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Paradoxical brain embolism shadowing massive pulmonary embolism

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ABSTRACT

Patent foramen ovale is frequently observed in the general population. In case of massive pulmonary embolism, the sudden increase in the right heart cavity's pressure may cause a right-to-left shunting across this foramen, which could be associated with conflicting outcomes. Herein, we report a case of reversible cardiac arrest preceded by seizures, and followed by hemodynamic stability without any vasopressor. A brain CT-scan showed a limited ischemic stroke. Initial echocardiographic assessment revealed an acute cor pulmonale and a right-to-left intracardiac shunt across a large patent foramen ovale, suggesting the diagnosis of massive pulmonary embolism that was lately confirmed by a multidetector CT-angiography. Anticoagulation therapy was rapidly complicated by a hemorrhagic transformation of the ischemic stroke leading to a fatal outcome. This case illustrates the double-edged circulatory effect of shunting across a patent foramen ovale in case of massive pulmonary embolism: it may have limited circulatory failure but caused in the meanwhile a fatal paradoxical brain embolism.

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A 44-year old man recently hospitalized for a psychiatric disorder without other medical history, was referred to the ICU for a non-shockable cardiac arrest preceded by seizure. The spontaneous circulation was resumed 15 min after initial cardiopulmonary resuscitation, with no hemodynamic instability, but a persistent impaired consciousness prompting to endotracheal intubation. A brain computed tomography (CT) scan was performed first before ICU admission and revealed a low-density area into the left parietal lobe, compatible with an ischemic stroke (Fig. 1a). Upon ICU admission, transthoracic echocardiography (TTE) disclosed an acute cor pulmonale (Fig. 1b and Supplemental videos 1 and 2). Contrast-enhanced TTE (sub-costal view), using a modified fluid gelatin solution (9 mL of gelofusine agitated with 1 mL of room air) to make the right heart chambers opaque [1], evidenced a right-to-left intracardiac shunt across a large patent foramen ovale (Supplemental video 3). Multidetector CT-angiography revealed a bilateral pulmonary embolism (Fig. 1c). Parenteral anticoagulation with unfractionated heparin was introduced. No thrombolytic treatment was administered. On day-1, unilateral mydriasis arose, rapidly followed by progressive disappearance of brainstem reflexes. A second brain CT scan showed a hemorrhagic transformation of the ischemic

stroke with cerebral edema, responsible for brainstem compression (Fig. 1d). Brain death was diagnosed a few hours later.

Patent foramen ovale is common, occurring in up to one quarter of the population [2]. In case of massive pulmonary embolism, a variable level of shunt across the foramen ovale frequently arises [3,4], due to the increase in right heart cavity's pressures. The presence of patent foramen ovale and its resulting right-to-left intracardiac shunt during massive pulmonary embolism is associated with conflicting outcomes; protective when shunting prevent fatal obstructive shock [5]; or deleterious when shunting worsens hypoxemia or allows paradoxical embolism [3,4]. Paradoxical embolism is a dreaded complication [6] of pulmonary embolism that was first described in the 19th century [7]. The possible protective effect of shunting across a patent foramen ovale during massive pulmonary embolism remains controversial [5,8,9]. Nevertheless, systematic realization of contrast-enhanced TTE at initial assessment during massive pulmonary embolism could be proposed in order to search for a patent foramen ovale and therefore anticipate its potential consequences.

This case illustrates the double-edged circulatory effect of shunting across patent foramen ovale in case of massive pulmonary embolism. In fact, the intra-cardiac shunt has presumably favored the return of spontaneous circulation and limited circulatory insufficiency after resuscitation. On the other hand, it led in the meantime to a fatal paradoxical brain embolism.

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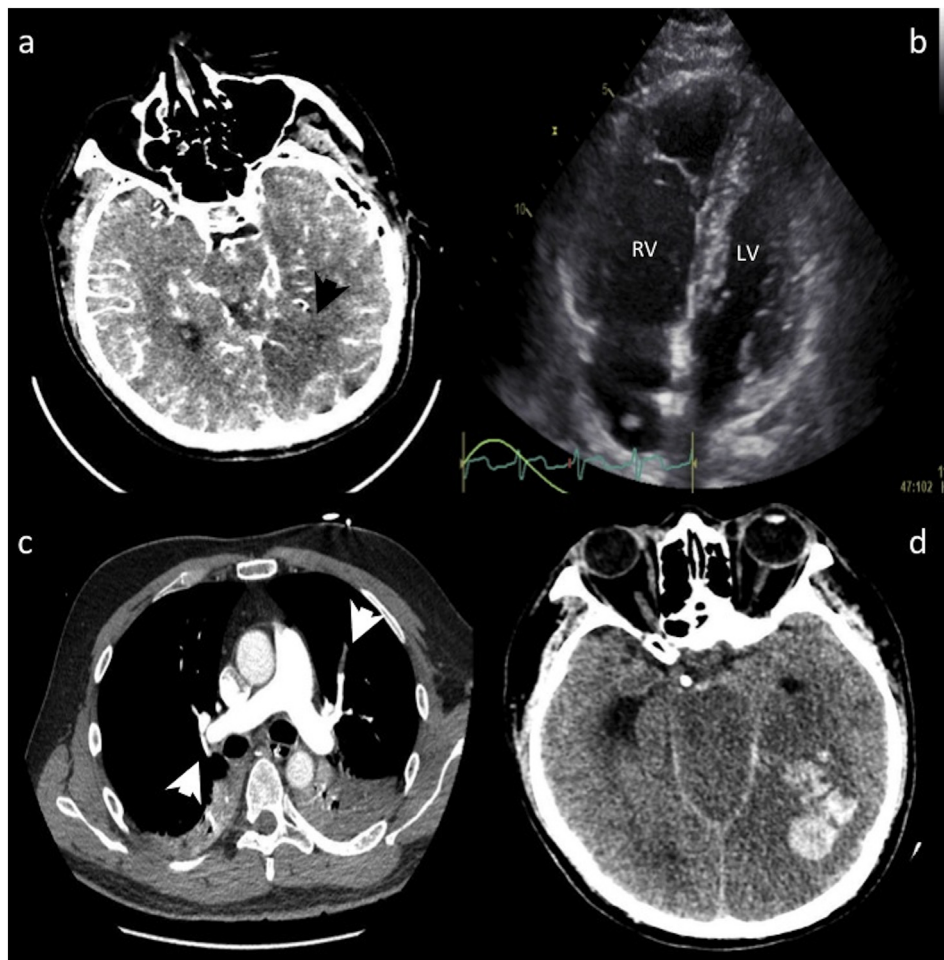


Fig. 1. a Initial brain CT-scan revealed an acute ischemic stroke in the posterior cerebral artery territory (black arrowhead). b Transthoracic echocardiography (four-chamber view) highlighted a massive acute cor pulmonale with severe dilation of the right ventricle (RV) compared to the left ventricle (LV). c Thoracic CT scan showed bilateral segmental pulmonary embolism (white arrowheads). d Second brain CT-scan exhibited hemorrhagic transformation of the ischemic stroke.

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