

The out-of-hospital cardiac arrest in patients with acute myocardial infarction and pre-existing aortic stenosis

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Background

- Out-of-hospital cardiac arrest is the third leading cause of death in developed countries with an estimated annual incidence of 40.8–100.2 persons per 100,000 habitants worldwide and from 67 to 170 per 100,000 inhabitants in Europe.^{1,2}
- The most common cause of such events (70-85%) is cardiac, with acute myocardial infarction being the leading cause.³
- Out-of-hospital cardiac arrest is one of the feared and often fatal complications that occur early after AMI in the prehospital setting, with an incidence of approximately 7-10%.⁴

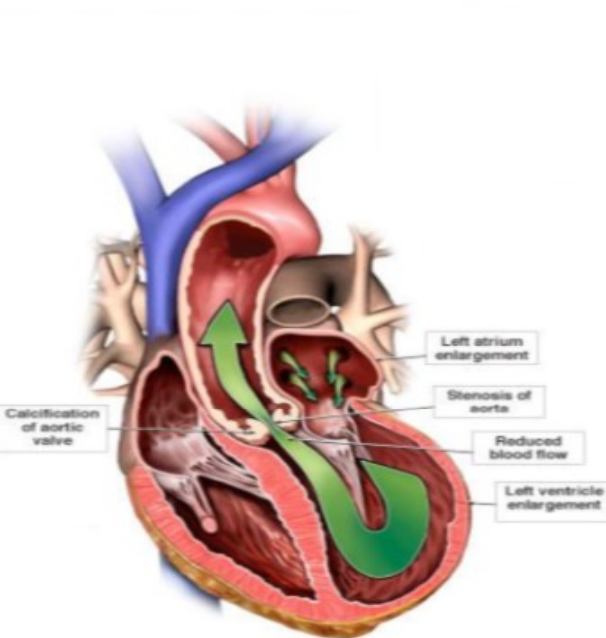
¹ Baumgartner, H. et al. 2017 ESC/EACTS Guidelines for the management of valvular heart disease. Eur. Heart J. 38, 2739–2791 (2017).

² Otto, C. M. et al. 2020 ACC/AHA guideline for the management of patients with valvular heart disease: a report of the American college of cardiology/American heart association joint committee on clinical practice guidelines. Circulation 143, e72–e227 (2021).

³ Lindman, B. R. et al. Calcific aortic stenosis. Nat. Rev. Dis. Primer 2, 1–28 (2016).

⁴ Otto, C. M. & Prendergast, B. Aortic-valve stenosis — from patients at risk to severe valve obstruction. N. Engl. J. Med. 371, 744–756 (2014).

