VŠEOBECNÁ FAKULTNÍ NEMOCNICE V PRAZE

1. LÉKAŘSKÁ FAKULTA Univerzita Karlova

Pulmonary embolism - related refractory cardiac arrest

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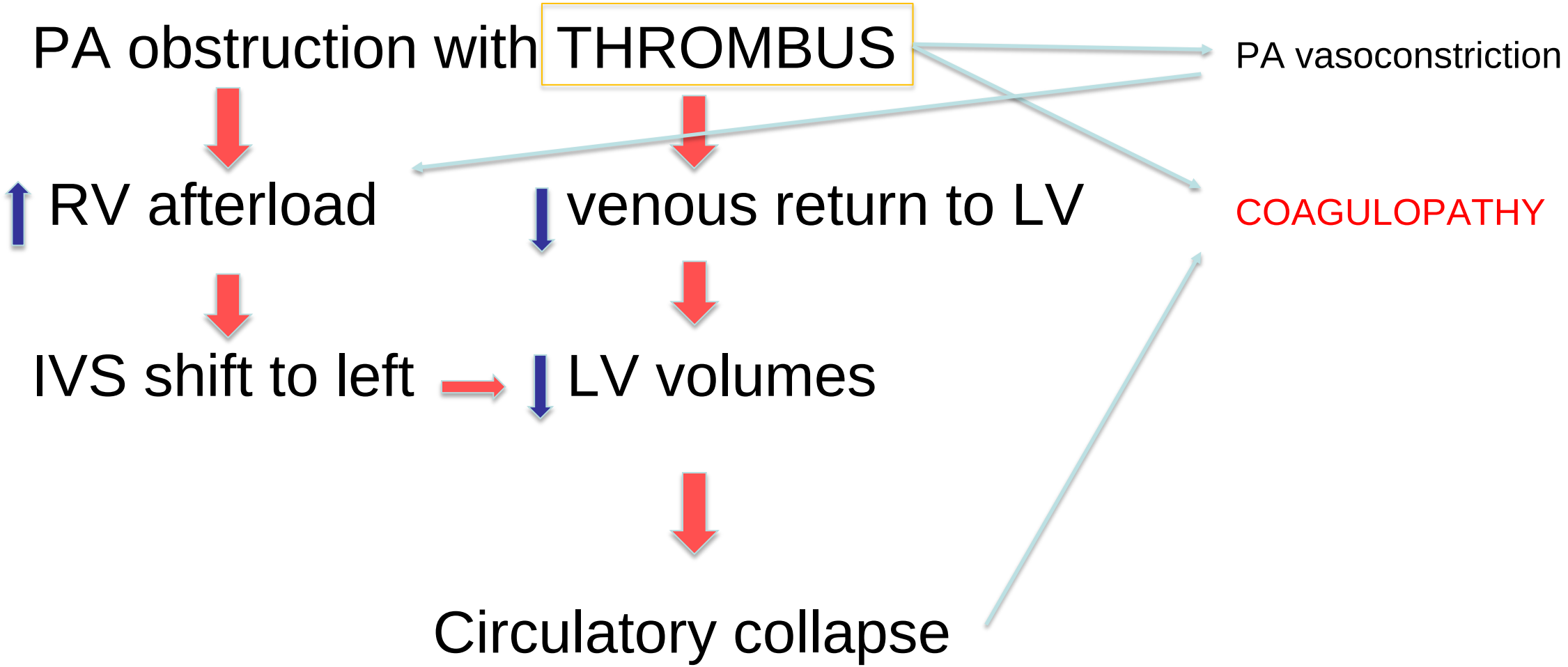
PULMONARY EMBOLISM - RELATED CARDIAC ARREST

Epidemiology

- 2 – 7% of out–of–hospital CA, 5 – 6% in-hospital CA [1]
  - Prague OHCA trial – 9.4% of all patients[2]
    - 23% among non-shockable rhytms
    - Higher share of females
  - 95% with non - shockable rhytm
- High mortality – 65 to 95% [3]

