

Organ perfusion pressure predicts outcomes in cardiogenic shock patients

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- Nessuna.

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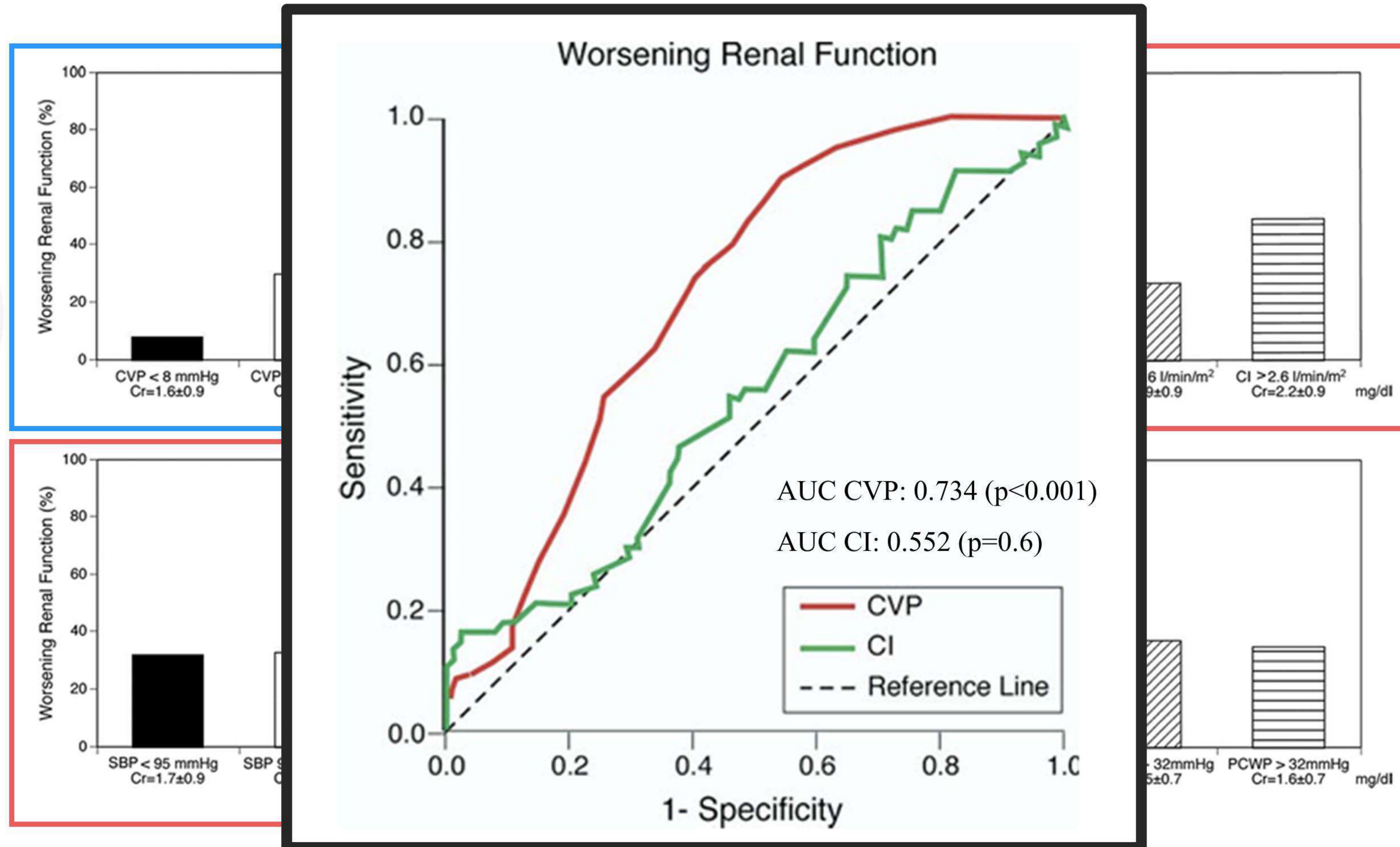
Background

- Cardiogenic shock (CS) is characterized by end-organ hypoperfusion due to insufficient cardiac output, resulting in a 30% to 50% short-term mortality rate.
- Hypotension refractory to volume resuscitation with features of end-organ hypoperfusion is a hallmark of CS diagnosis.
- Hypotension alone is an unreliable gauge of tissue perfusion, which depends more on the balance of anterograde cardiac output and systemic congestion.

Chioncel O, et al. Epidemiology, pathophysiology and contemporary management of cardiogenic shock—A position statement from the Heart Failure Association of the European Society of Cardiology. Eur J Heart Fail 2020;22:1315–1341.

Mullens W, et al. Importance of venous congestion for worsening of renal function in advanced decompensated heart failure. JACC 2009;53:589–596

