DOI 10.4149/BLL_2024_66

Bratisl Med J 2024; 125 (7):
429–434

CLINICAL STUDY

Five-year prognosis of patients with acute myocardial infarction and out-of-hospital cardiac arrest

Daniel ALUSIK[1], Andrej CORBA[1], Jan KMEC[1], Ignac KUBICA[2], Lubomira ROMANOVA[2], Peter GAL[3], Martin STUDENCAN[4]

East Slovak Institute of Cardiovascular Diseases, Inc., Kosice, Slovakia. **mstudencan@vusch.sk**

ABSTRACT

OBJECTIVES: This study aimed to assess the mortality and prognosis of acute myocardial infarction (AMI) patients with out-of-hospital cardiac arrest (OHCA) initially admitted to Department of Anesthesiology and Intensive Care in comparison with patients initially admitted to Cardiac Centre (CC).

BACKGROUND: Global acute coronary syndrome (ACS) registries often omit patients with OHCA initially admitted to anaesthesiology and intensive care units. This exclusion may lead to underestimated mortality rates in patients following acute MI worldwide.

METHODS: A retrospective analysis was conducted in patients admitted in 2014 to the (Department of Anesthesiology and Intensive Care) at a single center, J.A. Reiman Teaching Hospital in Presov, Slovakia. Survival rates were evaluated in-hospital, at 30 days, and annually over a five-year period. Patients with STEMI and NSTEMI were analyzed separately, particularly during the early in-hospital phase.

RESULTS: In the OHCA group, 52% of STEMI patients experienced in-hospital mortality, whereas the CC group reported only 3% mortality. The total hospital mortality for STEMI patients was 6.69%. Among NSTEMI patients in the OHCA group, in-hospital mortality reached 50%, compared to 4.33% in the CC group. The total center mortality for all NSTEMI patients was 6.09%.

CONCLUSION: Although the short-term prognosis for MI patients with OHCA is unfavorable, with a 30-day mortality rate of 54.9%, for those who survive the initial 30 days following cardiac arrest and are successfully discharged from the hospital, the long-term prognosis aligns with MI patients without OHCA. In light of these findings, the inclusion of all patients with MI (from both OHCA and CC groups) in global ACS registries could significantly raise in-hospital and 30-day mortality rates *(Tab. 3, Fig. 4, Ref. 21).* Text in PDF www.elis.sk

KEY WORDS: myocardial infarction, resuscitation, prognosis, OHCA.

Introduction

Based on the World Health Organization cardiovascular diseases are the leading cause of mortality, accounting for approximately 17 million deaths worldwide each year. Among these fatalities, ischemic heart disease, primarily in the form of acute coronary syndrome (ACS) and especially myocardial infarction (MI), constitutes a substantial proportion. In approximately 6–8% of MI cases, malignant rhythm disorders manifest within 48 hours. However, more frequently, they occur during the pre-hospitalization phase, requring immediate cardiopulmonary resuscitation (CPR) (1, 2, 3).

In official registries of ACS patients, both globally and within Slovakia, there is a notable omission: those initially admitted to anesthesiology and intensive care units (ICU) due to their severe condition. Often, the disease progression is rapid, and cardiologists might not even be aware of these patients. This specific group frequently undergoes prolonged CPR, mechanical pulmonary ventilation, and catecholamine support, rendering them unconscious and sometimes in an areflexic comatous state, leading to a significantly poorer prognosis (4). The inclusion of this patient cohort in ACS registries is crucial, necessitating adjustments to the total mortality data, as their presence is expected to elevate overall mortality rates substantially.

Out-of-hospital cardiac arrest (OHCA) affects approximately 35–40 individuals per 100,000 annually (5, 6). Short-term survival prospects following OHCA remain grim, with roughly 5–10% for all initial rhythm disorders and approximately 21–27% for those initially presenting with ventricular fibrillation. According to some literature sources, only a quarter of successfully resuscitated pre-hospital patients survive to be discharged to ambulatory care. Out of a hypothetical 100 patients experiencing OHCA outside a medical facility, 60 succumb without the restoration of vital functions. Of the remaining 40 who undergo successful resuscitation, merely 10 survive subsequent hospitalization and are eligible for discharge (4, 7, 8, 9, 10, 11, 12). These literature findings contrast with the results of our analysis, which indicate

