latin (Form - Tab., Sol., Supp., single dose in mg or g, the path and frequency of administration in English or Latin language), all medications are prescribed under the international name. - The analyzes should be interpreted with clinical, laboratory and laboratory - instrumental syndromes, which will later be used to put a clinical diagnosis. - Differential diagnosis should be presented as a program of the differential diagnosis of the scheme: the leading syndrome, nozoforms, comparence of leading syndrome with other states. - Explanation of the clinical diagnosis - Formulation of clinical diagnosis according to scheme: - Main disease - Complications - Concomitant illness Case history (must include recommendations for the correction of patient lifestyle, diet, drug treatment and its duration)

Materials for self-control.

Tasks for self-control.

1. The main symptoms of pulmonological pathology.
2. Basic examination in pulmonology.

3. Physical examination of patients with broncho-pulmonary pathology. The main symptoms and syndromes, their clinical interpretation.
4. Radiological semiotics of respiratory diseases.
5. Indications and contraindications for bronchoscopy.
6. Diagnostical opportunities of bronchocopy. Indications and contraindications.
7. Sputum microscopy and its clinical interpretation.
8. Technique of pleural puncture. Indications and contraindications.
9. Microscopic examination of the pleural fluid.

III. Tests for self-control

Usage of tests (for students who this year will be involved in the licensing test "Krok") and tests rector's control

1. A man 25 years, a dry cough, sharp pain in the right side of chest and fever. It was treated with Nimesulide. After 2 days there was shortness of breath, pain in the right chest half decreased in intensity. All of the above can occur, EXCEPT:

A. Pleural rub

B. Attenuation of voice tremor at the right side

C. Dullness at the right side

D. Reducing vesicular breathing at the right side

E. Weakened bronhofoniya at the right side

2. 64 years old patient complains on cough with expectoration, sometimes hemoptysis. Smokes over 30 years. Lost 8 kg in the last 3 months. X-ray: in the middle lobe of the right lung cavitary, contains a small amount of fluid, right radical lymph nodes are enlarged. What research is most useful to confirm the diagnosis?

A. Bronchography

B. **Bronchoscopy with biopsy**

C. Sputum analyze

D. Spirography

E. CT

3. Patient, 54 years, complains of shortness of breath on slight exertion, cough with sputum. Objectively: diffuse cyanosis. Chest shaped like "barrel". Auscultatuion: weakened vesicular breathing with prolonged exhalation, dry wheezing. AT-140/80 mm Hg, Ps-92 bpm, rhythmic. Spirography: FEV1 60%, OFV1/FZHEL-70 %. Determine the type of respiratory failure (RF) in the patient:

A. Respiratory function is normal

B. Mixed RF with prevalence of obstruction

C. Mixed RF with prevalence of restriction

D. Restrictive type RF

E. **Obstructive type RF**

4. A man 35 years old, while weight lifting felt a sharp pain in the left side of the chest. The disease progressed: intensified shortness of breath, weakness, dizziness. Percussion revealed thympanitis, auscultation – absence of breathing. What is the diagnosis?

A. **Pneumothorax**

B. Myositis

C. Left-sided radiculitis

D. Pulmonary embolism

E. Myocardial infarction

5. 28 years old patient was undergoing treatment for pulmonary tuberculosis. Complaints on severe pain in the right side of the chest, which arose suddenly, shortness of breath. Percussion over the right lung is determined by the box sound, breathing is not auscultated. X-ray:

collapse of right lung to the 1/2 volume, heart and mediastinal organs shifted to the left. What complication occurred in a patient?
A. pulmonary infarction
B. **spontaneous pneumothorax**
C. empyema
D. dry pleurisy

6. A man 52 years complains of a progressive shortness of breath, cough with purulent sputum for 2 days. He smokes a pack of cigarettes a day for 30 years. Temperature of 37.2^0C. Breathing is weakened, with single dry and wheezing. In blood count: $9*10^9$/L, the formula is not changed. Gram smear shows large numbers of neutrophils and Gram-negative diplococci. Chest radiograph increased air lungs. What is the most likely diagnosis ?
A. bronchiectasis
B. Pulmonary embolism
C. **COPD**
D. streptococcal infection
E. asthma