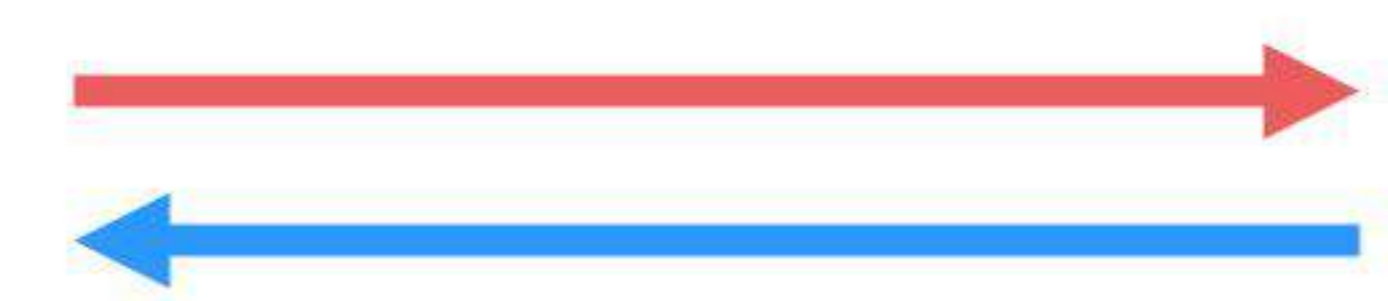
Background



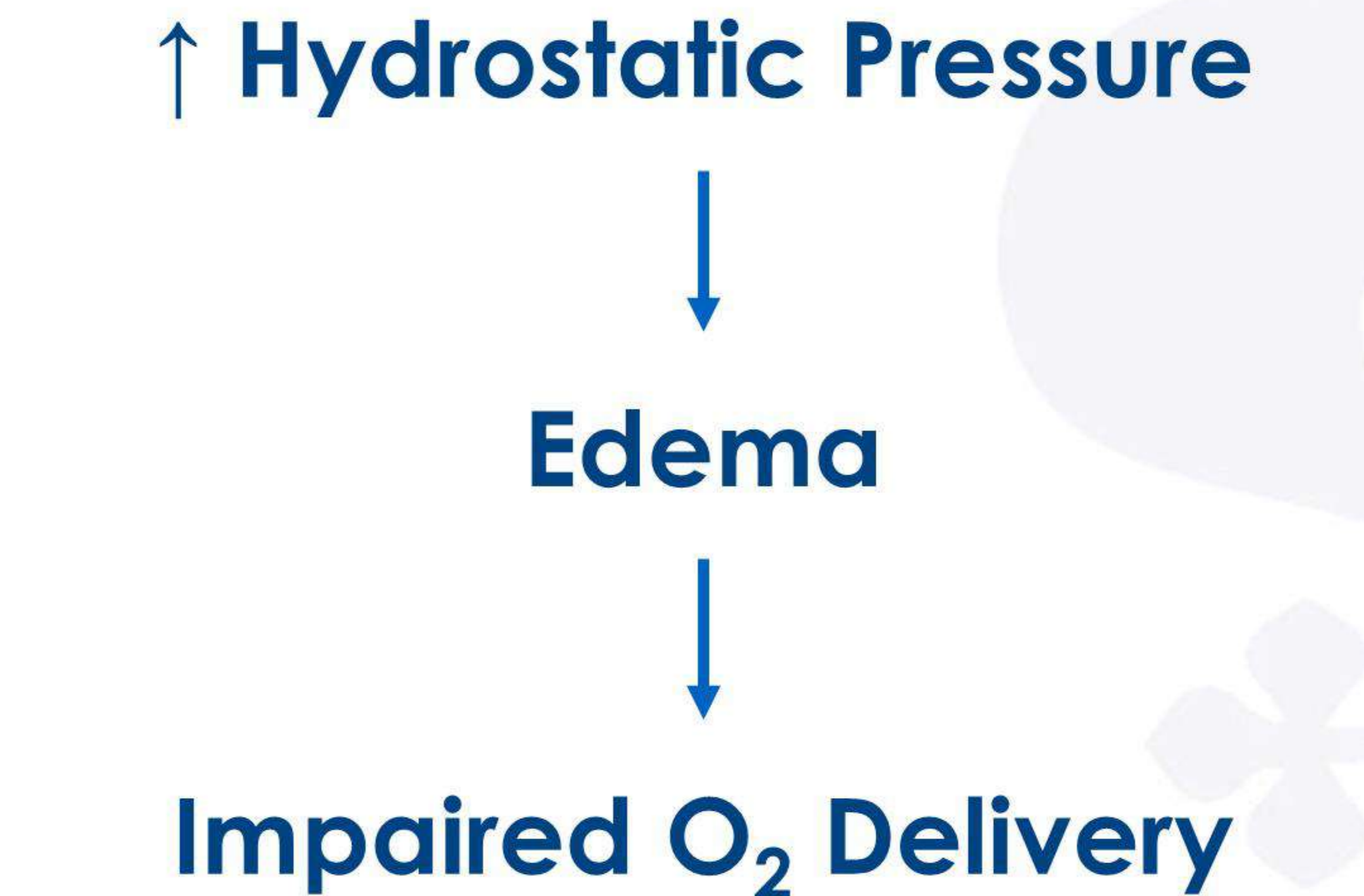
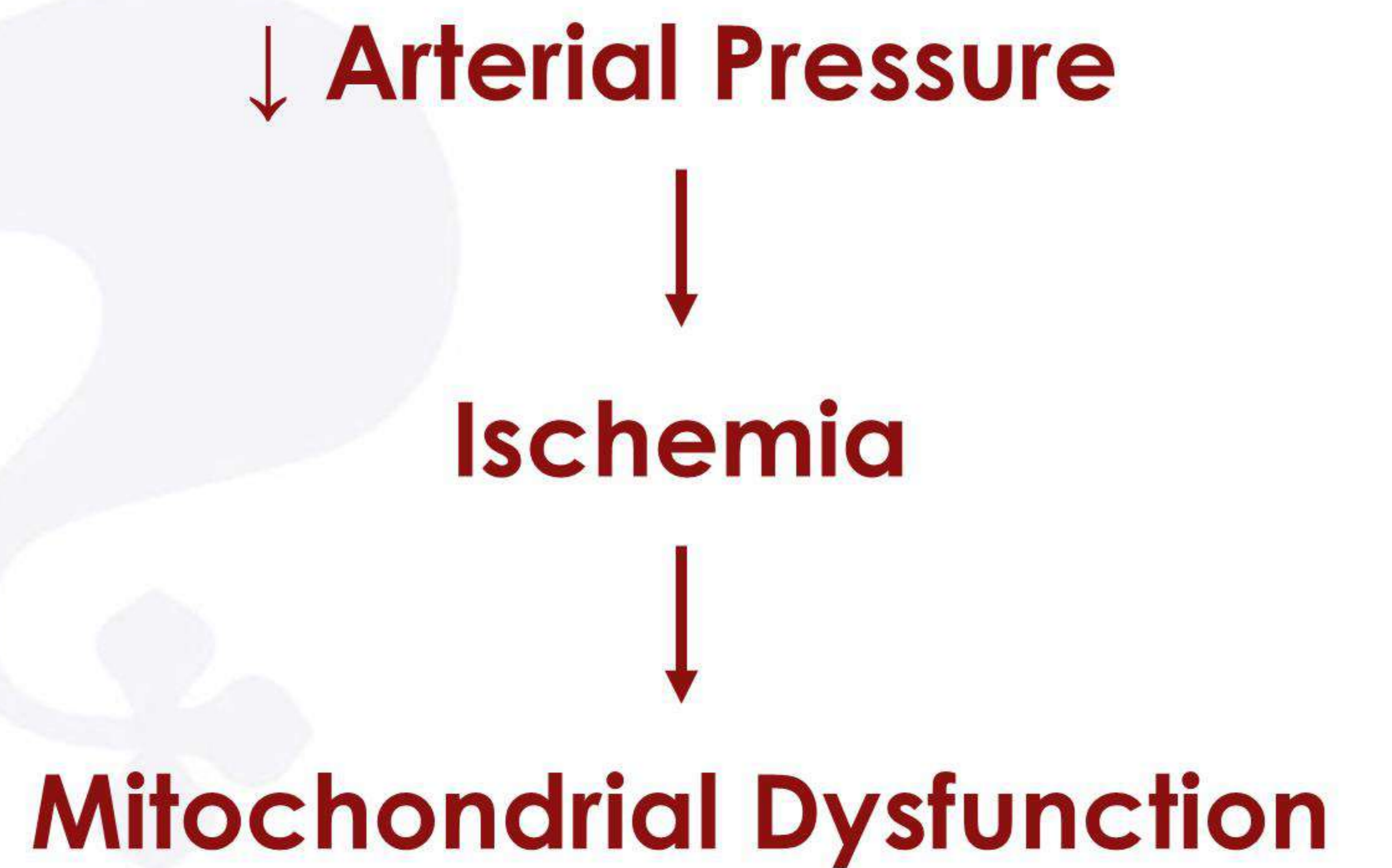
Mullens W, et al. Importance of venous congestion for worsening of renal function in advanced decompensated heart failure. JACC 2009;53:589-596

Background

LOW CARDIAC OUTPUT



VENOUS CONGESTION



Cellular Death

Organ Perfusion Pressure (OPP) = Mean Arterial Pressure (MAP) – Central Venous Pressure (CVP)

Background

Retrospective cohort study:

146 patients hospitalized for acute heart failure treated with sodium nitroprusside

