Interstitial syndrome-lung ultrasound B lines: a potential marker for pulmonary metastases? A case series

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ABSTRACT

Four patients presented to the Emergency Department with dyspnea and they underwent point-of-care ultrasound. Lung ultrasound showed a diffuse bilateral B-profile pattern-interstitial syndrome, they underwent contrast-enhanced computed tomography scan of thorax that showed multiple bilateral lung metastases. The detection, in a dyspneic patient, of a diffuse B-profile pattern not attributable to traditional interstitial syndrome conditions (pulmonary fibrosis, acute respiratory distress syndrome, acute pulmonary edema, interstitial pneumonia) could be indicative of multiple pulmonary metastases.

Introduction

Dyspnea is a common symptom in the general cancer population affecting the quality of life of these patients.[1] Most cases of dyspnea are directly due to cancer:[2] pulmonary parenchymal involvement (primary or metastatic), lymphangitic carcinomatosis, intrinsic or extrinsic airway obstruction by tumor, pleural tumor, pleural effusion, pericardial effusion, ascites, hepatomegaly, phrenic nerve paralysis, multiple tumor microemboli, pulmonary leukostasis, superior vena cava syndrome. The aim of this study is to evaluate the utility of lung ultrasound B lines as a potential marker for pulmonary metastases.

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Case 1

A 71-year-old man with history of myocardial infarction and a recent discovered laryngeal lesion (waiting for mass biopsy result) presented to the Emergency Department (ED) with severe resting dyspnea for the last fifteen days. At the time of admission, blood pressure was 120/70 mmHg, heart rate (HR) 59 bpm, regular, oxygen saturation was 87% (FiO_2 28%) and respiratory rate was 28 breaths/min. Chest auscultation revealed right basal crackles. Cardiovascular examination revealed normal cardiac rhythm, no murmurs, normal peripheral pulses and no edema. The electrocardiogram (ECG) was normal. Arterial blood gas analysis (FiO_2 28%) revealed respiratory alkalosis with mild metabolic alkalosis, reduced partial pressure of oxygen (48 mmHg), normal electrolytes and lactate levels. Blood tests revealed leukocytosis of 12,640 cells per mm^3, normal hemoglobin, renal and liver function.

Point-of-care ultrasound (POCUS), performed at admission in the emergency room with pocket size device, showed a diffuse bilateral B-profile pattern-interstitial syndrome in lung examination (Figures 1 and 2), left ventricle mildly dilated with mild reduced ejection fraction (EF 50%), normal left atrium size, normal right ventricular size and function. Following chest radiography revealed a diffuse bilateral reticulonodular interstitial pattern (Figure 3). The patient underwent contrast-enhanced computed tomography (CT) scan of thorax that showed multiple bilateral lung metastases (Figure 4).

Case 2

A 65-year-old man with a recent medical history of community-acquired pneumonia and no other relevant history, presented to the ED with resting dyspnea. At the time of admission blood pressure was 135/67 mmHg, HR 99 bpm, regular, oxygen saturation was 92% (FiO_2 21%) and respiratory rate was 24 breaths/min. Chest auscultation revealed abolished vesicular murmur at the right lung base. Cardiovascular examination revealed normal cardiac rhythm, no murmurs, normal peripheral pulses and no edema. The ECG was normal. Arterial blood gas analysis on room air revealed mild respiratory alkalosis with mild metabolic alkalosis, reduced partial pressure of oxygen (57 mmHg), normal electrolytes and lactate levels.

Results of blood tests showed a normal white blood cell count (8.540 cells per mm^3), normal hemoglobin, renal and liver function.

POCUS showed a right basal pleural effusion and a diffuse bilateral B-profile pattern-interstitial syndrome in lung examination, normal left and right ventricular size and function. Chest radiography revealed a right basal pleural effusion and a diffuse bilateral reticulonodular interstitial pattern. The patient underwent contrast-enhanced CT scan of thorax that showed an upper right lobe lesion (26×28 mm) suggestive of lung carcinoma and multiple bilateral lung metastases. The contrast-enhanced CT scan confirmed a right basal pleural effusion.

Case 3

A 78-year-old man with history of hypertension, presented to the ED with exercise dyspnea and dysphagia. At the time of admission blood pressure was 111/86 mmHg, HR 87 bpm, regular, oxygen saturation was 96% (FiO_2 21%) and respiratory rate was 18 breaths/min. Chest auscultation revealed right basal crackles. Cardiovascular examination revealed normal cardiac rhythm, no murmurs, normal peripheral pulses and no edema. The ECG was normal. Arterial blood gas analysis on room air revealed mild respiratory alkalosis, normal partial pressure of oxygen, electrolytes and lactate levels.

Results of blood tests showed a normal white blood cell count (8.830 cells per mm^3), normal hemoglobin, glomerular filtration rate was 44 mL/min/1.73 m^2.

POCUS showed a diffuse bilateral B-profile pattern-interstitial syndrome in lung examination, normal left ventricular size and function, normal left atrium size and right ventricular dilation. Chest radiography revealed a diffuse bilateral reticulonodular interstitial pattern and cardiomegaly. The patient underwent contrast-enhanced CT scan of thorax that showed multiple mediastinal lymphadenopathy with esophageal and right pulmonary artery compression and multiple bilateral lung lesions suggestive of metastases.

Figure 1. Case 1: Lung ultrasound (right lung) showing B-profile pattern-interstitial syndrome.

