ST-Segment Elevation Myocardial Infarction Patients Complicated by Out-of-Hospital Cardiac Arrest May Not Benefit from Emergency Percutaneous Intervention

Kun Wang, Yu Shen, Pei-Wen Li, Rong Gu, Jing-Mei Zhang, Lian Wang, Jian Bai, Biao Xu

Department of Cardiology, Drum Tower Hospital of Nanjing Medical University, Nanjing, Jiangsu 210008, China

To the Editor: Out-of-hospital cardiac arrest (OHCA) of cardiac origin is one of the leading causes of death in the industrialized world. The American Heart Association recommended patients who have been successfully resuscitated from OHCA and whose initial electrocardiogram (ECG) showing ST-segment elevation myocardial infarction (STEMI) should undergo emergent cardiac catheterization with the intent to identify and revascularize the culprit lesion by percutaneous intervention (PCI) when clinically applicable. However, few recent retrospective studies and prospective registries observed a beneficial effect of emergency coronary angiography and PCI on the outcome of resuscitated patients with OHCA. Emergency PCI seemed to improve in-hospital outcome of resuscitated but unconscious patients with OHCA in developed countries.[1] However, data on how many patients with OHCA were able to receive emergency PCI are still lacking. Conversely, whether emergency PCI improves survival rate in patients who remain unconscious after OHCA in developing country is still debatable. This study retrospectively analyzed STEMI patients who suffered from OHCA in our department, and we hoped to provide some experience for future reference.

We retrospectively collected data of seven STMEI patients complicated by OHCA who remained unconscious when admitted to hospital, between September 2013 and December 2015 in the Department of Cardiology, Nanjing Drum Tower Hospital. Meantime, we selected 157 STEMI patients without OHCA during this period as control. All patients received emergency coronary angiograph and revascularization if needed. We registered patients' baseline characteristics, including age, gender, risk factors, and previous angina. In cardiac arrest group, we recorded the time from symptom onset to consciousness loss, and time from consciousness loss to reperfusion.

During emergency PCI, TIMI Grade 3 was considered as successful criterion. Coronary angiographic data were also collected, including infarct coronary artery, collateral circulation, drug-eluted stent (DES) implantation, intra-aortic balloon pump (IABP) implantation, temporary pace maker implantation, and tracheal intubation. Coronary lesions ≥50% luminal diameter during angiograph was documented as coronary stenosis. Severe complications included hemorrhage, pulmonary infection, and death. Telephone follow-ups were made on 30 and 180 days.

Chi-square test or Fisher's exact test was used in categorical variables, and the independent-sample t-test was used for comparing medians.

Kaplan-Meier curve was used to identify to 30 days and 180 days survival rate. IBM SPSS statistical 19.0 (IBM Co., USA) was utilized for statistical analyses. $P < 0.05$ was considered statistically significant. Seven cardiac arrest patients and 157 patients without cardiac arrest successfully received emergency PCI. There were no differences in baseline characteristics of the study population, except that 68 out of 157 patients in control group presented angina previously. Between groups, there were no differences in infarction area, infarct-related coronary artery, collateral circulation, or the number of atherosclerotic coronary artery. All patients had successfully received DES implantation and similar TIMI grade blood flow after DES implantation. However, patients with cardiac arrest received more IABP implantation and more tracheal intubation (5/7 vs. 27/157, $P = 0.003$; 7/7 vs. 0/1570, respectively). Four cardiac arrest patients received ice cap for the purpose of brain protection, and three received therapeutic hypothermia, the temperature was controlled between 33 and 35°C by ice blanket and maintained 24–48 h.

In Table 1, the time from symptom onset to first admission in patients without cardiac arrest was longer than OHCA group ($P = 0.021$). Moreover, all OHCA patients presented ventricular fibrillation in emergency room. Thus, the D-B time was much longer than patients in control group ($P = 0.025$).

Due to patients' critical condition, the complications in OHCA patients were much higher than control, including upper gastrointestinal hemorrhage ($P < 0.001$), subarachnoid hemorrhage ($P = 0.043$), subdural hemorrhage ($P = 0.043$), and pulmonary infection ($P = 0.000$). Thus, the hospitalization time was longer (16 [5,32] vs. 11.0 [1,31], $P = 0.218$), and coma were more commonly seen in OHCA ($P < 0.001$). At 30 days, the mortality rate was similar; however, there was significantly different between two groups in 180 days ($P = 0.215$ and $P = 0.039$, respectively; Table 1).

