The possibilities of uniportal videothoracoscopy in the diagnostics of pleural effusion

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Abstract

Background. In pulmonology the diagnostics of pleural effusionappears to be a rather complex and time-consuming problem. The existing traditional methods – pleura puncture and studies of punctata do not give the opportunity to state an accuracy diagnosis. Based on the data of various authors [1, 2], their diagnostic accuracy makes up 46.5%. Therefore, recently thoracoscopic biopsy of pleura has been actively introduced. In opposite to blind biopsy, this method allows to perform a visual control of pathological focus in pleural cavity, as well as to take the material from the damaged areadirectly.
Aim of this research was to establish a diagnostic accuracy, effectiveness and economy of uniportalthoracoscopy during pleural effusion.
The material and methods .Retrospective study was performed using the data of 86 patients, who in the period of January 2016 to December 2020 were subjected to diagnostic uniportalthoracoscopy at the National Center for Tuberculosis and Pulmonary Diseases. Histomorphological research of obtained biopsy material was carried out along with the standard studies.
The results. Oncopathology was stated in 48 (55.8%) patients, including 37(43%)patientswith metastasis damage to pleura, 20 (23.3%) – with tuberculosis. Among malignant tumors the most frequent was lung cancer with metastasis in pleura – 86.5%. Its frequency was high in patients over 50 years old. The pleurisy of tuberculous etiology was the most frequent in 17-50 years old patients. In 13 (15.1%) cases the reason for pleurisy had a non-specific character, the diagnosis could not be confirmed in 5 (5.8%) patients. as the studied material did not allow to accuracy verification. The intervention was characterized by low complications (8.7%) and lethality (0%).
The diagnostic possibility of thoracoscopic method made up 94.2% during pleural effusioin. The duration of staying at clinic decreased from 6.5 bed days to 2.8 b/days. The terms of diagnosis clarification and beginning of etiotropic treatment also reduced by 10-23 days.
The conclusion. The proposed diagnostic thoracoscopic method appears to be a rather safe and high diagnostic opportunity surgery, which in 94.2% of cases allows us to set an accuracy diagnosis. Accordingly, it is expedient to perform a thoracoscopic biopsy in: All the patients with relapsed pleurisy, who had been gone routine researches and the diagnosishad not been verified. The patients, who had stated tumors of other organs and pleural effusion in anamnesis.
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Key words: medical thoracoscopy, pleura effusion, diagnosis, cancer of lungs and pleura, tuberculosis

Introduction

In pulmonology the diagnostics of pleural effusionappears to be a rather complex and time-consuming problem. Often the available traditional methods - puncture of pleura and studies of punctata do not give the opportunity to state an accuracy diagnosis. Based on the data of various authors, accuracy of the above-mentioned method makes up 46.5% [1, 2].
Recently thoracoscopic biopsy of pleura has been actively introduced. In opposite to blind biopsy, this method allows to perform a visual control of pathological focus in pleural cavity, as well as to take the material directly from the damaged area and to carry out immune histomorphological research of obtained biopsy material. Based on the data of various literary sources [3-6], a diagnostic accuracy of thoracoscopy reaches 71-100%. Particularly, according to retrospective research of Hansen et al. [7], a diagnostic accuracy of the above-mentioned method made up 90.4% in 146 patients, while based on standard cytological and microbiological studies of pleura punctata the diagnosis was

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set only in 48.4%.

The goal and tasks of the research. This work consists of a retrospective study of clinical data of 86 patients, who have subjected to a diagnostic thoracoscopy and histomorphology of biopsy material for establishing pleural effusion at the National Center for Tuberculosis and Pulmonary Diseases in the period of January 2018 to December 2021.

