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Clinical anatomy of the thoracic cavity. Endoscopic diagnosis of respiratory diseases. Fundamentals thoracoscopic diagnosis of diseases of the chest cavity. Endoscopic thoracic surgery.

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The chest consists of the chest wall, thoracic cavity, organs located in it, and vasculonervous formations.

The thorax is formed by: the bony skeleton, fasciae, muscles and vessels and nerves located in the intercostal intervals. The skeleton is formed by: the breastbone, 12 pairs of ribs and 12 thoracic vertebrae. For the projection of the organs of the thoracic cavity it is accustomed to draw the vertical lines:

1- the frontal median line passes through the middle of the breastbone;
2- the sternal line – along the external margin of the breastbone;
3- the parasternal line– at a middle distance between the breastbone and the middle clavicular line;
4- the middle clavicular line passes through the middle of the clavicle;
5- the frontal axillary line corresponds to the external margin of the large thoracic muscle;
6- the back axillary line - along the external margin of the wide muscle of the back;
7- the middle axillary line is drawn from the highest point of the axillary armpit downwards through the middle of the distance between the frontal and back lines;
8- the scapular line– along the medial border of the scapula;
9- the paravertebral line lies at equal distance between the vertebral and scapular lines;
10- the vertebral line – along the transversal processes of the vertebrae;
11- the back median line – along the spinal process of the vertebrae.

The intercostal vertebrae occupy the external and internal muscles. However, along the costal cartilages, instead of the external muscles there are shining ligaments. The internal intercostal muscles stretch from the costal corners up to the lateral border of the breastbone. In the fissures between them, there lie vasculonervous bunches: at the top – the vein, at bottom – the nerves, and between them – the intercostal arteries .

In the interval between the back and middle axillary lines the vessels are located in the costal sulcus. More distally of this line, the vasculonervous bunch appears from above the rib and occupies the median position in the interval. That is why the puncture of the pleural cavity is reasonable to perform along the upper border of the rib.

1.Describe the anatomical structure of the lungs.

The lungs are the pair organ. The right lung occupies 58% of the common volume, the right one – 42%. In males, the length of the right lung makes 27 cm, that of the left one – 27 cm; in females – 21 and 23 cm respectively. They distinguish the apex, the base and three surfaces of the lungs: costal, mediastinal and diaphragmatic. The right lung along the middle clavicular line reaches the VII rib, along the middle axillary line– the VII rib. The left line along the middle

clavicular line reaches the IV rib, and further her borders coincide with the right line: along the scapular line - the IX rib, and along the paravertebral line – the XI rib. Anatomically, the left lung is divided into two lobes – the upper and the lower ones, the right lung – into three ones: upper, lower, and middle. The orientation at the borders of the projection of the lobes at the thoracic wall gives the possibility to draw the topical diagnostic**???** of the pathological process in percussion and auscultation .

In both lungs they single out by 10 segments, each of which is ventilated by the bronchus of the third order.

The right lung: 3 – segments in the upper lobe; 2 – in the middle one, and 5 – in the lower one.

The left lung: 5 in the upper lobe, of them – 2 uvular lobes, and 5 – in the lower one. The lung is composed of the bronchovascular system and parenchyma which counts about 800 lobes. In their centre, there is the lobular bronchus (bronchioles) with the diameter of 0.5-1mm. The lobular bronchi are divided into the terminal bronchioles, and the latter – into the respiratory ones.?? of the I,II and III orders. The bronchioles of the III order turn into the alveolar meatuses on whose walls there are the alveoli with the total area of 60-120 square metres.

The blood supply of the lungs is provided by the system of pulmonary and bronchial arteries. The pulmonary vessels supply the alveoli and participate in gas exchange, while the bronchial arteries feed the bronchial tree up to the respiratory bronchioles.

The gates??? of the lungs are located at the level of the II-IV ribs, or the V-VII costal cartilages. Through them, the root of the lungs passes. The placement of its elements in the right and left lungs is different.

In the left lung, in discerning the root in the frontal plane, the highest position is occupied by the pulmonary artery, the lowest one - by the vein, and between them – the bronchus (ABV). In the right lung, the bronchus is located most cranially, lower – the artery, still lower – the pulmonary veins (BAV)??? .

On the left: anteriorly, the root is attached by the diaphragmatic nerve and diaphragmo-pericardial vessels:

- superiorly – the arch of the aorta and the reverse branch of the vagus nerve;
- posteriorly – the vagus nerve, esophagus, descending aorta;
- inferiorly – the left ventricle with the pericardium.

On the right: superiorly – the arch of the odd vein which enters the upper cavernous vein;

- anteriorly – the pericardo-diaphragmatic vessels, diaphragmatic nerve and partially the upper cavernous vein;

- posteriorly - the vagus nerve, the unpaired vein;
- inferiorly – the right atrium.

Lymphatic outflow is provided by a superficial and deep intrapulmonary net (???).

The regional nodes: 1) intrapulmonary – in the tissues of the lungs and the corners of the pulmonary branching;

2) brocnhopulmonary – in the area of the pulmonary root;

3) tracheobronchial (right, left, bifurcation) – are located in the corners formed by the division of the trachea into bronchi.

The function of the external breathing is characterized by the indexes which can be used in clinical practice for the assessment of the ventilation properties of the lungs. They distinguish the static and dynamic indexes of the respiratory function of the lungs.

The static indexes are the values which characterize quiet inspiration in the fixation of the extreme positions of different levels of the lungs' filling with the air.

2. Characterize the dynamic indexes of different pulmonary capacities.

The pulmonary volumes:

- **the reserve volume** of inspiration (RVinsp) – between the levels of quiet inspiration and maximum inspiration (the physiological norm -1000-1500 ml);
- **the respiratory volume (RV) -** between the levels of quiet inspiration and quiet expiration (the physiological norm -500 ml);
- **the reserve volume** of expiration (RVE) – between the levels of maximum inspiration and maximum expiration (the functional norm – 1000-1500 ml);
- the residual volume of the lungs (RV) – between the levels of maximum expiration and a complete pulmonary collapse.

The pulmonary capacities;

- the capacity of inspiration (Cinsp) = RV+RVexp);
- the vital capacity of the lungs (VCL) = RVinsp+RVL;
- the functional residual volume of (FRV) = RVexp+RV;
- the total capacity of the lungs (TCL) = VCL+RVL.

The dynamic indexes – the date which can be obtained in forced respiration or in physical loading:

- one- minute volume of respiration (MVR) – the amount of the air which is breathed in??? the process of ventilation for 1 mi. In physical loading it reaches 20-30 l;
- the forced vital capacity of the lungs (FVCL) is the volume of the air in extremely forced expiration after quiet maximum inspiration. In norm, FVCL is 100-200 ml less than that of VCL. Greater figures point out to the disturbance of the bronchial patency;

- Tifno index – the relation??? of the volume of the air during the first second of the forced expiration up t0 VCL. The norm makes 70-78%.

