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ORIGINAL RESEARCH

Percutaneous Coronary Intervention After Return of Spontaneous Circulation Reduces the In-Hospital Mortality in Patients with Acute Myocardial Infarction Complicated by Cardiac Arrest

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Background and Objective: The role of percutaneous coronary intervention (PCI) after return of spontaneous circulation (ROSC) in patients with acute myocardial infarction (AMI) complicated by cardiac arrest (CA) is controversial. This study aimed to evaluate the effects of PCI on the in-hospital mortality after ROSC in patients with AMI complicated by CA.

Methods: The clinical data of 66 consecutive patients with ROSC after CA caused by AMI from January 2006 to December 2015 at the First Affiliated Hospital of Sun Yat-sen University were collected. Among these patients, 21 underwent urgent PCI. We analyzed the clinical characteristics of the patients during hospitalization.

Results: The patients who underwent PCI had a higher rate of ST-segment elevation, and their initial recorded heart rhythms were more likely to have a shockable rhythm. Further, they had a high PCI success rate of 100%. The in-hospital mortality in the patients who did not undergo PCI was significantly higher than that in the patients who underwent PCI (68.9% vs 9.5%, $P<0.05$). Multivariate logistic regression analysis showed that cardiogenic shock (odds ratio [OR], 3.537; 95% CI, 1.047–11.945; $P=0.042$) and Glasgow Coma Scale score of ≤8 after ROSC (OR, 14.992; 95% CI, 2.815–79.843; $P=0.002$) were the independent risk factors for in-hospital mortality among the patients. Meanwhile, PCI was a protective factor against in-hospital mortality (OR, 0.063; 95% CI, 0.012–0.318; $P=0.001$). After propensity matching analysis, the results still showed that PCI (OR, 0.226; 95% CI, 0.028–1.814; P=0.0162) was a protective factor for in-hospital death.

Conclusion: The patients with ROSC after CA caused by AMI who underwent PCI had a lower in-hospital mortality than those who did not undergo PCI.

Keywords: percutaneous coronary intervention, cardiac arrest, in-hospital mortality, neurological performance

Introduction

Cardiac arrest (CA) refers to the sudden termination of an individual's cardiac ejection function, which is mainly manifested as loss of consciousness and disappearance of aortic pulsation. The mortality in patients experiencing CA is very high, especially in cases occurring outside the hospital setting.[1] Although many efforts have been made to prevent CA, CA is still the leading cause of mortality in many parts of the world.[2] In the absence of an evident non-cardiac cause, acute myocardial infarction (AMI) is a common cause of out-of-hospital CA (OHCA).[3] Because

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percutaneous coronary intervention (PCI) can rapidly, completely, and continuously dredge the infarct-related coronary arteries, rescue the dying myocardium, and improve the prognosis of patients, it has become an important treatment method for patients with AMI.[4,5] The latest consensus guidelines suggest that patients with return of spontaneous circulation (ROSC) after CA should consider receiving emergency cardiac intervention if they have ST-segment elevation myocardial infarction or unstable cardiogenic shock or require mechanical circulatory support.[6] However, owing to the lack of large, multi-center randomized controlled trials, the roles of PCI in patients experiencing CA caused by AMI are still controversial.[7,8] To date, studies on PCI in patients with AMI complicated by CA after ROSC are still relatively rare in China. There are also differences in ethnic, regional, and medical configurations with those of other countries. Therefore, the role of PCI after ROSC in patients with AMI complicated by CA still needs to be studied. Our retrospective study aimed to investigate the effects of PCI on the in-hospital mortality of patients with ROSC after CA caused by AMI and analyze the factors related to mortality to provide a basis for clinical decision-making for these patients.

