

A retrospective study of an invasive versus conservative strategy in patients aged ≥ 80 years with acute ST-segment elevation myocardial infarction

Journal of International Medical Research

2019, Vol. 47(9) 4431–4441

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DOI: 10.1177/0300060519860969

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Yong-Gang Sui, Si-Yong Teng, Jie Qian,
Yuan Wu, Ke-Fei Dou, Yi-Da Tang,
Shu-Bin Qiao and Yong-Jian Wu 

Abstract

Objective: To investigate what is the most appropriate strategy for patients with ST-segment elevation myocardial infarction (STEMI) aged ≥ 80 years in China.

Methods: This cohort study retrospectively enrolled patients with STEMI aged ≥ 80 years old and grouped them according to the treatment strategy that was used: a conservative treatment strategy or an invasive treatment strategy. Factors associated with whether to perform an invasive intervention, in-hospital death and a good prognosis were investigated using logistic regression analyses.

Results: A total of 232 patients were enrolled: conservative treatment group ($n = 93$) and invasive treatment group ($n = 139$). Patients in the invasive treatment group had a better prognosis and lower incidence of adverse events compared with the conservative treatment group. Advanced age, creatinine level and a higher Killip class were inversely correlated with whether to perform an invasive intervention, while the use of beta-receptor-blocking agents was a favourable factor for invasive treatment. Hypertension and a higher Killip class were risk factors for in-hospital death, while the use of beta-receptor-blocking agents and diuretics decreased the risk of in-hospital death.

Conclusions: An invasive treatment strategy was superior to a conservative treatment strategy in patients with STEMI aged ≥ 80 years.

Department of Cardiology, Fuwai Hospital, National Centre for Cardiovascular Diseases, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China

Corresponding author:

Yong-jian Wu, Fuwai Hospital, Chinese Academy of Medical Science, 167 North Lishi Road, Xicheng District, 100037, Beijing, China.

Email: wuyongjianwork@163.com



Keywords

ST-segment elevation myocardial infarction, invasive strategy, conservative strategy, older patients, prognosis

Date received: 20 February 2019; accepted: 11 June 2019

Introduction

Cardiovascular disease accounts for 30.8% of all deaths in the United States and 65% of deaths attributable to cardiovascular disease that occurred in people aged >75 years old.¹ ST-segment elevation myocardial infarction (STEMI) is caused by coronary atherosclerotic plaques obstructing the coronary arteries and is the most common and severe form of acute coronary syndrome in the elderly.^{2,3} Patients with cardiovascular disease aged >80 years form a rapidly growing cohort and >20% of patients have received percutaneous coronary intervention (PCI) in real-world practice.⁴

Percutaneous coronary intervention is a commonly used invasive strategy for the treatment of STEMI irrespective of age.^{5,6} Although this invasive strategy is recommended for patients with STEMI, whether a greater proportion of patients aged ≥ 80 years, particularly those with higher risk characteristics, should receive invasive management remains unclear. In addition, because the proportion of patients aged ≥ 80 years old is usually relatively small in large randomized controlled trials of the effects of invasive versus medical treatment of STEMI, the benefits and disadvantages of the two strategies remain uncertain in this age group. To date, there is no guidance for the management of STEMI in patients from the Chinese population that are ≥ 80 years old.

The present study compared the prognosis following conservative or invasive strategies in patients with STEMI in order to

identify the factors associated with the choice of whether to perform invasive treatment, in-hospital death and a good prognosis. The study aimed to provide research evidence for clinicians and patients to help them to select the most appropriate treatment strategy for elderly patients with STEMI.

Patients and methods

Patient population

This cohort study included consecutive patients aged ≥ 80 years with STEMI treated in the Department of Cardiology, Fuwai Hospital, National Centre for Cardiovascular Diseases, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China between August 2014 and August 2017. Fuwai Hospital is a top-tier hospital and a National Centre for Cardiovascular Diseases, so it represents the highest level of clinical practice. STEMI was diagnosed according to the International Classification of Disease [ICD] 10 code I21.3. The diagnostic criteria for STEMI in this study were ischaemia and ST segment elevation ≥ 0.1 mV in ≥ 2 contiguous leads or new left bundle branch block on electrocardiogram. Patients who did not meet the criteria were excluded even if they had an ICD 10 code I21.3. Patients were stratified based on whether they underwent an invasive or conservative treatment strategy. Invasive strategies

included emergency PCI, emergency coronary angiography, emergency balloon dilatation, selective coronary angiography and selective PCI. The last follow-up day was 30 August 2018.