Background



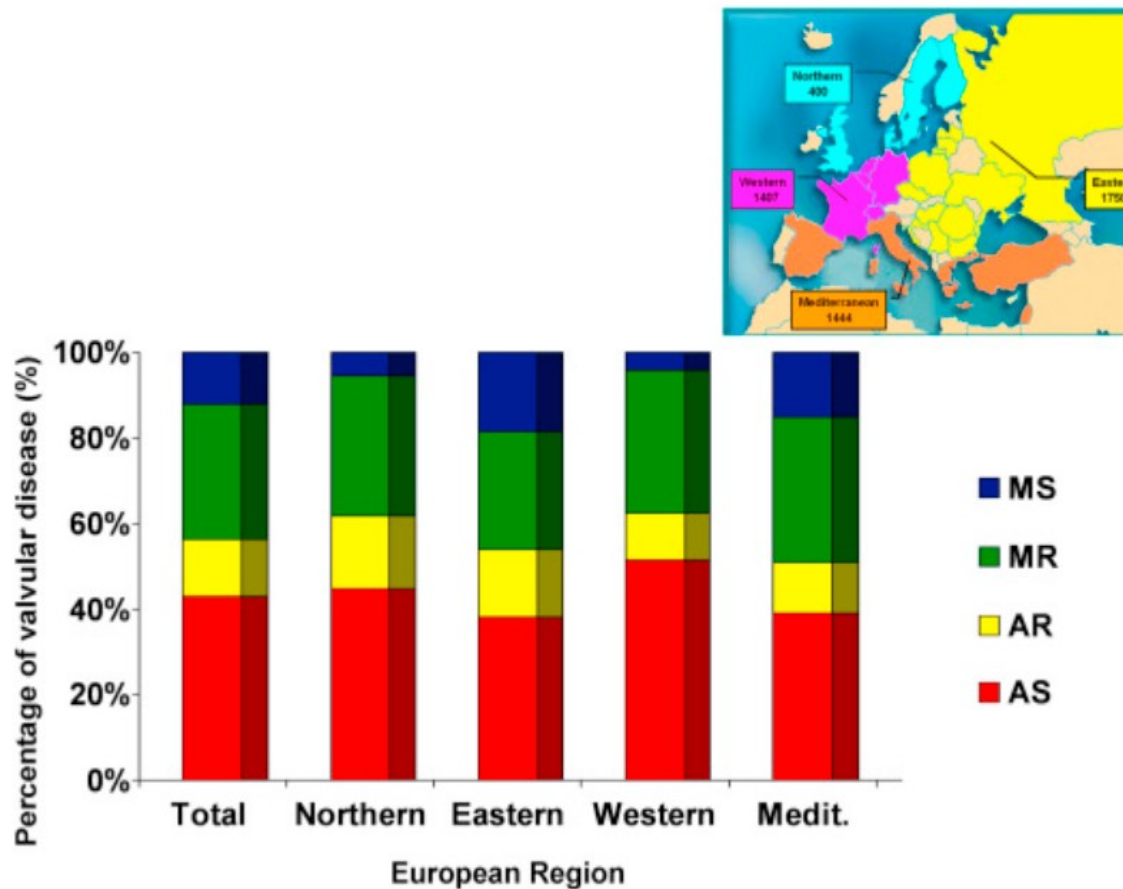
- The chances of survival after OHCA are significantly higher when the immediate resuscitation is initiated.
- At the heart of resuscitation lies the aim to maximize flow through the left ventricular outflow tract, in order to generate cerebral and myocardial perfusion pressure until circulation can be restored.
- In aortic stenosis the effectiveness of chest compressions may be ineffective due to the obstruction of the outflow tract, preventing adequate forward blood flow and increasing the myocardial oxygen demand.
- Even after return of spontaneous circulation, patients with AS may still be hemodynamically unstable due to continued blood obstruction and impaired left ventricle function.

Background

Valvular heart disease is an increasingly common condition, with aortic stenosis being the most prevalent valvular lesion worldwide

Left-sided valvular lesions, particularly aortic stenosis, are associated with increased risk of sudden cardiac arrest and death.

The annual incidence of SCD ranges from 0.3% to 3% in patients with aortic stenosis, and one study showed that the cumulative incidence of SCD was 14% at 8 years.



background

Because of their common risk factors, left-sided valvular heart disease and AMI often coexist. VHD and AMI are the leading causes of cardiovascular morbidity and mortality and are progressively increasing.¹ However, only 28% of the studies analyzing survival outcomes in cardiac arrest adjust results for comorbidities, and the predictive role of VHD in OHCA outcome is rarely discussed²

o VT, Gardin JM, Skelton TN, Gottdiener JS, Scott CG, Enriquez-Sarano M. Burden of valvular heart diseases: a population-based study. *The Lancet*. 2006.

e PF, Carlson JN, Ghosh A, Zverinova KM, Doi SA, Rittenberger JC. Frequency of adjustment with comorbidity and illness severity scores and indices in cardiac arrest *Resuscitation*. 2017