The decrease of Tifno index down to 55% points out to the moderate disturbances of the bronchial patency, from 54 to 40% - significant, and below 40% - the drastic disturbances of patency. Tifno index is objective just in normal values of VCL and stops being informative as a consequence of its decrease in the pathology of the lungs.

The pressure in the pleural cavity during quiet breathing makes 30-40 mm of the water column (3.06 – 5.1???PA). In the forced regimes of ventilation, it can increase up to 100 cm of the water column (102.PA).

The pleura. They distinguish the parietal pleura, which covers the internal surface of the breastbone, and the visceral or pulmonary one which covers the pulmonary surface.

The parietal pleura turns into the pulmonary one in the area of the pulmonary roots and forms in this a closed space – the pleural cavity. Below the roots, the transitive fold of the pleura forms a duplicature - the pulmonary ligament which is located in the frontal plane.

In the parietal pleura, they single out the costal, mediastinal, and diaphragmatic part. The costal and mediastinal ones form the cupula of the pleura which closes the pleural cavity from the cervical side and anteriorly is lifted over the clavicle by 1-3 cm. Posteriorly, its border reaches the VII cervical vertebra. The cupula of the pleura is immediately attached by the subclavicular artery. In its injury by the fragments of the clavicle hemothorax can arise. Such a complication can also occur as a consequence of the injury of the named artery in the catheterization of the subclavicular vein.

The lines of the transition of the right and left costal pleura into the mediastinal one are projected on the frontal thoracic wall differently.

The frontal border of the right pleura stretches from the interval between the pedincules of the thoraco-claviculo–papilla-like muscle, crosses the thoraco-clavicular articulation, goes downwards reaching the median line of the breastbone at the level of the II rib. Then it swiftly goes down as far as the VI rib, turns laterally and forms the lower border of the pleura. In this, the pleura crosses the VII rib along the middle clavicular line, along the middle axillary – the X rib, along the scapular line – the IV rib, and along the paravertebral line – the XII rib.

The frontal border of the left mediastinal pleura has a vertical direction along the breastbone from the left thoraco-clavicular junction as far as the site of the articulation of the cartilage of the IV rib with the breastbone. Below this point, it diverts and teaches the lateral end of the cartilage of the VI rib.

3. Describe the anatomical structure of the pleural cavity.

The pleural cavity is a capillary fissure with the width of not over 7 mcm, contains 5-10 ml of the serous liquid which diminishes the friction of the leaves during breathing.

It is believed that the serous liquid is produced by the visceral pleura, while it is absorbed by the parietal one. In this the lymphatic capillary absorb colloid substances, while crystalloids penetrate through the venous **capillaries (??).** In the pleural cavity, in the turning of one of its parts into another one, there are sinuses – the reserve spaces of the pleura: costodiaphragmatic, costomediastinal (frontal, back), diaphragmatic mediastinal.

The blood supply of the pleura: parietal – the intercostal arteries, internal thoracic and upper diaphragmatic arteries, visceral – the pulmonary arteries.

Innervation is performed by the intercostal and diaphragmatic nerves of the parietal leaf and the viscero-vegetative nervous system.

Intrapleural pressure: inspiration – 70 mm of the water column, expiration – 30 mm of the water column.

4. What is the structure of the bronchial tree?

The trachea and bronchi

The commonly accepted of now is the the dichotomic structure of the bronchial tree.confirmed by the International Congress of Anatomists in Paris in 1955. It determines the segmental structure of the lungs .

The bronchi – are part of the air ways: the tubular branches of the trachea which unite it with the respiratory parenchyma of the lungs.

The trachea at the level of the V-VI of the thoracic vertebra is divided into the right and left primary bronchi. They enter the corresponding lung where they ramify 16-18 times and form the bronchial tree. The right primary bronchus occupy a more vertical position and is shorter than the left one. The length of the right primary bronchus is 2-3 cm, the diameter - 1.5-2.5 cm, it contains, as a rule, 6-8 unclosed cartilaginous rings. The length of the primary left bronchus is 4-6 cm, the diameter – 1-2 cm, it consists of 9-12 unclosed cartilaginous rings. In females, the bronchi are narrower and shorter than in males.

The primary bronchi while enteringthe lungs are gradually divided first into lobular, and then into segmental bronchi. The right primary bronchus forms the upper, middle and lower lobular bronchi. The upper lobular bronchus is divided into apical, back, and frontal segmental (BI, BII, BIII), the middle lobular one – into the lateral and medial segmental (BIV, BV), the lower lobular - into the apical (upper), medial (cardiac) basal, frontal basal, lateral basal, back basal (BVI, BVII, BVIII, BIX, BX). The left primary bronchus is divided into the upper and lower lobular bronchi. The upper lobular bronchus forms the apicoposterior, frontal, upper uvular, lower uvular segmental bronchi (BI-II, BIII, BIV, BV),

the lower lobular apical (frontal), medial (cardiac) basal which is usually absent, the frontal basal , lateral and back basal (BVI, BVII, BVIII, BIX, BX).??? An image of the trachea, primary, lobular and segmental bronchi. The segmental bronchi are divided into the subsegmental ones , then - into the bronchi of the 4-8 orders. The finest bronchi are lobular (the diameter is about 1mm) ramify within the lobe of the lung. The lobular bronchi are divided into a number of the terminal bronchi which end with the respiratory bronchioles which turn into the alveolar meatuses and alveoli. The respiratory bronchioles, alveolar meatuses and alveoli form the respiratory parenchyma of the lungs.

The bronchial wall consists of 3 membranes: mucous, fibro-musculo-cartilaginous and adventitias. The mucous membrane is reperesented by many-rowed prismatic ciliated epithelium. Apart from the ciliated cells, the mucous membrane of the bronchus contains the goblet cells which form the mucous secret , neuroendocrine cells which secrete biogenic amines (first of all, serotonine), basal and intermediate cells which participate in the regeneration of the mucous membrane. The mucous membrane is tightly united and does not form folds. The fibro-musculo-cartilageous membrane is formed by the unclosed hyaline cartilaginous rings, the free ends of which are connected with the smooth muscles. The cartilaginous rings are connected to each other with dense fibrous tissue. With the reduction of the caliber of the bronchus the number of muscular elements and their size also decrease, the cartilage becomes elastic, the number muscular elements decreases. Their epithelium from many-rowed ciliated prismatic gradually becomes two-rowed, and then turns into a ??one-layered ciliated cuboid. The adventitious membrane is formed by a (**fluffy????))))** not shaped connective tissue.

The blood supply of the bronchus is performed by the arterial bronchial branches from ???yjr thoracic aorta as well as from the esophageal arteries. The outflow of the venous blood is performed by the odd and half-paired veins. The lymphatic vessels from the bronchi enter the pulmonary, tracheobronchial and bifurcation lymphatic nodes. The innervation of the bronchi is performed by the branches from the frontal and back pulmonary nervous plexuses.