[1]Department of Cardiology, Cardiocenter, J.A. Reiman Teaching Hospital, Presov, Slovakia, [2]Department of Anesthesiology and Intensive Care, J.A. Reiman Teaching Hospital, Presov, Slovakia, [3]Department of Biomedical Research, East Slovak Institute of Cardiovascular Diseases, Kosice, Slovakia, and [4]1st Department of Cardiology, East Slovak Institute of Cardiovascular Diseases and Pavol Jozef Safarik University, Kosice, Slovakia

Address for correspondence: Martin STUDENCAN, Assoc Prof, MD, PhD, East Slovak Institute of Cardiovascular Diseases, Inc., Ondavska 8, AK-040 11 Kosice, Slovakia.
Phone: +421.55.7891615, Fax: +421.55.7891613

a more favorable outcome. In the category of patients admitted after successful resuscitation, our study observed a 45% survival rate within one month.

Our objective was to conduct a retrospective monocentric analysis of MI patients with OHCA admitted to the ICU at J.A. Reiman Teaching Hospital in Presov, Slovakia. Inclusion criteria comprised MI cases in 2014, diagnosed according to the universal definition of MI (ESC 2012), either with OHCA or respiratory failure requiring mechanical ventilation. We analyzed patients with STEMI and NSTEMI separately. Within this group, we assessed patient survival at specific intervals: in-hospital, at 30 days, and subsequently on an annual basis over a 5-year period. This evaluation relied on data from the official Health Care Surveillance Authority, which records the date of health insurance termination due to the patient's demise.

Methods

Study design

We conducted a retrospective analysis (with obtained approval from the Ethics Committee of the J.A. Reiman Teaching Hospital) of patients admitted to the ICU (Department of Anesthesiology and Intensive Care, J.A. Reiman Teaching Hospital in Presov, Slovakia) in 2014. These patients underwent a comprehensive evaluation using a pre-prepared form, which included basic personal information and several crucial indicators. These indicators encompassed ECG details for the determination of MI type, information about the patient's pre-existing conditions (acquired from relatives or prior documentation), the duration of CPR, the level of consciousness disorder as assessed by the Glasgow Coma Scale (GCS) score upon admission, and details regarding hospitalization management. This management included the performance of coronary angiographic examinations with percutaneous coronary intervention (PCI), echocardiographic examinations, and the necessity for temporary cardiac stimulation.

Among all hospitalized individuals, 51 patients met the inclusion criteria for MI and OHCA. This group consisted of 37 men (73%) and 14 women (27%), with an average age of 67 and 70 years, respectively. Of these patients, 33 (64.7%) received an initial diagnosis of STEMI, while 18 (35.3%) were diagnosed with NSTEMI. All patients underwent pre-hospital resuscitation due to cardiac arrest resulting from malignant rhythm disorders, asystole, or respiratory insufficiency. The precise distribution of initial rhythm disturbances could not be determined due to documentation limitations from emergency medical support. Additionally, information regarding the duration of resuscitation was available for only 32 patients. Upon admission, 40 patients (78.4%) were in a comatose state, as indicated by a GCS score of 8 or lower. A summary of the characteristics of the entire patient group is presented in Table 1.

Additionally, the clinical progression of the patients was monitored. In cases where patients displayed an improvement in their clinical condition and were successfully weaned from mechanical ventilatory support, the possibility of transferring them to another department or the intensive care unit of another hospital was considered. This transfer included an assessment of the patient's cardiac and neurological status prior to the transfer.

Statistical analysis

We conducted statistical analysis using the SPSS program. To describe the sample, basic descriptive statistics were employed.

Tab. 1. Characteristics of the group of MI patients after CPR hospitalized in 2014 at the Deparment of Anesthesiology and Intensive Care.