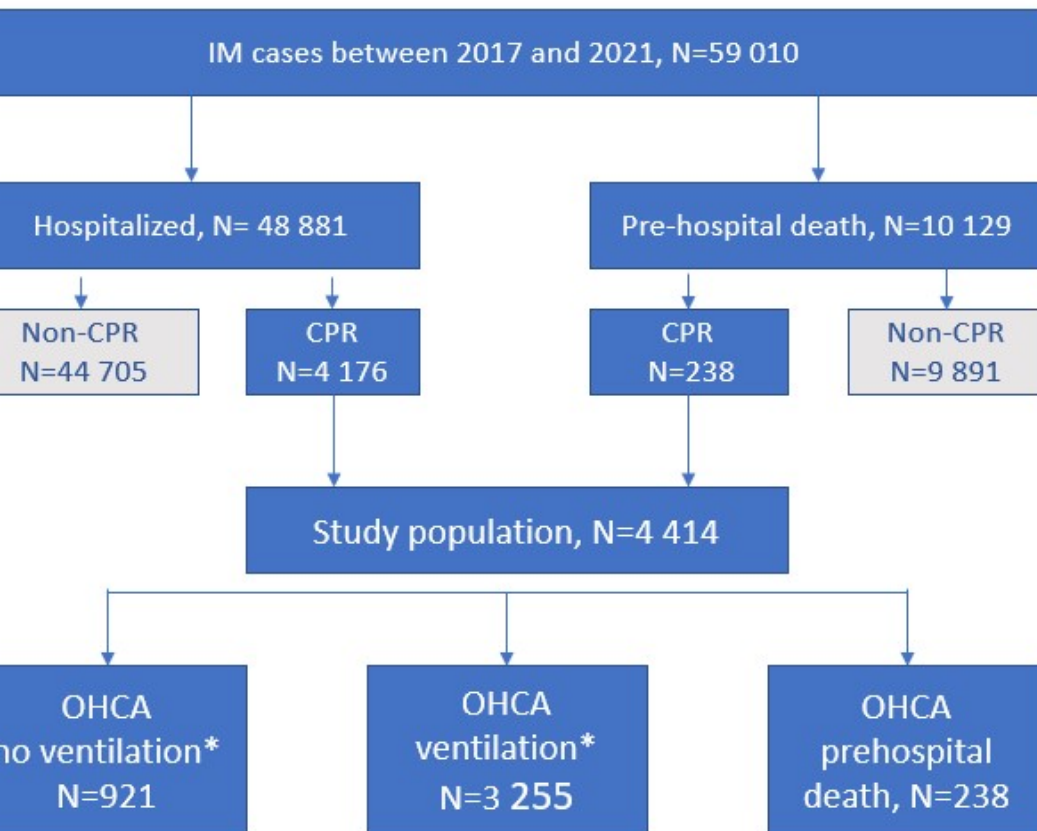
Aim of the study

To evaluate the predictive value of significant aortic stenosis on the complexity of resuscitation and survival of patients after the out-of-hospital cardiac arrest due to acute myocardial infarction

Complexity of resuscitation = the necessity of mechanical ventilation on admission

Significant aortic stenosis = moderate to severe aortic stenosis diagnosed before OHCA

Study population



Data source

In cooperation with the Institute of Health Information and Statistics of the Czech Republic a complex algorithm and methodology was developed to obtain BigData by connecting several National Registers:

The National Health Information System is defined in 70 par. I of the Act No. 372/2011 Coll., on Health Services and Conditions of Their Provision (Act on Health Services)

The National Registry of Cardiovascular Surgery Interventions: Module of Cardiovascular Intervention