5. Describe the thoracoscopic pattern of the thoracic wall and lungs.

The thoracoscopic pattern of the thoracic wall, lungs and parts of the mediastinum:

The upper part of the pleural cavity, limited at the bottom by the line of the I rib is called the cupula of the pleura. The landmark of the thoraco-clavicular junction is the internal surface of the end of the clavicle, which in thoracoscopy has the view of the bony hump noticeably invading the pleural cavity. In the cupula, one should differentiate the subclavicular artery and vein. The costal part of the parietal pleura and thoracic wall should be divided into costothoracic, costal and costovertebral surfaces.

The right counts 10 segments, the left one – 9. Accessible in thoracoscopy are??? **5jhe** surfaces of all the segments of the right and left lung (with the exception of C7). A normal lung has the pink colour and lobular structure. The lung is in a permanent movement as a consequence of respiratory excursions and pushes which are transmitted from cardiac contractions (which, in its turn, are more expressed on the right).

The roots of the lungs are not always accessible. For their examination, it is necessary to reach an almost complete collapse of the lungs, and sometimes to use a thoracoscopic manipulator. At the same time, it is necessary to perform the examination of this areas in a horizontal and vertical positions.

The mediastinum is divided into the upper and lower ones. The lower one is divided into frontal, middle and back.??? For examination in thoracoscopy the surfaces of the upper, lower frontal and back mediastinum. In the upper mediastinum on the right, they single out the initial part of the subclavicular artery, brachiocephalic vein, the upper cavernous vein and part of the arch of the odd vein. In an unchanged pleura, one can clearly see the right diaphragmatic nerve which descends along the right side of the upper cavernous vein. Anteriorly of it, they single out the ascending part of the arch of the aorta, posteriorly – the contour of the margin of the cartilaginous semi-rings of the trachea and the right primary bronchus as well as of the branch of the vagus nerve.

In the frontal mediastinum on the right, they visually single out the right atrium, pericardium, pericardo-diaphragmatic artery and vein, diaphragmatic nerve, prepericardial fat cellular tissue. In the frontal mediastinum on the left, there are the heart, pericardium, prepericardial fat cellular tissue, pericardo-diaphragmatic artery and vein, diaphragmatic nerve.

On the surface of the back mediastinum on the right, they single out the odd vein with the intercostal vein which enter?? it, part of the root of the lungs and the pulmonary ligaments. In the area of the upper mediastinum on the left in examination, - the arch of the aorta and the subclavicular artery which leaves it , brachocephalic vein, additional half-paired vein, diaphragmatic and vagus nerves. Below the arch of the aorta, one can partly see the pulmonary artery. Between the arch of the aorta and the pulmonary artery, they single out the ligament – the imperforated arterial duct.

In the examination of the lower mediastinum on the right, they single out: the pericardium, pericardo-diaphragmatic artery and vein, diaphragmatic nerve, pericardial fat cellular tissue. In the back mediastinum on the left, they single out: the descending part of the aortic arch, back surfaces of the pulmonary root and the pulmonary ligament.

The middle part of the mediastinum in thoracoscopy on the both sides of examination is inaccessible.

6. What kinds of manipulations and operations are performed in thoracoscopy?

Thoracoscopy allows to examine the central and peripherical parts of the diaphragm. To recognize the diaphragm is easy after the typical structure of the muscular and membranous parts, location above them of the distal part of the diaphragmatic nerve and characteristic displacement of the thoracoabdominal border in breathing. The diaphragma has the view of the prominence turned upside-down with a paler colouring of its tendinous ???aprt with a well developed wall of the vessels and a brighter muscular part. The sites of the attachment of the diaphragm to the thoracic wall are better seen during inspiration.

Instrumental manipulations in thoracoscopy:

- Intrathoracic puncture and excisional biopsy;
-Puncture and excisional biopsy of the lungs, neoplasias and cysts of the internal localization, biopsy of the lymphatic nodes;
-obtaining the material for bacteriological and cytological investigation;
-collection of blood for reinfusion;
- chromobronchothorascopy;
- chromoesophagothorascopy;
- thoracoscopic sanation of the pleural cavity;
- ???diathermocoagulation;
- Intrathoracic anesthesia (anesthesia of the pleura; blockade of the nerves);
- Thoracoscopic intratissuenal introduction of remedies;
-inroduction into the pleural cavity of chemically active substances for he sale of pleurodesis;
- ultrasonic processing of the pleural cavity;
- laser, plasmic coagulation of tissues.

Operations in thoracoscopy:

-excision of tissues;
-dissection of the pleura, tissues, pleurectomy;
-thoracoscopic draining of the pleural cavity, cysts of the lungs, intrathoracic abscesses;
- decompression of the intrathoracic hematomas;
- removal of the reduced(???) hemothorax;
- removal of the lung's entrapment;
- thoracoscopic decortication of the lungs;
- thoracoscopic adhesive hermetization of the lung's defects;
- thoracoscopic suturing the lung and bronchopleural junctions' wound;

- thoracoscopic hermetization of the stump large bronchus in the incapability of its sutures;
- puncture, disclosure and excision (?) of the pericardium under the control of a thoracoscope;
- thoracoscopic sympaticotomy, sympatectomy, vagotomy and enervation of the pulmonary root;
- thoracoscopic removal of the intrathoracic cysts and tumours;
- removal of foreign bodies out of the thoracic cavity.

The sanation of the pleural cavity occupies a leading position in the treatment of pleuritises of different etiology.

Pleuritis is the inflammation of the pleura which is accompanied by the formation of exudate of different nature in the pleural cavity. As a rule, pleuritis is an independent nosologic form, while it complicates the course of pathological processes in the area of the lungs, thoracic wall, diaphragm, organs of the mediastinum and subdiaphragmatic space or is a symptom of some systemic diseases.

Classification.

By etiology: infectious and aseptic pleuritises. Infectious: staphylococcal, pneumococcal, tuberculous etc.; aseptic: depending on the nature of the basic disease of which they are a manifestation or **a complication** – rheumatic, carcinomatous etc.

By course: acute, subacute, and chronic pleuritisis.

By spreading: diffuse and encapsulated (?). Encapsulated pleurites???, depending on the localization of exudate are divided into apical, paracostal, diaphragmatic (basal), mediastinal, interlobular.

By the nature of exudate: fibrinous, serous, serous, serous-fibrinous, suppurative, saprogenic, hemorrhagic, hilious (??). In clinical practice fibrinous pleuritis is called dry, while other types – exudative.

After the peculiarities of the cellular composition of leucocytes in the pleural cavity, serous pleurites are divided into lymphocytic, neutrophilic and eosonophilic.