Characteristics of the OHCA group (n=51)	
No. of patients	n=37 (73%) ♂ / n=14 (27%) ♀
Myocardial infarction in the past	19.60% ♂: 8 (15.6%), ♀: 2 (4.0%)
Diabetes mellitus	21.50% (♂: 7 (13.7%), ♀: 4 (7.8%)
Stroke in the past	7.80% (♂: 3 (5.8%), ♀: 1 (2.0%)
Chronic kidney disease	31.3% (♂: 10 (19.6%), ♀: 6 (11.7%)
Average length of hospitalization at ICU (days)	4.0±2.5 (1–14): ♂: 3.0±2.9, ♀: 4.0±2.7
Average age	♂: 67.0 ± 6.8 /♀: 70.0 ± 5.6
STEMI/NSTEMI	64.70/35.30% (33/18), STEMI ♂: 24 (72.7%), STEMI ♀: 9 (27.3%), NSTEMI ♂: 13 (72.2%), NSTEMI ♀: 5 (27.8%)
CPR	100% (51) (♂: 37 (73%), ♀:14 (27%)
CPR due to cardiac arrest	84.3% (43): Length of CPR: 24.3±8.7 min (♂: 25.2±6.1 min; ♀: 19.6±5.3 min)
CPR due to respiratory failure	15.7% (8): ♂: 5 (10.0%), ♀: 53 (5.7%)
Unconsciousness on admission	78.4% (40): ♂: 30 (58.8%), ♀: 10 (19.6%)
The need for a ventilatory support	100% (51): ♂: 37 (73.0%), ♀: 14 (27,0%)
Coronary angiography	96% (49): ♂: 35 (69.0%), ♀: 14 (27.0%)
Echocardiography (n=40)	EFLV: 36.5% (19–63.5%) ♂: 32.5% ♀: 38.5%
Exitus during hospitalization at ICU	29.4% (15): ♂: 10 (19.6%), ♀: 5 (9.8%)
Transfer to another department	70.6% (36): ♂: 27 (52.9%), ♀: 9 (17.7%)
Exitus up to 30 days	54.9% (28): ♂: 21 (41.2%), ♀: 7 (13.7%)
Cardiac decompensation at the time of transfer	15.7% (8): ♂: 6 (11.8%), ♀: 2 (3.9%)
Neurological deficit at the time of transfer	35.3% (18): ♂: 12 (23.5%), ♀: 6 (11.8%)

Groups were compared using the unpaired t-test. Significance was accepted at $p<0.05$.

Results

Out of all the patients, 44 (86.3%) underwent coronary angiography, predominantly revealing 3-vessel coronary involvement (56%). Among catheterized patients, 10% displayed left main stem (LM) stenosis, 14% exhibited 2-vessel disease, and 20% had 1-vessel disease, with no patient showing non-significant coronary heart disease. A total of 73.5% of patients underwent ad hoc PCI, resulting in an overall success rate of 93.8%. The most frequently intervened vessel was the left anterior descending coronary artery (LAD) in 45.7% of PCIs, followed by the right coronary artery (RCA) at 28.3%, the left circumflex coronary artery (CX) at 19.5%, and LM PCI was performed in 6.5% of cases. Despite these relatively favorable outcomes, 28 patients succumbed in the first month, resulting in a 30-day mortality rate of 54.9% within this group (Tab. 2). Of these, 15 patients (29.4%) did not survive their hospitalization at Department of Anesthesiology and Intensive care and 13 of them passing away after being transferred to another department (Fig. 1). Among the transferred patients, 35% exhibited some form of neurological deficit at the time of transfer.

In a subsequent analysis of all MI patients in the Hospital group over time, the 1-year mortality reached 60.9%. It's noteworthy, however, that a significant majority of deaths occurred within the first month after MI. To illustrate, the 1-year mortality among survivors who managed the initial four weeks after MI was just 13%. Over two years of follow-up, it increased to 17%, three years to 21%, four years to 30%, and after five years, the mortality of those who survived the first 30 days was approximately 35%. Table 3 presents mortality data for MI patients with out-of-hospital cardiac arrest recorded up to 5 years in the OHCA group.

Discussion

Despite international statistics indicating high in-hospital mortality (up to 75%) for patients experiencing cardiac arrest with pre-hospital CPR (8, 9, 10, 11, 12), this patient subset is frequently overlooked in international ACS registries. Our study, albeit conducted on a limited patient pool, affirmed a significant in-hospital and 30-day mortality rate of nearly 55% for myocardial infarction patients requiring CPR and initially admitted to the ICU. Of note, Figures 3 and 4 illustrate the short-term and long-term survival of MI patients, differentiated by the presence or absence of OHCA. Upon integrating these patients with MI but without CPR, initially hospitalized in the CC, we observed a substantial, statistically significant increase in mortality rates for both the STEMI and overall MI (STEMI+NSTEMI) groups. While the rise in mortality for the NSTEMI group lacked statistical significance, the trend was noticeable. Our findings underscore the critical impact of including CPR patients in ACS registries, revealing the pressing need for improved data integration and analysis in this vulnerable patient population. In detail, the overall in-hospital mortality rate for MI patients in the OHCA group stood at 51%, while patients admitted to our hospital's CC achieved an in-hospital mortality rate of 3.8%. Combining both groups resulted in a total in-hospital mortality