The need for informed consent and ethical approval was waived due to the retrospective nature of the study.

Data collection and study endpoints

As patients aged ≥ 80 years with acute myocardial infarction (MI) are admitted to the emergency department of Fuwai Hospital, this study collected data from all patients aged ≥ 80 years with acute STEMI that met the inclusion criteria from the patient registration system in the emergency department. Relevant information for the patients was retrieved by the data query system of Fuwai Hospital. All of the patients were followed-up by telephone consultations undertaken by one of the authors (Y.G.S.). Aspirin (75–100 mg orally once daily for life) and clopidogrel (75 mg orally once daily for 1 year after stenting) were used for dual antiplatelet treatment in both groups and very few patients were treated with ticagrelor (90 mg orally twice daily for 1 year after stenting).

The primary endpoint was in-hospital death. The secondary endpoints were good prognosis, rehospitalization, MI, target vessel revascularization, cerebral haemorrhage, cerebral infarction and gastrointestinal bleeding. The baseline characteristics of all patients including age, sex, creatinine, systolic blood pressure, heart rate, comorbidity, Killip class, ejection fraction (EF) and coronary angiographic data were collected from the hospital medical records. The clinical characteristics including functional state, management strategies and in-hospital outcomes were extracted from the hospital medical records. In-hospital death, MI and other outcomes were confirmed

from review of the clinical follow-up data. Any of the following conditions was considered to be a poor prognosis: in-hospital death, rehospitalization, cardiac infarction, target vessel revascularization, cerebral haemorrhage, cerebral infarction and gastrointestinal bleeding.

Statistical analyses

All statistical analyses were performed using SAS software (version 9.4) (SAS Institute, Cary, NC, USA). Data are presented as mean \pm SD or n of patients (%). Categorical variables were evaluated using χ^2 -test and continuous variables were evaluated using Student's t -test. Analysis of the factors associated with whether to perform an invasive intervention, in-hospital death and a good prognosis was conducted using multivariate logistic regression analysis. The variables included in the multivariate logistic regression were those with univariate analysis results of $P < 0.1$ or variables that may have an effect on the dependent variable. A P -value < 0.05 was considered statistically significant.

Results

A total of 250 patients with STEMI aged ≥ 80 years were consecutively included in this study. Of these, 18 patients were excluded from the study, with 12 of them transferred to other institutions and six of them missing follow-up data. A total of 232 patients were analysed, of which 93 underwent a conservative treatment strategy and 139 underwent an invasive treatment strategy for STEMI. Of the patients that underwent an invasive treatment strategy, eight had mild non-obstructive coronary atherosclerosis and 13 had severe coronary lesions. Another 114 patients underwent successful PCI, of which 104 received drug-eluting stents and 10 received traditional balloon angioplasty (drug balloon

angioplasty used in two patients). The remaining four patients underwent unsuccessful PCI; one patient had aortic tortuosity and three had culprit lesions that could not be crossed. In addition, 14 patients received an intra-aortic balloon pump (IABP) and 14 patients received thrombus aspiration during the intervention operation.

The baseline characteristics of the patients stratified according to the treatment strategy are shown in Table 1. The patients that underwent an invasive treatment strategy were significantly younger (mean \pm SD age: 83.4 ± 3.1 versus 84.8 ± 3.8 years; $P=0.0033$) and had a significantly lower mean \pm SD creatinine level (95.8 ± 34.5 versus 125.5 ± 67.4 $\mu\text{mol/l}$; $P=0.0002$) compared with the conservative treatment group. The patients that underwent an invasive treatment strategy also had better renal and heart function compared with the conservative treatment group. Systolic blood pressure (mean \pm SD SBP: 123.7 ± 32.4 versus 131.6 ± 25.6 mmHg; $P=0.0487$), EF (mean \pm SD EF: 45.3 ± 1.4 versus $51.9 \pm 0.6\%$; $P < 0.0001$) and the proportion of patients using beta-receptor-blocking agents and angiotensin-converting enzyme inhibitor (ACEI)/angiotensin II receptor blockers (ARB) ($P < 0.05$ for both comparisons) were significantly different between the two groups.

As shown in Table 2, comparison of the prognosis between the conservative and invasive treatment strategy groups demonstrated that patients managed invasively had a significantly better prognosis, lower adverse events and in-hospital death rates ($P < 0.05$ for all comparisons). There was no significant difference of in the occurrence of adverse events during follow-up between the two treatment strategies.

