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EVALUATION OF THE INFORMATIVE VALUE OF TRANSTHORACIC TREPAN LUNG BIOPSY UNDER THE CONTROL OF MULTISLICE COMPUTED TOMOGRAPHY OF INTRATHORACIC FORMATIONS IN THE DIAGNOSIS OF LUNG FORMATIONS

As of today, minimally invasive interventional diagnostic and therapeutic methods play a crucial role in modern medicine. Percutaneous transthoracic biopsy (TTB) is a minimally invasive and highly effective procedure that allows for histological verification of intrathoracic neoplasms. The aim of the study was to evaluate the information content of the method of percutaneous transthoracic trephine lung biopsy under the control of multislice computed tomography in the diagnosis of intrathoracic lesions in patients with suspected malignant neoplasm of the lung. The study included 155 patients who underwent TTB of intrathoracic formations under MSCT guidance between 2021 and 2022 at the Oncology and Radiology Hospital of the Republic of Sakha (Yakutia). Of these, 94 (60.65%) were male and 61 (39.35%) were female. The average patient age was 65.4 years (range 44-89). As a result of the study, malignancy was detected in 118 patients (76.13%), with primary lung malignancies identified in 102 (65.81%) patients, secondary lung malignancies in 16 (10.32%), and benign lung neoplasms in 27 (17.42%). Non-informative material (scarce material) was obtained in 10 (6.45%) cases. Perioperative complications were identified and included pneumothorax requiring Bülau pleural cavity drainage in 25 patients (16.67%), which occurred in patients with concurrent upper respiratory tract pathology such as bullous emphysema, interstitial changes, giant bullae, and hemoptysis developed in 16 patients (10.67%). Thus, it was determined that the application of percutaneous TTB of the lung under multislice computed tomography guidance in lung cancer has significant diagnostic value.

Keywords: percutaneous transthoracic trephine biopsy, lung trephine biopsy, computed tomography, biopsy under MSCT guidance, lung biopsy, non-small cell lung cancer.

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Introduction. Currently, according to statistical data in the Russian Federation for 2020, lung cancer ranks first among malignant neoplasms in men and first in mortality among both men and women in Russia and globally [2]. This problem is also prevalent in the oncology service in the Sakha Republic. It has been established that in the period from 2013 to 2022, there has been an increase in lung cancer incidence among the population by 22.1% [2].

Considering the growing trend in detecting new focal lung neoplasms in patients, one of the most pressing tasks in thoracic surgery and oncology is the timely and safest diagnosis of intrathoracic lung neoplasms [1, 11, 13]. Numerous methods for obtaining morphological materials from intrathoracic tumors have been described in domestic and foreign literature [3, 4, 12].

For tumors located in the trachea and bronchi, bronchoscopy is used, which allows obtaining material from exophytic bronchial tumors. For central lung tumors, the endobronchial ultrasonography method is used [6, 7]. The aforementioned methods do not allow obtaining material from peripherally located lung tissue neoplasms. To diagnose these formations, clinicians often resort to performing diagnostic invasive operations, such as diagnostic thoracotomy, video thoracoscopy, and mediastinoscopy [6, 8, 14]. The application of these methods implies hospitalization, significant intraoperative trauma, and considering that the highest percentage of oncology patients are elderly and senile individu-

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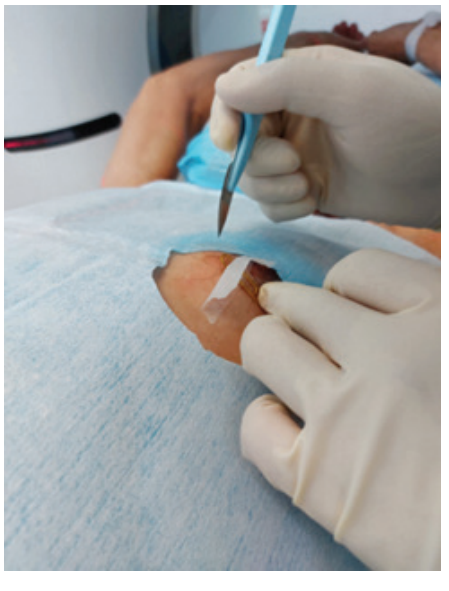

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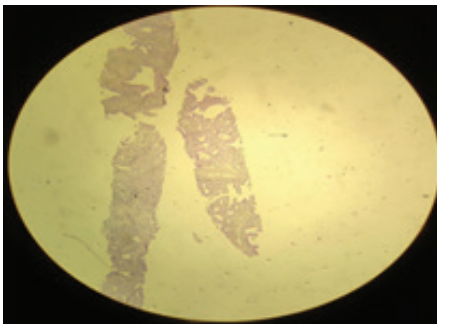