The National Registry of Reimbursed Health Services

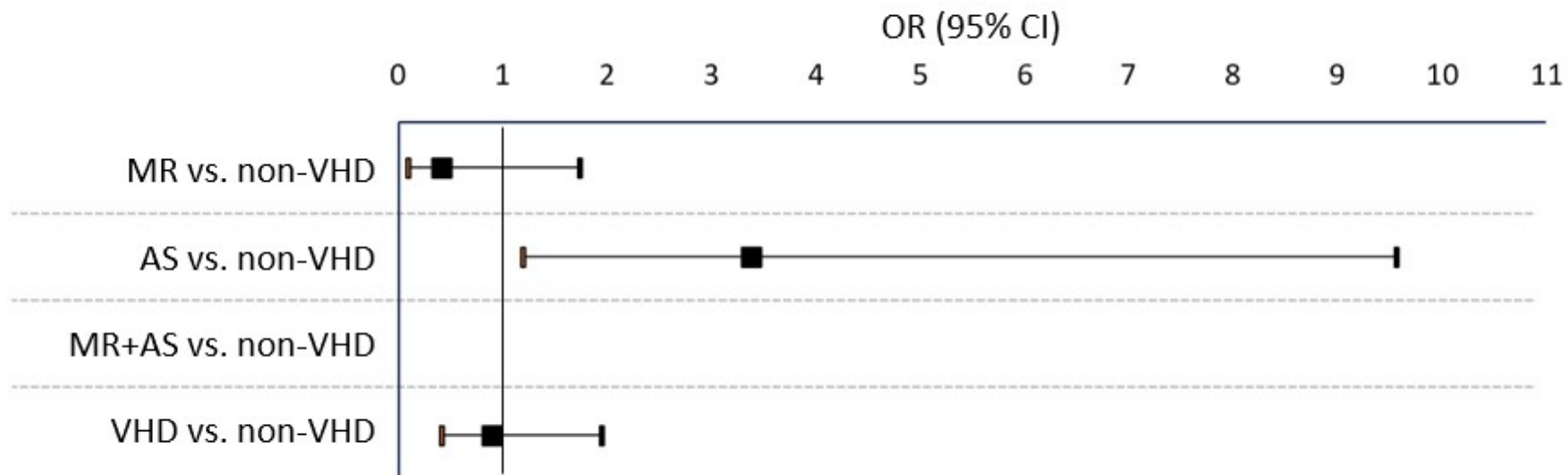
The National Registry of Deaths

The characteristics of the groups

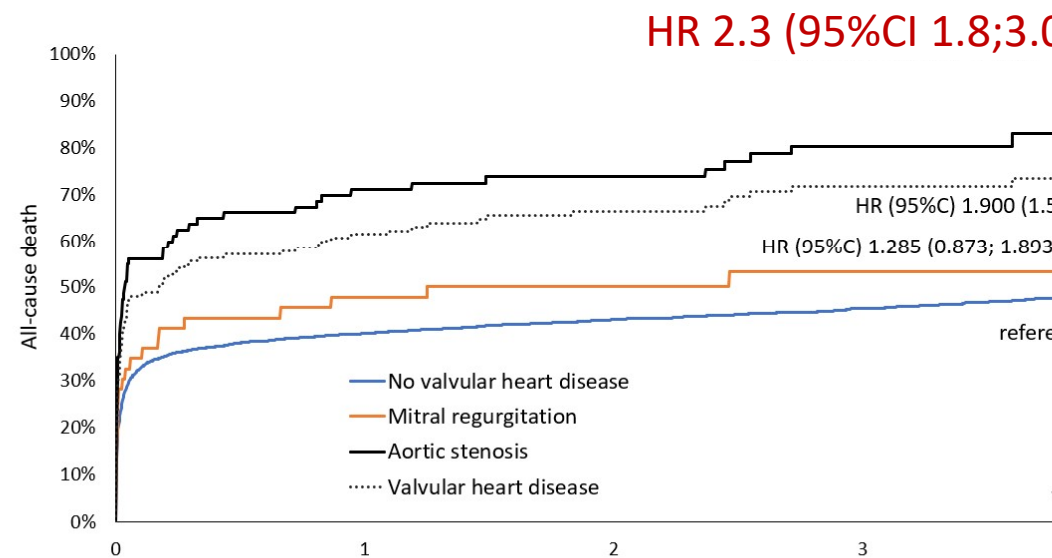
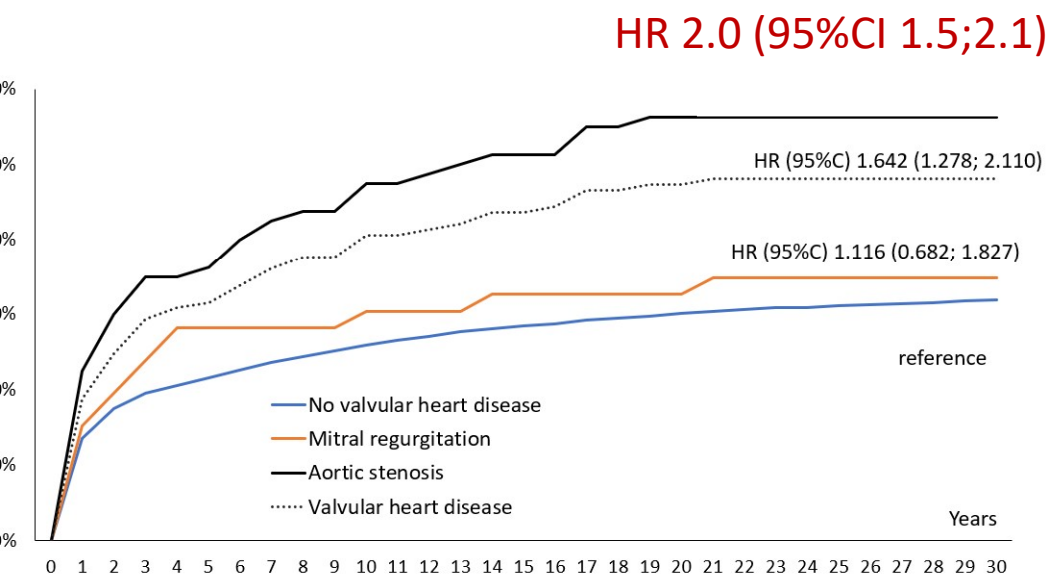
		a) OHCA - no ventilation	b) OHCA ventilation	c) OHCA - death before hospital	p (a x b)	p (a x c)	p (b x c)
Total		N = 921	N = 3 255	N = 238			
VHD		30 (3.3%)	91 (2.8%)	13 (5.5%)	0.44	0.12	0.028
MR		16 (1.8%)	28 (0.9%)	3 (1.3%)	0.03	0.78	0.47
AS		11 (1.2%)	59 (1.8%)	10 (4.2%)	0.24	<0.01	0.025
Gender	Men	695 (75.5%)	2 456 (75.5%)	142 (59.7%)	1.00	<0.01	<0.01
	Women	226 (24.5%)	799 (24.5%)	96 (40.3%)	1.00	<0.01	<0.01
Age (years)	mean (SD)	63.4 (12.7)	64.3 (12.5)	71.2 (11.5)	0,07	<0.01	<0.01
Age	< 40	27 (2.9%)	75 (2.3%)	2 (0.8%)	0.28	0.1	0.17
	40–49	112 (12.2%)	346 (10.6%)	12 (5.0%)	0.19	<0.01	<0.01
	50–59	197 (21.4%)	642 (19.7%)	19 (8.0%)	0.26	<0.01	<0.01
	60–69	278 (30.2%)	1 014 (31.2%)	60 (25.2%)	0.60	0.15	0.06
	70–79	218 (23.7%)	837 (25.7%)	90 (37.8%)	0.21	<0.01	<0.01
	≥ 80	89 (9.7%)	341 (10.5%)	55 (23.1%)	0.50	<0.01	<0.01
Age 65 years and above		447 (48.5%)	1 711 (52.6%)	182 (76.5%)	0.03	<0.01	<0.01
CHOPN		145 (15.7%)	425 (13.1%)	31 (13.0%)	0.04	0.31	1.00
DM		160 (17.4%)	647 (19.9%)	123 (51.7%)	0,1	<0.01	<0.01
Hypertension		699 (75.9%)	2 380 (73.1%)	187 (78.6%)	0.1	0.44	0.07
Heart failure		361 (39.2%)	1 186 (36.4%)	72 (30.3%)	0.13	0.011	0.06
CAD		871 (94.6%)	2 854 (87.7%)	128 (53.8%)	<0.01	<0.01	<0.01
Atrial fibrillation		140 (15.2%)	366 (11.2%)	30 (12.6%)	<0.01	0.36	0.53