Materials and Methods

Research Object

In this retrospective study, the clinical characteristics and outcomes of 66 consecutive patients resuscitated from CA caused by AMI and admitted to the First Affiliated Hospital of Sun Yat-sen University between January 2006 and December 2015 were evaluated. AMI was defined using the third edition of the universal definition of myocardial infarction published by the ESC, AHA, ACC, and WHF in 2012.[9] Patients were included in the study if they fulfilled the following inclusion criteria: (1) age of ≥18 years; (2) sustained ROSC, defined as ROSC lasting for 20 minutes; and (3) absence of any obvious non-cardiac cause, such as respiratory failure, metabolic disorder, stroke, hemorrhage, brain injury, electric injury, or drug overdose. For each patient fulfilling the inclusion criteria, we reviewed their medical records and documented the coronary risk factors and history of coronary artery disease. A total of 214 patients who experienced CA achieved successful resuscitation. Among them, CA was considered to be a non-cardiac cause in 116 patients (54.2%) and a cardiac cause in 98 patients (45.8%). Meanwhile, respiratory failure (37%), metabolic disorder (16%), stroke (12%), hemorrhage (6%), brain injury (5%), electric injury (4%), drug overdose (3%), or unknown cause (17%) were considered to be non-cardiac causes. The cardiac causes were related to non-AMI diagnoses in 32 patients and AMI diagnoses in 66 patients. Among the patients with AMI, 10 were resuscitated from OHCA and 56 from in-hospital CA (IHCA). The study focused on these 66 patients who were resuscitated from CA caused by AMI.

Treatment

All 66 patients received cardiopulmonary resuscitation, including chest compression, external defibrillation, or endotracheal intubation by experienced physicians and nurses. Cardiogenic shock was defined as a sustained episode (>30 min) of a systolic blood pressure of <90 mmHg and/or the requirement for inotropic or vasopressor drugs or mechanical support, including intra-aortic balloon pumping (IABP) or extracorporeal membrane oxygenation (ECMO), to maintain a systolic blood pressure above 90 mmHg. Vasopressors (eg, epinephrine or dopamine) were administered when they experienced cardiogenic shock or hemodynamic instability. Antiarrhythmic drugs (eg, atropine, lidocaine, or amiodarone) were administered when the electrocardiogram (ECG) showed ventricular fibrillation (VF)/pulseless ventricular tachycardia (PVT) and pulseless electrical activity/asystole. The neurological status of the patients after ROSC was assessed using the Glasgow Coma Scale (GCS).[10] For the conscious patients, aspirin (300 mg) and clopidogrel (300 mg) were administered preoperatively, while unfractionated heparin was administered intraoperatively. For the unconscious patients, glycoprotein IIb/IIIa receptor blockers were administered preoperatively, while unfractionated heparin was administered intraoperatively. IABP or ECMO was performed for cardiogenic shock or severe hemodynamic instability. Temporary pacemakers were used in the presence of severe bradycardia causing severe hemodynamic instability. Among the patients, 22 underwent coronary angiography (CAG), and 21 underwent subsequent PCI. PCI success was defined as a final Thrombolysis in Myocardial Infarction flow in grade three with residual stenosis of <20%. After the procedure was completed, continuous medical treatment was performed in the coronary care unit. Mild hypothermia therapy (32–34°C)[11] was provided to each patient for 24 h after ROSC.

Follow-Up

During hospitalization, major adverse events were recorded in the medical records, including mortality from any cause, recurrent CA, and gastrointestinal hemorrhage. The recovery of neurological function at the time of discharge was evaluated using the Cerebral Performance Category (CPC) scale,[12] which was graded from 1 (good cerebral performance and being conscious, alert, and able to work and lead a normal life, despite possible minor psychological or neurological deficits) to 4 (permanent vegetative state, being unconscious and unaware, and no verbal or psychological interaction with the environment).

