

THE USE OF ULTRASOUND IN THE DIAGNOSIS OF DESTRUCTIVE PNEUMONIA IN CHILDREN

U. Kh. Khayitov

Samarkand State Medical University, Samarkand, Republic of Uzbekistan

Received: 2026-04-09 · Accepted: 2026-05-26

Abstract

Background: Ultrasound diagnostics is one of the most rapidly developing methods of clinical patient examination. For many years, it was widely believed that lung ultrasound was unfeasible due to the presence of air, which acts as an insurmountable barrier to ultrasound waves.

Materials and Methods: We observed 148 patients with various forms of acute destructive pneumonia admitted to the purulent-septic department of the Regional Children's Multidisciplinary Medical Center between 2015 and 2025.

Results: The study demonstrated that the accuracy of ultrasound diagnostics in cases of pyothorax and pyopneumothorax reached 100%. A crucial practical advantage of utilizing ultrasound in pleural cavity examinations is its ability to determine the optimal puncture site. Furthermore, destructive foci are detected via ultrasound earlier than through conventional radiography.

Conclusion: These findings provide a strong rationale for recommending the widespread implementation of ultrasound as a primary screening and diagnostic tool for managing destructive pneumonia in pediatric patients.

Keywords: children, destructive pneumonia, ultrasound diagnostics, pyothorax, pyopneumothorax.

1. Introduction

In recent years, the majority of clinicians have recognized the significance of ultrasound in the comprehensive evaluation of pediatric patients presenting with both abdominal and thoracic diseases. For many years, it was widely believed that lung ultrasound (LUS) was unfeasible due to the presence of air, which acts as an insurmountable barrier to ultrasound waves. However, the development of pathological processes in the pleura and lungs creates conditions that reduce pulmonary aeration in specific areas. This gives rise to the so-called "acoustic window," which enables investigators to obtain reliable diagnostic data and perform both diagnostic and therapeutic interventions in the affected region.

Currently, the rate of diagnostic and tactical errors in recognizing pleuropulmonary complications of destructive pneumonia in clinical practice remains substantially high. The problem of community-acquired pneumonia (CAP) in children retains its critical relevance today, primarily due to the persistently high incidence rates. Pulmonary complications of community-acquired pneumonia

include pleural empyema, abscesses, necrotizing or destructive pneumonia, bronchopleural fistula formation, and acute respiratory distress syndrome (ARDS). According to various authors, the incidence of purulent-destructive complications in community-acquired pneumonia ranges from 7% to 15%. Mortality rates in such cases vary between 8.7% and 18.5%, representing one of the highest mortality figures among all purulent-septic diseases.

Aim of the Study. To improve the diagnostic and treatment outcomes of destructive pneumonia in children.

2. Materials and Methods

We observed 148 patients with various forms of acute destructive pneumonia admitted to the purulent-septic department of the Regional Children's Multidisciplinary Medical Center between 2015 and 2025. Among them, 117 children aged from 1 month to 18 years presented with pleuropulmonary complications (72 with pyothorax and 45 with pyopneumothorax). The age distribution of the patients was as follows: 58 (49%) children were aged from 1 month to 3 years, 29 (25%) were aged 3 to 7 years, 16 (14%) were aged 7 to 11 years, and 14 (12%) were aged 11 to 18 years.

Linear and convex probes ranging from 3.7 to 7.5 MHz were utilized for the evaluation of the lungs and pleural cavity, selected depending on the child's age as well as the size and depth of the pathological focus.

Patients were examined in both supine (lying) and erect (standing) positions. Standard anatomical and topographic lines of the chest wall served as reference points for probe placement. The anterior and lateral surfaces of the chest wall were examined first, followed by a step-by-step intercostal space evaluation, moving the transducer from top to bottom. The basal segments of the lungs and the costodiaphragmatic recesses (sinuses) were scanned through the acoustic windows of the liver and spleen. Based on these examinations, the specific characteristics of echographic changes in the lungs and pleura were determined for various forms of destructive pneumonia.