7. Patient 68 years complains of shortness of breath, dry cough, often in the morning, aching pain in the right upper quadrant. For 20 years has COPD. Objectively: diffuse cyanosis, leg edema, ascites. Systolic murmur over the xiphoid process, accent of 2^{nd} tone on the pulmonary artery. ECG: right ventricular hypertrophy. What is the most likely complication of COPD occurs in this patient?
A. pleural effusion
B. Chronic pulmonary heart
C. Coronary heart disease
D. Lung cancer with liver metastases and peritoneal cavity
E. pericardial effusion

8. Patient 56 years complains of shortness of breath with difficulty exhaling, sputum in the morning for 22 years. He smokes one pack of cigarettes per day from18 year. The obstruction reversibility is 10%. What medications should be prescribed at the beginning of treatment?
A. Inhaled steroids (beclomethasone)
B. Membranostabilizatory
C. Antibiotics (moxifloxacin)
D. Inhaled anticholinergics (Atrovent)
E. Inhaled sympathomimetics (berotek)

9. 52 years old patient complains of shortness of breath on mild exertion, cough with phlegm, which is difficult to separate, sicks for 12 years. Objective: RR-26/min. Percussion - pulmonary tone tinged with boxed, weakened vesicular breathing with prolonged exhalation, scattered dry wheezes. Previously treated only with Teopek or Aminophyllinin. Prescribe basic therapy:
A. tayled
B. **atrovent**
C. alupent
D. aminophylline
E. ingakort

10. Man, 61 years old, complains of dyspnea, increasing during exertion , persistent cough with a minor amount of sputum, smoker more than 40 years. Objectively: T-36.5^0C, RR-24/min, pulse–84bpm, AT-125/85 mmHg. Asthenic, pale skin, exhale through pursed lips elongated, barrel chest, breathing muscles are actively involved in breathing. Auscultation: over a small amount of mild wheezing. Spirogram: VC-71%, FEV1-45% of predicted values. During the last 2 years, does not smoke

and uses daily tiotropium (Spiriva) inhalation. Additional application which therapy will be most effective in this case?
A Antihistamines
B Steroid hormones
C Mucolytic means
D Vaccine
E Low- oxygen therapy

11. 49 years old patient complains of dyspnea, cough. Repeatedly applied salbutamol Intalum, but without effect. Objective: sitting, leaning on a table. Cyanosis of the face, acrocyanosis. No peripheral edema. Shallow breathing, difficulty, sometimes does not listen; scattered rales, significantly lengthened exhalation. Cardiac sounds are muffled, and tachycardia. Ps-112 bpm, AT-110/70 mmHg. Liver - at the costal margin. Preliminary diagnosis?
A. Aspiration of a foreign body
B. pulmonary edema
C. CORD
D. Status asthmaticus
E. Pulmonary embolism

12. The patient, 35 years old, observed infrequently (2 times per month) episodes of shortness of breath, which can be easily removed inhaled beta2-short-acting sympathomimetic. During the attack the lungs listened dry wheezing, in between bouts of breathlessness FEV1 more than 80% of predicted. What is the most likely diagnosis?
A. Persistent moderate asthma
B. severe persistent asthma
C. **Intermittent asthma**
D. The given information is insufficient to determine the severity of asthma
E. mild persistent asthma

13. Pregnant 25 years old with a history or allergy (hay fever) at 28 weeks gestation, after the stressful situation, suddenly appeared noisy wheezing, dyspnea, cyanosis of the face. Auscultation: over lungs breathing weakened, many dry wheezing percussion - box sound. After an attack, the woman stood a small amount of viscous mucus. What is the most likely diagnosis?
A Bronchial asthma
B Pulmonary Edema
C Chronic obstructive pulmonary disease
D Pulmonary embolism
E Threat of abortion

14. Woman, 28 years old, suffering from bronchial asthma for 5 years, seizures buy salbutamol last six months, attacks began to occur more frequently disturbed night. Objectively: PS-88 bpm, regular, BP-120/80 mm Hg, RR-22/min. Auscultation of the lungs during inhalation and exhalation listened elongated dry wheezing. Which must be added to the treatment of the patient?
A Teofedrin in tablets
B Theophylline in tablets
C Inhaled steroids
D Steroids in tablets
E Eufillin intravenously

15. Patient K. complained of wheezing, shortness of breath, dry cough, dyspnea. Notes the appearance of attacks of breathlessness at night 3-4 times a month and day 2-3 times a week. OBJECTIVE: vesicular breathing with prolonged exhalation, scattered dry, wheezing. On examination: FEV1 60% of normal, daily fluctuations - 28%. That you want to assign for the relief of asthma attacks?
A Serevent