In a quick accumulation of a significant amount of exudate, disturbance of breathing and blood circulation they perform unloading pleural punctures. If the patient tolerates badly the evacuation of a huge volume of exudate , in the first puncture they remove not more than 1-1.5 l of the liquid and on the next day – all the remained volume. In traumatic, postoperative, parapneumonic, hemorrhagic (apart from carcinomatous) pleurites?? during pleural ??pubcture, the liquid should be removed completely due to a high probability of the development of suppurative complications. A small number of ??serous lymphatic exudate is

not obligatory to evacuate. In exudates which are not resorbed for a long time, after the removal of exudate, for speeding up recovery they introduce hydrocortisone intrapleurally. In carcinomatous ??pleurites, the evacuation of the liquid should be combined with the intrapleural introduction of cytostatics. In the absence of any effect from 3-4 punctures, they perform the drainage of the pleural cavity.

7. Describe the sanation of the pleural cavity in suppurative pleuritis.

8. What kinds of complications in thoracoscopy do you know?

In suppurative pleuritis, the way of the sanation of the pleural cavity depends on the severity and other peculiarities of disease. In the so-called closed empyemas which are not connected with the bronchial tree, they indicate daily pleural punctures with the aspiration of pus. **????** by a thorough lavaging of the cavity of the empyema with antiseptic solutions, to which they recommend to add fibrinolytic means. After completing the lavage, they introduce into the plural cavity a small amount of antibiotic selected according to sensitiveness. In the ineffectiveness of the punctural method, as well as in the absence of the hermeticity of the pleural cavity, it is drained. In typical cases, drainage is performed in 7-8 intercostal spaces along the back axillary line. In valvic pneumothorax , it is necessary to perform immediately aspirational drainage after vital indications. In case of a large bronchopleural junction and the impossibility to provide vacuum for the unfolding of the lung, they recommend the bronchoscopic temporary occlusion of the draining bronchus with a porolone or another obturator. In a severe suppurative pleiritis, they indicate the permament lavage of the cavity of the empyema. They also suggest systems for the periodic lavage of the cavity of the empyema through the draining tube (fractional lavage). In the treatment of suppuratve pleuritis, they also use the ultrasonic processing of the pleural cavity or a thoracoscopic opening. This method allows to reduce the volume of medicamentous therapy and, in a number of cases, even to give up draining the pleural cavity, to reduce the terms of treatment.

One of the key moments in the treatment of the non-specific empyema of the pleura which immediately effects the final results of treatment, is the way of the drainage and sanation of the pleural cavity. The tactics of the sanation of the empyemic cavity is nowadays based o the principles of the active drainage, early sterilization and obliteration of the cavity. Thoracospoy gives the possibility to assess visually morphological changes in the parietal(??) and visceral pleura, to examine the surface of the lungs, to find out the presence and localization of the bronchopleural junctions, to diagnose the unseen in x-ray investigation intrapleural encapsulations, to confirm the spread and stage of the empyemic pleura.

Complications in thoracoscopy (occur rarely):

- air embolism of the brain vessels (in the interference of pneumothorax, in pleural puncture, in the biopsy of the lungs), occur rarely;
- intrapleural hemorrhage;
- arising of bronchoplural junction;
- injure of the diaphragm, liver, lung;
- spread subcutaneous emphysema;
- pleural empyema;
- implantational metastases at the site of thoracocentesis (in thoracoscopic investigation);
- in thoracoscopic investigation;
- increased temperature of the body, infection.

Thoracoscopic surgery

The main theoretical achievement which has led to the intensive development of thoracoscopy surgery, was getting aware of the fact that the adequate (and, not infrequently, much better) visualization of the organs and tissues of the thorax in the presence of perfect videoscopic equipment can be obtained without a big incision too, and that the improved surgical instruments and operative technique gave the possibility to achieve safely the same results as before could be obtained only while having performed large incisions.

INSTRUMENTS

There exist three basic parts of thoracoscopes. First of all, these are straight thoracoscopes located either in the butt end part of the tool straightly, allowing to obtain a wide straight image, or under certain angles, which allows to get the field of view at the angles of 30, 60 or 90 degrees respectively. The most widely used in thoracoscopy are straight thoracoscopes (with butt optics) and thoracoscopes with the optics at the angle of 30. The thoracoscopes like these (without the so-called operative, or instrumental, channel) allow to get the brightest and far wider image than the diameter of the thoracoscope itself, as they consist completely of a set of lenses and light optic fibers.

Operative thoracoscopes consist of a quartz telescopic rod, the same as in ordinary straight thoracoscopes (but of slightly lesser size), fibrooptic light fibers and straight operative, or instrumental, channel through which one can conduct bioptic forceps, probes or a probe for irrigation and evacuation of liquid. The main advantage of this channel the thoracoscopes like

these consists in that they allow to fulfill the biopsy of tissues and perform examination trough a single thoracospic incision. In this, there is no need in the creation of a separate second incision or an incision of a larger size necessary for other soft tissues. On the whole, this instrument is used much more often than the majority other existing clips for the conductance of additional instruments for biopsy. The ability of such thoracoscopes to collect and save the light rays and their optic qualities are not so good as in other thoracoscopes, because they, to contain the instrumental channel and remain acceptable in terms of diameter, must have a little less number of optic components.

The third type of thoracoscopes are flexible ones. They allow to conduct examination at different angles and around the convex surface of the lung which is not allowed to be done by a hard thoracoscope. It is most likely that some areas of the thorax can be easier examined through one incision witht the application of a flexible thoracoscope than in the creation of some incisions and application of hard thoracoscopes, though with different angles of the placement of optical lenses. Still the quality of the image obtained through the fibroscope is not so good as in hard optical telescopes. The possible areas of the application of fibrogastroscopes are currently under study. Besides, one has to say that flexible thoracoscopes are two times and a half more expensive than hard straight ones.

The biopsy of tissues and just the diagnostic examination of the pleural cavity can be performed with the help of flexible endoscopes, mediastinoscopes or other hard optical instruments. The presence of TV monitors in this is not obligatory. Depending in the aims set, for the examination and illumination of the thorax one can use different optic devices. However, the enlarged and more qualitative image which is achieved in the application of the high resolution monitor and enlarging videocamera allows to reveal subtle, hardly perceived differences between normal and pathologically changed tissues.

THE EQUIPMENT AND ITS PREPARATION

In many cases, in performing thoracoscopy, the patients are laid down on a side, the operating surgeon in this can be on any patient's side, while the monitor – on the opposite side, at the main end of the table. Usually they recommend to have two monitors (per one on each side of the main end of the table) for facilitating the performance of an operation and not to make the surgeon's neck tired.

In the presence of one monitor, they need a powerful enough source of light (usually the brightest are xenon lamps) and a videocamera with high resolution. Despite the fact that videocameras and the rest of videoequipment continue to be being improved, we believe that the most important components of this equipment remain to be: a source of light with sufficient

brightness, a thoracoscope of a relatively big diameter (10-11 mm) and monitors with high resolution (by far higher quality than ordinary TV-sets).

