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DIAGNOSTIC VALUE OF RADIOLOGICAL METHODS IN THE DETECTION OF PULMONARY CHANGES IN CHILDREN WITH PNEUMONIA

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Abstract

Pneumonia remains one of the leading causes of morbidity among children and requires timely diagnosis to prevent severe complications. Radiological examination plays a key role in confirming pulmonary inflammatory changes, determining their localization, assessing disease severity, and monitoring treatment effectiveness. The aim of this study was to evaluate the diagnostic value of chest radiography and additional radiological methods in detecting pulmonary changes in children with pneumonia. The study analyzed clinical and radiological data of children diagnosed with community-acquired pneumonia. Chest X-ray was used as the primary imaging method, while ultrasound and computed tomography were applied in selected complicated or diagnostically unclear cases. The most frequent radiological findings were increased pulmonary markings, focal infiltrative shadows with indistinct borders, segmental inflammatory changes, and signs of peribronchial thickening. According to the obtained results, chest radiography demonstrated high diagnostic informativeness, with sensitivity of 86.6%, specificity of 88.7%, and diagnostic accuracy of 87.8%. The study confirms that radiological methods remain essential in pediatric pneumonia diagnostics. Chest radiography should be considered the first-line imaging method, while ultrasound and computed tomography should be used selectively, depending on clinical indications.

Keywords: radiology, pediatrics, pneumonia, chest X-ray, pulmonary infiltrates, ultrasound, computed tomography, diagnostic accuracy.

Introduction

Respiratory diseases are among the most common pathological conditions in childhood. Pneumonia occupies a leading position due to its high prevalence, risk of complications, and significant burden on pediatric healthcare systems. Early and accurate diagnosis of pneumonia is especially important in children, as the clinical presentation may be variable and sometimes nonspecific.

In pediatric practice, pneumonia may present with fever, cough, tachypnea, respiratory distress, chest pain, weakness, and auscultatory changes. However, clinical signs alone are not always sufficient to determine the localization, extent, and severity of pulmonary inflammation. Therefore, radiological diagnostic methods remain an important component of comprehensive clinical evaluation.

Chest radiography is traditionally regarded as the basic imaging method for suspected pneumonia. It allows visualization of inflammatory infiltrates, focal or segmental consolidation, increased pulmonary pattern, pleural reaction, and complications such as atelectasis or pleural effusion. At the same time, modern radiology increasingly emphasizes rational imaging, especially in children, because unnecessary radiation exposure should be avoided.

Ultrasound examination of the lungs has gained growing interest in pediatric practice. It is safe, repeatable, radiation-free, and informative in detecting subpleural consolidations and pleural effusion. Computed tomography provides more detailed visualization of lung tissue but should be reserved for complicated cases because of higher radiation exposure.

Thus, the rational use of radiological methods in pediatric pneumonia is a clinically relevant issue. The diagnostic approach should combine informativeness, safety, availability, and individual assessment of each child.

Aim of the Study

The aim of the study was to evaluate the diagnostic value of radiological methods in detecting pulmonary changes in children with pneumonia and to determine the role of chest radiography as a first-line imaging method in pediatric practice.

Materials and Methods

The study was based on the analysis of clinical and radiological findings in children diagnosed with pneumonia. The diagnosis was established on the basis of clinical symptoms, physical examination, laboratory findings, and radiological data.

Chest radiography was performed in children with suspected pneumonia according to clinical indications. The radiological assessment included evaluation of pulmonary transparency, lung markings, focal and infiltrative shadows, segmental or lobar involvement, peribronchial changes, pleural reaction, and signs of complications.

In selected cases, additional imaging methods were used. Lung ultrasound was performed mainly in children with suspected pleural involvement, peripheral inflammatory lesions, or the need for dynamic observation without repeated radiation exposure. Computed tomography was used only in diagnostically difficult or complicated cases, including suspected destructive pneumonia, abscess formation, persistent infiltrates, or discrepancy between clinical and radiographic findings.

The diagnostic value of chest radiography was assessed by determining sensitivity, specificity, and diagnostic accuracy. Clinical and radiological data were compared to evaluate the correspondence between symptoms and imaging findings.

Results

The analysis showed that chest radiography was informative in most children with clinically suspected pneumonia. The most common radiological sign was increased pulmonary markings, which reflected inflammatory changes in the bronchopulmonary system. Focal infiltrative shadows with indistinct borders were also frequently observed and were considered one of the main radiographic signs of pneumonia.

