



## Conference Paper

# Morphological Criteria for Diagnosis of Pulmonary Lesions of Lungs in Tumors Based on Resection Material

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## Abstract

Morphological criteria of diagnosis of dust lesions of lungs in tumors on resection material are considered in the article. It is shown that the complex application of various research methods allows the identification of dust particles in the lung and lymph node tissues, and contributes to the improvement of the diagnosis of dust lesions of the respiratory system. Morphological characteristics of bauxite pneumoconiosis in primary lung cancer on resection material are presented.

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## 1. Introduction

Currently there has been an increase in the number of malignant tumors of the respiratory organs, induced by dust effects of a professional and unprofessional nature. Diseases of the respiratory organs associated with inhaled mineral dust, and primarily pneumoconiosis, occupy a significant place in modern pulmonology [1, 2]. Dust pathology often appears as a "background" process in tumors and in most cases is not fully diagnosed by a pathologist during the morphological investigation of the surgical material. Analysis of literature data shows that the rate of occupational morbidity in the enterprises of the metallurgical industry in Russia, despite the good technical maintenance and operation of equipment, is still high [3]. Information on the relationship between occupation in the metallurgical industry and the development of pulmonary diseases has been confirmed by several studies [4, 5].

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## 2. Objective

Development of morphological criteria for diagnosis of dust lesions of respiratory organs in lung tumors on resection material, which will help to improve the diagnosis of dust pathology in tumors.

## 3. Material and Methods

Retrospective and prospective study of surgical material in patients with primary lung cancer was carried out. The study included 315 cases for the period 2010-2016. The study was conducted at the pathological department of the Tuberculosis Dispensary of Yekaterinburg, the histological laboratory of the Central Research Laboratory of the Ural State Medical University. Clinical and anamnestic data, including the experience of smoking, professional contact with a dust factor was revealed during the analysis of case-histories and questionnaires filled in by patients. Informed consent to process personal data has been received. Morphological study of the current operational material and the study of archival material were pursued.

The macroscopic and microscopic examination, along with the characteristics of the tumor node, included a description of dust pathology: the degree of dusting, the predominant localization of the process, the colour of the lung tissue and lymph nodes, the degree of fibrosis and others. In histological examination, additional picrofuchsin stains were used according to van Gieson, combined colouration with picrofuchsin and fuxelin, Perl's' reaction and others. In 15 cases (4.8%), an immunohistochemical study was performed to verify the histological variant of the lung tumor (antibodies to CK7, p63, TTF-1 and others were used). All cases of dust lesions of lung tissue and intrathoracic lymph nodes were investigated in polarized light to detect anisotropic structures possessing the property of birefringence in dust clusters. By using of olar-ization microscopy, information was obtained on the number and features of the histotopographic distribution of anisotropic particles, their size and shape. In some cases, scanning electronic microscopy of tissue samples was carried out on the basis at the Ural Federal University named after the first President of Russia B.N. Yeltsin. To assess the qualitative and quantitative elemental composition of dust particles, the energy dispersive microanalysis method was used.

## 4. Results

Morphological diagnostics of dust lesions of lungs in tumors is based on the complex investigation of surgical material and includes the stages of gross and microscopic examination using additional histochemical stains, the method of polarization microscopy and in some cases the method of scanning electronic microscopy with X-ray spectral microanalysis of dust particles. An important role in the diagnosis of dust lesions of the lungs and lymph nodes belongs to the evaluation of clinical and anamnestic data, primarily the professional dust history and history of smoking.

We distinguish dust lesions of the respiratory organs of the professional (pneumoconiosis) and unprofessional nature - household dust [6]. These changes have characteristic morphological features and have formed a grouping of dust lesions of respiratory organs in lung tumors. The most common signs of pulmonary and lymph nodes of varying severity are detected in lung tissue. Morphological criteria of household dust is the deposits of coarse black-brownish dust in interstitial lung tissue and lymph nodes with the development of interstitial lung sclerosis, the detection of a small or moderate amount of quartz-containing crystals in polarized light, in the absence of data on professional dust experience and a history of smoking. In our study, signs of household dust on resection material were found in 148 cases (46.9%), the severity of dusting varied.

When smoking, characteristic morphological changes were developed in the lungs: intraalveolar accumulation of macrophages of the "smoker", respiratory bronchiolitis with interstitial lung disease, as well as emphysema, interstitial fibrosis and desquamative interstitial pneumonia in some cases. In our study, tobacco smoking history was revealed in 208 (66.0%) patients, the average index of the pack / years was 32.8. In morphological studies, lesions associated with smoking were determined in almost all the cases.