Statistical Analysis

Quantitative data with normal distribution were expressed as means ± SDs, and the *t*-test was used to compare the mean values between groups. Quantitative data with non-normal distribution were expressed as medians, and the rank-sum test was used to analyze the differences between groups. Qualitative data were expressed as percentages, and the chi-square test and Fisher's exact test were used to compare the differences between groups. All demographic, clinical, angiographic, and procedural variables were initially assessed via a univariate analysis to select the predictors of in-hospital outcomes among the patients with AMI resuscitated from CA. Variables with a *P* value of <0.05 were included in a multiple stepwise logistic regression model to identify the independent predictors of mortality. All analyses were performed using SPSS 21.0. Statistical significance was set at *P* values of <0.05. The risk estimates for each variable were reported as odds ratios (ORs) and 95% CIs. In order to diminish the bias between different groups, propensity score matching was performed in this study. Patients were matched based on logistic regression model. Propensity scores were estimated according to 5 important baseline characteristics including age, ST-segment elevation, Cardiogenic shock after ROSC, GCS score of ≤8 after ROSC, PCI. One-to-one matching was performed using a 0.2 caliper. Statistical significance was considered as a two-sided P value of less than 0.05. The above statistical analysis was performed with the STATA/MP 14.0.

Results

Baseline characteristics of the study patients are described in Table 1.

The angiographic and procedural characteristics in the patients who underwent PCI are described in Table 2.

The major adverse events and clinical outcomes during hospitalization between the two cohorts are presented in Table 3.

The recovery of neurological function in the two groups of patients who survived to discharge was no significant difference between them, CPC 1 or 2, 9 (64.3%) in Non-PCI group, 18 (94.7%) in PCI group (*P*>0.05).

There were several reasons why the non-PCI group did not receive PCI: (1) Forty patients or their families (88.9%) rejected PCI. (2) Four patients (8.9%) were excluded for PCI by the physician's team based on their clinical data. (3) One patient (2.2%) was recommended for coronary artery bypass grafting.

The associated factors for in-hospital mortality after ROSC in the patients who experienced CA caused by AMI are presented in Tables 4 and 5. The significant variables in the univariate analysis (*P*<0.05) were included in the multivariate logistic regression model. Cardiogenic shock (OR, 3.537; 95% CI, 1.047–11.945; *P*=0.042) and a GCS score of ≤8 after ROSC (OR, 14.992; 95% CI, 2.815–79.843; *P*=0.002) were found to be the independent risk factors for in-hospital mortality in the patients with AMI complicated by CA. The patients who underwent PCI (OR, 0.063; 95% CI, 0.012–0.318; *P*=0.001) had a lower risk of in-hospital mortality (protective factor) than those who did not.

After propensity matching analysis (Table 6), we found that the results still showed that PCI (OR, 0.226; 95% CI, 0.028–1.814; P=0.0162) was a protective factor for in-hospital death, while cardiogenic shock (OR, 2.499; 95% CI, 0.284–22.009; P=0.409), GCS score ≤8 after resuscitation (OR, 1.984; 95% CI, 0.168–23.369; P=0.586) were still risk factors for in-hospital death, but their P value were not less than 0.05, we believed that this result may be related to the small sample size of this study.

Discussion

In this complex patient population that experienced CA caused by ST-segment elevation myocardial infarction or non-ST-segment elevation myocardial infarction, we found that the patients who did not receive PCI had a higher in-hospital mortality than those who did. With the deepening understanding of resuscitation in recent years, the public is becoming increasingly aware of the importance of early coronary artery reperfusion therapy for the prognosis of patients after CA caused by AMI. Thrombolytic therapy and PCI are the main

