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Lung Ultrasound – Optimal Diagnostic Tool for Intensivists

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Editorial

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Advantages of Ultrasound

Lung diseases are the most common pathological conditions that are very widespread in the world. These diseases include tumors, chronic obstructive pulmonary disease, idiopathic pulmonary fibrosis, and inflammatory diseases. For a certain number of lung diseases, an accurate morphological diagnosis is necessary, and it most often involves radiography of the lungs and computerized tomography. These radiological diagnostic methods use ionizing radiation and for this reason lead to an increased likelihood of developing cancer later in life. In addition, computed tomography is very expensive and it is not possible to perform it in severe patients in whom transport from the intensive care unit is not possible. Also, with this method, it is not possible to optimally monitor the patient's hemodynamic condition, which is important in the therapeutic approach. It is for these reasons that ultrasound has become one of the diagnostic methods of choice, primarily in children and adolescents, pregnant women and those who require repeated imaging in a short period of time. Ultrasound is a simple, safe and relatively inexpensive examination method that can use portable devices and can be performed in intensive care units. Lung ultrasound can be used as a complementary examination technique to radiography and computed tomography. The position that ultrasound cannot examine the lungs due to the presence of gas has been overcome and converted into the fact that precisely the artifacts of gas origin are useful for diagnosing pathological changes in the lungs and pleura [1].

Basic Principles

In a normally aerated lung, the only structure directly visualized is actually the pleura. It is represented by one horizontal hyperechoic line that can directly correspond to the pleura or the summation of the acoustic phenomena of the thoracic wall and the lungs, that is, two structures that surround the pleura. This line is called the pleural line and it moves horizontally in accordance with respirations - this phenomenon is called lung sliding. This phenomenon forms another one that is significant for the detection of good lung aeration - these are A lines that are parallel to the pleural line, are localized in the projection of the lung and are at the same distance from each other. They are the result of horizontal reverberations, while vertical reverberations can also occur. B lines belong to the family of cometail artifacts that lie from the pleural line, extend vertically to the bottom of the ultrasound image, interrupt A lines and are dynamically oriented in accordance with the horizontal movements of the pleural line. The number of B lines is directly correlated with lung density, that is, with the amount of transudate, exudate, blood, collagen and other content - an increased number of B lines occurs in case of a reduced amount of gas in the lungs and corresponds to interstitial syndrome. In the case of almost complete reduction of gas in the lungs, an excellent acoustic window occurs and lung consolidation can be directly visualized. Sometimes the limits of ultrasound due to a large amount of gas in the lungs become a paradoxical diagnostic advantage - in the case of the presence of gas between the thoracic wall and the pleura, as in the case of pneumothorax, they lead to the absence of the lung sliding phenomenon, which is of great diagnostic importance [2].

BLUE Protocol and Interstitial Syndrome

One of the most important roles of lung ultrasound is in the diagnosis of interstitial syndrome. In intensive care units, it is of important clinical importance to make a diagnosis of interstitial syndrome. The diagnosis of interstitial syndrome

can be made relatively easily by counting B lines in the intercostal space. More than three B lines in one intercostal space is the basic criterion for interstitial syndrome and therefore they correlate with Kerley's B lines. According to certain criteria, B lines are detected only in the anterolateral parts of the lungs, while those in the posterior parts of the lungs are considered to be due to the effect of gravity [3].

In order to standardize the lung ultrasound protocol, the BLUE protocol was defined, which takes less than three minutes to perform. It enables the diagnosis of pulmonary edema, pneumonia, chronic obstructive pulmonary disease and pneumothorax, and if combined with echocardiography, which can quickly and accurately detect acute right ventricular dilatation and pericardial effusion, a definitive decision about the patient's volemia status can be made [4].

Conclusion for Intensivists

Lung ultrasound is not a simple diagnostic procedure - its performance requires optimal education. Some cases can be very difficult to interpretation, even for experts. There are also objective limits to the procedure such as massive subcutaneous emphysema. For these reasons, standardization of protocol and interpretation is necessary to minimize the possibility of errors when this method will be of great use in intensive care units.

Conflict of Interest: Not applicable.

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