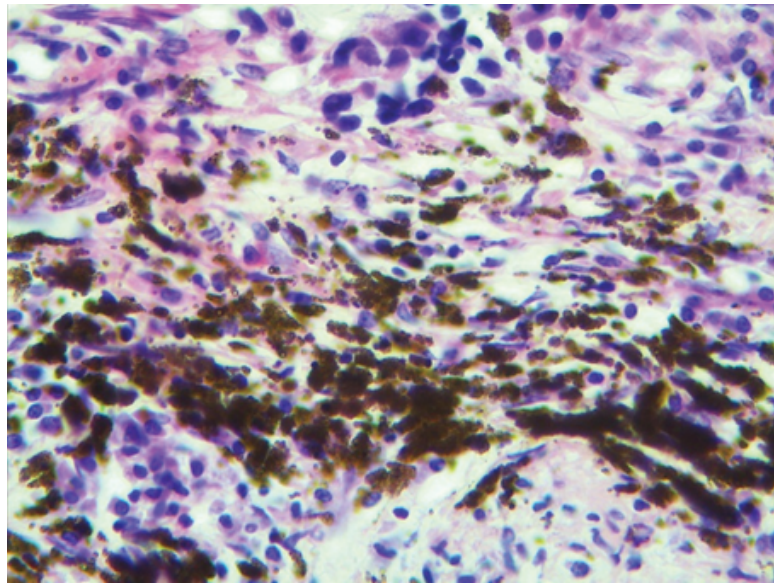
In our research, data on professional experience are presented in 139 (44.1%) cases, the morphological picture of pneumoconiosis was revealed in 34 (10.8%) cases. An important place in the structure of professional respiratory diseases in our study is taken by metalloconiosis. Morphological picture of pneumoconiosis of electric welder was found in 12 cases (35.3%), bauxite pneumoconiosis in 8 cases (23.5%) and pneumoconiosis caused by titanium dust in 2 cases (5.9%). The morphological picture of dust lesions of a professional nature was characteristic for these cases, the severity of the changes correlated with the data on professional experience. The morphological

picture of professional dust lesions can be accompanied by signs of household dust of the lungs and lymph nodes.

The morphological picture of the pneumoconiosis of welders is well described. Bauxite fibrosis is a pneumoconiosis that develops mainly in bauxite mine workers when exposed to alumina, inhalation of dust of mixed composition containing a high percentage of aluminum oxides, an admixture of silicon dioxide, part of which is in a bound state, an admixture of iron. The study included eight cases of morphologically verified bauxite pneumoconiosis in lung cancer in patients who had a long professional work experience at the bauxite mine. All patients were men at the average age of 61.1 + 6.4 years, four patients at the time of treatment were registered in the trade center with a diagnosis of pneumoconiosis or suspected pneumoconiosis. Seven patients at the time of the survey smoked, the average index of the pack / years was 20.4. In all the cases, a professional experience in the mining industry was revealed, which ranged between 16 and 38 years, at the average of 27 years. The following professions were represented: sinker, miner, shaker, gas cutter and others. The morphological examination of surgical material was carried out according to the standard scheme. In macroscopic examination, central lung cancer was detected in 1 case, massive cancer in 2 cases, peripheral carcinoma occurred in 5 cases. According to the histological examination, squamous cell carcinoma was found in 3 cases without keratinization, in 1 case with keratinization, in 2 cases small cell lung cancer, in 2 cases adenocarcinoma. Morphological examination of lung and lymph nodes revealed moderately expressed or expressed dustiness, and in the respiratory tissue, coniotic interstitial fibrosis of varying severity was detected. The changes associated with smoking, presented mainly by macrophage accumulations with the tobacco smoker's pigment, were detected. In the study of tissue samples in polarized light, quartz crystals in various quantities and anisotropic crystals with a characteristic colour glow were determined in all cases (Figure 1).

## 5. Conclusions

Only a complex morphological study enables us to adequately reveal and identify mineral dust in the lung tissue. Such a study should include the stages of gross and histological examination of the lung resection material, the use of polarization microscopy and, in some cases, scanning electron microscopy with microanalysis of dust particles. Morphological criteria of changes associated with smoking have been determined. The revealed morphological features of the combined dust and tumor lung lesions will help



**Figure 1:** The case of bauxite pneumoconiosis in lung cancer. Accumulations of dust particles in the interstitium of the lung. Histological examination, an increase of 200, stained with hematoxylin-eosin.

improve the diagnosis of lung tumors associated with dust pathology. The diagnosis of bauxite pneumoconiosis is established on the basis of characteristic morphological changes of the resection material and requires confirmation by an occupational physician.

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