Table 1 Baseline Characteristics of the Study Patients

Variable	Overall (n=66)	Non-PCI (n=45)	PCI (n=21)	*P* value
Age (y)	62.9±13.2	65.8±12.3	56.7±13.3	0.008
<65	35 (53.0)	19 (42.2)	16 (76.2)	
≥65	31 (47.0)	26 (57.8)	5 (23.8)	
Male sex	51 (77.3)	34 (75.6)	17 (81.0)	0.863
Smoking	35 (53.0)	25 (55.6)	10 (47.6)	0.487
Diabetes mellitus	22 (33.0)	18 (40.0)	4 (19.0)	0.082
Hypertension	34 (51.5)	26 (57.8)	8 (38.1)	0.113
Chronic renal failure	8 (12.1)	5 (11.1)	0 (0)	0.267
Previous myocardial infarction	10 (15.1)	6 (13.3)	4 (19.0)	0.843
Previous PCI	6 (9.1)	5 (11.1)	1 (4.8)	0.688
Known preceding chest pain	49 (74.2)	28 (62.2)	21 (100)	0.001
In-hospital cardiac arrest	56 (84.9)	38 (84.4)	18 (85.7)	1.000
Arrest witnessed by a bystander	65 (98.4)	44 (97.8)	21 (100)	1.000
Bystander CPR	58 (87.9)	39 (86.7)	19 (90.5)	0.971
Time from cardiac arrest to BLS (min) (mean ± SD)	2.17±3.12	2.23±3.20	2.05±3.01	0.830
Time from cardiac arrest to ROSC (min) (mean ± SD)	32.67±25.53	35.86±25.53	26.11±24.94	0.186
Initial recorded rhythm (VF/PVT)	41 (62.1)	22 (48.9)	19 (90.5)	0.001
Use of vasopressors	47 (71.2)	40 (88.9)	7 (33.3)	<0.001
Use of antiarrhythmic drugs	57 (86.3)	43 (95.6)	14 (66.7)	0.004
ST-segment elevation	35 (53.0)	18 (40.0)	17 (81.0)	<0.001
Cardiogenic shock after ROSC	29 (43.9)	25 (55.6)	4 (19.0)	0.005
GCS score of ≤8 after ROSC	31 (47.0)	29 (64.4)	2 (9.5)	0.002

Note: Values are expressed as mean numbers with percentages of the total in parentheses, except those indicated otherwise.
Abbreviations: PCI, percutaneous coronary intervention; CPR, cardiopulmonary resuscitation; BLS, basic life support; ROSC, return of spontaneous circulation; VF, ventricular fibrillation; PVT, pulseless ventricular tachycardia; GCS, Glasgow Coma Scale.

treatments for early coronary reperfusion. The vast majority of patients who experience sudden CA need extrathoracic compressions; however, long-term extrathoracic compressions are one of the contraindications of thrombolytic therapy.[13] Further, there are many contraindications for thrombolytic therapy, such as recent active visceral hemorrhage, stroke, major surgery, pregnancy, active peptic ulcer, or allergy to thrombolytic drugs. In this study, three patients who did not receive PCI but received thrombolytic therapy did not have a good prognosis. This is consistent with the conclusions of Spohr et al and Stadlbauer et al.[14,15]

This study showed that the average age of the patients in the non-PCI group was higher than that in the PCI group (P<0.05). This difference suggests that age may be an important factor influencing emergency physicians and interventional cardiologists in deciding whether to perform PCI in daily clinical work. Since most studies have shown that among patients who experience sudden CA, older patients who receive PCI have a poorer prognosis than younger patients.[16–18] The ECG findings after resuscitation were also significantly different between the two groups: 81% of the patients in the PCI group and only 40% of the patients in the non-PCI group had ST-segment elevation, which is similar to the study findings of Zanuttini et al.[19] This difference suggests that in the daily work in the hospital, emergency physicians and interventional cardiologists may decide whether to perform CAG and PCI based on the ECG results after resuscitation. However, Redfors et al found that approximately 40% of patients without ST-segment elevation after CA and resuscitation had acute coronary artery occlusion.[20] Moreover, this study showed that in the patients without ST-segment elevation after resuscitation, there was no significant difference in the in-hospital mortality between those who received PCI and those who did not (P=0.272), which is similar to the data reported by Wester et al;[21] however, some studies have shown that emergency PCI can improve the survival rate and neurological prognosis of patients who experience OHCA without ST-segment elevation.[22,23] A randomized, multi-center trial showed that emergency CAG did not improve survival in patients with ROSC after OHCA without ST-segment elevation.[24]

Table 2 Angiographic and Procedural Characteristics in the Patients Who Underwent PCI