1. Laher et al. Indian Heart J, 2018
2. Javaudin F et al. Chest, 2019
3. Pudil J et al., EHJ Acute Card Care, 2023

Patophysiology of PE-related CA



Diagnosis

- History, physical examination
  - Circumstances supporting DVT – immobilization, leg swelling,…
- Bedside echo when available
  - RV dilatation, …
    - NPV only 40-50%[1]
- Other
  - Low EtCO2 despite proper chest compression
  - Non-shockable rhytm, gender, EMS – witnessed arrest[2]

1. Javaudin F et al. Chest, 2019
2. Pudil J et al. EHJ:ACVC, 2023

Treatment options for PE - related CA

- Conventional CPR
  - Less effective due to obstruction
- Thrombolysis
  - Weak recommendation, equivocal evidence
- Thrombectomy (+ ECMO)
  - Surgical
  - Percutaneous

1. ERC Guidelines, 2021

ECPR IN PULMONARY EMBOLISM

ECPR in PE – concept

- Just restore circulation and get time
  - For reperfusion on heparin
  - For the effect of thromb
  - For surgical thr
  - For pers

DOES IT REALLY WORK?

- Observationa
  - No clear pro
- Case series
  - Poor result desp
- Data for massive
  - Most promising

RESUSCITATION 191 (2023) 109940

Available online at ScienceDirect

Original paper

Perfusion

Extracorporeal life support (ECLS) for cardiopulmonary resuscitation (CPR) with pulmonary embolism in surgical patients – a case series

Perfusion
1–6

DOI: 10.1177/0267659115583682
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Review

Perfusion

Extracorporeal membrane oxygenation in acute massive pulmonary embolism: a systematic review

Yusuff HO[1], Zochios V[2] and Vuylsteke A[3]

Perfusion
1–6

DOI: 10.1177/0267659115583377
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Letter to the Editor

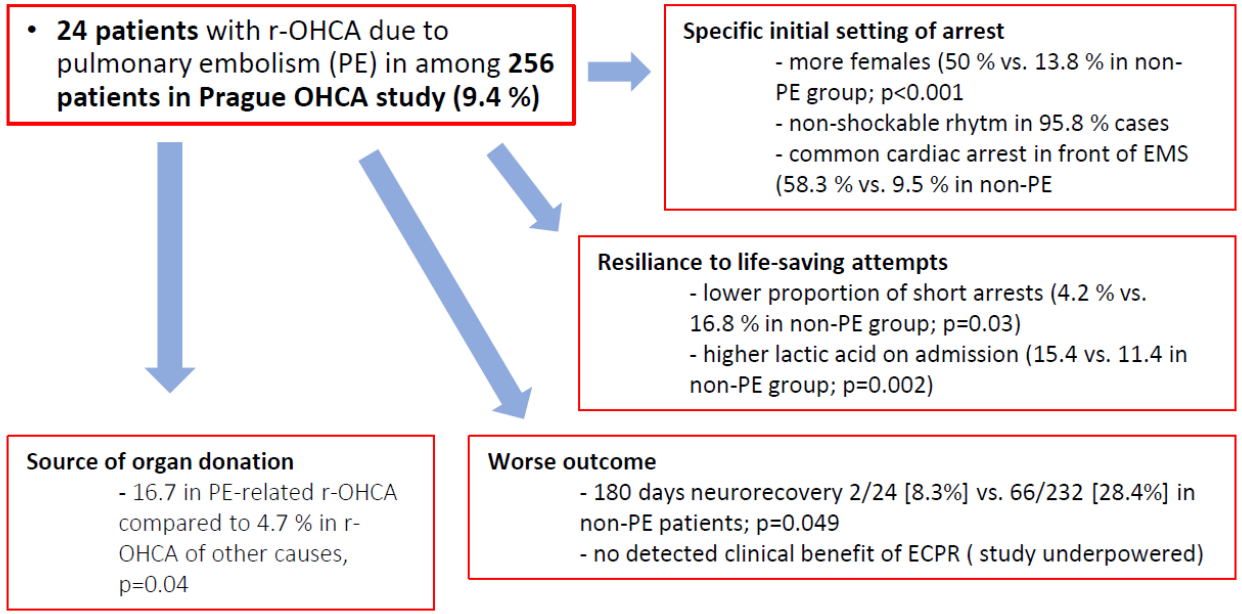
ECLS management in pulmonary embolism with cardiac arrest: Which strategy is better?