Videocameras are discriminated by their colour transmission, location on the telescope (on the end or at the very beginning, by the thoracoscope's ocular) and the number of processor chips (one, two, three).

1. ***What instruments are used in thoracoscopic surgery?***
2. ***What standart special instruments were developed for manipulations in thoracoscopic surgery?***

Below, there is the enumeration of the basic instruments which are necessary to have before performing thoracoscopic operations:

- endoscopic scissors with blunt branches (one- or multiple-use);
- clips (triangular Duval's forceps, forceps with windows, soft clips);
- instruments for the preparation of issues (Crile forceps with thin branches, one- or multiple-use);
- a set of instruments for biopsy (if an operative thoracoscope is used, these instruments must be longer than it; if the instruments are introduced through a separate port, the must be sufficient in terms of their length for penetrating through the thoracic wall;
- a system for irriagation and evacuation of liquid (ejectors-irrigators, both one- and multiple-use);
- probes for palpating tissues;
- electrocoagulating instruments (scissors, dissectors and aspirators);
- retractors (which extend in the pleural cavity, both one- and multiple-use);
- staplers (endoscopic, nowadays usually one-use).

It is always more convenient to work with standard instruments, specially developed for these or those manipulations. Forceps with windows, standard long Metzenbaum scissors, or long forceps are the most often used instruments in operations on the organs of the thorax. They are performed through a separate port or small incision known as 'thoracoscopic access'(cutting the tissues in the intercostal space not spreading over the ribs). Special instruments - 'endoclipators' – both of middle and large sizes can be purchased, at least, from two large firms-manufacturers of surgical instruments).

Linear staplers of the GIA type, when they put sic parallel rows of staples and perform an incision of the tissues between the third and the fourth rows. They are produced with the length of 30 mm and 60 mm, and it is highly likely that they will be soon offered for clinical application in all possible variants differing in the length of the operating part.

Most probably, a set of instruments for thoracoscopic surgery will become much larger after its development will be joined by engineers-designers. There are already curved, bent under angle instruments. The progress in the field of developing thoracoscopic instruments can go even faster than in laparoscopic surgery.

THE OPEARATIONS WHICH COULD BE PERFORMED WITH THE HELP OF THORACOSCOPY

At the present time, quite a lot of operations can be performed with the application of thoracoscopic technique.

1. Biopsy of the pleura.
2. Drainage of the pleural cavity and dissection of adhesions.
3. Mechanical abrasions (the removal of the superficial layer) of the pleura and/or insufflation of talcum for sclerotising the pleural cavity (pleurodesis).
4. Resection and suturing (or bandaging) of the bullas (with the abrasion of the pleura).
5. Cuneiform resection of the lung for performing biopsy or with a therapeutic aim.
6. Open biopsy of the lung (cuneiform biopsy) in infiltrative diseases of the lungs.
7. Puncture and aspiration of the mediastinal cysts or their excision (including esophageal cysts in the doubling of the esophagus).
8. Biopsy of the mediastinal lymphatic nodes.
9. Partial pericardectomy for biopsy and drainage of thee pericardial cavity.
10. Decortication of the lungs (in acute empyema).
11. Partial pleurectomy (in apical pneumothorax or tumour).
12. Examination of the pleural cavity, pericardium or diaphragm in penetrating injury.
13. Thoracic sympatectomy.
14. Truncal vagotomy.
15. Modified myotomy after Heller.
16. Lobectomy; pneumonectomy.
17. Resection of the esophagus (at the same time as the abdominal stage of operation).

3. Describe the biopsy of the pleura.

THE TECHNIQUE OF PERFORMING THE OPERATION

Biopsy of the pleura

The biopsy of the pleura can be performed simply enough through a single incision in the lateral area of the chest. The indications for performig the biopsy of the pleura are usually the relapsing of the pleural exudate or specification of the reason of its arising , thickening of the pleura and infiltrative neoplasms of the pleura. If on the computer tomogram they find out nodular formations or infiltrative neoplasms of the pleura, they should undergo biopsy;

the incision of the thorax should be done at the sufficient distance from that area, for the deployment of the thoracoscope and instrument for biopsy at such an angle that the area of injure could be easier to examine. Hard thoracoscopes can be bent in this or that side in the intercostal space just to a certain extent. Flexible or bent thoracoscopes give additional opportunities for the examination of the peripheral areas of the pleural cavity. For performing diagnostic pleuroscopy, it is necessary that the pleural space would be free; this enables to get an access practically to all the points within the area of interest. The contraindications for performing the biopsy of the pleura are not so numerous, especially if the surgeon is experienced enough. The incision of the thoracic wall is necessary to perform at the site, where the draining tube being conducted subsequently through the port, would be placed conveniently enough for draining the liquid and the patient would not be lying on the draining tube. In most patients the incision being performed approximately along the middle or back axillary line, is quite acceptable both for diagnostic purposes and the subsequent introduction of the draining tube.

For fulfilling the biopsy of the pleura we prefer to perform a single incision and use a thoracoscope with the instrumental channel. This thoracoscope can be easily manipulated with, turned to different sides achieving a good vision with the correct location of the videocamera. Besides, in such a thoracoscope there is a channel for introducing instruments.

At once after collabing, it is easy to perform sampling the necessary number of pieces of tissue for biopsy from different suspicious sites around the whole pleura. In this, there is no need in a pneumatic shutter.

The quantity of the imaging and the enlargement allowed by the system consisting of a videocamera and a monitor, has a great advantage which consists in that one can find out even minimum deviations in the pleural structures and perform the biopsy of these suspicious areas. In an ordinary examination of the pleural cavity they can be missed. If they use a straight thoracoscope with butt end optics without the instrumental channel, the bioptic forceps can be introduced into the pleural cavity or through a small additional port (5-6mm), or through the same incision together with the thoracoscope. After performing biopsy in the pleural cavity, they leave a draining tube which is connected to the adducting lock. If there is a suspicion or they have already found out malignant exudate, then further, up to the surgeon's decision, one can introduce talcum or a chemical substance for the sclerotization the plural cavity.

The open biopsy of the lung

The open biopsy of the lung can be performed with the application of thoracoscopic technique. The standard open access presupposes the performance of small thoracotomy for the removal of a cuneiform piece of tissue with the subsequent conductance of the draining tube through a small

incision into the pleural cavity. These manipulations on the lung are presently possible to perform with the application of thoracoscopic equipment and especially after the appearance of a stapler with long branches which allows to have large samples of tissue without excessive manipulations as it occurs in the performance of thoracoscopy.

4. Describe the open biopsy of the lung.

At the basis of the technique of the thoracoscopic biopsy of the lung there is the principle of 'triangle' which consists in that three thoracoscopic ports are introduced into the pleural cavity at the points forming a triangle the base of which is directed towards the head, while the apex – towards the feet. Two small ports are installed at the ends of the imaginary small lateral thoracoscopic incision in the third intercostal space. For many thoracoscopic operations, performing all the necessary manipulations and examining the pleural cavity with the help of the camera, three ports are sufficient which are located in the shape of a triangle.