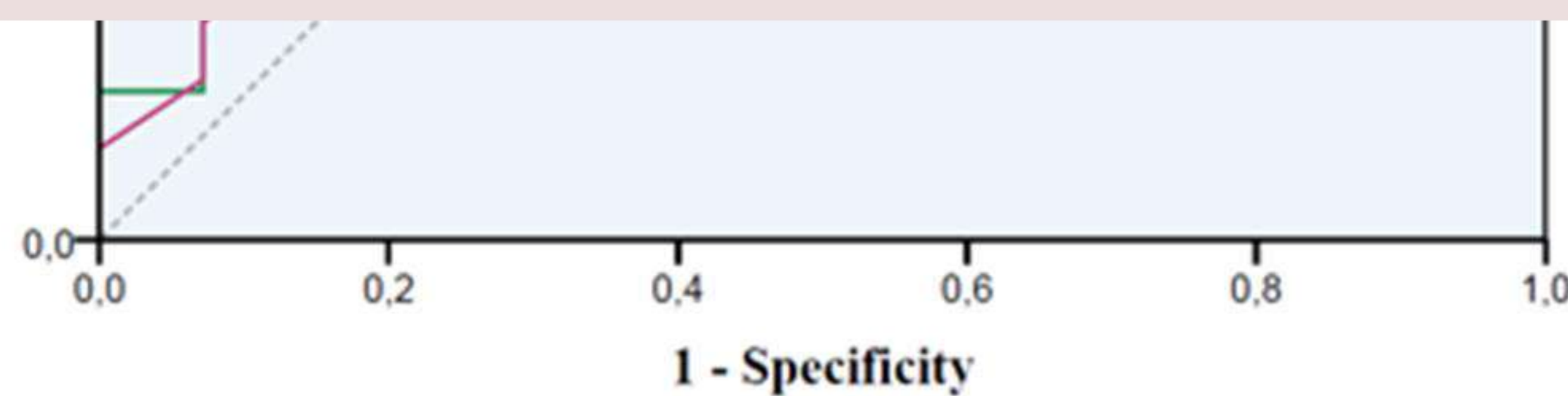
Organ perfusion pressure at admission and clinical outcomes in patients hospitalized for acute heart failure

Pier Paolo Bocchino ^{1*}, Marco Cingolani¹, Simone Frea¹, Filippo Angelini ¹, Guglielmo Gallone ¹, Laura Garatti², Alice Sacco², Claudia Raineri¹, Stefano Pidello¹, Nuccia Morici ³, and Gaetano Maria De Ferrari^{1,4}

ROC curve analysis for worsening heart failure at 48 hours

Table 5 Multivariable analyses on predictors of worsening heart failure

Variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
OPP	0.92 (0.85–0.99)	0.019	0.92 (0.86–0.99)	0.026	0.91 (0.84–0.98)	0.013	0.92 (0.86–0.98)	0.015	0.92 (0.85–0.99)	0.018	0.91 (0.85–0.98)	0.014
NYHA class	3.84 (1.08–13.67)	0.038	3.43 (0.94–12.57)	0.062	1.07 (0.21–5.32)	0.937						
Shock index	1.37 (0.04–44.6)	0.861					2.22 (0.94–52.58)	0.621	1.64 (0.05–52.73)	0.779		
CVP			1.08 (0.92–1.26)	0.374			1.03 (0.91–1.15)	0.684			1.00 (0.88–1.14)	0.982
LVEDD					1.06 (0.98–1.14)	0.127			1.03 (0.98–1.09)	0.201	1.03 (0.98–1.09)	0.213



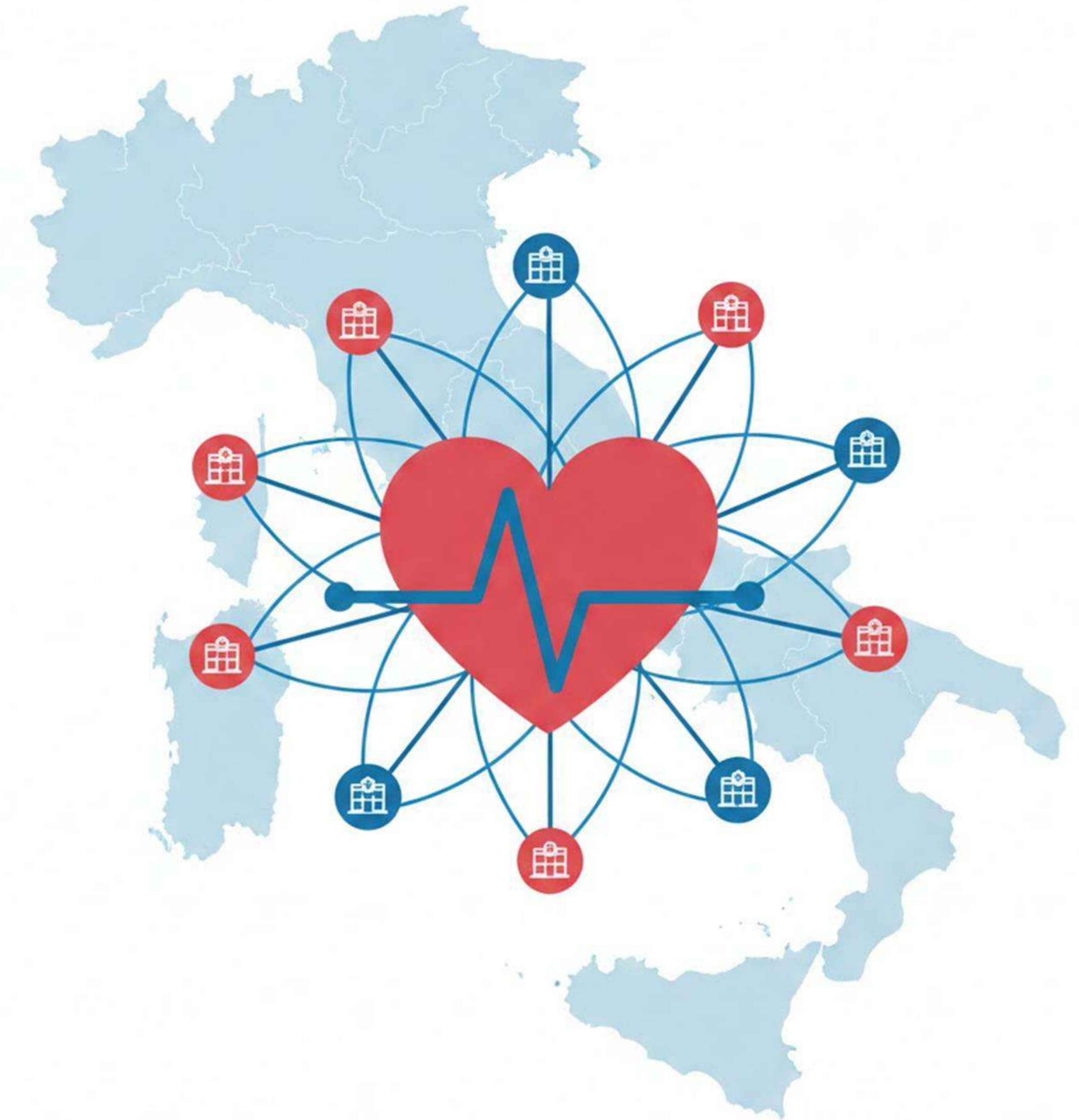
Study aim

To evaluate the prognostic performance of OPP in predicting in-hospital all-cause mortality in patients hospitalized for CS.



