References

(Accepted for publication December 30, 2011)

Transthoracic Ultrasound for Diagnosing Pneumothorax

To the Editor:
I read with interest the case report on intraoperative pneumothorax and transthoracic ultrasound by Ueda et al.1

Thoracic computed tomography should be regarded as the gold standard rather than chest radiography as suggested by the authors.2–4

The statement “because air does not reflect ultrasound” is puzzling. Ultrasound is reflected at the interface between two media with differing acoustic impedances, governed by the equation

$$R = \frac{100(Z2 - Z1)^2}{(Z2 + Z1)^2}$$

where R is the percentage of ultrasound reflected and Z1 and Z2 are the acoustic impedances of the respective media.

Because the acoustic impedance of air is so low in comparison with soft tissue, ultrasound is more or less completely reflected at the air-tissue interface and cannot penetrate beyond the surface of the lung. This raises two important points: first, that by removing the air in the lung, e.g., atelectasis, or replacing it with fluid, e.g., consolidation, a tissue image of the lung can be created; and second, only those lesions that reach the surface of the lung can be imaged. This leads to the labeling of figure 2 in the case report where the ultrasound image labeled lung parenchyma is in fact artifact and not a tissue image of the lung parenchyma. The object labeled rib is most likely costal cartilage because normal ribs are thick enough to prevent ultrasound penetrating them and the pleural line should not be visible below. This is not the case with costal cartilage where the pleural line is easily seen below it. With high-resolution probes it is sometimes possible to delineate both the visceral and parietal pleura with a small space between the pleural gap.5 This appears to be the case in figure 2, in which the deeper and thicker hyperechoic line labeled parietal and visceral pleura most likely represents the visceral pleura-lung interface, above which is a hyperechoic layer, the pleural gap followed by a thinner, slightly less hyperechoic line, the parietal pleura. When air is in the pleural space, the visceral pleura will not be visible through it and the hyperechoic line represents the parietal pleura-air interface.

Andrew Verniquet, M.D., Central Health-James Paton Memorial Hospital, Gander, Newfoundland, Canada. andrewverniquet@hotmail.com

References

(Accepted for publication December 30, 2011)

In Reply:
Thank you for your interest in our case report.1 The following are replies to Dr. Omar et al. and to Dr. Verniquet.

Dr. Omar et al. offer several important considerations regarding occult pneumothorax in trauma patients. However, our operating room patient population differs because most of these cases are elective operations. In case 1 (elective Nissen fundoplication), the etiology of pneumothorax was surgical entry into the pleural space causing lung collapse, not tension pneumothorax. A diagnostic pleural tap may not have yielded a rush of air and may have failed as a test for pneumothorax. Other circumstances (such as mucous plug) can cause low oximeter saturation, high airway pressures, and decreased breath sounds that resemble pneumothorax. Here, an unnecessary pleural tap could potentially make circumstances worse. If the lung-sliding sign was appreciated, the diagnostic tap would have been avoided and other differential diagnoses could be advanced. A key advantage of ultrasound is its ability to noninvasively contribute to the diagnosis.