Usually the manipulating ports (ports for instruments) are located closer to the head of the patient. Ports A and B are located at a sufficient distance from each other, along the imaginary thoracotomic dissection, for the freedom of manipulations with the instruments and at a sufficient remoteness from the camera. The videocamera is usually introduced in the pleural cavity through the most caudally located port denoted with C. The basic localization like this can be shifted closer to the head, or more caudally, depending on the peculiarities of disease or localization of injuries, in case of need, an additional port can also be installed. On the whole, the location of the ports at a maximally possible distance from each other is far more convenient for the surgeon's work. The port of the videocamera is installed two-four intercostal spaces lower and a bit more anteriorly.

Furthter, through this port or the port located anteriorly, they introduce the training tube into the pleural cavity. Incisions of the thoracic wall for the ports should be made perpendicularly to the skin so that straight channels would form which allows to have a maximum mobility for the instrument. Despite the fact that there are presently both one- and multiple-use trocars, part of which have a special trench for 'screwing' a trocar, very often there arises no need at all to leave any trocar for the conductance of instruments through it.

Usually, in thoracoscopic biopsy they easily put two manipulating ports just above the main interlobular fissure, which allows to get a good access to all three lobes and to perform biopsy easily. The lung is captured tenderly but reliably with the help of a window clamp introduced through the back port. Then a staple is easily put on the tissue which is introduced through the frontal port and with the help of which the pulmonary parenchyma is gradually transsected. One can introduce the stapler and suture the lung for the first (third, fourth) time through the same port, or it can be done through another port, adducting the stapler from another direction. One

usually has to suture the lung three or four times with the stapler with a short operating part (30 mm) or two times with a larger stapler (with a long operating part – 60 mm) to get the same sample of tissue as in thoracotomy. At this stage of operation, the lung is usually collabbed with the help of a two-lumen endotracheal tube. After performing biopsy, samples of tissue are removed from the pleural cavity through one of the ports and sent away for investigation. The area of pulmonary tissue which was captured with a window clamp (and as a consequence of that, was slightly crushed) is usually used for bacteriological investigation.

Sometimes the cut samples of pulmonary tissue (or nodular neoplasms) can be too large, for them to be removed from the plural cavity through the port and, in this, not to destroy or to drop part of tissues. In this situation, one can introduce a plastic endoscopic sac into the pleural cavity through one of the ports, place there a sample and take out the sac so that the preparation being removed would not contact with the surrounding tissues. Sometimes, the incision can be enlarged so that the preparation can be easily removed.

After the removal of the preparation from the pleural cavity, the lung swells and the draining tube is introduced. Usually it happens to be very easy to install as long as the lung is still in the collapsed state. The draining tube is installed under endoscopic control using in this a probe or a clip introduced into the pleural cavity through another port. So, one can be sure that drainage is well installed for draining the sinus and not in the interlobular fissure or along the diaphragm.

A cuneiform resection of the lung

A great advantage of thoracoscopic technique is the possibility to perform it with the help of a diagnostic cuneiform resection of the lung through a small incision. This technique allows, easily and without complications which can arise after wide thoracoscopy, to remove many small peripheral granulamatous formations and nodular thickenings of pulmonary tissue which can turn out to be both scars and benign tumours (for example, hamartoma). This method also enables to reveal peripheral pulmonary cancer.

If a cuneiform resection of the lung can be an adequate method of treating cancer is a highly controversial question, with the exception of those questions when there are significant disturbances of the pulmonary function. This operation can be by no means recommended as a method of the radical treatment of pulmonary cancer, with the exception of those patients who cannot absolutely tolerate a massive operation. Presently, most of thoracic surgeons after finding out and confirming the diagnosis of pulmonary cancer in histological investigation of frozen sections perform an ordinary thoracotomy to do a radical resection of the lung with an adequate excision of the lymphatic nodes. However, potential advantages of thoracoscopy for making the diagnosis of pulmonary cancer (especially in patients with the disturbance of the pulmonary function) are obvious. A relative inconvenience is that in need of transition to an open operation

some amount of expensive one-use staplers appears to have been already used and the videoequipment turns also out to have been involved (which has also to be paid for by the patient). That is why one should display a considerable prudence towards the patients appointed to be operated on thoracoscopically through a cuneiform resection of the lung. A thoracoscopic access is the most suitable in those cases when the likeliness of benign disease is high enough, or in the patients with the expressed disturbances of the pulmonary function. To simplify the task, one can perform puncture biopsy before the operation, which allows to make the diagnosis of cancer and refuse from performing a thoracoscopic operation in the patients who in effect would not get any profit from it (because thoracoscopy would not get them rid of thoracotomy).

5. *Describe a cuneiform resection of the lung.*

The doubts about the possibility of performing an adequate thoracoscopic cuneiform resection of the lung in peripheral cancer are based on the following factors: (1) there are some doubts as for the adequacy of the thoracoscopic assessment of the state of the lymphatic nodes and their removal; (2) during thoracoscopy, it is difficult to assess the state of the margins of the cuneiform area of pulmonary tissue being excised; (3) during thoracoscopy, it is impossible to palpate and, in so doing, assess other formations being found out in the lung (for example, nodular neoplasias and thickenings of the parenchyma) or the mediastinum (for example, lymphatic nodes), which can sometimes change radically the surgical tactics and produce a great influence on concluding about the patient's operability. In performing an open (traditional) cuneiform resection of the lung with the help of a stapler, the surgeon always defines the borders of the nodular neoplasm. It is considerably more complicated to define the borders of the changed tissue during thoracoscopy, so the surgeon should rely upon just the visual assessment of the state of the tissue. If only the nodes are immediately attached to the port, the surgeon can introduce a finger through the port and palpate the borders of the nodes. In extreme cases, in the presence of doubts one can palpate the of borders the removed area of pulmonary tissue. If it appears that the node has not been completely removed, then repeated resection (in particular with the help of thoracoscopic technology) is potentially far more complicated.

A cuneiform resection of the lung can also be performed in the presence of peripheral metastatic cancerous nodes in pulmonary tissue. Not infrequently during the operation, they find out more metastatic nodes than it was supposed, especially when it is necessary to remove all the metastatic nodes at once, it would be more reasonable to use thoracotomy. There is a great disparity of opinions on this problem, and this discussion can be eventually resolved only after performing massive randomized investigations.