of thrombolytics before ECLS complicates cannulae insertion and, after ECLS implantation, bleeding can easily occur. Lastly, massive thrombosis in the infrahepatic vena cava might jeopardize success-

Data from randomized trial

- Prague-OHCA trial secondary analysis[1]
  - 24 patients with PE….12 invasive arm … 9 ECLS implanted
  - 2 survivors with CPC 1,2 at 180 days … no clear benefit of invasive arm

Pulmonary embolism related refractory out-of-hospital cardiac arrest and extracorporeal cardiopulmonary resuscitation: Prague OHCA study post-hoc analysis.



Why the concept does not work so well?

- Bleeding
  - Organ laceration (18
  - Severe coagulopath
    - Presence of thrombu
    - Post resuscitation syndrome
    - Thrombolytic treatment
- Low effectivity of conventional CPR
  - Severe hypoxia during CPR (no lung perfusion)
  - Severe acidosis, higher lactate levels on admission

	Total	PE	Non-PE	p
Complications				
Bleeding -any	46 (24.9 %)	8 (53.3 %)	38 (22.4 %)	**0.01**
Fatal	4 (8.7 %)	2 (25 %)	2 (5.3 %)	
Intracranial hemorrhage	10 (21.7 %)	1 (12.5 %)	9 (2.37 %)	0.18
Overt	32 (69.6 %)	5 (62.5 %)	27 (71.1 %)	
Shock gut	61 (33.9 %)	4 (26.7 %)	57 (34.5 %)	0.78
Organ lacerations	7 (3.2 %)	4 (18.2 %)	3 (1. 5 %)	**0.002**
Technical	3 (1.2 %)	0 (0 %)	3 (1.3 %)	1.0

Who are usually the survivors?

- Short duration of conventional CPR
  - time from CA to cannulation < 20 min.
- Intermittent ROSC
- Ventricular fibrillation
  - Only 5% of PE - related cardiac arrest

	Initial recorded rhythm	pH at ECLS implantation	Time from CA to ECLS	Therapy	Thrombolytics	Anticoagulants	ECLS complication	Days on ECLS	Outcome
Patient 1	PEA	7.0	20 min	None	None	None	None	2	Survived
Patient 2	PEA	7.24	15 min	EKOS	Selective r-tPA 2 mg + 0.5 mg/h for 24	Bivarlirudin 0.0125 mg/kg/h	Post anoxic encephalopathy	2	Survived
Patient 3	Asystole	7.28	45 min	Surgical embolectomy		Heparin 200 ui/h	Rethoracothomy for cannula malpositioning, multi-organ failure	11	Died
Patient 4	Asystole	6.7	45 min	Systemic thrombolysis	r-tPA 100 mg after ECLS implantation	Heparin 10 ui/kg/h after ECLS	Major bleeding from puncture site	1	Died
Patient 5	Asystole	7.19	45 min	Systemic thrombolysis	r-tPA 50 mg before ECLS implantation	Heparin 10 ui/kg/h	Major bleeding, acute hemoperitoneum	1	Died
Patient 6	PEA	7.17	15 min	EKOS	r-tPA 0.5 mg/h for 24 h	Bivalirudin 0.025 mg/kg/h	Infectious colitis, laparotomy, multi-organ failure	10	Died

1. Table - Maj G et al. Resuscitation, 2014

Conclusion

- Refractory CA due to pulmonary embolism has poor outcome
- Hemodynamic stabilization with ECPR works
- Conventional CPR very ineffective
- ECPR struggles with bleeding complications in PE
- Selection of patients should be VERY VERY careful

Extracorporeal CPR

ECPR should be considered as a rescue therapy for selected patients with cardiac arrest when conventional CPR is failing in settings in which it can be implemented (weak recommendation, very low certainty of evidence).[103] ECPR is increasingly used to support

1. Lott. C et al., Resuscitation, 2021

Thank you for your attention !

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