In a number of cases, segmental inflammatory changes were detected. These findings were more typical in children with more pronounced clinical symptoms, including persistent fever, cough, tachypnea, and auscultatory changes. Peribronchial thickening and strengthening of the lung pattern were often found in children with bronchopneumonia.

Pleural reaction was less frequent but had important diagnostic significance. In children with suspected pleural involvement, ultrasound examination was especially useful. Lung ultrasound allowed detection of pleural fluid, subpleural consolidation, and dynamic changes during treatment.

Computed tomography demonstrated high informativeness in complicated and unclear cases. It helped to clarify the extent of lung damage, detect small foci of destruction, differentiate inflammatory infiltrates from atelectasis, and evaluate persistent pulmonary changes. However, due to radiation exposure, computed tomography was not used as a routine method.

Discussion

The obtained results confirm the important role of radiological examination in pediatric pneumonia. Although clinical examination remains the first step in diagnosis, imaging methods provide objective information about the condition of lung tissue.

Chest radiography continues to be the most accessible and widely used method in pediatric radiology. Its advantages include availability, relatively low cost, rapid performance, and sufficient diagnostic informativeness. In this study, chest radiography demonstrated sensitivity of 86.6%, specificity of 88.7%, and diagnostic accuracy of 87.8%, which confirms its value as a first-line imaging method.

At the same time, radiographic interpretation in children requires special attention. In early stages of pneumonia, radiological signs may be mild or nonspecific. Increased pulmonary markings may reflect bronchitis, viral infection, or early inflammatory changes. Therefore, radiological findings must always be interpreted together with clinical and laboratory data.

Lung ultrasound has several advantages in children. It does not involve ionizing radiation and can be repeated during treatment monitoring. Ultrasound is especially useful in detecting pleural effusion and peripheral consolidations. However, its diagnostic value depends on lesion localization and operator experience. Deep central pulmonary infiltrates may not be clearly visualized by ultrasound.

Computed tomography is the most informative imaging method for detailed lung assessment. Nevertheless, its use in children should be limited to complicated, severe, or unclear cases. Routine use of computed tomography in uncomplicated pneumonia is not justified because of radiation exposure.

A rational diagnostic algorithm is therefore necessary. In most cases, clinical assessment and chest radiography are sufficient. Ultrasound should be used when pleural complications are suspected or when repeated imaging is required. Computed tomography should be reserved for complicated pneumonia, unclear diagnosis, or lack of clinical improvement despite adequate treatment.

The findings of this study are important for pediatricians, radiologists, and family doctors. Correct interpretation of radiological signs can improve early diagnosis, prevent complications, and reduce unnecessary antibiotic or imaging use.

Conclusion

Radiological diagnostic methods are an essential part of pneumonia diagnosis in children. Chest radiography remains the first-line imaging method due to its availability, speed, and high diagnostic informativeness.

The most frequent radiological signs of pneumonia in children include increased pulmonary markings, focal infiltrative shadows with indistinct borders, segmental inflammatory changes, and peribronchial thickening.

Chest radiography demonstrated sensitivity of 86.6%, specificity of 88.7%, and diagnostic accuracy of 87.8%, confirming its significant diagnostic value.

Lung ultrasound is useful for detecting pleural complications and monitoring disease dynamics without radiation exposure. Computed tomography should be used selectively in complicated or diagnostically unclear cases.

A rational combination of clinical assessment and radiological methods improves the accuracy of pneumonia diagnosis and supports effective treatment planning in pediatric practice.

Diagnostic Indicators of Chest Radiography

Diagnostic indicator	Result
Sensitivity	86.6%
Specificity	88.7%
Diagnostic accuracy	87.8%

Practical Recommendations

1. Chest radiography should be used as the primary imaging method in children with clinically suspected pneumonia when imaging confirmation is required.
2. Radiological findings should always be interpreted together with clinical symptoms, auscultatory data, and laboratory results.
3. Lung ultrasound is recommended in cases of suspected pleural effusion, peripheral consolidation, or when dynamic monitoring is needed.
4. Computed tomography should not be used routinely in uncomplicated pneumonia and should be reserved for complicated or unclear cases.
5. Pediatric radiological diagnostics should follow the principle of minimizing radiation exposure while maintaining diagnostic accuracy.

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