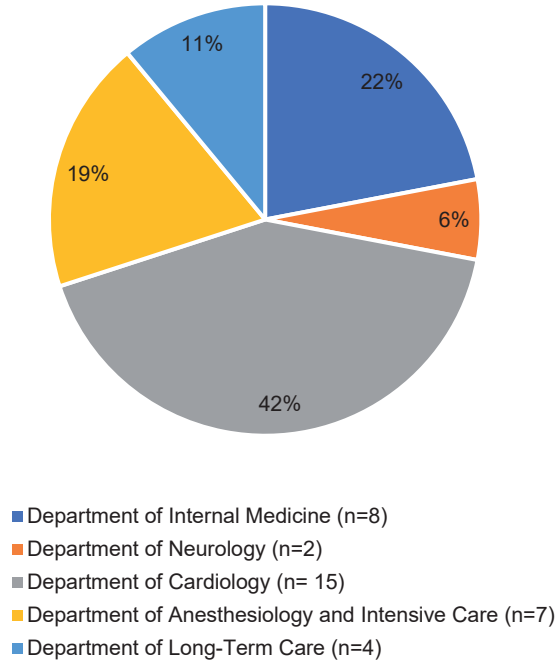

Fig. 1. The destination of transfers from the Department of Anesthesiology and Intensive Care (Out-of-Hospital Cardiac Arrest (OHCA) group).

Tab. 2. Comparison of PCI outcomes in the OHCA group between patients who died within 30 days of resuscitation and those who survived the first 30 days.

	Deceased	Survived
	54.9% (n=28)	**45.1% (n=23)**
Coronary angiography	75.0% (n=21)	100% (n=23)
1-vessel disease	23.8% (n=5)	21.7% (n=5)
2-vessel disease	9.5% (n=2)	21.7% (n=5)
3-vessel disease	66.7% (n=14)	56.5% (n=13)
Left main	9.5% (n=2)	13.0% (n=3)
Percutaneous coronary intervention (PCI)	76.2% (n=16)	91.3% (n=21)
Success of PCI	93.8% (n=15)	80.9% (n=17)

Tab. 3. Mortality data of MI patients suffering from out-of-hospital cardiac arrest recorded up to 5 years (OHCA group).

Mortality	
in-hospital	51.00%
30-days	54.90%
1-year	60.90%
2-years	63.00%
3-years	65.00%
4-years	68.60%
5-years	70.60%

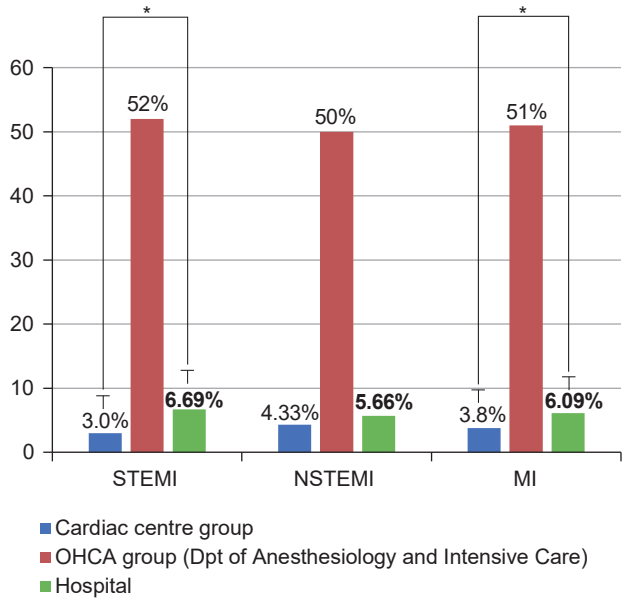

Fig. 2. In-hospital mortality according to the type of Acute Coronary Syndrome (ACS) and type of department (*p<0.05).