The material and methods Patients

Among 86 patients 50 were men and 36 - women, age range was 17±84, average age - 58±1.5. Out of 86 patients 75 had relapsed pleurisy (Table 1), 12 had bilateral effusion, 3 patients had polyserositis. Tumor of other organs (abandon, urinary system) was observed in 14 patients. Diagnostic thoracoscopy was carried out in all these patients in the period of January 2018 to December 2021. By standard studies of pleural effusion the diagnosis was not verified in the above-mentioned patients. Histomorphological research of obtained biopsy material was performed. The preparations were prepared by fixation in 10% formalin and pouring in paraffin. Then 6 μmsized slices were made, which were stained by the use of hematoxylin eosin method. The study of slices was performed using a light microscope by 10-50 fold magnification.

Table 1

General data of the patients under observation (n=86)

Clinical data	Number of cases –86
Age	58.0±15.0 (17–84)
Gender	Men - 50 (58.1%) Women - 36(41.9%)
Localization of pleural effusion	Right-sided- 48(55.8%) Left-sided- 26(30.2%) Bilateral- 12(14%)
Intensity of effusion	Relapsed - 75 (87.2%)

Uniportalthoracoscopy: Rigid type electronic thoracoscopeWOLF 22F 30 025 MM (Germany) with light source and video camera system was used for thoracoscopy.The thoracoscopy was carried out using the standard method in compliance with the existing protocols by uniportal approach. From each patient written informed consentswere receivedfor above-mentioned surgical intervention. Before the procedure, the patients were subjected to standard preoperative study. The surgery was performed in operating block using two-channel intubation tube under a general balanced anesthesia by the exclusion of operating side from respiratory cycle. Operating approach was performed in lateral decubitus posture.Between axillary lines in 6 and 7 intercostal areas the incision was about 3 cm. The thoracoscopy was placed in pleura cavity. Contraindication of the operation was adhesive process in pleura cavity and severe cardiopulmonary failure. After the evacuation ofeffusion, the visualization of parietal and visceral pleura was performed, the attention was paid to the existence of plaquesand scabrousformations in pleura layers, as well as to the condition of lymphatic nodes, pulmonary tissue and mediastinum. After a complete revision,a biopsy of pleura, lungs and lymphatic nodes was performed. On average, in each patient the number of biopsy specimen was 8-10.The weight of each of them varied in the frames of5-20 g. The operation was performed by lung expansion, complete aerohemostasis, pleural drainage. Thoracic wound was deaflyclosed with nodal sutures. The durationof thoracoscopy made up 38±8 min, on average.

Visual specific damages revealed during pleuroscopy

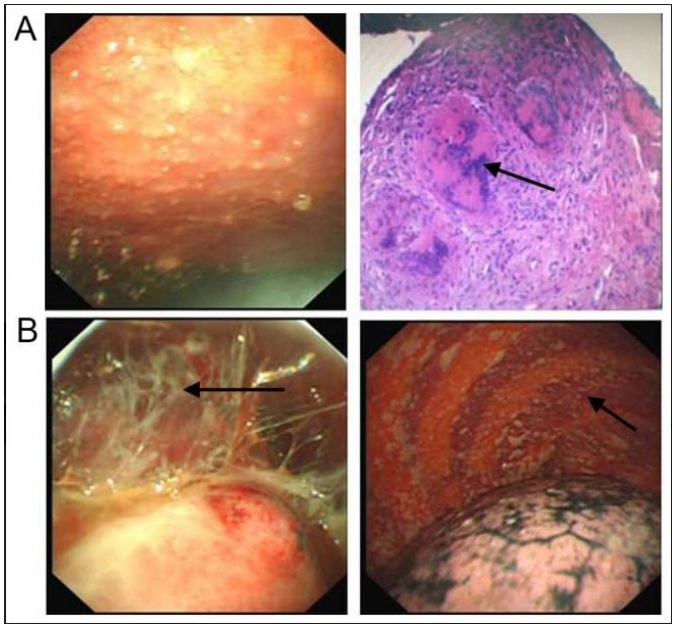

Fig.1. Thoracoscopic and morphological images of pleura tumors

During tumor processes (Fig. 1) pleural effusions were more hemorrhagic (it had meat broth color).

