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**EMERGING ROLES FOR TRANSTHORACIC ULTRASONOGRAPHY IN PULMONARY DISEASES**

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Transthoracic ultrasonographic (TUS) examination of the lung and pleura can be performed using conventional ultrasound equipment with linear and convex probes of 3.5-7.5 MHz, or even 10.0 MHz, using the intercostal spaces as an acoustic window. In some cases, this can be supplemented by the use of color Doppler and ultrasound contrast agents.

Most important, it must always be kept in mind that the diagnostic information provided by TUS is limited by the total reflection of sound waves by tissues that contain air and by the absorption of sound waves by bony structures. It follows that lesions within the aerated lung not in contact with the pleura, and subscapular, paravertebral, retrosternal or rear mediastinal lesions cannot be visualized with TUS. Likewise, TUS cannot provide any useful information in the presence of subcutaneous emphysema. However, a total of about 70% of the pleural surface is accessible to ultrasound examination. To perform posterior scans of the thorax, the patient should stay in a sitting or lateral position, while to perform anterior scans, the patient can be in a supine or sitting position. For optimal examination of the anterior and posterior parts of the chest, the arms of the patient should be elevated and the hands clasped behind the neck. The probe should be moved in longitudinal and transverse directions to visualize the pleura and the lung surface through the intercostal spaces, thereby avoiding the ribs.

The pleural band of reflections that can be readily delimited from the soft tissues of the thoracic wall consists of several components (the endothoracic fascia, parietal and visceral pleura, and interface reflections to aerated lung), and is created mainly by high-amplitude echoes at the boundary between the pleura and the aerated lung. Distal to this band of reflection, a largely homogeneous area of reverberation echoes is visible, which is elicited by total reflection of the sound waves at the lung surface.Based on these concepts, the normal artefacts originating from the lung and pleura should be well known, before approaching the study of pleural and pulmonary diseases. Indeed, respiration-dependent movement of the visceral pleura and lung surface with respect to the parietal pleura and chest wall (“gliding sign” or “lung sliding”) can be easily identified by real-time sonography, particularly in healthy lungs. Moreover, intensive band-like reverberation echoes (reverberation and comet-tail artefacts) evoked during breathing movements can be seen at the boundary between the pleura and the ventilated lung tissue. As a consequence, it is assumed that reverberation and comet-tail artefacts can be evoked only at the boundary between the visceral pleura and the normally aerated lung. Comet-tail artefacts are generally sporadic in healthy lungs, and become more frequent in diffuse parenchymal diseases.These common artefacts can appear as multiple parallel transversal echoes departing from the pleural line (reverberation artefacts, or as some discrete thickening comet-tail-like echoes originating from the pleura (comet-tail artefacts , depending on the difference in acoustic impedance between the pleura and the tissue nearby. Moreover, when a fluid component is present in the pulmonary alveoli or interalveolar septa near the pleura, the so called ring-down vertical artefacts can be evoked as a series of hyperechoic narrow-based bands or streaks spreading from the pleural line into the lung surface. It is assumed that the ring-down artefacts are frequent in interstitial lung diseases when a fluid collection is present (e.g. pulmonary edema)

The main pleural diseases are divided into pleural effusion, pneumothorax, and focal solid pleural lesions.

Conclusions. TUS is gaining increasing importance in the diagnostic work-up of pleural pathology, and in recent years, several studies have dealt with its usefulness and advantages in this setting. Besides the lack of radiation exposure, it appears to be as effective as chest radiography in detecting or excluding pneumothorax, is superior to chest radiography in detecting and characterizing pleural effusion, and is considered the method of choice to guide pleural fluid aspiration and percutaneous biopsy of pleural-based lesions. Moreover, unlike radiological methods, portable ultrasound devices allow examination at almost any location, and such an advantage can play an important role in emergency departments and intensive care units.