RADIOLOGICAL DIAGNOSIS OF PNEUMONIA: ROLE, TECHNIQUES, AND INTERPRETATION

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Abstract. *Radiological imaging plays a crucial role in the diagnosis, assessment, and management of pneumonia. While clinical evaluation is essential, imaging confirms the presence of lung parenchymal involvement, detects complications, and guides treatment decisions. This article discusses various imaging modalities used in pneumonia, including chest radiography, computed tomography (CT), lung ultrasound, and their diagnostic value in both pediatric and adult populations.*

Keywords*: Pneumonia, radiology, chest X-ray, CT scan, lung ultrasound, imaging diagnosis.*

РЕНТГЕНОЛОГИЧЕСКАЯ ДИАГНОСТИКА ПНЕВМОНИИ: РОЛЬ, МЕТОДЫ И ИНТЕРПРЕТАЦИЯ

Аннотация. *Рентгеновская визуализация играет решающую роль в диагностике, оценке и лечении пневмонии. Хотя клиническая оценка имеет важное значение, визуализация подтверждает наличие поражения паренхимы легких, выявляет осложнения и направляет решения о лечении. В этой статье обсуждаются различные методы визуализации, используемые при пневмонии, включая рентгенографию грудной клетки, компьютерную томографию (КТ), УЗИ легких, и их диагностическая ценность как для детей, так и для взрослых.*

Ключевые слова: *пневмония, радиология, рентгенография грудной клетки, КТ, УЗИ легких, диагностика с помощью визуализации.*

Introduction

Pneumonia is a common and potentially serious infection involving the lung parenchyma. While clinical signs such as fever, cough, and dyspnea are primary indicators, radiological imaging remains a cornerstone in confirming the diagnosis, especially in moderate-to-severe cases, atypical presentations, or when complications are suspected.

The most commonly used imaging techniques include:

Chest X-ray (CXR)

Computed Tomography (CT)

Lung Ultrasound (LUS)

Each modality has specific indications and diagnostic advantages depending on the clinical setting.

Chest X-Ray (CXR)

Role and Indications

First-line imaging modality in suspected pneumonia.

Confirms presence of alveolar or interstitial infiltrates.

Helps differentiate lobar pneumonia, bronchopneumonia, and interstitial pneumonia.

Detects complications such as pleural effusion or abscess.

Typical Radiographic Findings

Lobar pneumonia: homogeneous consolidation with air bronchograms.

Bronchopneumonia: patchy, peribronchial infiltrates in multiple lobes.

Interstitial pneumonia: reticular or ground-glass opacities.

Complications: pleural effusion (blunted costophrenic angle), empyema (loculated fluid), cavitation.

Limitations

Low sensitivity in early disease stages.

Poor specificity in differentiating pneumonia from other conditions (e.g., pulmonary edema, malignancy).

Radiation exposure, though minimal.

Computed Tomography (CT)

Indications

Inconclusive chest X-ray findings.

Severe or atypical pneumonia not responding to treatment.

Suspected complications (e.g., lung abscess, empyema, necrotizing pneumonia).

Immunocompromised patients.

Advantages

High-resolution images of lung parenchyma.

Better delineation of infiltrates, cavitations, nodules.

Superior in detecting early interstitial involvement or subtle consolidations.

Disadvantages

Higher radiation dose.

Expensive and less available in resource-limited settings.

Requires patient cooperation or sedation in children.

Lung Ultrasound (LUS)

Emerging Role in Pneumonia

Increasingly used, especially in pediatric and intensive care settings.

Non-invasive, bedside, radiation-free tool.

Ultrasound Findings in Pneumonia

Subpleural consolidations with dynamic air bronchograms.

B-lines (interstitial syndrome).

Pleural line abnormalities.

Pleural effusion.

Advantages

Ideal for children and pregnant women.

Useful in critically ill patients who cannot be moved.

High sensitivity and specificity in experienced hands.

Comparison of Modalities

Imaging Modality	Sensitivity	Radiation	Portability	Ideal Use Case
Chest X-ray	Moderate	Low	Moderate	Initial diagnosis
CT Scan	High	High	No	Complex cases, complications
Lung Ultrasound	High	None	Yes	Bedside assessment, pediatrics

Special Considerations in Pediatrics

CXR is usually sufficient for diagnosis in typical cases.

LUS is preferred in neonates and infants due to safety and bedside availability.

CT is reserved for severe, non-resolving pneumonia or when structural abnormalities are suspected.

Conclusion

Radiological imaging is a vital component in the diagnosis and management of pneumonia. While chest X-ray remains the mainstay of initial imaging, CT and lung ultrasound provide valuable supplementary information, especially in complex or critical cases. A tailored approach, considering patient age, clinical presentation, and available resources, is essential for optimal diagnostic accuracy and patient care.

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