**Research Article**

# MORPHORANGENOLOGICAL CHARACTERISTICS IN EARLY DIAGNOSIS OF CHILDREN WITH INFLAMMATORY PULMONARY DISEASES

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## ABSTRACT

The choice of this particular topic is due to the need to study morphofunctional studies and compare them with radiological data. The literature shows that in order to improve and timely diagnosis and prevention of inflammatory diseases of the bronchopulmonary system, the director carries out radiological diagnostic methods. Morphological studies of pleural fluid can affect the diagnosis and treatment of children with pneumonia.

## KEYWORDS

Morphology, bronchopulmonary system, X-ray examination.

## INTRODUCTION

According to recent data, more than 30% of children are admitted to hospitals due to inflammatory processes of the bronchopulmonary system in children. Connections with this, the development of science, technology, industry, and the urbanization of today's life have led to the emergence of the problem of radiodiagnosis of inflammatory processes of the bronchopulmonary system in children. In addition, the

increase in the frequency of pathology of inflammatory processes of this system in children has made the urgent problem of their radiological diagnosis in the structure of childhood diseases, especially at an early age (1, 2, 3, 4).

Respiratory diseases occupy a leading position among all diseases. The same trend was noted in pediatric practice, where their share is more than 60% (5, 6, 7, 8, 9).

The problem of preventing and treating inflammatory diseases of the bronchopulmonary system in children still remains relevant. In the structure of primary morbidity, this pathology occupies one of the first places in children of all age groups (10, 11, 12, 13, 14). Respiratory diseases are the most common pathology in childhood. Pulmonary diseases account for one in six deaths worldwide (15, 16, 17, 18, 19). In Russia, the incidence of acute respiratory tract infections is 672.1 per 1000 children. (3, 14, 15, 20). These diseases are fraught with various complications. At the same time, there is an increase in the frequency of severe chronic forms of lung diseases in children, leading to disability already in childhood (21, 17, 31, 49, 69, 73, 95).

The morphology of the functional activity of the structures of the airways and lungs under normal conditions and in a number of pathological conditions has been studied in great detail. Assessing the changes that develop in the bronchopulmonary system during a particular inflammatory pathological process serves as the basis for understanding the patterns of compensatory and adaptive reactions in the respiratory organs. Respiratory diseases are an urgent health problem due to their widespread prevalence, occupying one of the leading places in the structure of morbidity and mortality of the population. In recent years, there has been an increase in the incidence of chronic and recurrent lung diseases among children and adolescents (13, 22, 23, 24, 25, 26).

Despite the progress achieved in diagnosis and treatment, diseases of the respiratory system still occupy one of the first places in the structure of morbidity among children and adolescents. Along with the high level of morbidity, there is an increase in the general population in the number of recurrent and chronic forms of respiratory diseases, often leading to disability. Broncho-obstructive syndrome is more often observed in young children (20.1%). Moreover, in more than half of children (57.5%), episodes of obstruction recur (26, 27, 28, 29, 30, 31)

Some clinical studies show that computer aided diagnosis (CAD) can improve the diagnostic performance of junior radiologists. Chest X-ray is one of the most accessible radiological methods for screening and diagnosing various lung diseases. In many modern hospitals, huge numbers of X-ray images along with radiology reports are accumulated and stored in picture archiving and communication systems (PACS). However, it remains an unresolved question how such a large database containing valuable imaging data (i.e., freely labeled) can be used to support data-

intensive deep learning paradigms to create truly large-scale and highly accurate computer-aided diagnostic systems (CAD).

Structural changes in the respiratory organs detected during the analysis of biopsy samples of the bronchial mucosa, in comparison with the study of bronchial washings and induced sputum, can serve as the basis for determining tissue, cellular and molecular predictors of severe bronchial asthma, as well as differential criteria between bronchial asthma and chronic obstructive disease lungs (32, 33, 34).

Chest diseases and pulmonary abnormalities are the leading causes of death according to global statistics for 2017 (15, 35). Clinical methods for evaluating chest diseases include chest X-ray (CXR), computed tomography (CT), and magnetic resonance imaging (MRI). Chest X-ray, a painless test, remains one of the most commonly used radiological methods for screening and diagnosing chest diseases (10, 16, 25). A single x-ray may reveal abnormalities such as atelectasis, cardiomegaly, effusion, pleural thickening, and pneumonia. However, the diagnosis of chest diseases using radiography largely depends on the skill of the radiologist, and achieving highly accurate diagnostic results remains a significant challenge.

Chest X-ray (CXR) is an inexpensive but effective medical imaging technology. However, a shortage of qualified radiologists may significantly limit the use of this method. To improve the efficiency and accuracy of diagnosing abnormalities in chest X-rays, new technologies such as deep learning should be used.

Deep learning algorithms based on convolutional neural networks (CNNs) have made significant progress. The success of CNN in image classification has prompted researchers to explore its usefulness as a diagnostic tool for identifying and characterizing lung diseases. To achieve this goal, we leverage and extend the EfficientNet family of deep artificial neural networks, known for their high accuracy and small size in other applications. A collection of three datasets is used to train the proposed approach. The results show that the proposed approach produced a high-quality model with an overall AUC of 0.871 and an overall sensitivity of 79.4%, while having 5 to 30 times fewer parameters than other architectures (36, 37).