Address for correspondence: Dr. Biao Xu,
Department of Cardiology, Drum Tower Hospital of Nanjing Medical University, Nanjing, Jiangsu 210008, China
E-Mail: xubiao@medmail.com

Table 1: Symptom onset to emergency percutaneous coronary intervention, complication, and mortality

Items	Cardiac arrest (*n* = 7)	Control (*n* = 157)	*P*
Symptom onset to consciousness loss (min)	20.0 (10,115)	/	/
Symptom onset to admission (min)	40.0 (10,120)	175.4 (30,252)	0.021
Ventricular fibrillation	7	0	<0.001
Consciousness loss to reperfusion (min)	185.0 (100,272)	/	/
D-B time (min)	135.0 (90,272)	90.0 (41,184)	0.025
Cardiac arrest (min)	155.0 (30,300)	/	/
Complications			
Upper gastrointestinal hemorrhage	3	0	<0.001
Subarachnoid hemorrhage	1	0	0.043
Subdural hemorrhage	1	0	0.043
Pulmonary infection	3	0	<0.001
ICD implantation	0	0	/
Hospitalization time (days)	16.0 (5,32)	11.0 (1,31)	0.218
During hospitalization			
Death	1	7	0.215
Time (days)	5	10/5/7/16/8/1/7*	/
Coma	3	0	<0.001
Discharged	3	152	<0.001
30 days' follow-up			
Death	1	7	0.215
180 days' follow-up			
Death	2	12	0.215
Mortality rate (%)	28.6	7.6	0.039

All data were shown as *n* or median (range). D-B time: Door-to-balloon time; ICD: Implantable cardioverter-defibrillator; SEM: Standard error of the mean. *These 7 numbers mean the time of death from hospitalization. /: No data.

In China, fewer STEMI patients complicated by OHAC, who remained unconscious when arriving at the hospital, received emergency PCI; relevant clinical data are still lacking. Prompt PCI is a well-established strategy for treating STEMI patients, significantly reducing mortality. And also emergency PCI seems to improve in-hospital outcome of resuscitated but unconscious OHCA patients in developed countries.[1] In CHINA-PEACE study, the ratio of cardiac arrest in STEMI is 1.7% in 2011. However, the ratio maybe higher than 1.7%, and the ratio is 4.3% in our department.[2]

In Mager *et al.*'s retrospectively study, 1-month mortality is higher in the resuscitated group even after emergency PCI[3] which is consist with our finding at 180 days' follow-up. According to our study, OHAC patients who remained unconscious needed more circulatory and respiratory support, and these lead to more complications, such as hemorrhage and pulmonary infection, finally resulted in the higher mortality.

Bendz *et al.*[4] examined the outcome after an OHCA and successful cardiopulmonary resuscitation in patients with acute STEMI treated with primary PCI; their in-hospital mortality rate was 27.5%. Because the time of cardiac arrest is too longer in emergency room subjected to the emergency level. Thus, D-B time is markedly prolonged, with poorer prognosis.[5] In developing countries, lack of ambulatory ECG and ECG transporting system, the patient cannot receive diagnosis in time. This might be another reason.

However, it is a retrospective study with a relatively small population. The target temperature management maybe effective in OHAC remained unconscious, but this needs more sample to illustrate. We hope to continue registering data in multiple centers to further illustrate the real world in China.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s)/ patient's guardians has/ have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients/ patient's guardians understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Zanuttini D, Armellini I, Nucifora G, Carchietti E, Trillò G, Spedicato L, *et al.* Impact of emergency coronary angiography on in-hospital outcome of unconscious survivors after out-of-hospital cardiac arrest. Am J Cardiol 2012;110:1723-8. doi: 10.1016/j.amjcard.2012.08.006.
2. Li J, Li X, Wang Q, Hu S, Wang Y, Masoudi FA, *et al.* ST-segment elevation myocardial infarction in China from 2001 to 2011 (the China PEACE-Retrospective Acute Myocardial Infarction Study): A retrospective analysis of hospital data. Lancet 2015;385:441-51. doi: 10.1016/S0140-6736(14)60921-1.
3. Mager A, Kornowski R, Murninkas D, Vaknin-Assa H, Ukabi S, Brosh D, *et al.* Outcome of emergency percutaneous coronary intervention for acute ST-elevation myocardial infarction complicated by cardiac arrest. Coron Artery Dis 2008;19:615-8. doi: 10.1097/MCA.0b013e32831381b4.
4. Bendz B, Eritsland J, Nakstad AR, Brekke M, Kløw NE, Steen PA, *et al.* Long-term prognosis after out-of-hospital cardiac arrest and primary percutaneous coronary intervention. Resuscitation 2004;63:49-53. doi: 10.1016/j.resuscitation.2004.04.006.
5. Yudi MB, Ramchand J, Farouque O, Andrianopoulos N, Chan W, Duffy SJ, *et al.* Impact of door-to-balloon time on long-term mortality in high- and low-risk patients with ST-elevation myocardial infarction. Int J Cardiol 2016;224:72-8. doi: 10.1016/j.ijcard.2016.09.003.