Methods

- **Altshock-2 Registry:** prospective multicenter registry on consecutive CS patients (11 Centres).
- **Population:** adult AMI-CS and ADHF-CS patients.
- **Timeline:** March 2020 – November 2023.



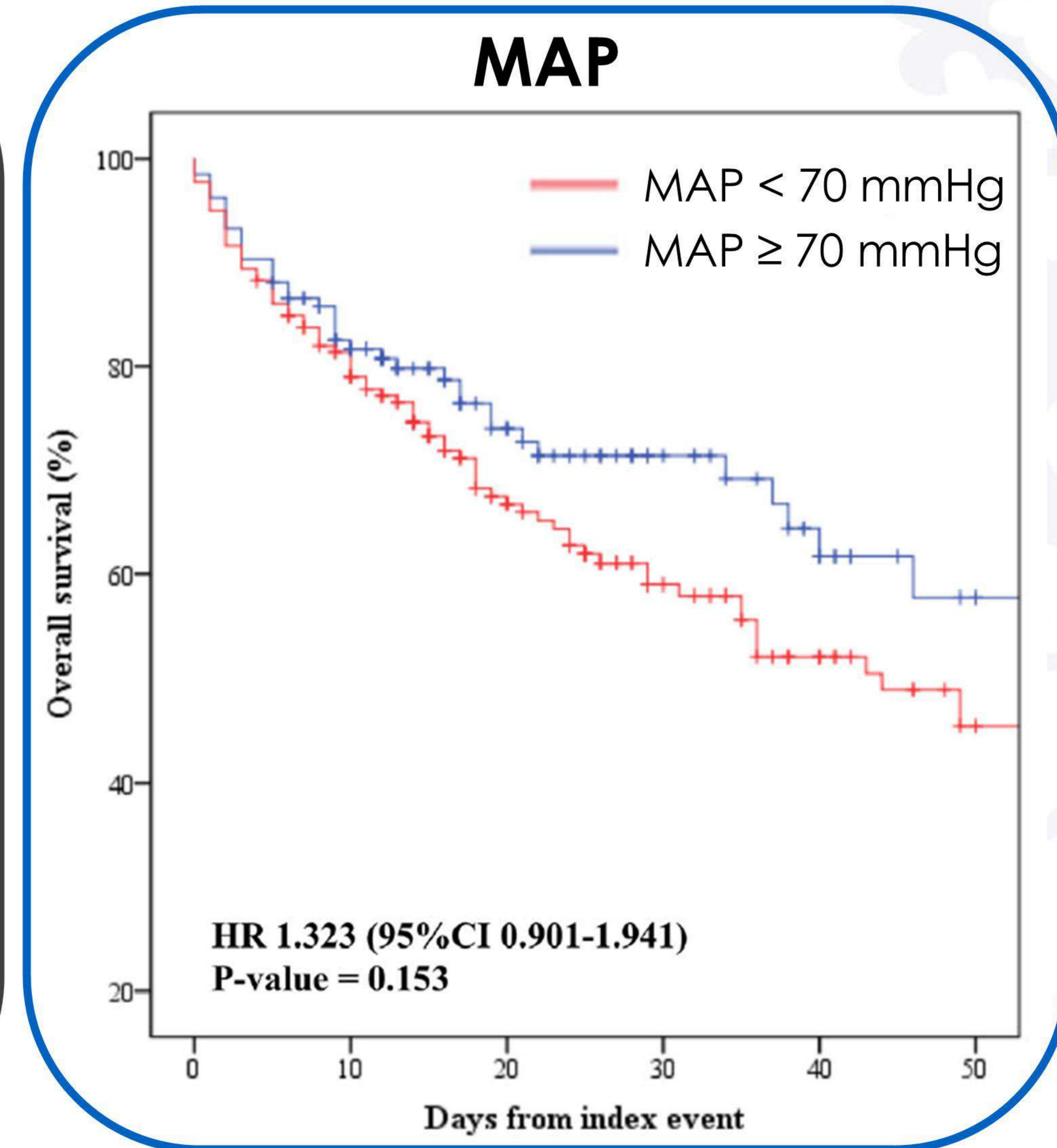
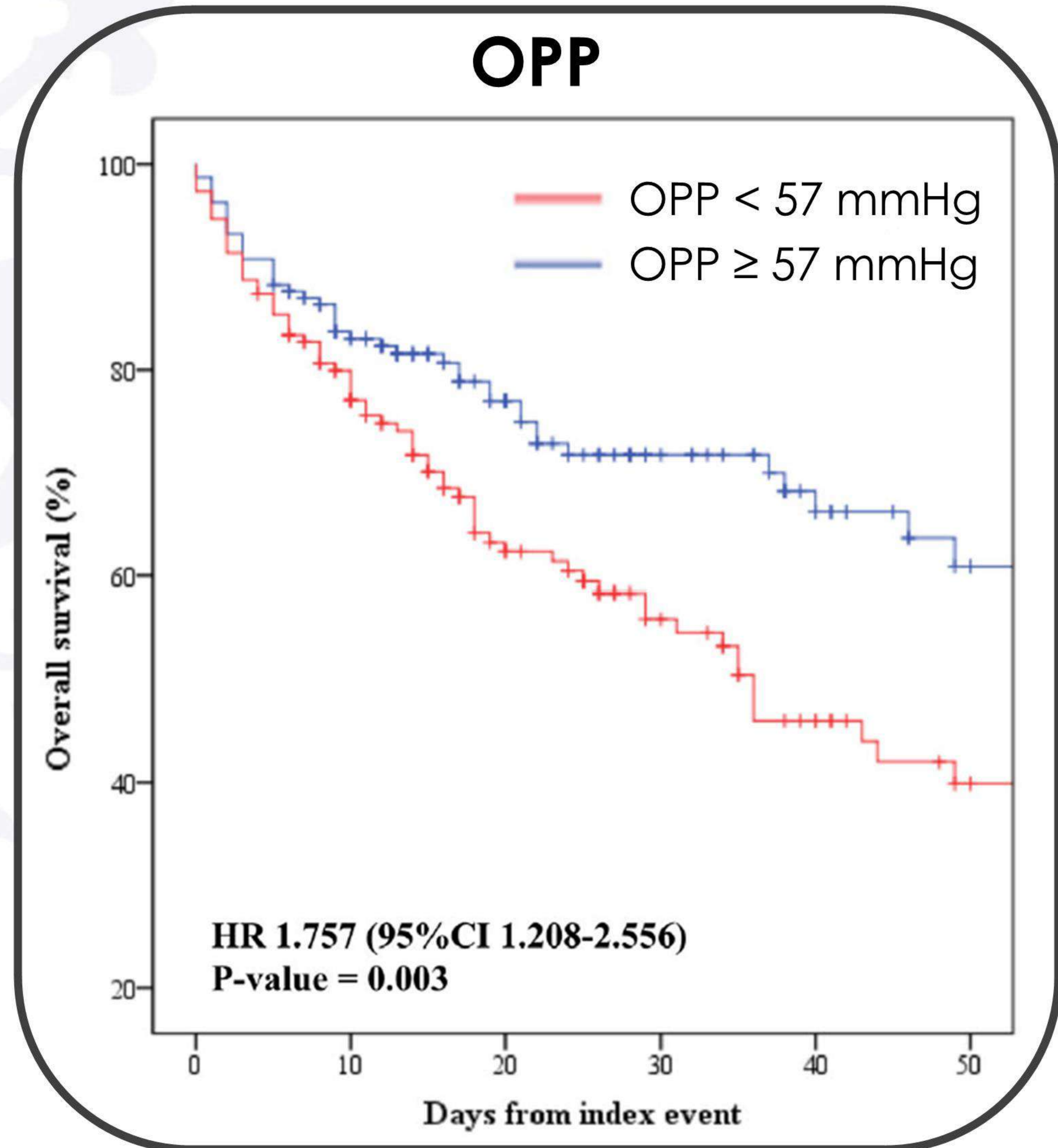
Results

