Original article

Percutaneous coronary intervention for nonagenarian patients with ST-segment elevation myocardial infarction: Experience of a single Japanese center

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A R T I C L E   I N F O

A B S T R A C T

Background: Old age is a prognostic risk factor for patients with ST elevation acute myocardial infarction (STEMI); however, few data exist describing STEMI patients aged over 90 years.
Methods: We retrospectively evaluated the clinical indices and outcomes of 282 consecutive STEMI patients who underwent primary percutaneous coronary intervention (PCI) in our hospital between January 2008 and December 2012. Patients with acute myocardial infarction complicated by out-of-hospital cardiopulmonary arrest, patients with a left main trunk culprit lesion, and patients diagnosed more than 24 h after symptom onset were excluded.
Results: Of the patients treated during the study period, 11 (3.8%) were >90 years old. The mean door-to-balloon time was significantly longer for nonagenarians than younger patients (66.2 vs. 44.0 minutes; $p < 0.001$). This was mainly attributed to delays in decision-making regarding invasive treatment by both the doctors and families. Nonagenarians had multiple coronary artery stenoses more frequently (36.4% vs. 15.0%; $p < 0.05$) and required intra-aortic balloon pumping more often (36.4% vs. 18.9%; $p = 0.15$) compared with patients aged ≤89 years. However, the peak creatinine kinase levels and the left ventricular ejection fractions were similar between the groups. Moreover, the in-hospital and 30-day mortality rates were similar (9.1% vs. 4.6%, $p = 0.50$; 9.1% vs. 3.6%, $p = 0.34$, respectively) between the groups. The two-year survival rate was 81.8% in nonagenarians.
Conclusions: Despite the longer door-to-balloon time, higher use of intra-aortic balloon pumping, and larger number of diseased vessels, the 30-day and 2-year survival rates of nonagenarians with STEMI were comparable to those of younger patients.

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Introduction

Japan's population is aging faster than that of any other country; more than 26.8% of Japanese citizens were already 65 or older in 2015 and this figure is expected to reach 30.3% in 2025 [1]. These rapid changes in the aging population have an impact on patient management in the emergency room for elderly patients with acute myocardial infarction (AMI). Although

percutaneous coronary intervention (PCI) is a well-established therapy for AMI [2], for elderly patients, such as those aged more than 90 years, doctors and families sometimes decline such invasive treatment even though it is commonly performed in younger patients. These decisions are most often driven by the finding that age is an independent predictor for death in AMI and for complications in primary PCI [3,4]. Furthermore, the paucity of data describing reperfusion therapy for the subset of patients >90 years old also discourages physicians from performing invasive therapy. The purpose of the current study was to evaluate the clinical outcomes of nonagenarian patients with ST elevation myocardial infarction (STEMI) who underwent primary PCI and compare their outcomes with those of younger patients.

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Methods

Study population

We retrospectively collected data from 473 consecutive patients undergoing emergency PCI for AMI diagnosed within 24 h from symptom onset, between January 2008 and December 2012 in our hospital. Patients with AMI complicated by out-of-hospital cardiopulmonary arrest ($n = 33$) or a left main trunk culprit lesion ($n = 23$) were excluded from the study population. Of these, 282 patients were diagnosed with STEMI and 11 were over 90 years old. The inclusion criteria were chest pain lasting >30 minutes, ST-segment elevation ≥ 1 mm in ≥ 2 adjacent electrocardiographic leads, new left bundle-branch block, or true posterior MI. The demographics, clinical and angiographic characteristics, and in-hospital and 30-day outcomes were investigated. Cardiogenic shock upon admission was defined according to the clinical criteria used in the SHOCK trial [5] as hypotension characterized by a systolic blood pressure of <90 mmHg for at least 30 minutes or the need for supportive measures to maintain a systolic blood pressure $\geqq 60$ mmHg.

In-hospital management

All patients were pre-treated with aspirin, clopidogrel, and heparin. After obtaining written informed consent, the patients were transferred to the cardiac catheterization laboratory for coronary angiography, and PCI was performed immediately after the diagnosis of AMI. After the interventional procedure, all patients were admitted to a coronary care unit. All patients underwent transthoracic echocardiography on day 1 post PCI. The assessment of the left ventricular ejection fraction (LVEF) was performed using the biplane method of discs (modified Simpson's rule). LV volumes were measured from the apical four-chamber and two-chamber views. The serum creatine kinase isozyme level was measured at baseline and 3, 6, 9, 12, and 24 h after PCI. Clinical follow-up information was obtained from the referring physicians or via telephone contact with the patients. The primary end point was 30-day mortality.