3. Results

Pleural complications were detected radiographically in 90% of cases. In contrast, ultrasound (US) detected the presence of pleural fluid in 100% of instances; moreover, 109 patients had an effusion volume exceeding 100 mL, while 8 patients presented with a minor amount (25–50 mL) that was not visualized radiographically. Echographic findings were correlated with clinical and radiographic results in all 117 patients; computed tomography (CT) scans were additionally performed in 10 patients for further clarification and differential diagnosis.

4. Discussion

During ultrasound scanning of a free pleural cavity, the effusion typically formed an echonegative zone and was clearly traced as anechoic areas, resembling an amoeboid pattern. Separation of the parietal and visceral pleural layers was clearly visualized, with the width of the separation determined by the volume of the pleural effusion. Pleural effusion accompanied by fibrinous deposits presented as multiple linear echostructures of varying thickness, caused by the precipitation of fibrin strands.

5. Conclusion

Thus, the results of this study demonstrated that the accuracy of ultrasound diagnostics in cases of pyothorax and pyopneumothorax is 100%. A vital practical aspect of utilizing ultrasound in pleural cavity examinations is its ability to determine the optimal site for thoracocentesis (puncture). Destructive foci are diagnosed via ultrasound earlier than by conventional radiography. All these findings provide a solid foundation for recommending the widespread implementation of ultrasound as a screening method and a primary tool for detecting pathological changes in the pleural cavity.

References

1. Beloborodova NV, Tarakanov VA, Barova NK. Analysis of the causes of destructive pneumonia in children and opportunities for optimization of antimicrobial therapy. *Pediatrics. Journal named after G.N. Speransky*. 2016;95(2):66–71. (In Russ.)
2. Vecherkin VA, Toma DA, Ptitsyn VA, Koryashkin PV. Destructive pneumonia in children. *Russian*

Journal of Pediatric Surgery, Anesthesia and Intensive Care. 2019;9(4):108–115. (In Russ.)

3. Mashkov AE, Elin LM, Slesarev VV, Filyushkin YuN. The role of superinfection in the etiological structure of acute purulent destructive pneumonia in children. *Pediatric Surgery (Detskaya Khirurgiya)*. 2018;22(5):241–245. (In Russ.) doi: 10.18821/1560-9510-2018-22-5-241-245

4. Tolstova EM, Besedina MV, Zaytseva OV, Zaytseva NS, Yatsyshina SB, Khaspekov DV, Olkhova EB, Turishchev IV, Sholokhova NA, Galeev PP, Belyaeva TYu. Pathogenetic mechanisms of destructive pneumonia development in children. Clinical observation with literature review. *Russian Journal of Woman and Child Health*. 2023;6(3):310–319. (In Russ.) doi: 10.32364/2618-8430-2023-6-3-15

5. Tolstova EM, Besedina MV, Elkina MA, Zaytseva OV, Yatsyshina SB, Zaytseva NS, Kuzina SR, Khaspekov DV, Turishchev IV, Belyaeva TYu. Etiology and clinical characteristics of destructive pneumonia in children. *Infectious Diseases: News, Opinions, Training*. 2024;13(1):42–51. (In Russ.) doi: 10.33029/2305-3496-2024-13-1-42-51

6. Khakimova RA, Khakimov NS, Ibragimova IV. The role of ultrasound examination in the diagnosis of hydrothorax. *New Day in Medicine*. 2019;4(4):335–337. (In Russ.)

7. Masters I, Isles AF, Grimwood K. Necrotizing pneumonia: an emerging problem in children? *Pneumonia*. 2017;9:11. doi: 10.1186/s41479-017-0035-0

8. Rodrigues CMC, Groves H. Community-acquired pneumonia in children: the challenges of microbiological diagnosis. *J Clin Microbiol*. 2018;56(3):e01318-17. doi: 10.1128/JCM.01318-17



Indexed & Abstracted In

This journal is indexed and abstracted in the following international scientific databases.



Google Scholar



ISSN



ORCID



CiteFactor



ResearchBib



DOI



Zenodo



Crossref

Crossref



Grammarly

Article Verification

Scan the QR code to verify the authenticity of this article

DOI: 10.4103/aams.0498