The primary pleura tumors (1-B) were characterized by whitish-grayish dense tissue formationsof variable sizes, on average 1.5 cm in diameter, which were cut in pleura cavity. The above-mentioned formations had a shape of cauliflower with sharply contoured borders and a good blood vessel net. Their arrangement was unsystematic and was characterized by tendency to bleeding during biopsy.

During metastatic damage (1 - B, C) the nodes were smaller and penetrated less into the pleural cavity, often was subjected to the consolidation and fusion in the form of granulomas.

Pleura mesothelioma (1-D) was characterized by a thickened parietal pleura, smooth surface, granulomatous structure and looked like "pavement".

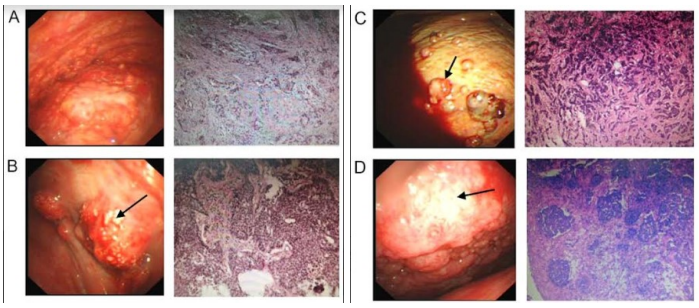

Fig. 2 Thoracoscopic and morphological images of pleura tuberculosis,

During tuberculous processes (Fig. 2), the effusion had a serous character, rarely with fibrinous impurities. Parietal pleura wasswollen, had whitish anemic or yellowish color and was covered with fine-grained 0.5 cm sized whitish subpleurally located nodes, was hyperemic and initiated with thin blood vessels. The visceral pleura was relatively mobile. The process had a diffuse character and was extended into the pericardium and diaphragm (Fig. 2, A). In acute cases caseoticwhitish masses were often

observed in the mentioned nodes, which looked like "snowflakes".

During chronic process (Fig. 2, B) the pleura layers wererelatively thickened and rigid, anemic and mainly were covered with thick fibrinous plaques, in the pleura cavity pleural adhesionswereobserved, the effusion wasrelativelyturbid and untransperant.

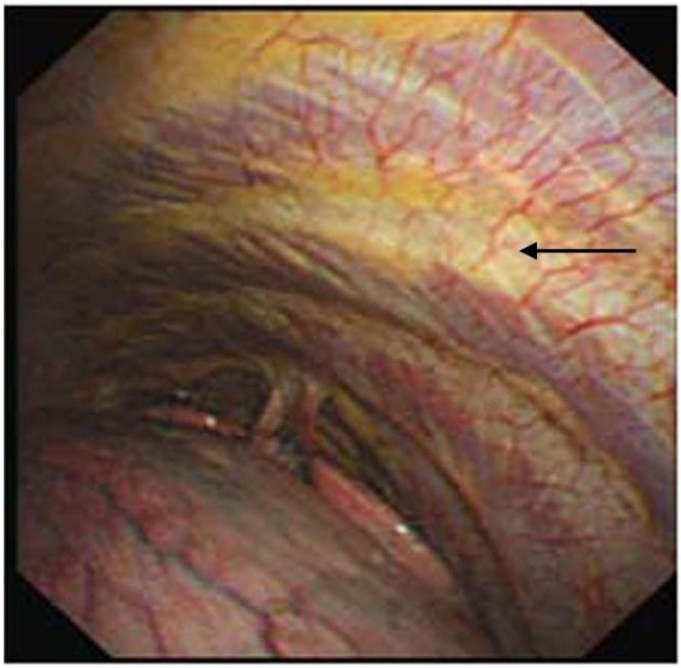

Fig.3 Nonspecific pleurisy is characterized by totally diffusive hyperemia and the swelling of parietal pleura, as well as by a strong vascular initiation. Granulation is not noted, during biopsy is rather bleeding, at prolonged processthe effusion may be turbid and fibrinous plaque may be seen.