Here it is necessary to make two problems very clear. The first one – whether it is possible to compare by results a thoracoscopic cuneiform resection of the lung coupled to the modern opportunities of x-ray diagnostics and a standard open resection of the lung. The second one – is the consecutive removal (with minimally invasive technique) of metastatic nodes in the lungs (when they are possible to be revealed in x-ray examination) less effective in terms of the duration of the patient's survivability than the primary single excision of all the nodes of different diameter (both visible in x-ray investigation and invisible) by the moment when they are initially revealed by different visualizing methods as well as palpation. The available experience of consecutive operations in metastatic nodes of the lung testifies definitely to that such a stage removal of metastatic nodes is an effective enough method of treatment, though primarily they can find out not all the metastases present. Besides, a good effect of the removal of metastases connected to the diminishing of the whole mass of the tumour in the organism can be more expressed in their consecutive removal, because in this there arise less expressed metabolic disturbances than in a single removal of all the metastases during the primary operation.

Draining the pleural cavity and dissection of adhesions

Not infrequently, draining the pleural cavity and dissection of adhesions are like the continuation of the diagnostic biopsy of the pleura. Free plural exudate is easy to drain when the pleura is visualized through a thoracoscope. A gelatinlike substance which often forms in the pleural cavity as an exudate**?????…..**, fibrinous superpositions leading to an incomplete drainage of the pleural cavity (as in paraneumotic or malignant exudates), as well as pleural adhesions limitating the examination of the pleural cavity, are easy to remove to cut across with the help of the thoracoscopic lavage and draining of the contents of the pleural cavity, and the separation of adhesions with clips and the curettage of the pleura, the development of empyema at its early stage can be easily interrupted. For facilitating cutting adhesions across between the parietal and visceral pleura, one can use scissors and preparation hooks connected to an electrocoagulator which is switched on by pressing a treadle with a foot. For dissecting adhesions one can also use Nd:YAG (granat neodymium-yttrium-aluminium) laser . On the whole, intrapleural adhesions can limitate and even be a contraindication for diagnostic pleuroscopy, however, in the application of the modern cutting and coagulating instruments it is much simpler to free the pleura of adhesions and make it accessible for a full-value examination than in the application of the earlier used instruments. Pneumolysis is an elimination of intrapleural adhesions with the subsequent collabing the lung in the treatment of tuberculosis is presently not used anymore in clinical practice. However, the surgeons just mastering thoracoscopic surgery, while revealing adhesions in the pleural cavity, should cut them across with the help of available instruments to

study the possibilities and limitations of thoracoscopic interventions as well as to gain thoracoscopic skills while performing manipulations with instruments in two dimensions (that is controlling his/her actions and watching them on the screen of a TV monitor).

Biopsy of the mediastinal lymphatic nodes, puncture and aspiration

In the application of thoracoscopic technique any organs and tissues of the mediastinum are accessible in the same way as in open operations, but in this surgeons are deprived of such advantages as palpation and tactile perception. A potential number of ports and their localization can vary depending on the peculiarities of the operation. A biopsy of tissues can be taken from any parts of the mediastinum. In some cases, for finding out the pathology of lymphatic nodes of the mediastinum, thoracoscopic technique has substituted parasternal mediastinomy, though the area under the tracheal bifurcation still remains hard to access for a thoracoscope.

6. Describe the biopsy of the mediastinal lymphatic nodes, puncture and aspiration.

The technical description of the removal of cysts and tumours of the mediastinum with the application of thoracoscopic technique has been published in some works, and in some therapeutic establishments this operation is considered to be a relatively simple and is performed often enough. Tumours of the superior posterior mediastinum growing from the sympatic chain, can be easily enough removed with the help of dissectors, clips, endoscopic clippers with the application of the standard placement of three ports. The best access to the superior posterior mediastinum is given by the following placement of the ports: one port – along the middle axillary line in the fifth intercostal space; the second - a bit forwards and above the first one, a long the lateral border of the large thoracic muscle; the third - a bit backwards, along the fifth intercostal space, medially of the scapula's border. Through the lateral ports one can also easily access the anterior mediastinum too, as they provide the distance between the thoracic wall and operative field sufficient for manipulating with instruments. It is sometimes necessary to change a little the patient's position so that the lung would be shifted aside of the anterior mediastinum. The possibility to use thoracoscopic technique for removing tumours of the anterior mediastinum is still being discussed so far as both the adequacy of the resection of tumour and the security of the operation have not eventually been stated.

Partial pericardectomy

As of now, such operations 'a window' in the pericardium (the resection of the pericardium or partial pericardectomy), biopsy of the pericardium or the drainage of the pecicardial area can be performed with the help of thoracoscopic technique. The basic difficulties which can arise in performing thoracoscopy are the heavy state of many patients which are operated on for the tamponade of the pericardium, or heavy hypotension. The ideal variant is the removal of liquid from the pericardial cavity with the help of a thoracoscope, or under echocardiographic control

for providing, primarily, the stability of the patients' hemodynamic indexes in their introduction in narcosis. This would allow to perform thoracoscopy in an ordinary position, on the side.

7. What are the peculiarities of partial pericardectomy?

For the biopsy of the pericardium or partial pericardectomy the most convenient is the lateral access which allows to get the sufficient space between the pericardium and thoracic wall for the introduction of instruments and manipulation with them. One can use both right side and left side lateral accesses; however, the access from the right gives a larger space for manipulations between the pericardium and thoracic wall; besides, in the access from the right the surgeons encounter a lesser amount of pericardial fat tissue. For a better view of the pericardium, an excision can be made laterally in the fifth or sixth intercostal space. The second incision can be performed anteriorly, over the pericardium, creating in so doing a possibility for a direct introduction of the capturing instrument (clip) for a convenient pulling the pericardium away. Through the third port, also being installed laterally, one can introduce scissors, retractors, electrocoagulating instruments or a clipper, which allows to dissect and coagulate much safer pericardial adipose tissue. In this one should take into account that in this pericardial adipose tissue can pass relatively massive vessels, that is way all manipulations should be performed very carefully. For dissecting adipose tissue and the pericardium one can use an endoscopic GIA stapler. It is always necessary to establish the site of the diaphragmatic nerve's passing through the diaphragm not to do any harm to it in that case if it passes a bit more anteriorly than usually.

The window in the pericardium usually forms anteriorly of the diaphragmatic nerve. This foramen can be made with the help of scissors or coagulation exactly like in the standard technique. After the opening of the pericardium for arresting hemorrhage one can use an endoscopic GIA stapler with which fat and vessels are sutured. The application of such a minimally invasive technique is especially preferable with in patients with the limited expected lifespan, in particular, in the presence of malignant exudate. One should not perform thoracoscopic pericardectomy in constrictive (adhesive) pericarditis, as in these patients, on the one hand, almost the whole pericardium is removed, on the other hand – there are expressed adhesions and dense fibrinous coats between the myocardium and pericardium, which should be carefully dissected, which is extremely complicated to do with the help of thoracoscopic technique.