Variables	All patients (n = 316)	In-hospital all-cause death		p-value
		Yes (n = 117)	No (n = 199)	
Age, years	64 ± 13	68 ± 11	62 ± 13	<0.001
Female sex, n (%)	62 (19.7)	27 (23.1)	35 (17.7)	0.075
Weight, kg	77.5 ± 15.7	76.8 ± 15.1	77.9 ± 16.1	0.554
Height, m	1.71 ± 9.01	1.70 ± 0.08	1.72 ± 0.10	0.012
BMI, kg/m ²	26.6 ± 8.0	26.7 ± 5.1	26.5 ± 9.3	0.838
NYHA class I–II, n (%)	183 (68.1)	68 (69.4)	115 (67.3)	0.694
Prior stroke/TIA, n (%)	23 (7.3)	15 (12.8)	8 (4.0)	0.004
Chronic kidney disease, n (%)	75 (23.7)	44 (37.6)	31 (15.7)	<0.001
Cancer history, n (%)	39 (12.4)	15 (12.8)	24 (12.1)	0.856
Prior PCI, n (%)	79 (25.1)	34 (29.1)	45 (22.7)	0.210
Prior CABG, n (%)	30 (9.5)	14 (12.0)	16 (8.0)	0.250
Atrial fibrillation, n (%)	74 (23.6)	34 (29.1)	40 (20.3)	0.077
ICD ^a , n (%)	57 (18.1)	20 (17.1)	37 (18.7)	0.723
CRT-D, n (%)	26 (8.3)	12 (10.3)	14 (7.0)	0.303
CS aetiology, n (%)				
ACS-CS	186 (58.9)	74 (63.2)	112 (56.3)	0.224
ADHF-CS	130 (41.1)	43 (36.8)	87 (43.7)	

Results

Variables	All patients (n = 316)	In-hospital all-cause death		p-value
		Yes (n = 117)	No (n = 199)	
SOFA score	7.1 ± 3.2	8.3 ± 3.0	6.4 ± 3.1	<0.001
SCAI shock stage, n (%)				
Stage A	9 (3.0)	2 (1.8)	7 (3.7)	
Stage B	34 (11.2)	10 (8.8)	24 (12.6)	
Stage C	160 (52.6)	45 (39.5)	115 (60.5)	<0.001
Stage D	75 (24.7)	46 (40.4)	29 (15.3)	
Stage E	26 (8.6)	11 (9.6)	15 (7.9)	
Haemodynamics				
Systolic blood pressure, mmHg	98 ± 22	94 ± 19	100 ± 23	0.024
MAP, mmHg	70 (60–80)	67 (60–75)	70 (60–83)	0.027
Diastolic blood pressure, mmHg	57 ± 15	55 ± 15	59 ± 15	0.043
Heart rate, bpm	92 ± 22	91 ± 23	92 ± 22	0.618
CVP, mmHg	11 (8–15)	14 (10–16)	10 (7–15)	0.001
Central venous oxygen saturation, %	61 ± 14	59 ± 15	61 ± 14	0.391
OPP, mmHg	57 (47–70)	54 (44–65)	61 (48–72)	0.002
Adjusted OPP, mmHg	35 (18–52)	28 (14–42)	40 (24–53)	<0.001
Shock index, bpm/mmHg	1.14 ± 0.41	1.13 ± 0.44	1.15 ± 0.39	0.613

