CORRESPONDENCE

Research Letter

The Prognosis of Cardiogenic Shock Following Acute Myocardial Infarction—an Analysis of 2693 Cases From a Prospective Multicenter Registry

Cardiogenic shock (CS) is the most common cause of death in patients with acute myocardial infarction (AMI) and complicates 5–12% of cases [1]. In-hospital mortality from AMI complicated with CS (CS-AMI) remains consistently high at about 50%[2]. Our analysis aims to examine the incidence, outcomes, and predictive factors in a large cohort of patients with CS-AMI.

Methods

The analysis is based on data from the national all-comers registry, the cardiovascular interventions module of which is a prospective multicenter registry that has collected data on all percutaneous coronary interventions (PCI) performed in all PCI centers in the Czech Republic since 2005.

Standard descriptive statistics were applied in the analysis: absolute and relative frequencies for categorical variables, means with standard deviations for continuous variables. Univariate and multivariate logistic regressions adjusted for the centers were used for the descriptive analysis of predictors of mortality. Kaplan–Meier methodology and the hazard ratio (HR), based on the Cox proportional hazards model, were applied for the description of time to event during the evaluated time window. Analyses were conducted using SPSS 28.0.1.1. For the evaluation of the association with comorbidities, the Deyo-Charlson Comorbidity Index based on the International Classification of Diseases codes was used.

Results

The initial dataset included 50 745 AMI patients from 2016–2020 (58.2% of them with ST-elevation myocardial infarction [STEMI] and 41.8% with non-ST-elevation myocardial infarction [NSTEMI]), of whom 2822 patients had CS-AMI. Patients with available information on 30-day mortality (N = 2693) were used in the detailed analysis. On average, 56.7% of CS-AMI patients required cardiopulmonary resuscitation (CPR) (both outand in-hospital), 67.1% mechanical ventilation and 53.5% both. The HR for the 30-day mortality of patients with CS against patients without CS based on survival analysis is 15.25 with 95% confidence interval (CI) [14.24; 16.33].

The basic characteristics of patients are presented in *Table 1*. The univariate logistic regression identified female sex (odds ratio [OR] 1.23, age (for each one-year increment: OR 1.04, chronic kidney disease/failure (OR 1.67), diabetes mellitus (OR 1.68), subacute STEMI (OR 1.48), resuscitation (OR 1.23), mechanical ventilation (OR 1.35), three-vessel disease (OR 1.79), left main disease (OR 1.42), and more than 8 hours delay from symptom onset to revascularization (OR 1.48) as the factors with the highest predictive power for 30-day mortality. Although the mortality rate was numerically higher during autumn and winter (54.2% vs. 45.8% and 51.45% vs. 48.55%, respectively, p = 0.020) and during the weekend vs. the working week (51.45% vs. 48.55%, p < 0.001) a predictive role of these factors was not confirmed neither in univariate nor in multivariate analysis.

TABLE 1

Basic characteristics of patients with cardiogenic shock in the period 2016-2020 with 30-day mortality

		Amount (%)	30-day mortality (%)
Total N (%)		2693 (100.0%)	1357 (50.4%)
Sex	Men	72.6%	49.0%
Age	< 40 40–49 50–59 60–69 70–79 ≥ 80	1.1% 6.5% 16.1% 31.7% 28.3% 16.3%	40.0% 33.7% 32.8% 46.1% 58.5% 69.5%
Diabetes mellitus		23.1%	59.8%
Previous PCI		17.7%	54.1%
Previous CABG		5.6%	46.7%
Chronic kidney disease/failure		8.1%	61.9%
Post CPR		57.4%	52.6%
Artificial lung ventilation		68.0%	52.8%
Time from symptom onset to PCI (in hours)			
	< 2	14.4%	46.3%
(acute STEMI only)	2–3 3–4 4–8 > 8 Not known	18.8% 10.3% 11.7% 7.5% 37.4%	42.8% 49.6% 53.2% 55.9% 54.0%
No. of diseased vessels	1 2 3 Not known	25.7% 28.5% 40.5% 5.2%	2.3% 47.5% 56.8% 56.4%
Left main stenosis >50%	No Yes Not known	81.3% 17.3% 1.4%	48.7% 57.4% 60.5%
DCCI	0–1 2–3 4–6 > 6	10.7% 31.3% 37.9% 20.2%	10.6% 29.0% 39.8% 20.7%

CABG, Coronary artery bypass graft; CPR, cardiopulmonary resuscitation; DCCI, Deyo Charlson Comorbidity Index; STEMI, ST-elevation myocardial infarction; PCI, percutaneous coronary intervention

Multiple logistic regression showed that age (> 80 years), diabetes mellitus, cardiopulmonary resuscitation, mechanical ventilation, three-vessel disease and left main disease were the independent factors with the highest predictive power for 30-day mortality (*Table 2*).

TABLE 2

Characteristics influencing 30-day mortality of patients with cardiogenic shock $\!\!\!\!\!^*$

	OR [95% CI]
Women vs. men	1.00 [0.83; 1.21]
Age (years) (p<0.001) 60–69 vs. < 60 years 70–79 vs. < 60 years ≥ 80 vs. < 60 years	1.67 [1.33; 2.11] 2.65 [2.07; 3.40] 4.69 [3.50; 6.28]
Previous PCI	1.28 [1.03; 1.60]
Previous CABG	0.65 [0.45; 0.94]
Diabetes mellitus	1.45 [1.17; 1.79]
Chronic kidney disease/failure	1.66 [1.21; 2.30]
MI type (p=0.062) Subacute STEMI vs. acute STEMI NSTEMI vs. acute STEMI	1.23 [0.97; 1.57] 0.87 [0.69; 1.09]
Post CPR	1.27 [1.02; 1.59]
Artificial lung ventilation	1.54 [1.21; 1.95]
Number of diseased vessels (p=0.006) 2 vs. 1 3 vs. 1	1.09 [0.87; 1.36] 1.36 [1.09; 1.70]
Left main stenosis 50%	1.36 [1.09; 1.71]
TIMI flow before PCI: 3 vs. 0–2	1.08 [0.86; 1.36]
TIMI flow after PCI: 3 vs. 0–2	2.68 [2.18; 3.29]
DCCI (p=0.137) 2-3 vs. 0-1 4-6 vs. 0-1 > 6 vs. 0-1	0.79 [0.59; 1.06] 0.82 [0.61; 1.10] 0.68 [0.49; 0.95]

*multivariate model adjusted for centers

CABG, Coronary artery bypass graft; CPR, cardiopulmonary resuscitation; DCCI, Deyo–Charlson Comorbidity Index; HR, hazard ratio; MI, myocardial infarction;

NSTEMI, Non-ST-elevation myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST-elevation myocardial infarction; TIMI, thrombolysis in myocardial infarction

Discussion

Our data are valuable because they include a large group of consecutive patients with CS-AMI. Analysis showed a 30-day mortality rate of 50.4%, similar to previous findings [3], [4]. These high numbers show that CS is an important target for further improvements in the management of patients with AMI.

The key finding of our study is that the outcome of patients with CS-AMI is highly affected by the patient's degree of instability, as documented by mechanical ventilation and resuscitation, and the timing of successful revascularization. The independent impact of comorbidity and nontraditional factors on the prognosis of these patients has not been confirmed. The analysis of predictors of 30-day mortality may be helpful in creating profiles of CS-AMI patients and in triage, which is important in the decision of management strategies.

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Conflict of interest statement

PK received lecture honoraria from Chiesi. The remaining authors declare that they have no conflicts of interest.

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