Decortication of the lung in empyema

Dense coats on the pleura which are common in empyema and limitate the mobility of the lungs undergo very well removal with the help of thoracoscopic technique. Contrary to operations on the open thorax when they perform general anesthesia with the application of one-lumen

endotracheal tube and the resection of a rib, in thoracoscopic decortication anesthesia should be conducted with the help of two-lumen tube as well as other thoracoscopic opearations. As long as the lung is covered with dense fibrinous coats , decortication can be performed on the blown out lung, however, further on, in the course of the enlargement of the decortication area, its performance becomes complicated without the collabing of the lung. So, if one continues to work on the blown out lung, there exists the real danger of missing some areas of the lung still covered with fibrinous coats.

8. Describe an operation of decortication of the lung in empyema.

The ports for introducing the thoracosope and instruments are created in the same way as in other thoracoscopic operations; they perform three (or more) small incisions, and under visual control they introduce a window clamp into the pleural cavity which captures a part of the lung. Then, through the third port, one can introduce through into the pleural cavity different instruments for eliminating inflammatory coats from the lung. Once the lung is collabbed, it is very important to maintain its permanent traction in the direction opposed to to the action of the instrument, with which the elimination of the inflammatory coats is performed. A curette of a middle size (the width of the operating part is from 0.75 to 1.0 cm) is the most convenient instrument for the elimination of the purulent material from the lung's surface. As in open operations, the aim of decortication is the utmost complete removal of the films which limitate the lung's mobility. The operation ends up with the installation of drainages, usually of large sizes. The basic drawbacks of thoracoscopic decortication are, firstly, the complexity of the defining the completeness of decortication, and, secondly, the possibility of leaving undrained leakages or uncrossed intrapleural adhesions.

The application of such a minimally invasive technique is especially indicated for patients with mental development retardation or with defects of psychic who are difficult to maintain a good contact with as well as adequate interaction during the operation and in the postoperative period. Besides, the performance of the operations like these in traumas, when the patients experience an increased need of analgetics (primarily, in narcotics) and their locomotor activityis sharply limited as a consequence of muscular pains, gives great advantages and eventually leads to the subsiding of pains in the postoperative period and a considerable decrease of the introduction of narcotic analgetics.

The thoracoscopic decortication of the lung can take much enough time and requires the surgeon's great patience for obtaining good results. Despite this, the operations like these lead to the almost complete restoration of the pulmonary tissue compliance, and, by its eventual results are very effective.

Thoracic sympatectomy

Transthoracic endoscopic sympatectomy can be performed simply enough with the help of a thoracoscope. The basic indications for thoracic sympatectomy are hyperhydrosis and causalgia. The patient is laid down on a side with the arms stretched by 90???o; anesthesia is performed with the application of a two-lumen endotracheal tube. The moderate position of Fowler can help to improve the view of the most superior parts of the pleural cavity.

9. ***What are the peculiarities of thoracic sympatectomy?***

During the operation, one should be especially careful to avoid an injure of the long thoracic nerve which passes along the lateral surface of the frontal dentitious muscle. The incision is performed along the frontal axillary line in the third intercostal space; the lung is being collabbed. The sympatic chain passes approximately along the line of the costal heads, immediately laterally of the costovertebral articulations. A second small incision is made in the fourth intercostal space through which they introduce a probe connected to an electrocoagulator. Then they perform the coagulation of the second, third and fourth nodes and uniting them fibres. One can also clip and excise these nodes. In the pleural cavity, one can leave a drainage tube or just suture both incisions; after that, the patient is followed up for some hours in a postoperative room where they take an x-ray image of the chest to confirm the absence of pneumothorax or expressed hemothorax.

Edmondson who had operated on 50 persons in this way, usually discharged his patients on the next day after the operation. As a rule, the operation was performed first on one side, and, 6 weeks later, on the other one. On the whole, this operation has an extraordinarily high percent of good results; the symptoms of disease subside completely in almost 98% of patients with hands injured only, and in 90% of patients with injured arms and axillary areas. However, in patients with the injure of just axillary areas the percent of recovery is a bit lower – 77%. After the operation, the patients develop compensatory sweating on the skin of the upper half of the trunk and upper extremities. In some patients, the perspiration like this disappears after some time. In about 16 % o the operated patients, there arose a slight recurrence of disease. One did not note the syndrome of Horner, probably, as a consequence of the preservation of the stellate ganglion. Some authors believe that it is necessary to remove the lower third of the first stellate ganglion. However, the results of the operations like these, especially when the Horner syndrome develops, are far worse. That is why, one should not remove a part of the stellate ganglion during thoracic sympatectomy.

OPEARATIONS ON THE ESOPHAGUS

Myotomy after Heller

In achalasia, or the absence of the relaxation of the lower esophageal sphincter in swallowing, they traditionally used balloon dilatation of the esophagus, while in patients after unsuccessful

balloon dilatation – open transthoracic myotomy. To avoid, if possible, the performance of broad thoracotomy, balloon dilatation of the esophagus is performed to patients first. The possibility of early primary thoracoscopic operation, avoiding balloon dilatation and a risk of the arisng of the perforation of the esophagus, is currently becoming a very attractive alternative. The technique of performing the operation described recently by Pellegrini with co-authors (the University of California), is conceptually simple enough.

10. What is the technique of performing an operation of myotomy after Heller?

The patient is laid down, as in open operations, on the right side. The fibrogastroscope is introduced into the esophagus for examination both the esophagus itself and the esophagogastric transition. Fibroendoscopy also allows to assess immediately the results of the operation just after cutting the sphincter across. In fibroendoscopy one can also bend a little the tip of the endoscope towards the patients' left side (or upwards) to outpouch slightly the esophageal wall, which facilitates the surgeon's work.

They install several ports, one in the third or fourth intercostal space, the second – in the seventh intercostal space, and the remaining two - in the fourth or fifth intercostal space for performing the retraction of the lung. The port for the videocamera (is installed in the seventh intercostal space) must be possibly installed utmost more posteriorly so that the instruments being introduced into the plural cavity through the frontal ports, would be located under right angles towards the thoracoscope. Besides, one of the frontal ports is used to shift the diaphragm downwards and displace the lung in the head direction.

Then, by bending the tip of the fibroscope, the wall of the esophagus is outpouched a little (and, in so doing, passed over to the surgeon), the esophagus is captured by the clip, and the wall of the esophagus is dissected with the help of an electrocoagulator. In this, one should be careful, not to injure the vagus nerves. Myotomy should be started immediately inferiorly of the lower pulmonary vein and be continued downwards onto the wall of the esophagus. In this, it is necessary to cut across the superficial longitudinal and circulatory muscular layers – up to the submucous layer. As in open operations, an injure to the vessels of the submucous layer can lead to considerable hemorrhage. This hemorrhage testifies to the fact that in the immediate vicinity there is already the mucous membrane and there exists a high risk of its perforation. The dissection of tissues is continued onto the stomach below the esophago-gastric transition by approximately 1 cm. It is believed that in this the diaphragmatico-esophageal ???ligament and antireflux function of the stomach are preserved.