CLINICAL IMAGES IN MEDICINE: A BREATHELESS AND HYPOTENSIVE PATIENT

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Plain chest X-ray of the patient on admission

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CASE PRESENTATION

A forty-two-year-old lady was admitted through emergency department complaining of shortness of breath with central chest pain of sudden onset. The chest pain was mainly in the right side, sharp in nature, and aggravated by inspiration and coughing. The patient had a low grade fever and a mild dry cough. There was no significant past medical history, apart from thyrotoxicosis four years ago, treated medically. She is a non-smoker and worked in an office as a clerk. No recent history of long travel or surgery. Clinical examination demonstrated low blood pressure of 96/50 mmHg, pulse 110 per minute, respiratory rate of 24 per minute and oxygen saturation of 86% at room air. The rest of the clinical examination was unremarkable. Blood gases showed pH of 7.53, PCO₂ of 3.9 kPa, PO₂ of 6.8 kPa and bicarbonate of 24 mm mol/L. Her D-dimer was greater than 10,000 units. However, her echocardiogram showed a dilated right ventricle with a moderate tricuspid regurgitation and pulmonary systolic pressure of 60 mm Hg. Her electrocardiogram showed no abnormality apart from sinus tachycardia and non-specific T-wave changes. In addition, her chest X-ray (Fig. 1) and computed tomography pulmonary angiography (CTPA) are shown in Figure 2.

QUESTIONS

• Describe two abnormalities on the chest X-ray (Fig. 1)
• Describe seven abnormalities seen on the CTPA (Fig. 2)

ANSWERS AND DISCUSSION

This patient presented of shortness of breath, chest pain, hypoxemia and hypotension suggesting an acute massive pulmonary embolism. Her blood gases revealed non-compensated respiratory alkalosis with hypoxemia and hypocapnia, signifying respiratory failure type 1. Although there was no significant history of a risk factor for PE, alternative diagnosis to explain the clinical presentation was lacking. Therefore, the clinical probability for PE was intermediate, according to the British Thoracic Society scoring system[1-3]. The chest X-ray showed bilateral large prominent pulmonary arteries suggestive of a pulmonary hypertension (Fig. 1A). In addition, the right pulmonary artery appeared amputated (Fleischner’s sign) with a peripheral oligemia (Westermark’s sign) in the right infra-hilar region (Fig. 1A)[4]. Computed tomography pulmonary angiography (CTPA) on the other hand, showed features diagnostic of massive PE. These features included a large pulmonary embolus in the main right pulmonary artery, a large pulmonary artery trunk with a diameter greater than that of the aorta, a dilated right ventricle which was larger than the left ventricle size, and bowing of the inter-ventricular septum to the left, plus reflux of contrast medium in the inferior vena cava and hepatic veins (Fig. 2A). Furthermore, the CTPA demonstrated a small clot in the left segmental artery, and a pleural based pulmonary infarction (Hampton hump) in the right side (Fig. 2A). As the patient was relatively young and there was no obvious risk factor, screening for thrombophilia was warranted[5].

Although, massive pulmonary embolism account for only 4.5% of cases of pulmonary embolism, identification of
this condition and early institution of thrombolytic therapy can be a life saving [6-7]. The use of CTPA scan as screening diagnostic test for PE has many advantages over ventilation/perfusion nuclear (VQ) scan, being quicker to carry out and easier to interpret. It is also less affected by the presence of cardio-pulmonary disease or abnormal chest X-ray [3,8-10]. Furthermore, CTPA can give an alternative diagnosis in many cases and provides a quantitative assessment of PE, which correlates well with the severity of the clinical picture [3,8-10]. Massive pulmonary embolism causes pulmonary hypertension leading to right ventricular overload and dysfunction. Right ventricular failure with consequent decreased right ventricular output, can cause decreased venous return to the left side with an end result of under filling of the left atrium and can impaired the left ventricle preload [11,12]. This can also be impaired by the decreased left ventricular compliance as a consequence of a leftward shift of the inter-ventricular septum [11,12]. In this setting, CTPA is especially valuable as it may show the central location and the large size of the clot, as shown in this case. In addition, CTPA can show features indicative of right ventricular overload and dysfunction [11,12]. These features include a right ventricle size larger than the size of left ventricle, bulging of the inter-ventricular septum to the left and a large pulmonary artery diameter that may exceed the aortic diameter; all of which are seen in this patient and shown in Figure 2. Moreover, CTPA may exhibit signs suggestive of tricuspid valve incompetence, as manifested in our case by the reflux of contrast medium in the inferior vena cava and in the hepatic veins [13].

The accuracy of CTPA, compared to echocardiography in detecting right ventricular dysfunction was studied by Lim et al. in 14 patients with massive PE. These authors found that CTPA had a sensitivity of 91.6% and a specificity of 100% in detecting right ventricular dysfunction, when using echocardiography as a reference gold standard test [14]. Others studied indicated the sensitivity and specificity of both CTPA and echocardiography in detecting right ventricular dysfunction using 30% pulmonary vascular obstruction as a reference standard test. In this study, however, the sensitivity and specificity were found to be 81% and 47% for CTPA, and 56% and 42% for echocardiography [15]. These studies suggest that CTPA is as good as an echocardiograph, if not better in detecting right ventricular dysfunction in the presence of massive PE.

This case highlighted the value of CTPA as a diagnostic test that can be also used in assessing the severity of PE. Particularly as it can be an invaluable investigation in evaluating the pathophysiological effects of massive PE, and can be used to detect the presence of right ventricular dysfunction, as in this setting.
**Figure 1A.** The chest X-ray of the patient on admission showing bilateral large prominent pulmonary arteries (1), indicating pulmonary hypertension. In addition, the right pulmonary artery appeared prominent and amputated (Fleischner’s sign) with small triangular area of peripheral oligemia (Westermark’s sign) in the right side (2).

**Figure 2A.** Computed tomography pulmonary angiography (CTPA) scan of the patient on admission, showing a large pulmonary embolism in the right pulmonary artery (1); an embolus in a left segmental artery (2); a large pulmonary artery trunk diameter greater than the aorta (3); a pleural based pulmonary infarction (Hampton hump) in the right side (4); dilated right ventricle which is larger than the left ventricle size (5); bowing of the inter-ventricular septum to the left (6) and reflux of contrast medium in the inferior vena cava and hepatic veins (7).
REFERENCES