Variable	n (%)
Time from cardiac arrest to balloon inflation	
<6 h	10 (47.7)
6–24 h	0 (0)
>24 h	11 (52.3)
Significant coronary lesions	
Single-vessel	10 (47.6)
Double-vessel	6 (28.6)
Three-vessel	5 (23.8)
Infarct-related vessel	
Left main	0 (0)
Left anterior descending	6 (28.6)
Left circumflex	1 (4.7)
Right coronary artery	14 (66.7)
Stenting	19 (90.5)
PTCA	2 (9.5)
Thrombus aspiration	8 (38.1)
Pre-PCI TIMI grade 0 to 2	21 (100)
PCI success	21 (100)
GP IIb/IIIa inhibitors	12 (57.1)

Note: Values are expressed as mean numbers with percentages of the total in parentheses, except where indicated otherwise.
Abbreviations: PCI, percutaneous coronary intervention; PTCA, percutaneous transluminal coronary angioplasty; TIMI, thrombolysis in myocardial infarction; GP, glycoprotein.

Therefore, the role of emergency CAG and PCI in patients who experience CA without ST-segment elevation remains to be confirmed.

Our study found that cardiogenic shock (OR, 3.537; 95% CI, 1.047–11.945; *P*=0.042) and a GCS score of ≤8 after ROSC (OR, 14.992; 95% CI, 2.815–79.843; *P*=0.002) were the independent risk factors for in-hospital mortality in the patients with ROSC after CA caused by AMI, which is consistent with the results of previous studies.[25,26] Lettieri et al showed that cardiogenic shock on admission is an independent risk factor for in-hospital mortality in patients who experienced OHCA caused by acute ST-segment elevation myocardial infarction (OR, 3.05; 95% CI, 1.04–8.91; *P*=0.035).[27]

Table 3 Comparison of the Major Adverse Events and Clinical Outcomes During Hospitalization Between the Two Groups

Variable	Non-PCI (n=45)	PCI (n=21)	*P* value
Gastrointestinal hemorrhage	8 (17.8)	1 (4.8)	0.294
Recurrent cardiac arrest	21 (46.7)	3 (14.3)	0.011
In-hospital mortality	31 (68.9)	2 (9.5)	<0.001
Men	24 (70.6)	1 (5.9)	
Women	7 (63.6)	1 (25.0)	

Note: Data are presented as numbers with percentages in parentheses, unless otherwise stated.

Similarly, Omer et al showed that among 499 patients who experienced CA caused by ST-segment elevation myocardial infarction, the in-hospital mortality of patients with cardiogenic shock was as high as 44%, while that of patients without cardiogenic shock was only 19%.[28] In the present study, even the use of IABP failed to reduce in-hospital mortality in patients with cardiogenic shock due to acute myocardial infarction, although this conclusion was not clear due to the small sample size, but similar findings have been reported in studies.[29] In the studies by Lettieri et al and Pan et al, the state of neurological function after ROSC is also an independent risk factor for in-hospital mortality.[27,30] However, it is important to note that the neurological impairment in these patients can be attributed almost entirely to the prolonged cerebral hypoxia caused by CA. However, we could not determine whether their neurological impairment was attributed to hypoxia alone or the ischemic complications during hospitalization. This study found that PCI (OR, 0.063; 95% CI, 0.012–0.318; *P*=0.001) can reduce the in-hospital mortality after ROSC of patients who experienced CA caused by AMI, which is consistent with the results of multiple observational studies.[16,23,31] Some case reports have described that PCI can improve survival and neurological prognosis despite long-term cardiopulmonary resuscitation.[32,33] The success rate of PCI in this study was as high as 100%, which further confirms that PCI is effective and feasible in such patients. In this study, all patients who underwent PCI within 6 h of CA survived to discharge, suggesting that early PCI may be more beneficial to survival. This is consistent with previous study findings,[34–36] although the definition of "early" is still controversial. A study suggests that only patients who experience CA with unstable lesions (chest pain, absence of coronary artery disease history, ST-segment elevation, and initial shockable rhythm) can benefit from early PCI.[37]