In-hospital mortality



In-hospital mortality

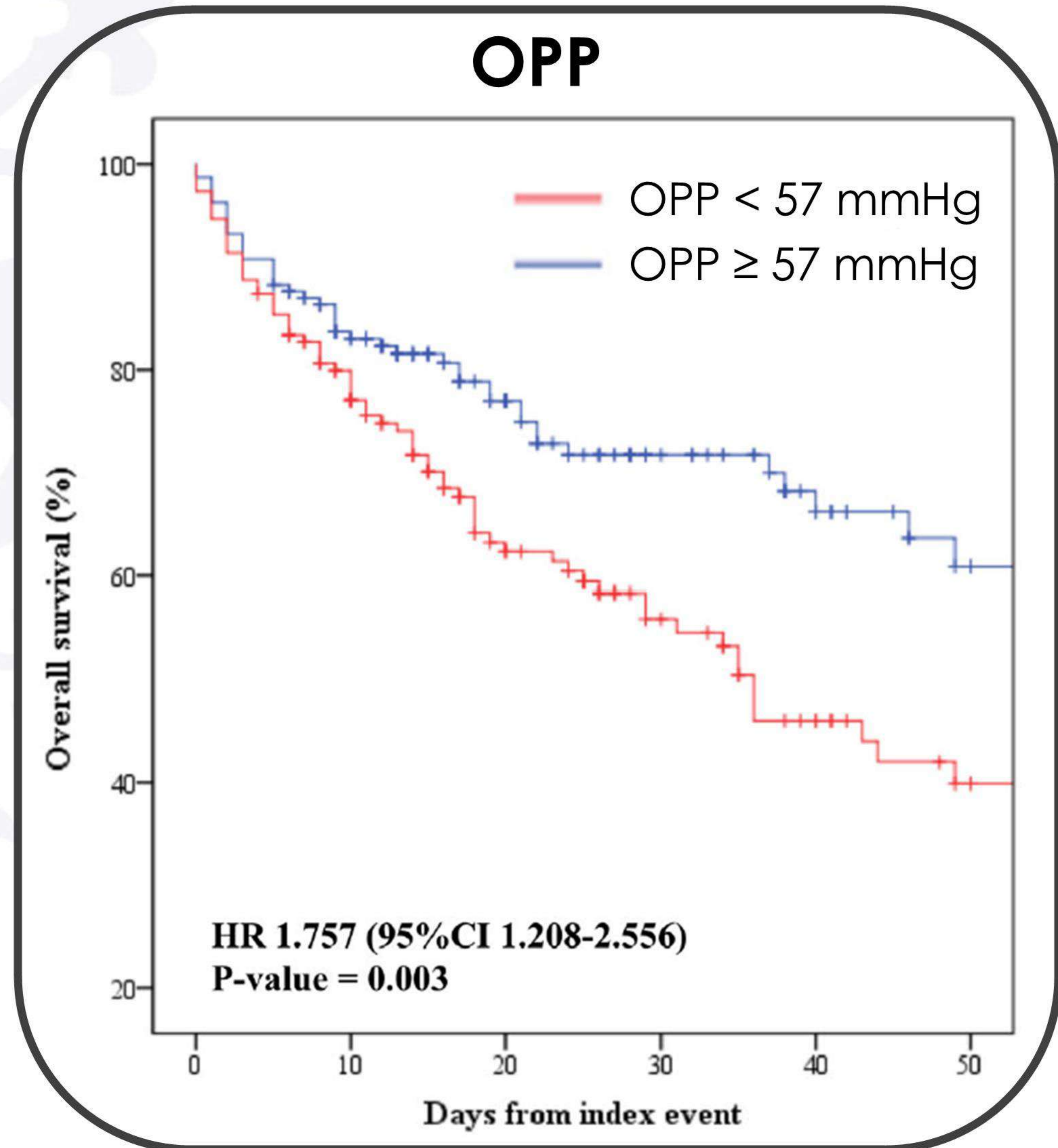


Table 2 Cox regression multivariable models on in-hospital all-cause mortality

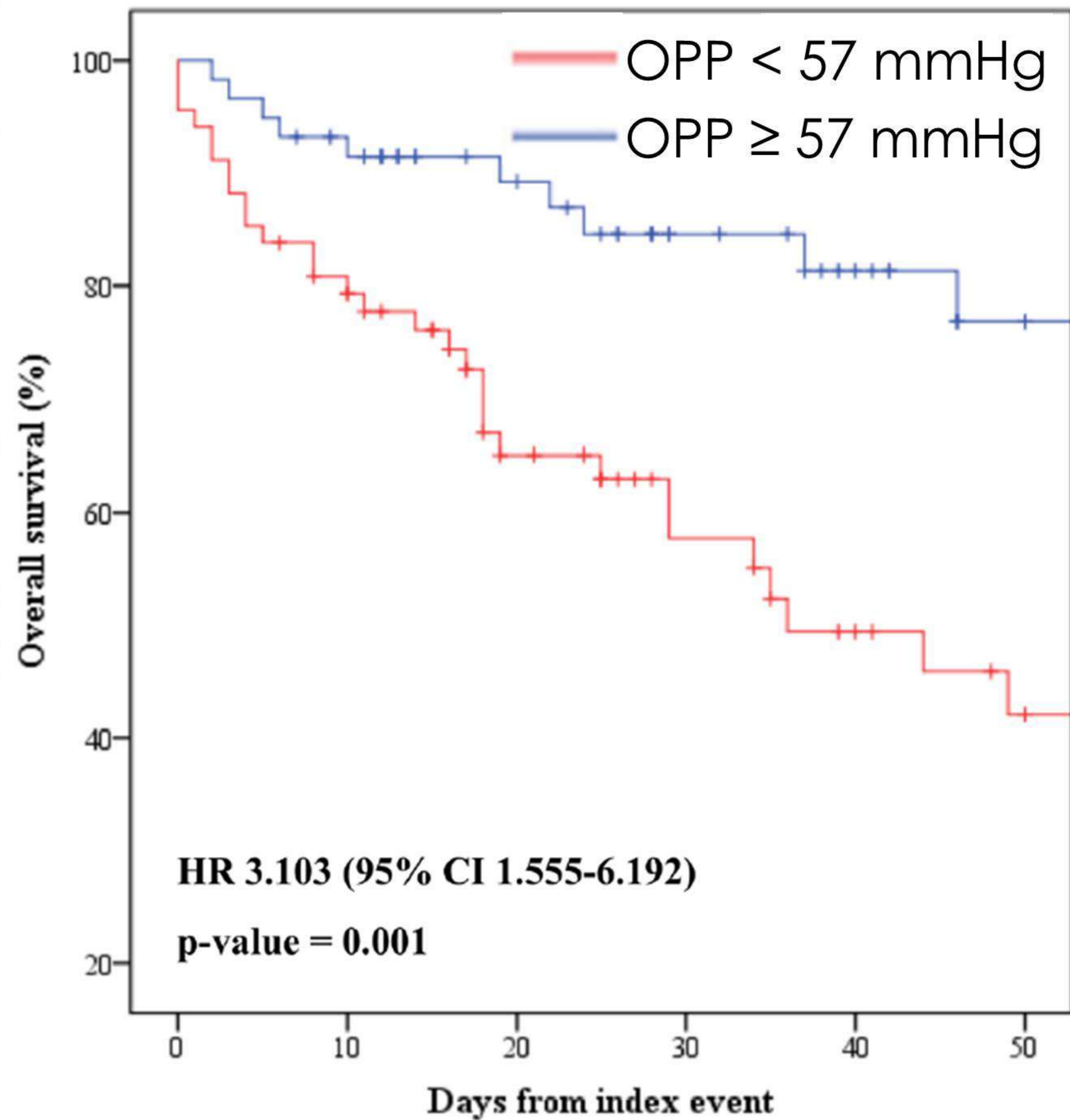
Variable	HR (95% CI)	p-value
Model 1		
Age	1.039 (1.022–1.057)	<0.001
OPP ^a	1.016 (1.004–1.029)	0.010
SOFA score	1.192 (1.121–1.268)	<0.001
Model 2		
Age	1.039 (1.022–1.056)	0.001
OPP ^a	1.013 (1.001–1.027)	0.048
CVP	1.021 (0.982–1.062)	0.289
SOFA score	1.186 (1.115–1.262)	<0.001
Model 3		
OPP ^a	1.014 (1.001–1.027)	0.030
Heart rate	0.996 (0.988–1.005)	0.387
CVP	1.038 (1.004–1.072)	0.027

CI, confidence interval; CVP, central venous pressure; HR, hazard ratio; OPP, organ perfusion pressure; SOFA, Sequential Organ Failure Assessment.

