ULTRASONIC DIAGNOSIS OF COMPLICATED PNEUMONIA IN CHILDREN

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ABSTRACT

In Uzbekistan, the incidence of pneumonia and its complications in childhood remains high. Considering that hospitalization rates for complicated forms of pneumonia remain high both in Uzbekistan and other countries, the imperfections of timely diagnosis and prevention methods for this disease become evident.

Target. Improving the diagnosis of pneumonia complications in children through the use of ultrasound scanning in a comprehensive clinical and radiological examination of patients.
Materials and methods of research. The study is based on the results of a comprehensive examination of 73 children with complicated pneumonia, conducted at the Tashkent Pediatric Medical Institute (TashPMI). Chest ultrasound examinations were performed using Acuson (USA) and Sonoscape 5000 (China) ultrasound machines with linear, convex, and sector transducers with frequencies of 3.5-5-7.5 MHz.
Results. We studied the informativeness of ultrasound imaging in pulmonary complications of pneumonia.
Of 47 patients with pulmonary complications of pneumonia, 32 children were diagnosed with pulmonary destruction and lung abscess, 32 with exudative pleurisy and pleural empyema (pyothorax), and 25 with pneumothorax and pyopneumothorax.

A comprehensive examination revealed pulmonary destruction in 29 patients. These were characterized by the presence of anechoic inclusions in the pulmonary infiltrate, rounded (10 patients) and irregularly shaped (14 patients), with smooth and irregular contours, ranging in size from 8 to 14 mm, representing foci of destructive lung tissue damage. In cases of suppuration, several small areas of increased echogenicity appeared in the airless portion of the lung. Anechoic inclusions with fuzzy margins, surrounded by an echo-positive rim, subsequently developed in the center. These areas were often multiple and represented developing foci of destruction.

This echographic pattern correlated with negative clinical progression.

Lung abscesses in 5 patients were initially identified echographically as an airless area of lung parenchyma with weakened or absent vascular markings (avascular). Subsequently, an area of decreased lung tissue echogenicity (destructive changes) appeared within the pulmonary infiltrate, acquiring clear contours over several days. Its contents became anechoic, indicating abscess formation. Large foci of lung tissue destruction were always accompanied by pleural

complications.

Using ultrasound, we visually tracked the echographic progression of abscess formation and identified four echographic stages of lung abscess formation. At the first stage, destruction of the lung parenchyma was observed; the second stage of formation (non-draining lung abscess) was visualized as an anechoic rounded formation with clear, smooth contours and an echogenic suspension in the lumen (pus). Ultrasound visualization of abscesses draining into the bronchus (the third stage of formation) became significantly difficult due to the presence of air in it, which has a shielding effect. The stage of abscess resolution was characterized by complete release of the lesion from pus and obliteration of the cavity with subsequent resorption. The accuracy of echography in the diagnosis of pulmonary destruction and lung abscess, according to our data, was 96.6 ± 3.4%; and plain radiography, respectively, 93.1 ± 4.9%.
One of the objectives of this study was to examine the sonographic semiotics of pleurisy and pleural empyema in children (29 cases).
Of the 73 patients with complicated pneumonia, exudative pleurisy was observed in 9 (12.3%), and pleural empyema (pyothorax) in 20 (27.4%) children.
The following were identified: minimal (radiographically negative) pleurisy (up to 50 ml) – in 10 cases; small (from 50 to 150 ml) – in 10 cases; moderate (from 150 to 500 ml) – in 8 cases; and large (from 500 ml to 1 liter) – in one patient.

The main sonographic sign of exudative pleurisy was the separation of two signals from the pleural sheets by an anechoic area of a homogeneous or heterogeneous structure, representing the contents of the pleural cavity. The width of the area depended on the amount of fluid in a given area of the pleural cavity. The minimum amount of fluid in the pleural sinus accessible to ultrasound imaging was 5 ml.
A purulent form of exudative pleurisy—pleural empyema (pyothorax)—was diagnosed in 20 patients. Depending on its duration, it had various echographic features.
A comparative analysis of radiographic and ultrasound data revealed that the minimum volume of pleural effusion detectable by ultrasound is 5 ml, while radiographic data reveals 50-100 ml, demonstrating the high resolution capabilities of ultrasound. The information yield of plain radiography for small amounts of pleural effusion does not exceed 13.3%. The accuracy of ultrasound in diagnosing exudative pleurisy and pleural empyema was 100.0%, while that of radiographic examination was 86.2%+6.4%.
In 15 patients, a comprehensive examination revealed pathological air pockets in the pleural cavity: pyopneumothorax and pneumothorax. In pyopneumothorax, we visualized air in the pleural cavity, along with anechoic fluid, as individual bubbles represented by short linear or arcuate hyperechoic signals.

Due to the presence of air, which impedes ultrasound propagation, the accuracy of ultrasound, according to our data, was 85.0%+8.0%, while that of plain radiography was 100.0%. Radiographic examinations have greater advantages than ultrasound and are the preferred method for recognizing this pathology.
Conclusions. Thus, the ultrasound semiotics of complicated pneumonia in children is detailed depending on the early signs of accumulation of effusion in the pleural sinuses, forming abscess, empyema, facilitating timely diagnosis and correction of treatment and health measures.

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