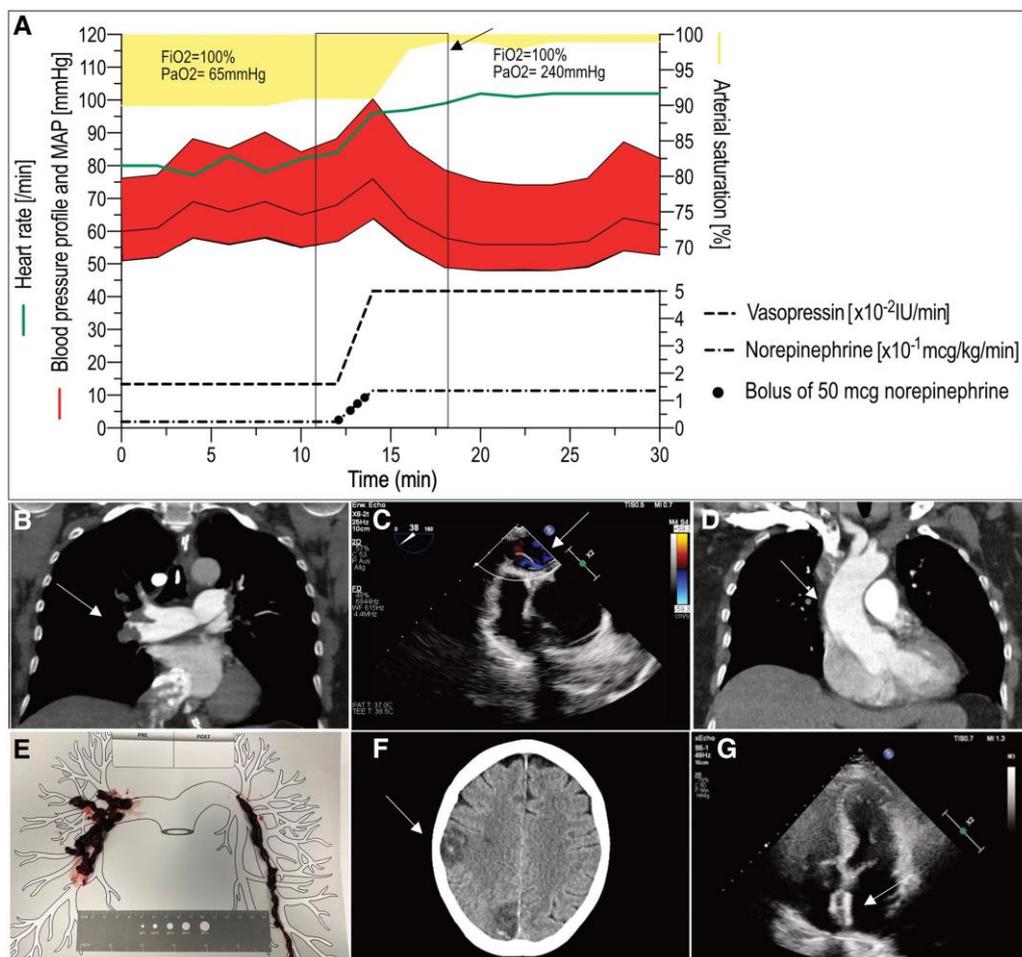


# Patent foramen ovale: life-saving, but breath-taking in fulminant pulmonary embolism

Kathrin Reuthner <sup>1\*</sup>, Thomas Müller<sup>2</sup>, and Alexander Dietl <sup>2</sup>

<sup>1</sup>Department of Internal Medicine III, University Hospital Regensburg, Franz-Josef-Strauß-Allee 11, Regensburg D-93053, Germany; and <sup>2</sup>Department of Internal Medicine II, University Hospital Regensburg, Franz-Josef-Strauß-Allee 11, Regensburg D-93053, Germany

Received 3 December 2024; revised 1 February 2025; accepted 25 March 2025; online publish-ahead-of-print 2 April 2025



\* Corresponding author. Tel: +49 941 9440, Fax: +49 941 944 7530, Email: [kathrin.reuthner@ukr.de](mailto:kathrin.reuthner@ukr.de)

Handling Editor: Milenko Cankovic

Peer-reviewers: Albert Galyavich; Takeshi Kitai

© The Author(s) 2025. Published by Oxford University Press on behalf of the European Society of Cardiology.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.

Two days after knee surgery, a 61-year-old female patient developed acute dyspnoea followed by hypoxaemic respiratory failure. The patient had no medical history. A week before, she had been able to cycle to work. A CT scan revealed bilateral central pulmonary artery emboli despite the administration of thromboprophylaxis (*Panel B*). In critical hypoxaemic failure despite non-invasive ventilation (NIV), bronchoscopic intubation was performed in upright position through the oronasal NIV mask. After the upper body was lowered, there was a sudden haemodynamic collapse accompanied by a significant improvement in oxygen saturation (*Panel A*). With persistent hypoxaemia, a right-to-left atrial shunt was suspected. In line, transthoracic echo revealed a jet on colour Doppler. Transoesophageal echocardiography provided further information on the morphology, showing a patent foramen ovale (PFO) (*Panel C*). The thin, rather mobile atrial septum was displaced to the left atrium resulting from high right atrial pressure. When pulmonary embolism initially increased pressures in pulmonary circulation, the right-to-left shunt most probably had prevented the right heart from acute failure. Lowering the upper body in the presence of a PFO as well as aortic elongation (*Panel D*) reduces the right-to-left shunt volume in orthodeoxia syndrome. In our case, reduced right-to-left shunt volume improved oxygenation but unmasked the fulminant obstructive shock. As progressive shock could not be stabilized by conventional therapy, veno-arterial extracorporeal membrane oxygenation (VA-ECMO) was established. Ischaemic stroke within previous six months was a contraindication for systemic fibrinolysis. Due to acute haemodynamic instability, interventional aspiration thrombectomy was performed and removed a large amount of thrombus material (*Panel E*). After further clinical stabilization, the ECMO

could be removed after 5 days. On Day 8, the patient was extubated. Patent foramen ovale was most likely causal for multi-temporal, sub-acute, and older cerebral ischaemic insults, which were detected by CT (*Panel F*). After interdisciplinary assessment and shared decision-making with patients' relatives, early transcatheter closure was performed (*Panel G*). The coagulation disorder assessment did not reveal thrombophilia. After neurological rehabilitation, the patient was discharged with oral anticoagulation and is now an active part in her family's daily life again.

## Acknowledgements

The authors extend their sincere gratitude to Prof. Stefan Stadler, Mr Maik Foltan, and Dr Maria Heinrich for their valuable suggestions and insightful discussions.

**Consent:** The authors confirm that informed written consent was obtained for the submission and publication of this case report, including the accompanying images and associated text as per Committee on Publication Ethics (COPE) guidelines.

*Conflict of interest.* None declared.

**Funding:** There was no funding for this case.

## Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.