The results

By means of the analysis of the results of carried out uniportalthoracoscopic study, it has been established that the research is characterized by a high degree of diagnostic opportunities (Table 2). Out of 86 (100%) cases the diagnosis was verified in 81 (94.2%) cases, among them oncopathologywas diagnosed in 48 (55.8%) patients, out of these cases secondary metastatic damage to pleura was observed in 37 (43.0%) patients. Diagnosis of tuberculosis was stated in 20 (23.3%) patients, while in 13 (15.1%) cases the reason of pleurisy was nonspecific. The diagnosis could not be confirmed in 5 (5.8%) patients, as the studied material did not give the opportunity of accuracy verification.

T able 2 The distribution of diagnoses according to nosologies

Oncology - 48(55.8%)					
Secondary metastatic tumor of pleura - 37(77.1%)				Primary pleura tumor- 11(22.9%)	
Metastases of lung carcinoma – 26 (30.2%)	Metastases of squamous cell lung cancer - 6 (6.9%)	Metastases of breast cancer - 1 (1.1%)	Metastases of digestive system tumor - 2 (2.3%)	Small cell carcinoma - 5(5.8%)	Pleura mesothe lioma - 6(6.9%)
Pleurisy of tuberculous etiology - 20 (23.3%)					
Nonspecific pleurisy- 13(15.1%)					
Parapneumonic-5(5.8%)		Reactive pleurisy-5(5.8%)		Posttraumatic - 3(3.5%)	
Without diagnosis- 5(5.8%)					
Technically, the material could not be taken - 1		Verification failed -4			

Among the confirmed malignant tumors in 48 (100%) cases, the majority was lung cancer with metastasis in pleura (66.5%), which was mainlyobserved in the patients over 50 years, in 50-65 years old patients 30 (62.5%) cases were observed, over 65 years old patients - in 15 (31.2%),in 16-50 years old patients pleura cancer was diagnosed in 3 (6.3%). The tumor process was almost twice as high in men (73.5%), as compared to women (37.5%).

Out of 20 cases of tuberculosis, 13 (65%) cases were observed in 16-35 years old patients. Tuberculous process was equally found in both sexes, while the frequency of nonspecific pleurisy was higher in women, than in men (Table 3).

Table 3 The distribution of diagnosis according to age and sex

	Nosology			
Age	Tumor(n=48)	Tuberculosis (n=20)	Nonspecific pleurisy(n=13)	N=81
16–35	3 (14.3%)	13 (65%)	5 (2.7%)	21 (25.9%)
36–65	30 (73.2%)	5(12.2%)	6 (14.6%)	41 (50.6%)
Over 65	15 (78.9%)	2 (10.55%)	2 (10.55%)	19(23.5%)
Sex				
Men	36 (73.5%)	10 (20.4%)	3 (6.1%)	49(60.1%)
Women	12 (37.5%)	10 (31.25%)	10 (31.25%)	32(39.9%)

The complications of thoracoscopy

After the surgery major discomfort was pain in thoracic area, which was observed in 47 (54.7%) patients. In 16 (18.6%) cases patients postoperatively had subcutaneous emphysema, which disappeared on its own in 3.6±1 days, on average. In 5 (5.8%) patients subfebrile temperature was observed during 3.8±1.2 daysand disappeared on its own. Postoperative complication was observed in 8 (9.3%) patients, 3 (3.5%) patients out of them had intrapleuralhemorrhage, two of them were stoppedconservatively and one - by thoracotomic method. Prolonged depressurization of lung tissue was observed in 3 (3.9%) patients lasting 7±1.2 days, on average and vacuum was reached using a conservative method. The swelling of lungs was found in 2 (2.3%) patients, who needed to carry out the course of intensive therapy. Based on literary data [8, 9] and our observations, the majority of above-mentioned complications is due to the existing concomitant diseases and not to severity of the intervention. The staying at the stationary made up 2.8±0.8 bed days. Lethality was not observed.