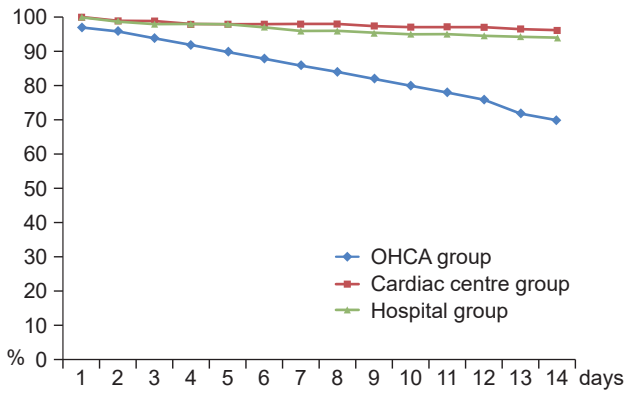

Fig 3. Short-term survival (up to 14 days) of Myocardial Infarction (MI) patients according to department.

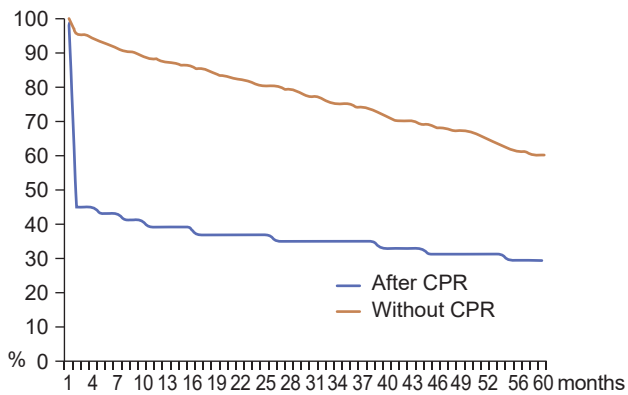

Fig 4. Long-term survival (60 months) of Myocardial Infarction (MI) patients in the Out-of-Hospital Cardiac Arrest (OHCA) group, compared with literature data on the survival of patients with MI who did not require resuscitation (17).

of 6.09% (Fig. 2), a statistically significant increase confirmed by the t-test (t=2.4113, p<0.05). Upon a detailed examination of these patients and an analysis of the STEMI and NSTEMI groups separately, a substantial difference was observed within the STEMI patient group, with a mortality increase from 3% to 6.69% (t=2.5289, p<0.05). However, in the NSTEMI group, the difference was not statistically significant, with rates of 4.33% and 5.66% (t=1.067, p>0.05).

Statistics regarding the long-term survival of resuscitated patients exhibit variability. In studies such as that conducted by Kvakkestad and colleagues (13), up to 80% survival among patients after OHCA was documented over an 8-year period. Similarly, in the study by Sideris and colleagues (14), a 5-year survival rate as high as 82% was observed, contingent on the management of the critical hospitalization phase post-resuscitation and subsequent discharge to ambulatory care. However, other studies report varying 5-year survival rates, ranging from 41% (15) to 64% (16), and even 84% (17). Ten-year survival rates after discharge also span a spectrum, with values between 12–38% depending on the timely performance of PCI (18). It is evident that several variables profoundly influence the long-term prognosis of patients, and statistical outcomes differ from study to study based on their selection criteria. Nonetheless, a consensus across most studies is that long-term prognosis significantly improves after successfully navigating the early post-resuscitation phase and managing hospitalization with the prospect of discharge (13).

When comparing in-hospital mortality rates, incorporating both CC and OHCA patient groups in our study revealed higher mortality rates than those reported in the SLOVAK registry of ACS (SLOVAKS) from 2011 and 2015. For STEMI, the combined Presov CC/OHCA from 2014 had a mortality rate of 6.69%, whereas SLOVAKS reported rates of 5.99% and 5.77% for 2011 and 2015, respectively. Similarly, NSTEMI patients displayed higher in-hospital mortality when both CC and OHCA groups were included in the comparison with SLOVAKS from 2011, with a rate of 5.66% for CC/OHCA from 2014 versus 3.9% in SLOVAKS from 2011 (19).

Recent research (20) has identified several predictors of a worse short-term prognosis for resuscitated patients, including the presence of a non-defibrillatory rhythm at the outset, advanced age, delayed and prolonged resuscitation, and comorbid conditions such as diabetes mellitus, renal insufficiency, dementia, malignant disease with metastases, or chronic heart failure. Therapeutic interventions like early revascularization or target temperature management have the potential to enhance patient outcomes, contingent on the overall condition post-restoration of spontaneous circulation and the underlying cause of cardiac arrest (4). In our study, successful PCI did not emerge as a significant marker for improved 30-day survival. However, this observation should be interpreted with caution, considering the relatively small patient cohort in our study, and does not diminish the recognized importance of early coronary intervention.