Intraoperative photos of the transthoracic trepanobiopsy of the left lung formation under MSCT navigation: a - 128-PHILIPS X-ray computed tomography with fluoroscopy, b - MAGNUM pistol with a single 18 - gauge biopsy needle G 150 mm long, c - layered anesthesia of the skin with a local anesthetic, d - incision of the skin at the puncture site, e - installation of the coaxial system to the formation of the left lung, f - MSCT control of the placement of the coaxial needle over the tumor, g, h - obtaining histological material, i - morphological picture, stained with hematoxylin and eosin, increased 200. In the material of the structure of the lung adenocarcinoma with the immunophenotype: TTF1(+), Napsin(+), CK7(+), CK20(-)

als with multiple comorbidities of varying degrees of compensation, the use of the aforementioned surgical interventions is associated with a high risk of anesthesiologic assistance and the development of unfavorable postoperative outcomes (American Society of Anesthesiologists), as well as an increased duration for patients to receive specialized treatment [10, 14].

Currently, minimally invasive interventional diagnostic methods, such as percutaneous transthoracic core biopsy (TCB) [3-5], are widely used in the diagnosis of intrathoracic neoplasms. This method is a highly effective procedure that allows for histological verification of intrathoracic neoplasms [4-6, 14].

We previously conducted a retrospective analysis of the results of percutaneous TCB under the control of multislice computed tomography (MSCT) in 156 patients, in which 76.28% of cases were verified as malignant processes.

Aim of the Research: To assess the information content of the method of percutaneous transthoracic trephine lung biopsy under the control of multislice computed tomography in the diagnosis of intrathoracic lesions in patients with suspected malignant neoplasm of the lung.

Materials and Methods: From January 2020 to December 2022, 270 transthoracic biopsies (TTBs) were performed at the Department of Radiosurgical Diag-

nostic and Treatment Methods (DRDTM) of the Sakha Republic's Yakutsk Republican Oncological Dispensary in Yakutsk, among which 155 patients underwent percutaneous TTB of lung neoplasms under MSCT control. Of these, 94 were men (60.65%) and 61 were women (39.35%). The average age of the patients was 65.4 years (44; 89). Absolute contraindications for percutaneous TTB included neoplasm localization in a single lung, anticoagulant intake, blood disorders accompanied by increased bleeding, pronounced respiratory insufficiency, and written patient refusal of the procedure.

All biopsies were performed using the MAGNUM automatic gun with a disposable 18 G biopsy needle of 150 mm length. Navigation was provided by a 32-slice BodyTom MSCT and a 128-slice PHILIPS X-ray computed tomography with fluoroscopy (Fig.1-A, E). Patients were examined in supine, lateral, or prone positions depending on the neoplasm localization. Scanning was conducted with a slice thickness of 1 mm. The procedure was performed under local infiltration anesthesia with a 20 mg/ml Lidocaine solution after triple antiseptic treatment of the operative field (Fig.1-B, C, D). Biopsies were performed using the MAGNUM automatic gun with a disposable 18 G biopsy needle of 150 mm length (Fig.1-B). Three tissue columns were collected and fixed in a 10% formalin solution (Fig.1-F, G, H). The puncture site was covered with an aseptic dressing. Patients were then routed to a hospital ward for dynamic observation of vital functions. The average procedure duration was 33±12 minutes. Chest radiography was performed at 2-4 hours and the following morning (12-24 hours), with immediate radiography in case of pneumothorax symptoms or signs of respiratory insufficiency.

The average total radiation dose during the biopsy ranged from 2.67 to 10.84 mSv. To reduce radiation exposure to medical personnel, all biopsies were conducted wearing radioprotective aprons with collars and protective glasses.

The diagnostic procedure stages are shown in Fig. 1.

Statistical analysis of the research results was performed using Microsoft Excel and Statistica-8 software.

Results and Discussion: The registered anthropometric data are presented in Table 1. The analysis revealed that the majority of patients were male and elderly (60-74 years old).

As a result of the study, malignant characteristics were detected in 118 patients (76.13%): malignant lung neoplasms were found in 102 patients (65.81%), secondary malignant lung neoplasms in 16 patients (10.32%), and benign lung neoplasms in 27 patients (17.42%). Non-informative material (scarce material) was observed in 10 cases (6.45%).

Upon evaluating the lung tumor size and histological type, it was determined that the tumor size at the time of TTB was statistically significantly larger in patients with non-small cell lung cancer (NSCLC) ($p < 0.05$). However, the tumor size was not dependent on the histological type of NSCLC ($p > 0.05$). These data are presented in Table 2.

During the analysis of perioperative complications, the following were identified: development of pneumothorax requiring drainage of the pleural cavity using Bülau's method in 25 patients (16.67%). Pneumothorax predominantly occurred in patients of older age groups with concomitant upper respiratory tract pathology, such as bullous emphysema, interstitial changes, giant bullae, and hemoptysis developed in 16 patients (10.67%). All the aforementioned complications were resolved.

