

Emergency ECMO implantation during management of high-risk massive pulmonary embolism

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Background

- Pulmonary embolism (PE) is a cardiovascular emergency that can lead to a life-threatening right ventricular dysfunction when pulmonary artery is occluded.⁽¹⁾
- The presence of mobile right heart thrombi increases the morbidity and mortality rate and should be treated as a high-risk PE either by thrombolysis or by embolectomy.⁽²⁾
- Extracorporeal membrane oxygenation (ECMO) is a temporary circulation and oxygenation support provided by partial cardiopulmonary bypass.

PE-related early MORTALITY RISK	RISK MARKERS			Potential treatment implications
	CLINICAL (shock or hypotension)	RV dysfunction	Myocardial injury	
HIGH >15%	+	(+) ^a	(+) ^a	Thrombolysis or embolectomy
NON HIGH 3-15%	-	+	+	Hospital admission
		-	-	
Low <1%	-	-	-	Early discharge or home treatment

Table 1: Risk stratification according to expected pulmonary embolism-related early mortality rate.⁽²⁾

Case Report

We present a case of a 51 years old male patient who was admitted to our hospital one year after pulmonary endarterectomy with acute progression of severe dyspnea.

Medical history:

- Chronic thromboembolic pulmonary hypertension (CTEPH) – progression to a severe stage despite anticoagulation (PASP 85 mm Hg, NYHA class III) within 2 years after an episode of deep vein thrombosis. Pulmonary endarterectomy performed with a good result (PASP 30 mmHg, NYHA II), patient regularly examined in cardiovascular centre.
- Anticoagulation (Warfarin)
- Heterozygous for MTHFR mutation
- Arterial hypertension
- Splenectomy



Image 1: Pulmonary endarterectomy specimen

Hospital Course

- Patient admitted with acute severe dyspnea, NYHA class IV, with cough related chest pain
- Hemodynamically stable, blood pressure 115/70 mmHg, heart rate 110/min, SpO2 93%
- INR 1.1 (despite Warfarin 7.5 mg/day)
- High risk pulmonary embolism confirmed by CT angiography and echocardiography.



Image 2: Echocardiography - mobile thrombus in the right atrium, right ventricular dilatation

Treatment

Patient indicated to systemic thrombolytic therapy. Despite hemodynamic stability at admission, the procedure was associated with a high risk of acute circulatory failure (due to subtotal occlusion of right pulmonary artery, progressing dilatation and dysfunction of right ventricle, large mobile thrombus in right atrium). ECMO team activated stand by.

- 1:15 pm: Thrombolysis started using Actylise agent, regular echocardiography examinations.
- 1:50 pm: Sudden hemodynamic instability, respiratory insufficiency, shock progression. Emergent ECMO implantation indicated
- 2:10 pm: Venoarterial ECMO initiated (implanted via a. femoralis l. sin. and v. femoralis l. sin.)
- 2:15 pm: Rapid hemodynamic improvement, patient stable, conscious, no catecholamine support needed.

Angiographic control reveals severe right ventricular hypertension (PASP 70 mmHg) and obstruction of proximal right pulmonary artery. Patient indicated to surgical pulmonary embolectomy and transported to the operation theatre with VA ECMO support.

