

Clinical Image

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Severe hypoxemia in acute pulmonary embolism**Amichai Gutold^{1*}; Doron Aronson^{2,3}; Michael Mutlak^{2,3}; Asaf Miller^{1,3}**¹Medical Intensive Care Unit, Rambam Health Care Campus, Haifa, Israel.²Department of Cardiology, Rambam Health Care Campus, Haifa, Israel.³Ruth and Bruce Rappaport, Faculty of Medicine, Technion, Haifa, Israel***Corresponding Author: Amichai Gutgold**

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Keywords: Pulmonary embolism; Contrast echocardiography; Right-to-left-shunt; Agitated saline study.**Description**

A 69-year-old female with asthma and hypertension, presented with dyspnea, chest pain and severe hypoxemia. She was normotensive. A chest computerized tomography angiography revealed bilateral lobar and segmental Pulmonary Embolism (PE) (Figure 1). Elevated levels of troponin and pro brain-natriuretic-peptide, and echocardiography showing severely enlarged right ventricle with severely reduced systolic function, graded the PE as moderate to severe. We started Enoxaparin anticoagulation. However, despite invasive mechanical ventilation, FiO_2 of 1.0 and inhaled nitric oxide treatment, hypoxemia persisted, with oxygen saturation of 85%. Hypoxemia in PE occurs most often due to “physiologic dead space”, typically corrected by supplemental oxygen. Refractory hypoxemia is usually associated with intrapulmonary shunt. In our case, lung parenchyma was intact on imaging, raising the possibility of an intracardiac right-to-left shunt, facilitated by the high right sided pressures. An agitated-saline study demonstrated early ap-

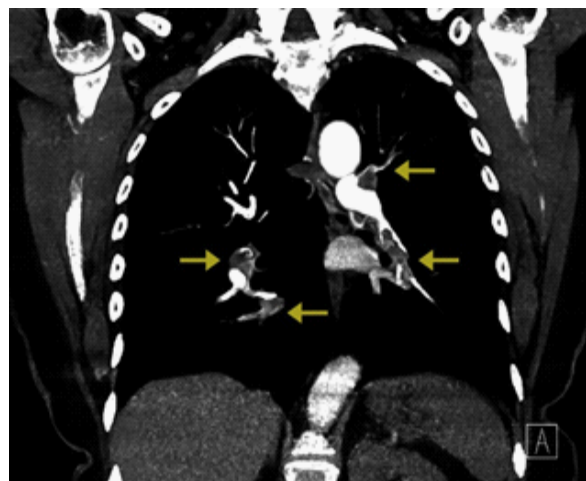


Figure 1: CT-Angiography of the chest showing multiple filling defects (arrows).

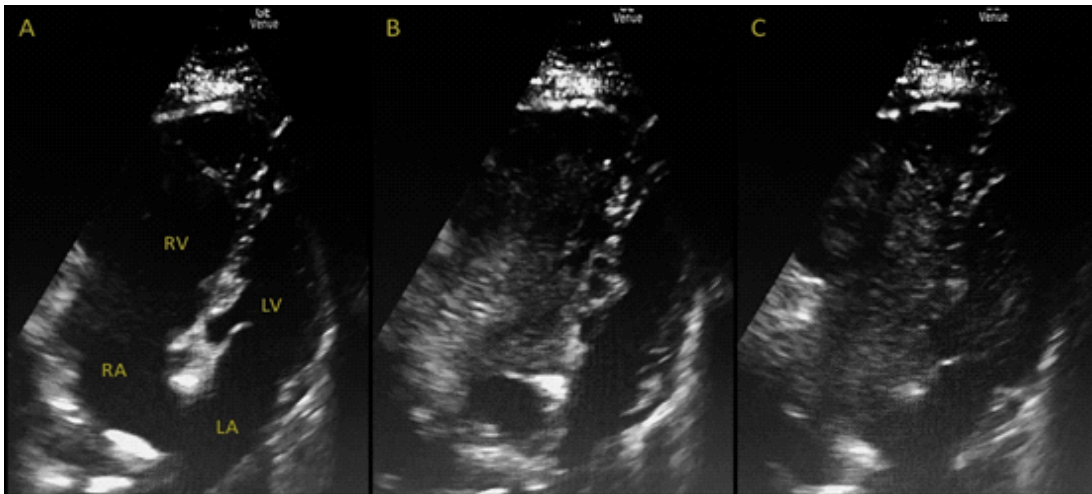


Figure 2: Agitated-saline study. (A) Before injection, enlarged right ventricle (RV) and atrium (RA) compared with left ventricle (LV) and atrium (LA). After injection of agitated saline, (B) bubbles fill the right side of the heart and immediately after, (C) appear in the LA and LV, indicating a right-to-left shunt.

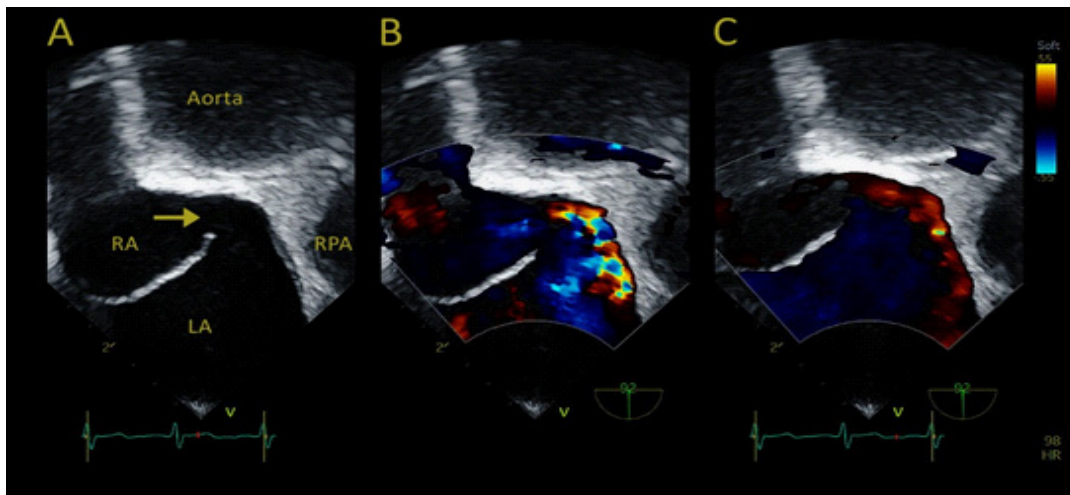


Figure 3: Trans-esophageal-echocardiography. Bicaval view (A) showing a PFO (arrow). RA right atrium, LA left atrium, RPA right pulmonary artery. Colordoppler showing a continuous right-to-left flowthrough the PFO both on (B) systole and (C) diastole.

pearance of bubbles in the left atrium, confirming the presence of a right-to-left shunt at the atrial level [1,2] (Figure 2). Trans-Esophageal-Echocardiography showed a large Patent-Foramen-Ovale (PFO) with a continuous right-to-left flow throughout the cardiac cycle (Figure 3). Thrombolysis resulted in a rapid but transient improvement in hypoxemia. Gradually, RV function, right-sided pressures and arterial saturation improved and she was weaned off respiratory support. Ambulatory endovascular closure of the PFO was scheduled.

Declarations

Conflicts of interest: The authors declare no conflicts of interest. The researchers did not use any funding.

Author contribution: Data collection was performed by Amichai Gutgold and Michael Mutlak. The first draft of the manuscript was written by Amichai Gutgold and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards: The patient's identity has been kept confidential.

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