To better treat such patients, we also analyzed other risk factors related to in-hospital mortality. This study showed no significant difference in the time from CA to basic life support and the time from CA to ROSC between the patients who died during hospitalization and those who survived to discharge, which is different from the results of Lim et al[25] this may be related to the fact that

Table 4 Associated Factors of In-Hospital Mortality in the Patients with Acute Myocardial Infarction Complicated by Cardiac Arrest After ROSC

Variable	Mortality (n=33)	Survival (n=33)	*P* value
Age (y)	67.21±11.89	58.52±13.25	0.007
<65	13 (39.4)	22 (66.7)	
≥65	20 (60.6)	11 (33.3)	
Male sex	25 (75.8)	26 (78.8)	0.769
Smoking	17 (51.5)	18 (54.5)	0.909
Diabetes mellitus	14 (42.4)	8 (24.2)	0.097
Hypertension	18 (54.5)	16 (48.5)	0.531
Chronic renal failure	6 (18.2)	2 (6.1)	0.238
Previous myocardial infarction	5 (15.2)	5 (15.2)	1.000
Previous PCI	4 (12.1)	2 (6.1)	0.640
Known preceding chest pain	25 (75.8)	24 (72.7)	0.778
In-hospital cardiac arrest	29 (87.9)	27 (81.8)	0.731
Arrest witnessed by a bystander	33 (100)	32 (97.0)	1.000
Bystander CPR	30 (90.9)	28 (84.8)	0.706
Time from cardiac arrest to BLS (min) (mean ± SD)	2.18±3.24	2.16±3.04	0.974
Time from cardiac arrest to ROSC (min) (mean ± SD)	37.34±26.31	27.46±24.05	0.153
Initial recorded rhythm (VF/PVT)	15 (45.5)	26 (78.8)	0.005
Use of vasopressors	30 (90.9)	17 (51.5)	<0.001
Use of antiarrhythmic drugs	32 (97.0)	25 (75.8)	0.031
ST-segment elevation	14 (42.4)	21 (63.6)	0.084
Cardiogenic shock after ROSC	21 (63.6)	8 (24.2)	0.001
GCS score of ≤8 after ROSC	25 (75.8)	6 (18.2)	<0.001
Temporary pacemakers	6 (18.2)	6 (18.2)	1.000
IABP	7 (21.2)	3 (9.1)	0.303
Mechanical ventilation	30 (90.9)	18 (54.5)	0.001
PCI	2 (6.1)	19 (57.6)	<0.001
Thrombolysis	3 (9.1)	2 (6.1)	1.000
Mild hypothermia therapy	7 (21.2)	3 (9.1)	0.303

Note: Data are presented as numbers with percentages in parentheses, unless otherwise stated.
Abbreviations: ROSC, return of spontaneous circulation; PCI, percutaneous coronary intervention; CPR, cardiopulmonary resuscitation; BLS, basic life support; VF, ventricular fibrillation; PVT, pulseless ventricular tachycardia; GCS, Glasgow Coma Scale; IABP, intra-aortic balloon pumping.

most of the patients (84.8%) in this study had an IHCA. Patients who experience IHCA are more likely to be witnessed by medical staff when they collapse, are surrounded by more medical equipment, and can receive professional treatment earlier than patients who experience OHCA. This study showed that the patients who survived to discharge had a higher rate of shockable rhythm (VF/PVT) than those who died during hospitalization (78.8% vs 45.5%, $P<0.05$), which is consistent with the results of Lettieri et al.[27] Previous studies have shown that the presence of shockable rhythms (VF/PVT) can improve the success rate of ROSC in patients who

Table 5 Multivariate Logistic Regression Analysis for the Independent Risk Factors of In-Hospital Mortality After ROSC in the Patients with Acute Myocardial Infarction Complicated by Cardiac Arrest

Variable				95% CI	
	B	Sig.	Exp (B)	Lower Limits	Upper Limits
Cardiogenic shock after ROSC	1.263	0.042	3.537	1.047	11.945
GCS score of ≤8 after ROSC	2.707	0.002	14.992	2.815	79.843
PCI	−2.771	0.001	0.063	0.012	0.318

Abbreviations: ROSC, return of spontaneous circulation; GCS, Glasgow Coma Scale; PCI, percutaneous coronary intervention.