An intriguing discovery in our subsequent analysis is the 1-year mortality rate for patients successfully discharged from the hospital, which stands at 13%. This trend aligns closely with the

1-year mortality rate for ACS in general. A similar observation was documented in a large observational study (21), confirming that the 1-year mortality of patients with MI and prehospital cardiac arrest with CPR does not significantly differ from that of patients with MI but without cardiac arrest in the acute stage. In the mentioned study, 54,860 patients over 65 years old who experienced MI were included, of which 54,219 did not experience cardiac arrest, while 641 required CPR in the prehospital phase. The resuscitated group featured slightly younger patients, with twice the incidence of STEMI compared to the non-resuscitated group. In one of the largest recent studies focusing on patients after OHCA and acute MI, the survival of resuscitated patients with MI was compared to that of patients with STEMI or NSTEMI who did not require CPR, involving nearly 10,000 patients. The majority of resuscitated patients underwent emergent coronary angiography (87.4%), and a significant portion also received ad hoc PCI (67.6%). Understandably, 30-day survival was lower in the resuscitated group, at 63.4%, compared to 94.1% and 93.8% for STEMI and NSTEMI patients in the non-resuscitated group, respectively. After an 8-year follow-up, the overall survival rate in the resuscitated group was 48.7%. However, for those who survived 30 days post-resuscitation, the survival rate reached 77.6%, which was comparable to the non-resuscitated group, underscoring that the chance of long-term survival after the initial 30 days post-MI is similar in both resuscitated and non-resuscitated patient groups (13).

Conclusion

In conclusion, our study sheds light on the often overlooked cohort of patients with MI who experience OHCA and underwent CPR prior to hospitalization. These patients face a notably high short-term mortality rate of almost 55% within the first 30 days. Integration of these patients into MI registries significantly elevates in-hospital mortality rates, underlining the imperative need for accurate data representation. We observed significant mortality disparities between STEMI and NSTEMI patients in the OHCA group but not within the NSTEMI subgroup. Our findings align with previous research, which highlights that the long-term prognosis of post-resuscitation patients improves significantly beyond the initial critical phase and hospitalization. Factors such as patient age, comorbidities, and the nature of the initial rhythm disorder at the beginning of resuscitation substantially impact short-term outcomes. Interestingly, our study shows that the 1-year mortality rate of OHCA patients who survive hospitalization closely mirrors that of the general ACS population. This corresponds with larger studies indicating that, after surviving the early post-resuscitation phase, the long-term survival prospects for patients with MI and OHCA do not significantly differ from those without cardiac arrest. These results underscore the importance of including CPR patients in ACS registries and advocate for further research into optimizing interventions, such as early revascularization and controlled hypothermia, to enhance the outcomes of this vulnerable patient population. Ultimately, our study emphasizes the need for comprehensive data analysis and targeted strategies to improve the prognosis of MI patients with OHCA.

References

1. Priori SG, Blomstrom-Lundqvist C, Mazzanti A, Blom N, Borggrefe M, Camm J et al 2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: The Task Force for the Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death of the European Society of Cardiology (ESC). Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC). Eur Heart J 2015; 36: 2793–867.

2. Roffi M, Patrono C, Collet JP, Mueller C, Valgimigli M, Andreotti F et al 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). Eur Heart J 2016; 37: 267–315.

3. Steg PG, James SK, Atar D, Badano LP, Blömstrom-Lundqvist C, Borger MA et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J 2012; 33: 2569–619.

4. Kern KB. Optimal treatment of patients surviving out-of-hospital cardiac arrest. JACC Cardiovascular interventions 2012; 5: 597–605.

5. Neumar RW, Nolan JP, Adrie C, Aibiki M, Berg RA, Böttiger BW et al. Post-cardiac arrest syndrome: epidemiology, pathophysiology, treatment, and prognostication. A consensus statement from the International Liaison Committee on Resuscitation (American Heart Association, Australian and New Zealand Council on Resuscitation, European Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Asia, and the Resuscitation Council of Southern Africa); the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesia; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Clinical Cardiology; and the Stroke Council. Circulation 2008; 118: 2452–2483.