Table 3 presents the multivariate logistic regression analysis results of factors associated with whether or not an invasive strategy was undertaken. Age (odds ratio [OR] 0.892, 95% confidence interval [CI] 0.812,

0.981) and creatinine level (OR 0.988, 95% CI 0.978, 0.998) were risk factors for the use of an invasive treatment strategy. Compared with patients with Killip class I, patients with Killip class II (OR 0.227, 95% CI 0.102, 0.505), III (OR 0.203, 95% CI 0.054, 0.768) or IV (OR 0.305, 95% CI 0.096, 0.969) were less likely to have had an invasive treatment strategy. The use of beta-receptor-blocking agents (OR 2.525, 95% CI 1.160, 5.497) was a favourable factor for invasive strategy ($P < 0.05$ for all of above factors).

Multivariate logistic regression analysis of factors associated with in-hospital death showed that hypertension (OR 6.029, 95% CI 1.048, 11.698), diabetes mellitus (OR 1.211, 95% CI 1.890, 2.234) and a higher Killip class III & IV compared with Killip class I (OR 11.45, 95% CI 1.547, 84.756) increased the risk of in-hospital death, whereas the use of beta-receptor-blocking agents (OR 0.018, 95% CI 0.001, 0.255), diuretics (OR 0.013, 95% CI 0.001, 0.334) and a higher SBP (OR 0.958, 95% CI 0.926, 0.992) decreased the risk of in-hospital death ($P < 0.05$ for all of the above factors) (Table 4).

A multivariate logistic regression analysis was performed with a poor prognosis as the control to determine the factors associated with a good prognosis. As shown in Table 5, age (OR 0.911, 95% CI 0.835, 0.994) and heart rate (OR 0.979, 95% CI 0.962, 0.996) were inversely associated with a good prognosis, while the use of an invasive treatment strategy (OR 2.137, 95% CI 1.153, 3.959), EF (OR 1.050, 95% CI 1.014, 1.087) and SBP (OR 1.012, 95% CI 1.000, 1.025) were positively associated with a good prognosis ($P < 0.05$ for all of the above factors).

Discussion

It is well known that patients aged ≥ 80 years have multiple complications

Table 1. Comparison of the baseline demographic and clinical characteristics of patients ($n = 232$) with ST-segment elevation myocardial infarction (STEMI) that underwent invasive or conservative treatment strategies.

Characteristic	Treatment strategies		Statistical significance ^a
	Conservative $n = 93$	Invasive $n = 139$	
Age, years	84.8 ± 3.8	83.4 ± 3.1	$P = 0.0033$
Sex			NS
Male	53 (57.0)	73 (52.5)	
Female	40 (43.0)	66 (47.5)	
Creatinine, $\mu\text{mol/l}$	125.5 ± 67.4	95.8 ± 34.5	$P = 0.0002$
Systolic blood pressure, mmHg	123.7 ± 32.4	131.6 ± 25.6	$P = 0.0487$
Hypertension	64 (68.8)	93 (66.9)	NS
Diabetes mellitus	32 (34.4)	56 (40.29)	NS
Hyperlipidaemia	84 (90.3)	130 (93.5)	NS
Renal dysfunction	34 (36.6)	33 (23.7)	$P = 0.0348$
History of cerebral infarction	16 (17.2)	24 (17.3)	NS
History of myocardial infarction	16 (17.2)	16 (11.5)	NS
Peptic diseases	29 (31.2)	59 (42.5)	NS
Gastrointestinal bleeding	7 (7.5)	11 (7.9)	NS
Cerebral haemorrhage	0 (0.0)	2 (1.4)	NS
Anaemia	8 (8.6)	13 (9.4)	NS
Atrial fibrillation	8 (8.6)	13 (9.4)	NS
Diagnosis of myocardial infarction			NS
Acute lateral STEMI	3 (3.2)	2 (1.4)	
Acute anterior and high lateral STEMI	4 (4.3)	5 (3.6)	
Acute anterior and inferior STEMI	4 (4.3)	4 (2.9)	
Acute anterior STEMI	41 (44.1)	53 (38.1)	
Acute inferior STEMI	41 (44.1)	75 (54.0)	
Lesion branches			—
I	0 (0.0)	22 (15.8)	
2	0 (0.0)	38 (27.3)	
3	0 (0.0)	79 (56.8)	
Left main disease	0 (0.0)	17 (12.2)	
IABP during operation	0 (0.0)	14 (10.1)	$P = 0.0016$
Killip class			$P < 0.0001$
I	28 (30.1)	99 (71.2)	
II	31 (33.3)	24 (17.3)	
III	13 (14.0)	6 (4.3)	
IV	21 (22.6)	10 (7.2)	
Concomitant valvular disease	6 (6.5)	11 (7.9)	NS
Ejection fraction, %	45.3 ± 1.4	51.9 ± 0.6	$P < 0.0001$
Heart rate, beats/min	79.3 ± 2.5	74.5 ± 16.8	NS
Aspirin	83 (89.2)	127 (91.4)	NS
Clopidogrel	82 (88.2)	123 (88.5)	NS
Statin	82 (88.2)	127 (91.4)	NS
Beta-receptor-blocking agent	45 (48.4)	96 (69.1)	$P = 0.0016$
ACEI/ARB	21 (22.6)	70 (50.4)	$P < 0.0001$
Diuretic	39 (41.9)	42 (30.2)	NS