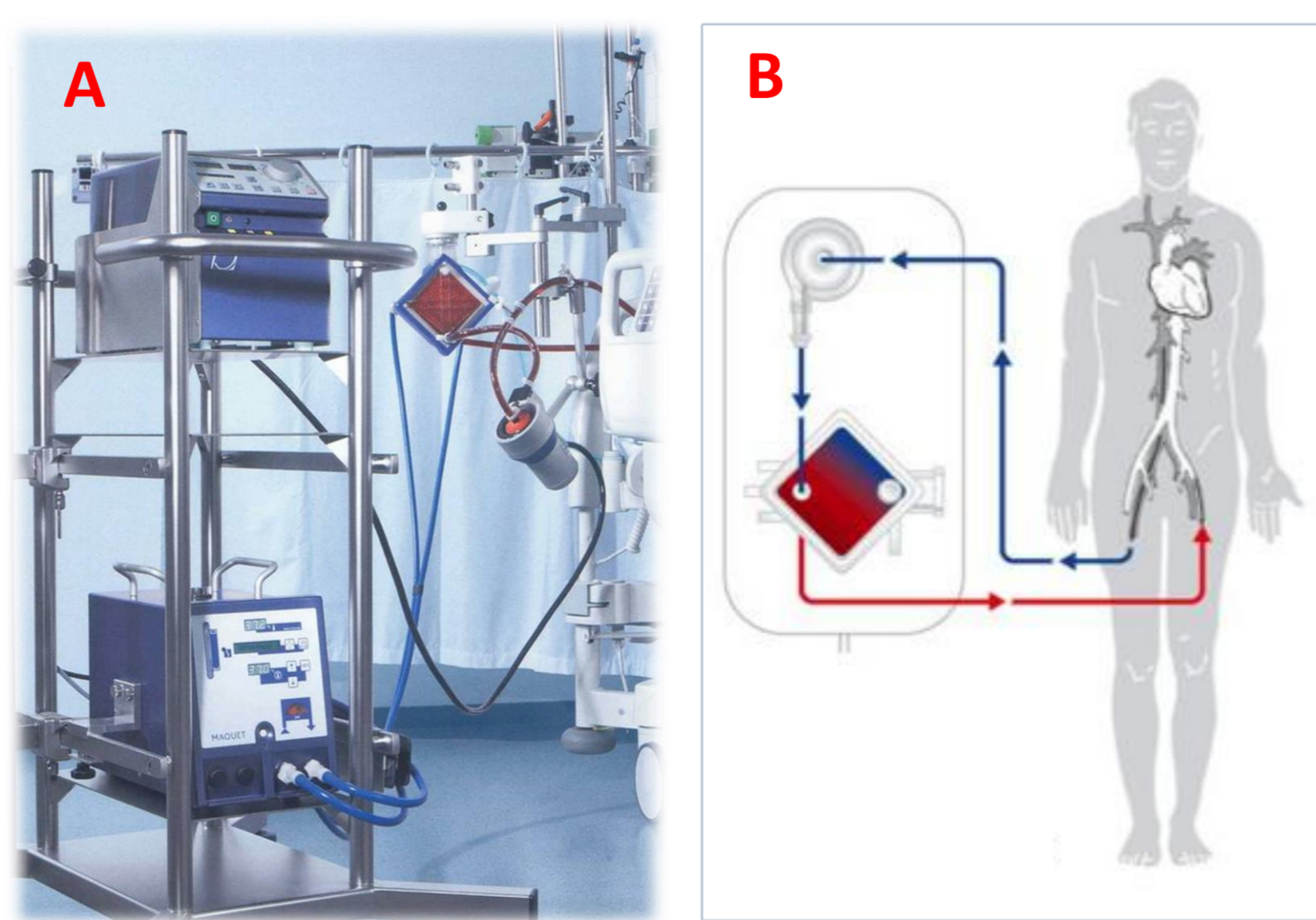


Image 3: A) Extracorporeal membrane oxygenation (ECMO) B) VA-ECMO circuit

Pulmonary embolectomy

After median resternotomy we established standard cardiopulmonary bypass, VA-ECMO terminated. Patient cooled down to 33°C. Ascending aorta cross-clamped and cardiac arrest achieved using blood cardioplegia.

We performed embolectomy from the right pulmonary artery where we found large fragile embolus. After its removal we achieved significant retrograde blood flow. In accordance with angiography there was no obstruction in the left pulmonary artery.

Weaning from the cardiopulmonary bypass unsuccessful (bypass time 144 min, cross clamp time 36 min). Despite high catecholamine support we were unable to restore sufficient cardiac output. VA-ECMO initiated again, patient transported to the ICU.

VA-ECMO weaning began on 3rd postoperative day, explanted on day 5. Patient extubated, hemodynamically stable. On day 7 transvenous caval filter implanted.

Long term follow up

Patient is regularly examined - hemodynamically stable, NYHA class II, PASP 35 mmHg, with sufficient anticoagulation achieved by Warfarin.