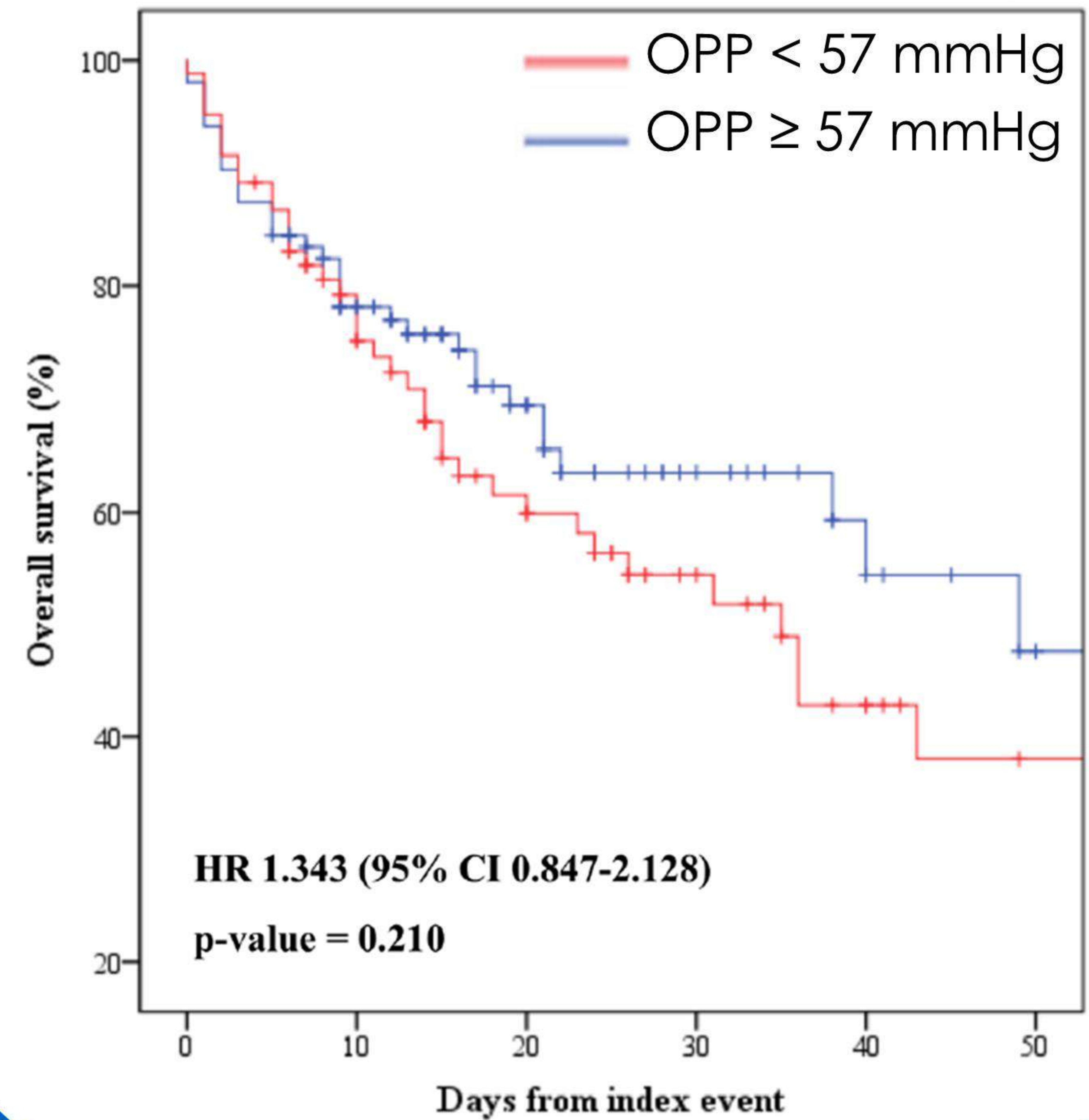
^aThe HR for OPP is per unit of mmHg decrease.