Data presented as mean ± SD or n of patients (%).

^aCategorical variables were evaluated using χ^2 -test and continuous variables were evaluated using Student's t -test; NS, not significant between-group difference ($P \geq 0.05$).

IABP, intra-aortic balloon pump; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker.

Table 2. Comparison of the prognosis of patients ($n = 232$) with ST-segment elevation myocardial infarction (STEMI) that underwent invasive or conservative treatment strategies.

Characteristic	Treatment strategies		Statistical significance ^a
	Conservative $n = 93$	Invasive $n = 139$	
Good prognosis	31 (33.3)	85 (61.2)	$P < 0.0001$
Adverse events	39 (41.9)	35 (25.2)	$P = 0.0065$
In-hospital death	30 (32.3)	13 (9.4)	$P < 0.0001$
Rehospitalization	4 (4.3)	11 (7.9)	NS
Myocardial infarction	2 (2.2)	1 (0.7)	NS
Target vessel revascularization	2 (2.2)	4 (2.9)	NS
Cerebral haemorrhage	1 (1.1)	1 (0.7)	NS
Cerebral infarction	0 (0.0)	3 (2.2)	NS
Gastrointestinal bleeding	0 (0.0)	1 (0.7)	–

Data presented as n of patients (%).

^aCategorical variables were evaluated using χ^2 -test; NS, no significant between-group difference ($P \geq 0.05$).

Table 3. Multivariate logistic regression analysis of factors associated with whether an invasive treatment strategy was undertaken in patients ($n = 232$) with ST-segment elevation myocardial infarction (STEMI).

Factor	β	SE	Wald	P -value	Odds ratio	95% confidence interval
Intercept	12.1546	4.2647	8.1226	$P = 0.0044$		
Age	-0.1141	0.0483	5.5842	$P = 0.0181$	0.892	0.812, 0.981
Sex						
Male	Ref	Ref	Ref	Ref	Ref	Ref
Female	0.2777	0.3546	0.6133	NS	1.32	0.659, 2.645
Renal dysfunction	0.6877	0.4387	2.457	NS	1.989	0.842, 4.700
Peptic diseases	0.0782	0.3582	0.0477	NS	1.081	0.536, 2.182
Hypertension	-0.3181	0.3691	0.7428	NS	0.728	0.353, 1.500
Diabetes mellitus	0.4366	0.3708	1.3859	NS	1.547	0.748, 3.201
Hyperlipidaemia	0.0801	0.5985	0.0179	NS	1.083	0.335, 3.502
Beta-receptor-blocking agent	0.9262	0.397	5.4441	$P = 0.0196$	2.525	1.160, 5.497
ACEI/ARB	0.6916	0.3916	3.1183	NS	1.997	0.927, 4.302
Diuretic	-0.7259	0.4168	3.0322	NS	0.484	0.214, 1.095
Ejection fraction	0.00902	0.0189	0.2282	NS	1.009	0.972, 1.047
Creatinine	-0.0122	0.00511	5.7258	$P = 0.0167$	0.988	0.978, 0.998
Systolic blood pressure	-0.00662	0.00748	0.7832	NS	0.993	0.979, 1.008
Heart rate	-0.00824	0.0095	0.7512	NS	0.992	0.973, 1.010
Killip class						
I	Ref	Ref	Ref	Ref	Ref	Ref
II	-1.4817	0.4079	13.1982	$P = 0.0003$	0.227	0.102, 0.505
III	-1.5947	0.6788	5.5199	$P = 0.0188$	0.203	0.054, 0.768
IV	-1.1872	0.5896	4.0546	$P = 0.0441$	0.305	0.096, 0.969

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; NS, no significant association ($P \geq 0.05$).