B Fliksotid
C teopeka
D Salbutamol
E Tavegil

16. The patient 32 years after hypothermia appeared weakness, sweating, fever, cough. Objectively: general state of moderate severity, the skin is moist, cyanosis of the lips. Thorax symmetrically involved in respiration, the right hand side under the shoulder blade slight dullness, weakened vesicular breathing moist sonorous finely wheezing. Over the rest of the light - hard breathing, scattered dry rales. Heart sounds are loud, accentuated 2nd sound on the pulmonary artery. In Blood count: L.- $8.2*10^9$/l, ESR-21mm/h. What is the most likely diagnosis?

A. Chronic obstructive bronchitis in the acute stage
B. lung cancer
C. acute bronchitis
D. Right-sided pneumonia
E. tuberculosis

17. Male 68 years called a GP because of paroxysmal cough with a little "rusty" sputum, pain in his right side, associated with deep breathing and coughing. He suffers insulin-dependent diabetes mellitus. Objectively: T-39,2°C, RR-24/min, Ps-14bpm, AT-110/70 mmHg. Dry skin, hyperemia of the face. Auscultation of the right lower lung: wet sonorous moist rales. What tactics should be at general practics GP?

A. Assign outpatient.
B. Hospitalized in medical department
C. Hospitalized in the intensive care
D. Hospitalized in endocrinological department.
E. Refer for examination at the clinic.

18. Male 38 years old complains of paroxysmal cough with a small number of "rusty" sputum, pain in his right side, associated with deep breathing and coughing. Ill after acute hypothermia. Objectively temperature - 39,2 ° C, BH - 22/min, pulse - 114/min, AT -110/70 mm Hg. Skin is moist, flushing cheeks. Auscultation of the right lower lung - wet sonorous finely wheezing. What is the pathogen most likely to cause disease in a patient?

A. **pneumococcus**
B. aureus
C. enterococcus
D. mycoplasma
E. Klebsiella

19. 55 years old patient complains of weakness within 2 - months, pain in the right side of the chest, cough, sputum streaked with blood. Radiographically: intense shade triangular shape on the bottom of the plot is related to the mediastinum. What disease should consider?

A. pleuropneumonia
B. tuberculosis
Pulmonary infarction C.
D. bronchiectasis
E. Lung cancer

20. Male 28 years old discharged from the hospital after undergoing community-acquired pneumonia. No complaints. Objectively: T-36,6°C, RR-18/min, Ps-78 bpm, AT-120/80 mmHg. Auscultation of the right lower lung - harsh breathing. X-ray: no infiltrative changes, increased pulmonary pattern determined at the

bottom right. During which time the local doctor should monitor the patient?
A. From month
B. constantly
C. **12 months**
D. 6 months
E. 1 month

21. On X-ray determined intense homogeneous darkening corresponding to the position of the lower lobe of the left lung. There is on the lateral radiograph - damage of all lobe, and its reduction in volume. Heart somewhat shifted to the left and posterior. What disease is caused by X-ray pattern indicated?
A. Atelectasis of the lower lobe of the left lung
B. Lobar pneumonia
C. Left-sided pleural effusion
D. Echinococcus left lung
E. Peripheral cancer of the left lung

22. Patient 34 years old with low grade fever for 3 days exhibited reduced diaphragm excursion, dullness at the percussion and decreased breath right. Trachea rejected right. What is the most likely diagnosis?
A. **Pleurisy**
B. mediastinal tumor
C. diaphragmatic hernia
D. Pneumothorax
E. Athelectasis

23. 25 years old patient complains of cough with a minor amount of muco-purulent sputum, shortness of breath, increased body T up to 38.5^0C, and weakness. He is ill during 7 days after overcooling. OBJECTIVE: over lungs - dullness under scapula and right axillaries area, there is - weak vesicular breathing, wet, sonorous finely wheezing. What is the diagnosis for a patient?
A. Pneumonia
B. Acute Bronchitis
C. Right-sided pneumothorax
D. Pericardial effusion