Transthoracic core needle biopsy (TTB) of intrathoracic lesions under CT guidance, according to various authors, varies from 89% to 96%. In a study by Kim D.Y. et al., they analyzed the outcomes of TTB under CT guidance in 70 patients with suspected lung cancer and found that the overall diagnostic sensitivity of the selected method was 85.7%, with non-informative material obtained in 18.6% of cases, and the overall complication rate was 35.7%. The authors concluded that a long transpulmonary needle path was a factor for developing pneumothorax ($p=0.007$) [9]. Cristina Borelli et al. evaluated the effectiveness of TTB under CT guidance in 183 patients. The authors divided the results into diagnostic and non-diagnostic. In 150 cases, diagnostic results (informative material) were obtained. Among these, 87.3% had malignant lung processes verified, and 12.7% had benign processes. Of the 33 non-diagnostic results (non-informative material), 66.7% underwent repeat biopsy and authors reported malignant processes in these cases, while 33.3% had benign processes. Multivariate analysis

Table 1

Gender and Age Characteristics of Patients, n (%)

Gender	Age Group				p
	18-44	45-59	60-74	75-90	
Total Number (n=155)	5 (3.2)	29 (18.7)	94 (60.6)	27 (17.4)	
Men (n=94)	4 (4.3)	16 (17.0)	62 (66.0)	12 (12.8)	0.156
Women (n=61)	1 (1.6)	13 (21.3)	32 (52.5)	15 (24.6)	

Note. In Tables 1-2, p is the achieved level of significance (Pearson's criterion $\chi 2$).

Table 2

Dimensions and Morphological Type of Lung Formations. Subjected to TTB Biopsy Under MSCT Control

Type		Total	Tumor Size				
			05-10	11-20	21-40	41-60	more than 60
Small Cell		3 (1.9)	0 (0)	1 (33.3)	0 (0)	1 (33.3)	1 (33.3)
NSCLC	Adeno NSCLC	51 (32.9)	1 (2.0)	6 (11.8)	30 (58.8)	8 (15.7)	6 (11.8)
	Squamous NSCLC	33 (21.3)	0 (0)	3 (9.1)	15 (45.5)	7 (21.2)	8 (24.2)
Neuroendocrine Lung Tumors		9 (5.8)	0 (0)	1 (11.1)	3 (33.3)	4 (44.4)	1 (11.1)
Other		6 (3.9)	1 (16.7)	2 (33.3)	3 (50.0)	0 (0))	0 (0)
Tuberculosis		3 (1.9)	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)
Hamartoma		2 (1.3)	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)
Other		22 (14.2)	1 (4.5)	4 (18.2)	11 (50)	5 (22.7)	1 (4.5)
Non-Informative		10 (6.5)	2 (20.0)	3 (30.0)	5 (50.0)	0 (0)	0 (0)
Metastasis		16 (10.3)	4 (25.0)	1 (6.3)	5 (31.3)	6 (37.5)	0 (0)
p			0.001				

of diagnostic failures revealed that when the lesion size was ≤ 20 mm (p = 0.006), the proportion of non-informative material was higher [5].

A meta-analysis assessing the complication rate of TTB under CT control found that, among 8133 TTB of the lung, the overall complication rate was 38.8%, and the rate of serious complications was 5.7% (extensive pneumothorax, hemoptysis with aspiration). The authors reported that the number of complications increased in 38.8% of cases with larger needle diameters. Other factors contributing to complications included a long transpulmonary needle path and lesion diameter ≤ 20 mm [8]. The effectiveness of TTB under CT guidance was evaluated by Yarynich K.V. et al., who assessed the procedure's effectiveness in 133 patients. Lesion size ranged from 5x8 mm to 10 cm, and tumor depth was 0-45 mm from the parietal pleura. The authors reported that 80 cases (59.3%) had malignant processes, 35 (25.8%) had benign processes, 8 (5.9%) had non-informative material, and 5 (3.8%) had false-negative results. Complication assessment revealed that 12 patients developed partial pneumothorax in 8.9%, and no pulmonary hemorrhages were detected. Similar results were obtained by Perepelevsky A.N. et al., who evaluated the outcomes of TTB under CT guidance in 63 patients. The study reported high informativeness of TTB in 96.6%. Complications were observed in 5 (7.6%) patients, pneumothorax developed in 4 (6.1%), and hemoptysis in 1 (1.5%) [3].

In our clinical study assessing the effectiveness of transthoracic biopsy (TTB) under CT guidance, we found that the effectiveness of the method was 93.59%. A systematic review of specialized literature allowed us to compare our results with global data [4-6, 8-13].

Conclusion: The use of percutaneous transthoracic core needle biopsy under multi-slice computed tomography (MSCT) control for lung cancer has significant diagnostic value in the histological verification of lung lesions. This method is simple to use and safe for the patient.

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