Table 4. Multivariate logistic regression analysis of factors associated with in-hospital death in patients ($n = 232$) with ST-segment elevation myocardial infarction (STEMI).

Factor	β	SE	Wald	P-value	Odds ratio	95% confidence interval
Intercept	-1.593	9.084	0.031	NS	-	-
Age	0.059	0.107	0.300	NS	1.060	0.860, 1.308
Sex						
Male	Ref	Ref	Ref	Ref	Ref	Ref
Female	1.104	0.910	1.470	NS	3.016	0.506, 17.963
Treatment strategy						
Conservative strategy	Ref	Ref	Ref	Ref	Ref	Ref
Invasive strategy	-1.859	0.965	3.709	$P = 0.054$	0.156	0.024, 1.033
Renal dysfunction	-0.541	1.000	0.293	NS	0.582	0.082, 4.130
Peptic diseases	-0.436	0.943	0.214	NS	0.647	0.102, 4.201
Hypertension	1.797	0.893	4.049	$P = 0.044$	6.029	1.048, 11.698
Diabetes mellitus	5.1778	1.7370	8.8854	$P = 0.0029$	1.211	1.890, 2.234
Hyperlipidaemia	2.047	1.664	1.514	NS	7.747	0.297, 10.044
Beta-receptor-blocking agent	-4.033	1.361	8.784	$P = 0.003$	0.018	0.001, 0.255
ACEI/ARB	-1.330	1.356	0.962	NS	0.265	0.019, 3.770
Diuretic	-4.332	1.651	6.884	$P = 0.009$	0.013	0.001, 0.334
Ejection fraction	-0.073	0.050	2.132	NS	0.930	0.844, 1.025
Creatinine	0.004	0.008	0.313	NS	1.004	0.989, 1.019
Systolic blood pressure	-0.043	0.018	5.786	$P = 0.016$	0.958	0.926, 0.992
Heart rate	0.038	0.024	2.445	NS	1.039	0.99, 1.089
Killip class						
I	Ref	Ref	Ref	Ref	Ref	Ref
II	1.788	1.170	2.338	NS	5.978	0.604, 59.163
III & IV	2.438	1.021	5.698	$P = 0.017$	11.450	1.547, 84.756

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; NS, no significant association ($P \geq 0.05$).

Table 5. Multivariate logistic regression analysis of factors associated with good prognosis in patients ($n = 232$) with ST-segment elevation myocardial infarction (STEMI).

Factor	β	SE	Wald	P-value	Odds ratio	95% confidence interval
Intercept	5.202	3.876	1.801	NS	-	-
Age	-0.093	0.044	4.411	$P = 0.036$	0.911	0.835, 0.994
Sex						
Male	Ref	Ref	Ref	Ref	Ref	Ref
Female	-0.548	0.300	3.332	NS	0.578	0.321, 1.041
Treatment strategy						
Conservative strategy	Ref	Ref	Ref	Ref	Ref	Ref
Invasive strategy	0.759	0.315	5.823	$P = 0.016$	2.137	1.153, 3.959
Ejection fraction	0.049	0.018	7.685	$P = 0.006$	1.050	1.014, 1.087
Systolic blood pressure	0.012	0.006	4.084	$P = 0.043$	1.012	1.000, 1.025
Heart rate	-0.021	0.009	5.714	$P = 0.017$	0.979	0.962, 0.996

NS, no significant association ($P \geq 0.05$).

and varying degrees of fragile functional status.⁷⁻⁹ As the population ages, the medical and surgical treatment of STEMI will continue to be a challenge. Clinicians have to make timely treatment decisions incorporating the clinical characteristics, functional status and end-of-life wishes of their patients.¹⁰ Timely reperfusion, preferably through percutaneous intervention, is recommended for the management of STEMI patients.^{11,12} However, the safety and efficacy of primary PCI remains uncertain in patients aged ≥ 80 years due to a paucity data and the side-effects of PCI.^{13,14} Consequently, the management of STEMI in the present study was decided by the physician attending the patient in the emergency department. The current study consecutively enrolled 232 Chinese patients with STEMI that were ≥ 80 years old with the aim of determining which is the most appropriate strategy for this age group. To the best of our knowledge, this is the first study undertaken in China to investigate patients with STEMI aged ≥ 80 years.