24. The patient, 42 years old, complains of increasing the temperature to 39ºC, cough, "stabbing" pain in the chest, the left more. On examination: the left half of the chest when breathing behind. Auscultation: at lower left corner of the scapula bronchial breathing and moist rales. In blood count: Er.-4,12*10^{12}/l, L-10,2x10^9/l, ESR-28 mm/h. Your preliminary diagnosis?
A. Lung Cancer
B. Left pleural effusion
C. **Left-sided lower lobe pneumonia**
D. Left infarction - pneumonia
E. Tuberculosis

25. 23 years old student complains of fever, chills, fatigue, dry cough, in which there is pain in the right side of the chest. He is ill during 5 days. Objective: Right below the angle of the scapula - dullness, moist rales and pleural friction rub from paravertebral to medium axillary line. Blood test: L.-14,0G/l, banded cells-15%, ESR-35mm/h. Your preliminary diagnosis?
A. Pneumonia
B. Dry pleurisy
C. pericardial effusion
D. purulent bronchitis
E. Pulmonary Tuberculosis

26. After 4 days after acute respiratory infection the patient was hospitalized with complaints of cough with some spitting mucous expectoration. On the second day from hospitalization once stood about 250

ml of purulent sputum streaked with blood. Moderate condition. RR-28-30/min. PS-96 bpm, BP-110/70 mmHg. On the left breathing is vesicular type, at the right - weakened, moist rales and amphoric sound under scapula. What is the diagnosis?

A**. Acute lung abscess**
B. Empyema
C. Piopneumathorax
D. Acute bronchoalveolitis
E. Pleural effusion

27. Patient 29 years complains of pain in the left side of the chest during 2 months, wheezing, cough, increased body T to 39^0 C. Objectively: the left half of the chest – limitation of excursion, the weak vesicular breathing and shortening of percussion sounds on the left. X-ray determined rounded shadow in the lower lobe of the left lung. What is the diagnosis?

A. Purulent pleurisy
B. Empyema
C. L**ung abscess**
D. Pneumosclerosis
E. Lung cancer

28. Patient 52 years old complains of pain in the right side of the chest, shortness of breath, cough with foamy sputum looks like "meat slops", malodorous. Objectively: severe condition, cyanosis, RR-31/min, percussion - shortened sound over the right lung, auscultation - rales. What is the most likely diagnosis?

A. Bronchiectasis
B. Lung abscess
C. Chronic pneumonia
D. Empyema
E. Gangrene

29. Patient 32 years old, who was treated in hospital for acute abscess of the right lung, after coughing suddenly appeared shortness of breath, cyanosis, pain in the right side of the chest. What complication is most likely in a patient?

A. Perforation of the esophagus
B. Myocardial infarction
C. P**yopneumotorax**
D. Infarct- pneumonia
E. Pleural effusion

30. Patient 62 years old who smokes and suffers often from "pneumonia". When you review a chest radiograph in the right lung blackout found a triangular shape with the apex pointing towards the root of the lung, as well as the offset of the shadow of the heart and mediastinum toward destruction. What is the most likely diagnosis?

A. Peripheral lung cancer
B. Lung cyst
C. Lung abscess
D. Athelectasis
E. Central lung cancer

IV. Individual assignments for students on the topic classes.

1. Presentation for students on the theme: "The differential diagnosis of asthma and COPD"
2. Presentation for students on the theme: "Pharmacological agents for anti-smoking"
3. Presentation for students on the theme: "SIT therapy for asthma"
4. Presentation for students on "Aspirin asthma"
5. Presentation for students on "SARS" and COVID-19

6. Presentation for students on the theme: "Opportunities computed tomography in the diagnosis of pneumonia"
7. Presentation for students on the theme: "Aspiration Pneumonia"
8. Presentation for students on "Diagnostic help with pleural effusion"
9. Presentation for students on "Diagnostic help with pulmonary insufficiency"
10. Presentation for students on the theme: "Opportunities of CT in diagnosis of destructive diseases of the lungs"

Recommended literature

Basic:

1. Harrison's Manual in Medicine. 20th edition / Ed.by J. L. Jameson, A.S. Fauci, D.L. Kasper et al. / McGraw-Hill Education, 2020. 1245 p.
2. Harrison's Principles of Internal Medicine. 20th edition / Ed.by J. L. Jameson, A.S. Fauci, D.L. Kasper et al. / McGraw-Hill Education, 2020. 3528 p.
3. Global Initiative for Chronic Obstructive Lung Disease (GOLD) POCKET GUIDE TO COPD DIAGNOSIS, MANAGEMENT, AND PREVENTION A Guide for Health Care Professionals. 2020
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