6. Nolan JP, Neumar RW, Adrie C, Aibiki M, Berg RA, Böttiger BW et al. Post-cardiac arrest syndrome: epidemiology, pathophysiology, treatment, and prognostication. A Scientific Statement from the International Liaison Committee on Resuscitation; the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesia; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Clinical Cardiology; the Council on Stroke. Resuscitation 2008; 79: 350–379.

7. Jennings PA, Cameron P, Walker T, Bernard S, Smith K. Out-of-hospital cardiac arrest in Victoria: rural and urban outcomes. The Medical journal of Australia 2006; 185: 135–139.

8. Mashiko K, Otsuka T, Shimazaki S, Kohama A, Kamishima G, Katsurada K et al. An outcome study of out-of-hospital cardiac arrest using the Utstein template--a Japanese experience. Resuscitation 2002; 55: 241–246.

9. Stiell IG, Wells GA, Field B, Spaite DW, Nesbitt LP, De Maio VJ et al. Advanced cardiac life support in out-of-hospital cardiac arrest. N Engl J Med 2004; 351: 647–656.

10. Herlitz J, Engdahl J, Svensson L, Angquist KA, Silfverstolpe J, Holmberg S. Major differences in 1-month survival between hospitals in Sweden among initial survivors of out-of-hospital cardiac arrest. Resuscitation 2006; 70: 404–409.

11. Langhelle A, Tyvold SS, Lexow K, Hapnes SA, Sunde K, Steen PA. In-hospital factors associated with improved outcome after out-of-hospital cardiac arrest. A comparison between four regions in Norway. Resuscitation 2003; 56: 247–263.

12. Nichol G, Thomas E, Callaway CW, Hedges J, Powell JL, Aufderheide TP et al. Regional variation in out-of-hospital cardiac arrest incidence and outcome. Jama 2008; 300: 1423–1431.

13. Kvakkestad KM, Sandvik L, Andersen G, Sunde K, Halvorsen S. Long-term survival in patients with acute myocardial infarction and out-of-

hospital cardiac arrest: A prospective cohort study. Resuscitation 2018; 122: 41–47.

14. Sideris G, Voicu S, Yannopoulos D, Dillinger JG, Adjedj J, Deye N et al. Favourable 5-year postdischarge survival of comatose patients resuscitated from out-of-hospital cardiac arrest, managed with immediate coronary angiogram on admission. Eur Heart J Acute Cardiovasc Care 2014; 3: 183–191.

15. Naess AC, Steen PA. Long term survival and costs per life year gained after out-of-hospital cardiac arrest. Resuscitation 2004; 60: 57–64.

16. Dumas F, White L, Stubbs BA, Cariou A, Rea TD. Long-term prognosis following resuscitation from out of hospital cardiac arrest: role of percutaneous coronary intervention and therapeutic hypothermia. J Am Coll Cardiol 2012; 60: 21–27.

17. Bergman R, Hiemstra B, Nieuwland W, Lipsic E, Absalom A, van der Naalt J et al. Long-term outcome of patients after out-of-hospital cardiac arrest in relation to treatment: a single-centre study. Eur Heart J Acute Cardiovasc Care 2016; 5: 328–338.

18. Geri G, Dumas F, Bougouin W, Varenne O, Daviaud F, Pène F et al. Immediate Percutaneous Coronary Intervention Is Associated With Improved Short- and Long-Term Survival After Out-of-Hospital Cardiac Arrest. Circulation Cardiovascular interventions 2015; 8.

19. Studenčan M, Kovář F, Hricák V, Kurray P, Goncalvesová E, Šimková I et al. Two-year survival of STEMI patients in Slovakia. An analysis of the SLOVak registry of Acute Coronary Syndromes (SLOVAKS). Cor Vasa 2014; 56: e297–e303.

20. Hirlekar G, Jonsson M, Karlsson T, Hollenberg J, Albertsson P, Herlitz J. Comorbidity and survival in out-of-hospital cardiac arrest. Resuscitation 2018; 133: 118–123.

21. Fordyce CB, Wang TY, Chen AY, Thomas L, Granger CB, Scirica BM et al. Long-Term Post-Discharge Risks in Older Survivors of Myocardial Infarction With and Without Out-of-Hospital Cardiac Arrest. J Am Coll Cardiol 2016; 67: 1981–1990.

Received December 15, 2023.
Accepted February 12, 2024.