Table 6 Multivariate Logistic Regression Analysis for the Independent Risk Factors of In-Hospital Mortality After ROSC in the Patients with Acute Myocardial Infarction Complicated by Cardiac Arrest (After Propensity Score Matching)

Variable				95% CI	
	B	Sig.	Exp (B)	Lower Limits	Upper Limits
Cardiogenic shock after ROSC	0.916	0.409	2.499	0.284	22.009
GCS score of ≤8 after ROSC	0.685	0.586	1.984	0.168	23.369
PCI	−1.486	0.0162	0.226	0.028	1.814

Abbreviations: ROSC, return of spontaneous circulation; GCS, Glasgow Coma Scale; PCI, percutaneous coronary intervention.

experience CA and the prognosis of those who receive PCI.[38,39] The presence of non-shockable rhythms is usually attributed to the failure of patients to receive timely and effective cardiopulmonary resuscitation, resulting in long-term myocardial ischemia and hypoxia; therefore, the probability of survival to discharge is lower.[40] It is then necessary to popularize medical first aid knowledge to the public and configure first-aid equipment in public places, so that patients can receive effective cardiopulmonary resuscitation as soon as possible. Conversely, the presence of non-shockable rhythms may also be attributed to multi-vessel lesions of the coronary artery or left main coronary artery infarction, and the heart injury in these patients is more extensive and severe. This study showed that mild hypothermia therapy does not improve the survival and neurological outcome of patients with a GCS score of ≤8 after ROSC, which is inconsistent with the results of a previous systematic review of multiple randomized trials.[41] This result may be related to the small number of patients included in our study and the small number of patients who received mild hypothermia.

In this study, we compared the neurological function between the PCI and non-PCI groups. The analysis showed that although the rate of good functional neurological recovery (CPC 1 or 2) in the PCI group was higher than that in the non-PCI group, there was no significant difference found between them (94.7% vs 64.3%, *P*=0.074), which is inconsistent with previous results.[22] This result may be related to the small number of patients included in our study.

After analyzing the angiographic data of the patients undergoing PCI, we found that the infarct-related artery in most of them was the right coronary artery (66.7%). In the studies by Lettieri et al and Kunadian et al, the infarct-related artery in most patients was the left anterior descending artery (53% and 46.5%, respectively); meanwhile, the infarct-related artery in a few patients was the left main artery (1% and 2.5%, respectively).[27,42] This result may be related to the strong adaptability of the right coronary artery to ischemia and hypoxia, and patients have more time to receive early treatment after the onset of symptoms. In contrast, AMI with the involvement of the left main artery develops rapidly and is often complicated by cardiogenic shock, and patients are more likely to die in a short period.[43] Patients whose infarct-related artery is the left main artery may find it difficult to achieve ROSC after CA; thus, they miss the opportunity to undergo CAG and PCI.

Limitation

First, this study was a single-center, retrospective, observational study; thus, causality cannot be confirmed. Second, owing to the incompleteness of some medical records, there may be some lack of information and bias. Finally, the number of cases included in this study was small, and there was a lack of long-term follow-up data.

Conclusion

In this complex patient population that experienced CA caused by ST-segment elevation myocardial infarction or non-ST-segment elevation myocardial infarction, we found that the patients who did not receive PCI had a higher in-hospital mortality than those who did.

Ethical Approval

The patients or the patients' next of kin provided their written informed consent to participate in this study. The data was anonymized or maintained with confidentiality. The publication of this study is in accordance with the Declaration of Helsinki. Ethical review and approval was not required for the retrospective study on human participants in accordance with the local legislation and institutional requirements. The study is exempt from the approval of the ethics committee of the Third Affiliated Hospital of Sun Yat-sen University.

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Disclosure

The authors declare that they have no conflicts of interest.

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