Discussion

Pleural effusion appears to be the manifestation of concomitant complication of various diseases and by using the existing routine methods the diagnostics of processes in the pleura does not exceed 20-35% [1, 10].

The provided diagnostic thoracoscopy appears to be a method, which sharply has increased diagnostic possibilities [6-8] and in our case it makes up 94.2%. This research is especially informative in onco- and tuberculous patients, as according to standard cytological research of pleural effusion because of a low concentration of tumor cell in punctata, the diagnostic probability is very low [11] and makes up 12.5%. And,thoracoscopy allows us to take the material from damaged tissues under visual control, which, on its turn, allows to establish not only the existence of

tumor process, but also the nature of the tumor, its spread and etiology.Also the probability of mycobacterium existence in pleura punctata is low (12.3%) [7]. The terms of mycobacterium on specific ground are 35-45 days, on average and the probability of receiving the culture is 43.4% [3, 7]. Accordingly, at an early stage the method of thoracoscopy gives the opportunity of establishment of tuberculous process. After performing the mentioned procedure tuberculosis was diagnosed in 83.8% andmost importantly the term of diagnostics reduced by 28.5 days, on average. This gave us the possibility to timely involve the patients in the scheme of specific treatment and to prevent the transmission of the process into the formation of resistant form.

Thoracoscopy is indispensable in the diagnostics of such pathologies, as a pleura primary tumor and mesothelioma, where according to standard researches,a diagnostic probability made up 35.7% [11, based on our study a diagnostic accuracy of oncology made up 100%.

Summary

The provided diagnostic thoracoscopy appears to be a rather safe and high diagnostic opportunity operation, which in 94.2% of cases allows us to state an accuracy diagnosis, to reduce the terms by 10-23 days, on average and relatively, as well as to start timely etiotropic treatment. The intervention is characterized by the probability of low complications (8.7%) and lethality (0%). Also this procedure is rather effective economically, significantly reduces the duration of staying at the clinic from 6.5 b/days to 2.8 b/days.

Accordingly, it is expedient to perform a thoracoscopic biopsy in:

1. All the patients with relapsed pleurisy, who had been gone routine researches and the diagnosishad not been verified.
2. The patients, who had stated tumors of other organs and pleural effusion in anamnesis.
3. In cases of current pleurisy with extensive character in patients aged over 40 years.
4. In cases when tuberculosis was suspected.

Fig.1. Thoracoscopic and morphological images of pleura tumors

Which were received by using video camera WOLF 22F 30 025 MM (Germany). The slides were prepared from 6 μm slices and stained with hematoxylin eosin. The visualization was performed underthe light microscope 500 K CCD, Olympus by 50 fold magnification. A - metastasis of lung adenocarcinoma, B-primary tumors of pleura, C - breast cancer metastasis, D - pleura mesothelioma

Fig.2. Thoracoscopic and morphological images of pleura tuberculosis

Which were received by using video camera WOLF 22F 30 025 MM (Germany). The slides were prepared from 6 μmslices and stained with hematoxylin eosin. The visualization was performed under light microscope 500 K CCD, Olympus by 50 fold magnification. A- Microscopically gigantic Langerhans cells are characterized, B -Fibrinious plaques and rigidallythickened pleura

Fig.3. Nonspecific pleurisy

The image is received by using video camera WOLF 22F 30 025 MM (Germany). The slides are prepared from 6 6 μm slices and stained with hematoxylin eosin. The visualization was performed under light microscope 500 K CCD, Olympus by 50 fold magnification. Black arrow - parietal pleura initiated by blood vessels

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