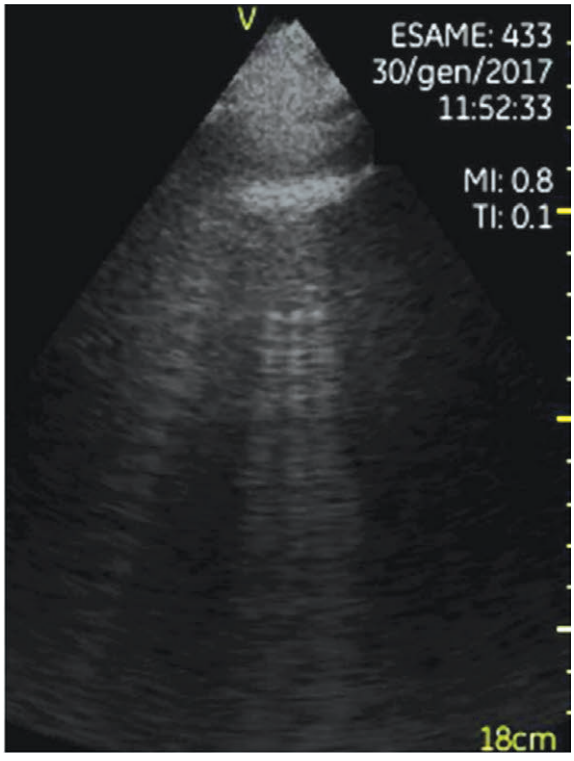

Figure 2. Case 1: Lung ultrasound (left lung) showing B-profile pattern-interstitial syndrome.

Case 4

A 79-year-old man with history of gastric cancer, hypertension and myocardial infarction, presented to the ED with exercise dyspnea. At the time of admission blood pressure was 136/67 mmHg, HR 97 bpm, regular, oxygen saturation was 97% (FiO_2 21%) and respiratory rate was 18 breaths/min. Chest auscultation revealed no abnormalities. Cardiovascular examination revealed normal cardiac rhythm, no murmurs, normal peripheral pulses and no edema. The ECG was normal. Blood gas analysis on room air revealed mild respiratory alkalosis with mild metabolic alkalosis, normal partial pressure of oxygen, normal electrolytes and lactate levels.

Blood tests showed a normal white blood cell count (7940 cells per mm^3), normal hemoglobin, renal and liver function.

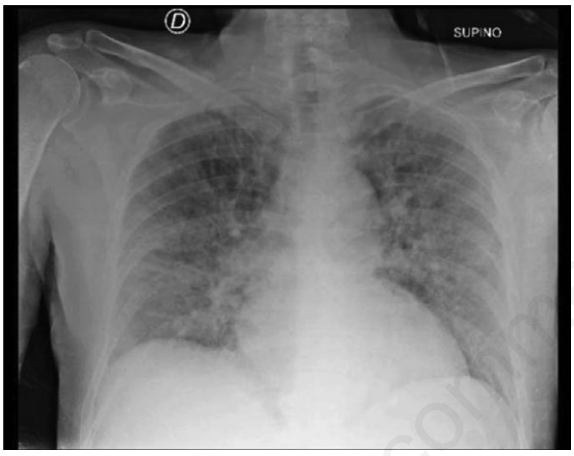

Figure 3. Case 1: Chest radiography showing a diffuse bilateral reticulonodular interstitial pattern.

Figure 4. Case 1: Contrast-enhanced computed tomographic scan of thorax showing multiple bilateral lung metastases.

POCUS showed a diffuse bilateral B-profile pattern-interstitial syndrome in lung examination, mild reduced EF (45%), normal left atrium size and normal right ventricular size and function. Chest radiography revealed no specific abnormalities. The patient underwent contrast-enhanced CT scan of thorax that showed multiple bilateral lung metastases and multiple mediastinal lymphadenopathy.

Discussion

Lung-cardiac integrated ultrasound examination plays an important role in the management of dyspneic patients.[3] Interstitial syndrome (IS) is a condition in which alveolar air is impaired due to an increase in fluids in the interstice. IS is defined as the visualization of some vertical reverberation artifacts, the B-lines, that are expression of high impedance discontinuities due to a close opposition between alveolar air and increased interstitial fluids.[4] IS includes several heterogeneous conditions (pulmonary fibrosis, acute respiratory distress syndrome, acute pulmonary edema, interstitial pneumonia) characterized by diffuse involvement of the interstice and impairment of the alveolo-capillary exchange capacity, which leads to more or less severe respiratory failure.[5]

Lung is an extremely common site for metastases, in particular breast, colon, kidney, uterus, head and neck are the most common primary sites with a pulmonary metastasis.[6] In patients with known primary malignancies, the appearance of multiple bilateral pulmonary nodules is highly indicative of metastatic disease and obviates the need for further diagnostic procedures.[7] Migratory and invasive ability of tumor cells, at the invasive front, is initiated and propelled by an inflammatory microenvironment,[8] thus it is convincible that lung metastases presence increases interstitial fluids inducing an inflammatory interstitial syndrome. Furthermore, chest radiographic signs of lymphangitic carcinomatosis include reticular or reticulonodular interstitial markings, usually with irregular contours and thickening of the interlobular septa[7] (Kerley B lines representing a radiologic equivalent of lung ultrasound B lines[9]).

Conclusions

Could the detection of diffuse B-profile pattern not attributable to traditional interstitial syndrome conditions (pulmonary fibrosis, acute respiratory distress syndrome, acute pulmonary edema, interstitial pneumonia) be indicative of multiple pulmonary metastases, in dyspneic patients? Based on these few observations, the answer might be positive, and our

experience suggests to appropriately evaluate this possibility, through *ad hoc* designed studies.

A second hypothesis that might be raised from the reported cases is that if a patient with history of cancer (without history of radiotherapy) develops dyspnea, lung ultrasound might be a valuable tool for early detection of B-profile pattern as a potential marker for multiple pulmonary metastases. Also, this hypothesis needs to be tested in appropriately designed studies.

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