When comparing high-resolution computed tomography studies of the lungs with histological lung remodeling in explants with usual interstitial pneumonia, HRCT findings were found to be typical of UIP and HRCT of the lungs correlated best with bronchiolectasis histologically. The NSIP pattern is common and is associated with CT detection of HGO. Histologic features were compared with three HRCT findings: diagnostic appearance (UIP, probable UIP, or incompatible with UIP), degree of honeycombing, and degree of ground-glass opacification (38).

Acute fibrinous and organizing pneumonia is a histologic pattern associated with the clinical presentation of acute lung injury that differs from the

classic histologic patterns of DAD, BOOP, or EP. Similar to these patterns of acute lung injury, the AFOP pattern can occur in idiopathic settings or with a number of clinical associations. The overall mortality rate is similar to DAD and may therefore represent a histological variant; however, AFOP appears to have two distinct patterns of disease progression and outcome. The need for mechanical ventilation was the only parameter correlated with prognosis. None of the patients with subacute clinical course required mechanical ventilation (39).

Medical imaging methods allow us to identify and record abnormalities in the human body. These techniques are critical for the assessment, diagnosis and treatment of lung diseases. Currently, there are a variety of research methods: ultrasound of the respiratory organs, densitometry, digital radiography, fluoroscopy of the lungs, CT scan of the lungs, MCT and other research methods. Radiation diagnostics is the main method of radiation examination in children of the first age, which allows identifying functional and clinical changes in the lungs (40, 41, 42).

Densitometry is a key method in multislice computed tomography (MSCT), which helps to detail pathological changes in the organs of the chest cavity. Chronic progressive inflammatory process of the airways, especially respiratory bronchioles and pulmonary parenchyma, leads to obstructive disorders of the ventilation function of the lungs, mucociliary dysfunction, accumulation of neutrophils in the respiratory tract mucosa and bronchial remodeling (43, 44, 45).

In children with pneumonia, chest X-ray (CXR) is usually the first diagnostic test. If complications such as abscesses or empyema occur, repeat X-rays or CT scans are often required, increasing radiation exposure. This retrospective study assessed the potential of radiation-free chest MRI to detect complications initially and later compared with chest radiography and pulmonary ultrasound (LPUS). CXR and USL are usually sufficient, but in cases where USL is not possible or the combination of CXR+USL is ineffective, MRI should be preferred. However, the use of contrast agents is not necessary (46, 50).

USL has high internal consistency (IRR) for detecting consolidation. Compared with CT, ultrasound and chest x-ray (CXR) show similar sensitivity, but CXR has greater specificity in diagnosing pneumonia (46, 17, 49, 50)

Chest X-ray (CXR) is the mainstay of diagnosis for community-acquired pneumonia (CAP). Some authors have recently suggested that chest ultrasound (CUS) can effectively complement or even reliably replace X-ray examination in the diagnosis and surveillance of CAP. We examined the clinical utility of USG in a large sample of patients with CAP to challenge the hypothesis that it can replace radiography.

To improve understanding of the clinical, radiological and pathological features of acute fibrinous and organizing pneumonia (AFOP), the clinical data of 5

patients with AFOP were retrospectively reviewed. AFOP was diagnosed using percutaneous lung biopsy guided by computed tomography (CT) of the chest. The predominant findings on chest HRCT were bilateral infiltrates with a diffuse and pathotype distribution. A pathological examination revealed slightly dilated alveolar septa, lymphocytic and plasmacytic infiltration, as well as the presence of intra-alveolar fibrin in the form of fibrin "balls" (organizations) inside the alveolar spaces. No neutrophilic, eosinophilic infiltration, or hyaline membrane formation were observed, which was in contrast to other well-known histologic features of acute lung injury such as diffuse alveolar injury, cryptogenic organizing pneumonia, and eosinophilic pneumonia. All patients received corticosteroids and showed significant clinical and radiological improvement. Thus, acute fibrinous and organizing pneumonia has no specific features, and its diagnosis depends on pathological examination. However, whether this is a unique interstitial disease requires further clinical investigation (47).

## CONCLUSIONS

Thus, literature data show that in order to improve and timely diagnosis and prevention of inflammatory diseases of the bronchopulmonary system, it is advisable to carry out radiological diagnostic methods. Morphological studies of pleural fluid can affect the course of diagnosis and treatment of children with pneumonia. Ultrasound examination revealed pulmonary consolidation in more than 70% of patients with radiographic community-acquired pneumonia, but gave false negative results in 26.5% of cases. Longitudinal results from some authors support the role of USG in the surveillance of detectable lesions. In summary, USG should be considered as an additional tool for monitoring pneumonia rather than as a primary imaging modality. Digital radiography (CheXGAT) is considered more sensitive, reliable, and highly specific. Multislice computed tomography gives less radiation exposure to the child's body, and in addition, in relation to digital radiography, it is more sensitive, specific and reliable.

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