This study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki and was approved by the institutional review board of our institution.

Statistical analysis

All data were retrospectively analyzed. Categorical variables are expressed as numbers and percentages, and continuous variables are given as the mean $\pm$ standard deviation (SD). After testing for a normal distribution, differences were compared with an unpaired Student's t test, a χ^2 test, or Fisher's exact test, as appropriate. Differences among each generation groups were compared with one-way analysis of variance followed by Scheffe's multiple range test. Statistical tests were performed with StatMate version 5 (ATMS Co., Ltd., Tokyo, Japan). A two-tailed p-value <0.05 was considered statistically significant.

Results

A total of 11 (3.8%) patients were over 90 years old. The mean door-to-balloon time for these patients was significantly longer than that of younger patients (66.2 minutes vs. 44.0 minutes; $p < 0.001$) (Table 1). Surprisingly, the mean door-to-balloon time for nonagenarians was significantly longer than that of patients aged 80–89 years. Nonagenarians were more likely to have multiple coronary artery stenoses (36.4% vs. 15.0%; $p < 0.05$) and tended to require intra-aortic balloon pumping (IABP) more often

(36.4% vs. 18.9%; $p = 0.15$) compared with patients aged ≤ 89 years. However, the peak creatinine kinase level and LVEF were similar between the two groups. Moreover, there were no significant differences in the in-hospital and 30-day mortality rates (9.1% vs. 4.6%, $p = 0.50$; 9.1% vs. 3.6%, $p = 0.34$, respectively) between the groups.

Discussion

The results of the current study demonstrate that the feasibility and efficacy of primary PCI for nonagenarian patients with STEMI is similar to that of younger patients. The 30-days and 2 years-mortality rate after primary PCI for STEMI showed no significant difference between nonagenarian and younger patients groups, although the nonagenarian patients had a significantly longer door-to-balloon time, a higher incidence of renal insufficiency, a larger number of diseased coronary vessels, and lower hemoglobin level.

To date, several studies evaluating the clinical outcomes of nonagenarian patients with acute coronary syndrome have reported relatively worse in-hospital mortality rates (14.0–34.2%) than the current study [6–10]. The main difference between the current study and these prior studies is the prevalence of trans-radial coronary intervention (TRI) and the use of IABP. In the current study, TRI was used in 9 patients (81.8%), while in prior studies, a trans-femoral approach was predominantly used (>90%). IABP was used in 36.4% of the patients (4/11) in the current study and 7.7% in the previous study [10]. Notably, TRI is considered superior to the femoral approach in primary PCI for STEMI patients [11–13]. For nonagenarians with STEMI, femoral access has been reported to be an independent risk factor for in-hospital mortality [8]. The use of IABP was also possibly effective for the nonagenarian patients in this study, who predominantly had multi-vessel disease and cardiogenic shock, although the use of IABP in patients with compromised hemodynamic conditions is still controversial [14–17]. Determining the reasons for the relatively better outcomes observed in the current study is difficult because of the small sample size; however, these relatively superior 30-day and 2-year mortality rates are similarly observed in the octogenarian cohort, with a larger number of patients (9.1% vs. 7.3% and 81.8% vs. 75.6%, respectively), which is also considered a high-risk group for primary PCI.

The current guidelines strongly support primary PCI for patients with STEMI [18]. Since advanced age is a dominant predictor of death in AMI, prompt revascularization should be considered even for elderly patients. However, paradoxically, age is also an independent predictor of death in primary PCI due to possible comorbidities such as renal insufficiency, obstructive respiratory insufficiency, peripheral artery disease, and cognitive disturbance [19–22]. Furthermore, the number of diseased vessels is larger in elderly patients [3,4,6–10,19–22]; therefore, these patients are more likely to suffer hemodynamic instability. However, age is also known to be an independent predictor of complications with IABP [15–17]. For these reasons, physicians tend to avoid invasive interventions for elderly patients with AMI and the decision to perform PCI tends to be delayed.

Bare metal stents (BMS) were predominantly used (81%) in our nonagenarian cohort, at the operators' discretion. Although recent reports have suggested that second-generation drug-eluting stents (DES) have better clinical outcomes than BMS for the treatment of STEMI [23,24], in emergency settings, the patients' medical background is often not well evaluated, especially in nonagenarian patients, and therefore the longer mandatory duration of the dual antiplatelet therapy due to DES implantation may have to be avoided.