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LETTER TO THE EDITOR

Pneumothorax: between the beach and the stratosphere

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TO THE EDITOR:

Thoracic ultrasound (US) is an excellent diagnostic tool that is capable of characterizing a broad spectrum of diseases, presenting therapeutic and prognostic applicabilities, even regarding intraoperative approaches.(1-3) Great advances have been made in imaging acquisition and processing, as well as in US equipment portability.(1) The US method is dynamic and highly available; ionizing radiation is absent, and it dispenses with patient transport or with the mobilization of an entire multidisciplinary team.(1,4)

Thoracic US is preferably performed by combining high-frequency linear transducers and low-frequency convex transducers (3-5 MHz) with the patient in the supine position for scanning the intercostal spaces; for the evaluation of dorsal areas, patients can be mobilized in bed.(1) In the context of trauma or unstable patients, US is an auxiliary tool in the diagnosis of pneumothorax and hemothorax.(2)

The US echo signal of the normal pleura is a hyperechoic line that slides in synchrony with breathing. From it, artifact lines can be visualized; we cite, as examples, A-lines, which are equidistant, horizontal, and parallel to the echo signal of the pleura, representing reverberation artifacts; and B-lines, which are vertical, perpendicular to the echo signal of the pleura, with the appearance of a comet tail (representing the interlobular septa), which move along with the pleural line.(1)

In the context of pneumothorax, we can mention some classical criteria for its diagnosis(1): no visualization of the pulmonary movement with breathing, since air fills the pleural space and prevents the visualization of the movement of the pleural line; the lack of visualization of B-lines, since they emerge from the pleural line, admitting then that their presence discards the diagnosis of pneumothorax; the presence of the so-called "lung point", which represents the visualization of the aerated lung expanding at the site of pneumothorax.(1,2,5) In US M-mode, the area at the site of the pneumothorax demonstrates multiple horizontal bands of hyperechoic artifacts caused by the absence of lung movement. This appearance mimics a bar code (bar code sign) or even the stratospheric layer of Earth's atmosphere (stratosphere sign). In the normal lung, the M-mode study shows a

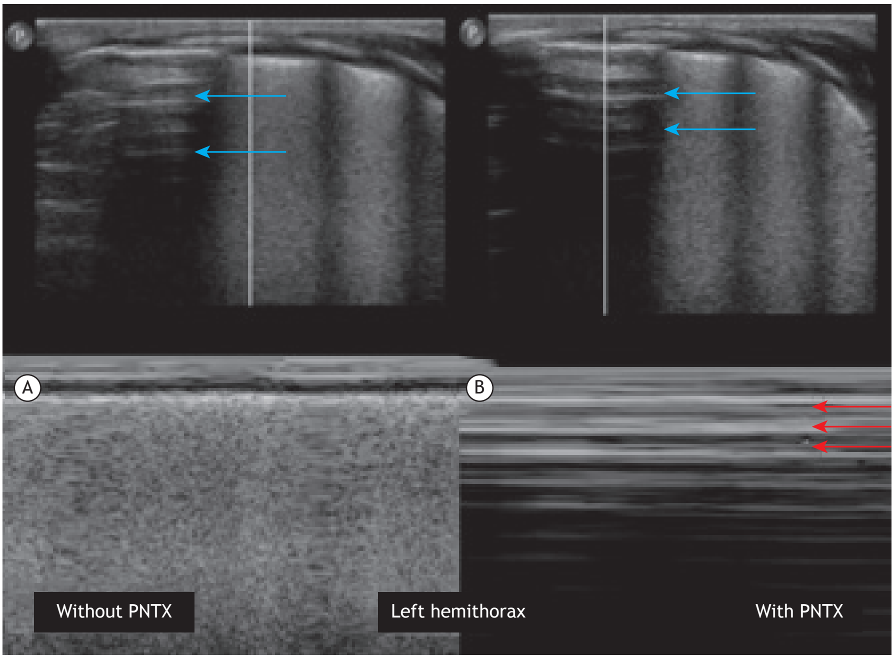

Figure 1. Pneumothorax (PNTX) in the left hemithorax: loss of normal pattern in B-mode. Note the absence of B-lines and the prominence of A-lines (blue arrows). During the examination, normal sliding between the lung pleura was no longer characterized. In M-mode, a stratosphere sign (B) is revealed, with multiple parallel lines equidistant to the echo signal of the pleura (red arrows) due to the absence of movement between the pleural surfaces due to gas interposition in the pleural space (PNTX). In M-mode, we found a pebble beach sign when examining the region of the hemithorax where there was no PNTX (A).

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movement pattern with an image similar to a beach landscape (pebble beach sign).[2]

Another classic and well-known indication of thoracic US is in the evaluation of pleural effusion, allowing the detection of contents that are not totally anechoic and which may denote a bloody or purulent component within the effusion. More than this, thoracic US has been already incorporated into the routine of thoracic drainage, avoiding various accidents that used to be inherent to that procedure.

To give an example, we report the case of a 31-week male infant (weight, 1,695 g) who presented with worsening of his respiratory condition and was submitted to US. On examination, pneumothorax was identified due to the loss of regular sliding lung signs, prominent A-lines, and absence of B-lines. In M-mode, the stratosphere sign was observed, with parallel and equidistant lines to the pleura (Figure 1). The lung point was also evidenced, representing the transition point between the region with and without pneumothorax, a finding considered to be 100% specific.[1,2] After the US diagnosis, water-seal drainage of the chest was carried out with good response.

Other uses of the thoracic US include pneumonia monitoring in order to evaluate the prognosis, risk of necrosis, and length hospital stay; fluid resuscitation protocols by means of the measurement of the dynamic variations of the vena cava diameter, especially in ICU patients; and initial evaluation of patients with respiratory distress, their evolution, and as a guidance to noninvasive alveolar recruitment maneuvers without using ionizing radiation.[3,4] Thoracic US is also a well-established method in the fluid administration limited by lung sonography (FALLS) protocol and in the bedside lung ultrasound in emergency (BLUE) protocol,[3,5] in which US is the central method and the definitive discriminator among the various types of shock. Besides pulmonary evaluation, thoracic US can also be used in the evaluation of the entire thoracic framework, showing excellent accuracy in identifying possible rib fractures, and as a tool for a brief overall assessment of the heart.

It is always important to highlight the fact that US offers a differential that few other imaging methods present: it is innocuous and dynamic; it can be done at bedside; and it avoids patient transport and its inherent risks. Most importantly, however, is the fact that there is no ionizing radiation, which allows it to be used as a control method with very few restrictions.

In summary, thoracic US is very advantageous and shows high accuracy in diagnosing pneumothorax; therefore, its use should be stimulated.

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