In-hospital mortality

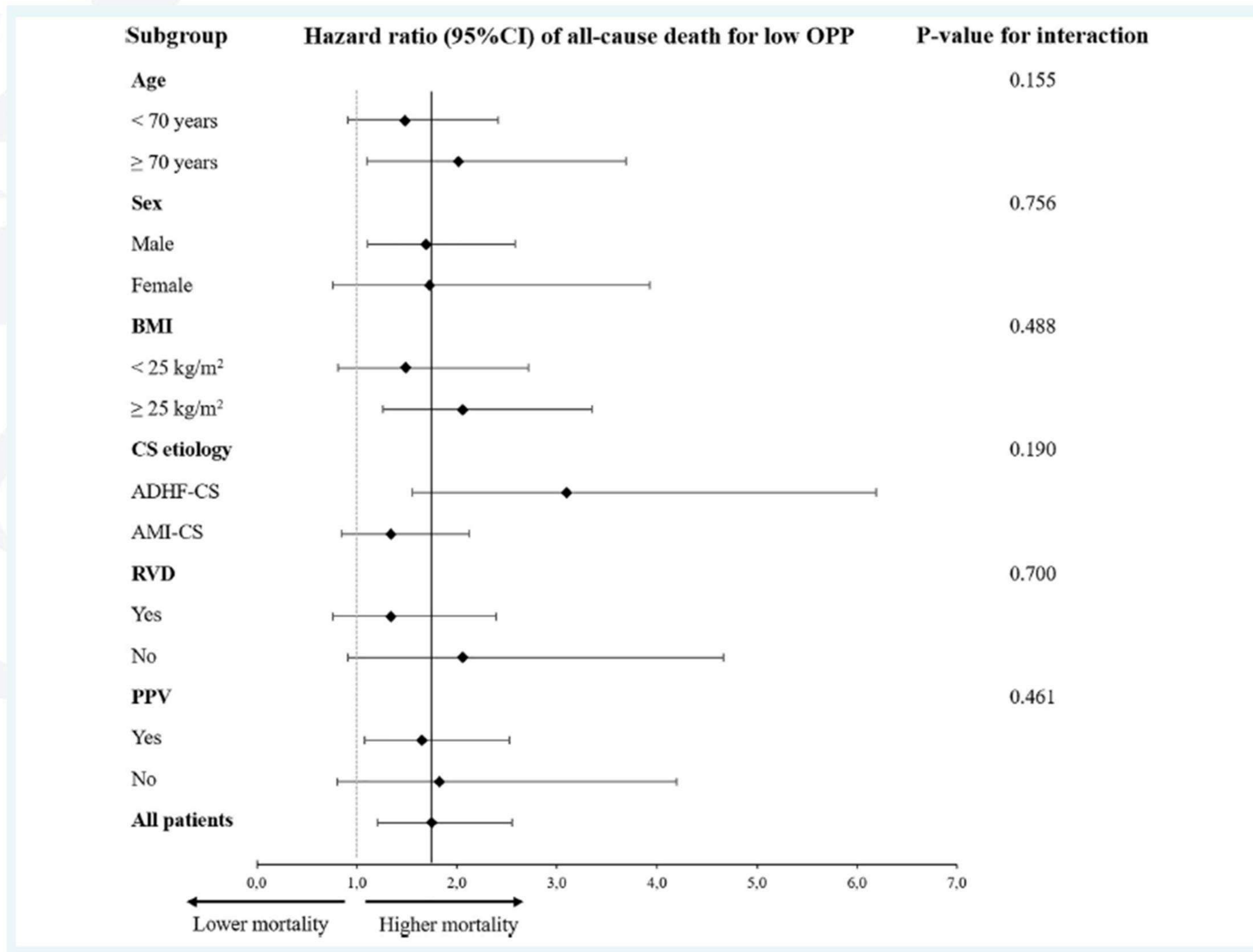
ADHF-CS



AMI-CS



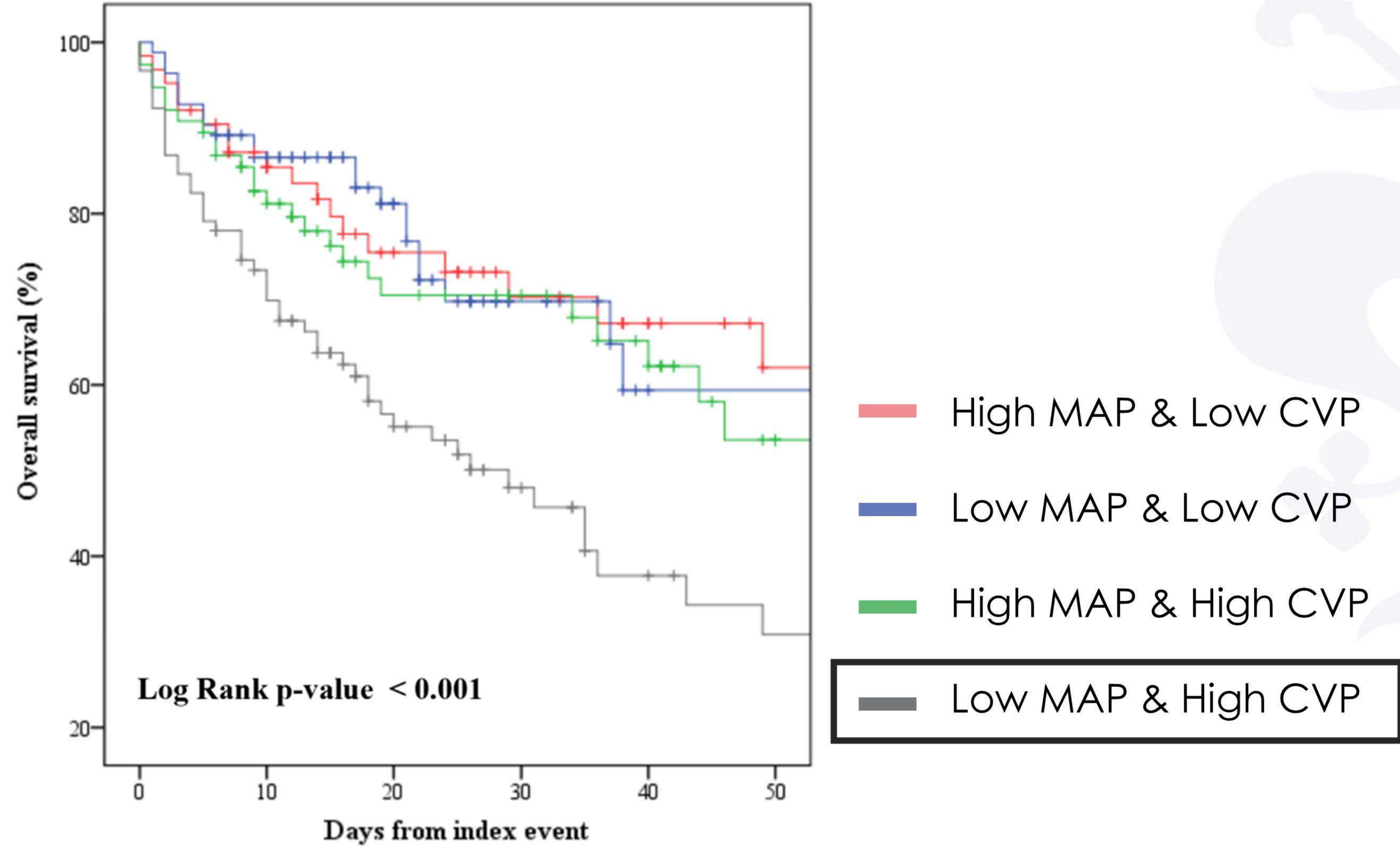
In-hospital mortality



Overall and subgroup analysis on low OPP as a predictor of in-hospital all-cause mortality. The dotted line shows the no effect point, and the bold line shows the overall effect point.

ADHF, acutely decompensated heart failure; AMI, acute myocardial infarction; BMI, body mass index; CI, confidence interval; CS, cardiogenic shock; PPV, positive pressure ventilation; RVD, right ventricular dysfunction

In-hospital mortality



Limitations

- **Post-hoc analysis** of an observational study.
- **Selection bias:** OPP and outcome data were not available for the whole Altshock-2 registry cohort.
- **Generalizability:** only ADHF-CS and AMI-CS were evaluated.
- **Heterogeneity:** different diagnosis and treatment algorithms.

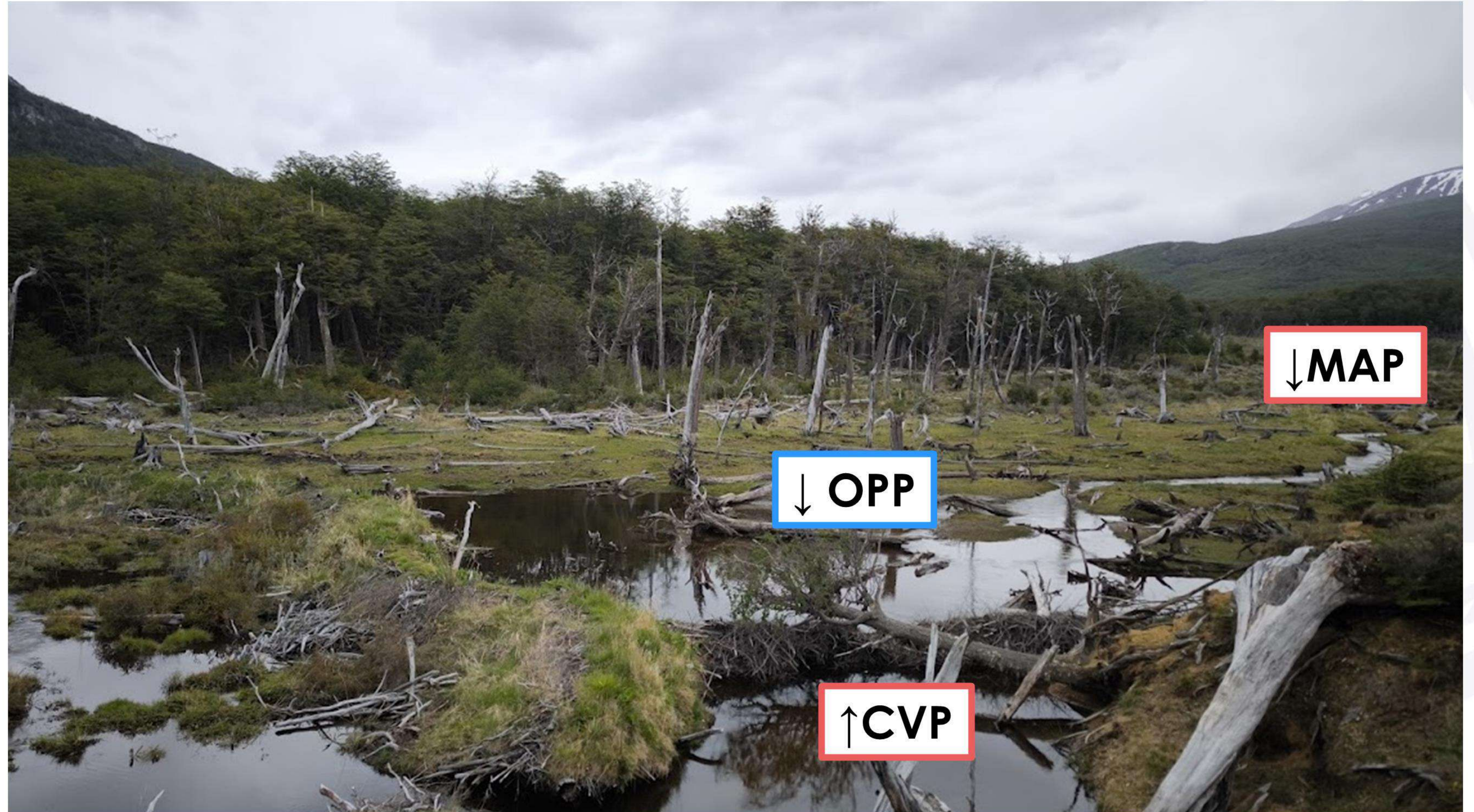
Take-home figure

Why did these trees die?

A) Slow river stream

B) Barrier to flow

C) Combination of both



Tierra del Fuego, Patagonia

GRAZIE PER L'ATTENZIONE!

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