Dyslipidemia		851 (92.4%)	2 559 (78.6%)	166 (69.7%)	<0.01	<0.01	<0.01

Multivariate analysis

Prehospital mortality of patients with OHCA due to AMI
(model adjusted for age, gender and comorbidities)



Kaplan-Meier survival curve for all-cause death of patients with AMI after OHCA according to preexisting significant aortic stenosis



Conclusion

Preexisting moderate to severe aortic stenosis has a significant adverse effect on the survival of patients with AMI after out-of-hospital arrest and is a significant risk factor for pre-hospital mortality.

Patients with moderate to severe aortic stenosis should be carefully screened for coronary artery disease, pharmacotherapy to prevent major cardiovascular events should be considered and earlier planning of valve intervention after AMI should be discussed.

Strength and Limitation

- This is the largest study examining the impact of aortic stenosis on survival in OHCA patients in Czech Republic. With regards to level of ascertainment the Registry information is complete and records every single case.
- However, using ICD-10 codes, we are unable to grade the severity of the valvular lesion (which would require echocardiographic parameters). This is a limitation of the current study.
- Therefore, the coefficients obtained represent the average population effect (i.e. the overall average association between the lesion and the outcome). It is likely that those with severe lesions (particularly severe AS) drive the estimates.



Thank you for your attention



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