This current study demonstrated that an invasive strategy, including emergency PCI, emergency coronary angiography, emergency balloon dilatation, hospitalized coronary angiography and hospitalized PCI, was associated with a better prognosis, a lower rate of adverse events and a lower rate of in-hospital death compared with the conservative treatment strategy in patients with STEMI aged ≥ 80 years. In addition, the markers of increased risk, age, creatinine level and Killip class II, III and IV, were all significantly associated with the decision to adopt an invasive treatment strategy. Although multivariate logistic regression analysis showed that invasive treatment did not differ from conservative treatment in terms of in-hospital mortality, it was a favourable factor for a good prognosis.

Implementation of PCI decreased the mortality in elderly patients with STEMI and the 5-year survival rate was more that

40%.^{2,15} In addition, a study on patients with STEMI aged ≥ 85 years revealed that invasive management had reasonable short- and long-term outcomes.¹⁶ Similarly, this current study showed that patients with STEMI aged ≥ 80 years that were managed invasively had a better prognosis and lower rates of in-hospital death compared with those managed conservatively. As reported in previous studies,¹⁶⁻¹⁸ there were no significant differences between the two treatment strategies in terms of rehospitalization, myocardial infarction, target vessel revascularization, cerebral haemorrhage and cerebral infarction during follow-up in this current study, suggesting that the invasive management of patients with STEMI aged ≥ 80 years was safe and effective. Results from the Chinese Acute Myocardial Infarction Registry study in Chinese patients with STEMI aged ≥ 75 years demonstrated that early reperfusion, especially primary PCI, were safe and effective with an absolute reduction of mortality compared with no reperfusion.¹⁹

Age was demonstrated to be independent predictor of in-hospital mortality in patients with STEMI.²⁰ A previous study showed that advanced age increased the risk of death and adverse events, but the prognosis was slightly improved after PCI in the early phase.²¹ The present study also found that advanced age was a risk factor for the implementation of an invasive treatment strategy and a good prognosis, but the use of an invasive strategy was still a favourable factor for a good prognosis.

Although STEMI patients aged ≥ 80 years treated with an invasive strategy had a better prognosis, a lower rate of in-hospital death, patients with a higher Killip class were less likely to receive invasive treatment. In addition, Killip class III & IV increased the risk of in-hospital death. A previous study revealed that a high Killip class can be predicted with older age in STEMI patients undergoing PCI and it is

strongly associated with in-hospital mortality.²² Indeed, this current study showed that patients that underwent an invasive treatment strategy were significantly younger and with lower rates of Killip class \geq II than those that underwent conservative treatment. Considering surgical tolerance and potential risks, many patients and their families were more inclined to choose conservative treatment, which may be one of the important reasons for the phenomenon above.

The assessment of kidney injury among patients with STEMI in the current study was defined on the basis of creatinine level.^{23,24} Lower levels of creatinine in patients with STEMI undergoing PCI could provide advantageous clinical outcomes.²⁵ The results of this current study showed that the rate of renal dysfunction in patients that underwent an invasive strategy was lower than that in patients that underwent conservative strategy. The creatinine level was negatively associated with whether to perform an invasive strategy in the current study. This finding was consistent with previous studies that demonstrated that renal dysfunction was associated with a higher mortality rate in patients with STEMI that underwent PCI; and renal dysfunction reduced the success rates of intervention strategies.^{26,27}

This current study provides well-needed data suggesting that the invasive treatment of patients with STEMI aged \geq 80 years in China results in a better prognosis than conservative treatment. However, there were a number of limitations in this study. First, due to the lack of guidance, selection of an invasive strategy or a conservative strategy mainly depended on the clinicians' experience and the wishes of patient's family, which might have resulted in selection bias. Secondly, the sample size was relatively small, which could also introduce some bias to the results. Thirdly, the study was retrospective and conducted in a single

centre, which might have limited general applicability. Further studies with larger sample sizes are required in the future.

In conclusion, the prognosis following the implantation of an invasive treatment strategy was superior compared with a conservative strategy in patients with STEMI aged \geq 80 years in China. However, clinicians should consider the Killip class and creatinine levels when selecting a treatment strategy for patients with STEMI aged \geq 80 years and carefully select the most appropriate discharge medications.

Acknowledgements

We thank all of the patients that participated in this current study. We thank the Key Laboratory of Cardiovascular Disease, Beijing, China and the National Centre for Cardiovascular Diseases, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China.

Declaration of conflicting interests

The authors declare that there are conflicts of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ORCID iD

Yong-Jian Wu  <https://orcid.org/0000-0002-0366-4334>

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