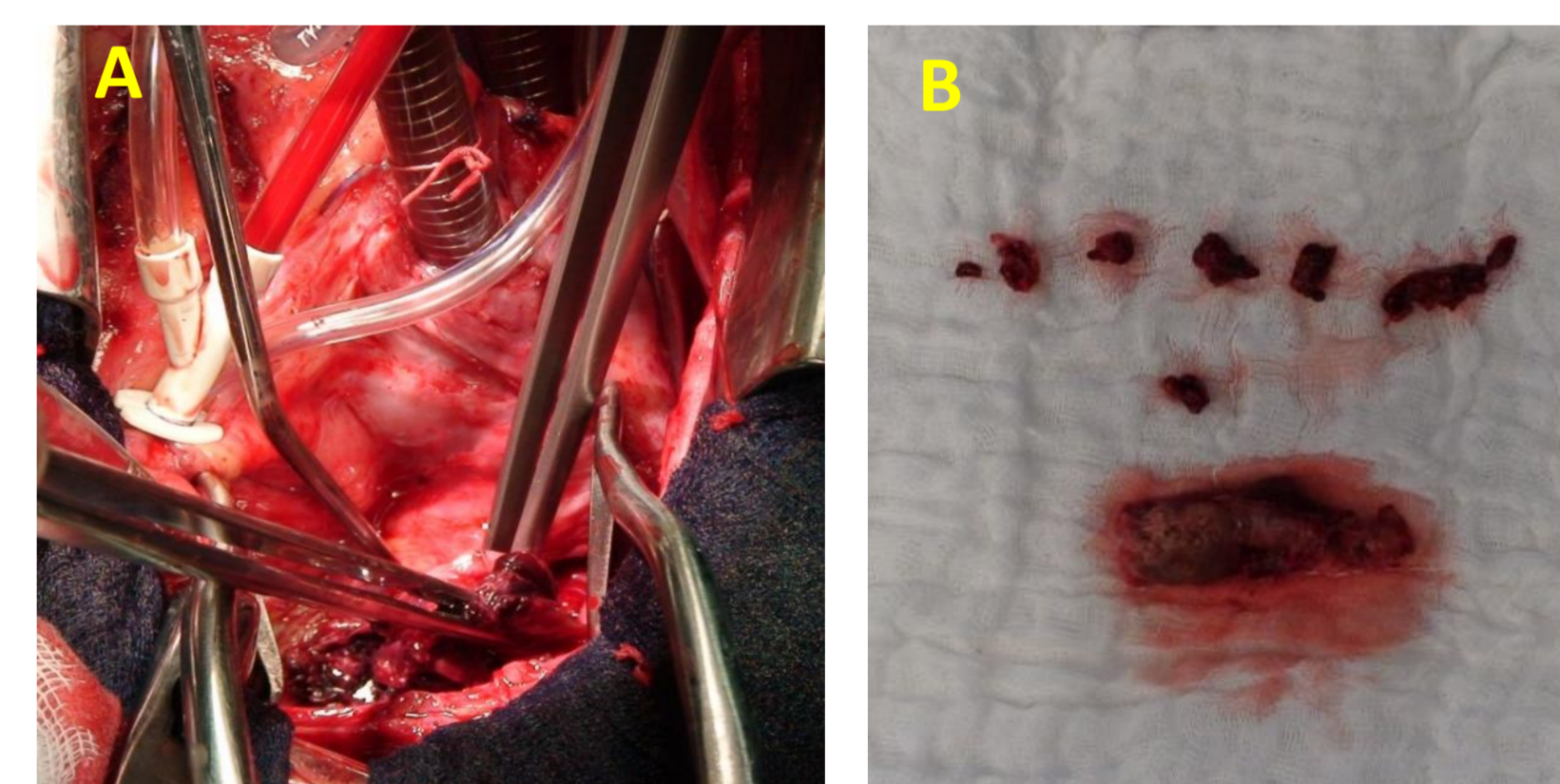


Image 4: A) Pulmonary embolectomy B) Pulmonary embolectomy specimen

Conclusion

- Use of ECMO during high-risk PE led to successful treatment even when sudden circulatory failure occurred during therapy.
- Patients with high-risk PE should preferably be treated in centres where ECMO team is available.

References

- Limbrey R., Howard L. Developments in the management and treatment of pulmonary embolism. Eur Respir Rev. 2015 Sep;24(137):484-97. doi: 10.1183/16000610.2015.02666
- Konstantinides, Tobricky, Perrier et al. 2014 ESC Guidelines on the diagnosis and management of acute pulmonary embolism. Eur Heart J. 2015 Oct 14;36(39):2666. doi: 10.1093/eurheartj/ehv13100



Image 5: Patient weaning from VA-ECMO after pulmonary embolectomy