Comparison Between Angiotensin-Converting Enzyme Inhibitors and Angiotensin Receptor Blockers in Patients with Unstable Angina with Preserved Left Ventricular Systolic Function

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Abstract
The present study evaluated the clinical results of angiotensin-converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) treatment in patients with unstable angina (UA) with preserved left ventricular systolic function who underwent percutaneous coronary intervention (PCI) due to uncertainty regarding the long-term prognosis using ACEI or ARB. A total of 1627 UA patients with preserved left ventricular systolic function after PCI were enrolled. After propensity score matching, there were no differences in major adverse cardiovascular and cerebrovascular events (MACCEs) (hazard ratio (HR) = .860, 95% confidence interval (CI): .465–1.590, P = .630), all-cause death (HR = .334, 95% CI: .090–1.238, P = .101), nonfatal myocardial infarction (HR = 4.929, 95% CI: .576–42.195, P = .145), stroke (HR = 1.049, 95% CI: 208–5.290, P = .954) and target vessel revascularization (TVR) (HR = 1.276, 95% CI: .537–3.031, P = .581) between the ACEI and ARB groups. In conclusion, prognoses were comparable between ACEI or ARB treatment in UA patients who had preserved left ventricular systolic function after PCI.

Keywords
angiotensin-converting enzyme inhibitor, angiotensin receptor blocker, unstable angina, left ventricular systolic function, percutaneous coronary intervention

Introduction
Unstable angina (UA) is a common type of non–ST-elevation acute coronary syndrome (NSTE-ACS) with severe conditions and rapid progression. In recent decades, percutaneous coronary intervention (PCI) has been a main treatment technique for UA. However, optimal therapeutic drugs remain the cornerstone of treatment in patients with UA even in the age of PCI. Angiotensin-converting enzyme inhibitor (ACEI) can decrease mortality and the risk of myocardial infarction in patients who have left ventricular systolic dysfunction. The European guidelines recommend that ACEI is suitable for UA patients with heart failure (HF) with left ventricular ejection fraction (LVEF) <40%, while angiotensin receptor blocker (ARB) is an alternative for those who are intolerant to ACEI.

However, there is a paucity of comparisons with regard to long-term use of ACEI or ARB therapy in UA patients with preserved left ventricular systolic function. Consequently, we compared 13-month clinical outcomes between ACEI or ARB treatment in UA patients undergoing successful PCI with preserved left ventricular systolic function.

Material and Methods

Study Population and Design
A total of 3812 coronary heart disease (CHD) patients who underwent successful PCI at Tianjin Economic-Technological Development Area (TEDA) International Cardiovascular Hospital from October 2016 to September 2017 were enrolled. We made these exclusion rules:

1. Stable CHD (n = 338, 8.9%);
2. Myocardial infarction (n = 890, 23.3%);
3. Follow-up loss (n = 224, 5.9%);

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(4) Patients who had not been treated with ACEI or ARB at discharge (n = 689, 18.1%);
(5) Patients with LVEF <40% (n = 44, 1.2%).

Ultimately, 1627 UA patients who had preserved left ventricular systolic function after PCI were included. We allocated those patients into 2 groups, the ACEI group (n = 918, 56.4%) and the ARB group (n = 709, 43.6%), based on the use of ACEI or ARB at discharge (Figure 1). This research was approved by the ethics committee of TEDA International Cardiovascular Hospital and was conducted according to the Declaration of Helsinki. After discharge, follow-up of the 1627 patients was carried out by clinic visits, readmission, or telephone at 13 months.

**PCI Procedure and Medical Treatment**

Coronary angiography (CAG) and PCI were performed through standard radial or femoral approaches. All patients were given a loading dose of aspirin 300 mg and clopidogrel 300 mg or ticagrelor 180 mg pre-procedure. After discharge, all patients were advised to continue taking medications following their hospital stay, including dual antiplatelet aggregation treatment, beta-blockers, lipid-lowering medication, and ACEI or ARB. In particular, dual antiplatelet aggregation treatment (aspirin 100 mg daily and clopidogrel 75 mg daily or ticagrelor 90 mg twice a day) was recommended for at least 1 year.

**Study Definitions and Clinical Outcomes**

UA was defined as myocardial ischemia in a resting state or on slight exertion in the absence of cardiomyocyte damage or necrosis. The primary endpoint was the incidence of major adverse cardiovascular and cerebrovascular events (MACCEs), including all-cause death, nonfatal myocardial infarction (MI), stroke and target vessel revascularization (TVR), with a follow-up period of 13 months. The secondary endpoint was the occurrence of separate components of MACCEs (all-cause death, nonfatal MI, stroke and TVR).

**Statistical Analysis**

Continuous variables are presented as mean ± standard deviation, and intergroup differences were compared using independent-samples t tests. Categorical variables are presented as numbers (percentages), and intergroup differences were assessed by the chi-square test. We applied the Kaplan–Meier method to depict survival curves, while intergroup differences were performed using the log-rank test. Multivariable Cox regression analysis was applied to assess the prognostic influence of various factors. To balance potential confounding biases derived from differences in baseline levels, propensity score matching (PSM) was used to adjust for confounders between the ACEI and ARB groups. We assessed all covariates regarded as potentially relevant, including demographics, previous medical history, laboratory indicators, discharge medication, and coronary angiography characteristics. PSM was conducted by 1:1 nearest-neighbor matching with a caliper of .02. After PSM, 660 pairs in each group were created. We applied multivariable Cox regression analysis to calculate the hazard ratio (HR) and 95% confidence interval (CI) in PSM patients. A P < .05 (2-sided) was considered statistically significant. All data analysis was performed using SPSS software, version 26 (IBM, city, New York, USA).

![Figure 1. Study population flowchart. CHD, coronary heart disease; PCI, percutaneous coronary intervention; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; LVEF, left ventricular ejection fraction; UA, unstable angina.](image-url)
Results

Baseline Clinical and Coronary Angiography Characteristics

Among the 1627 UA patients undergoing successful PCI with preserved left ventricular systolic function, 918 patients (56.4%) were treated with ACEI, and 709 patients (43.6%) were treated with ARB at the time of discharge. Table 1 displays the demographics, laboratory indicators, discharge medication and coronary angiography characteristics between the 2 groups.

Compared with patients prescribed ACEI, the average BMI (26.3 ± 3.3 vs 25.8 ± 3.2 kg/m², \( P = .009 \)) and the number of

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Table 1. Baseline Clinical and Coronary Angiography Characteristics.

| Variables                  | All Patients | Propensity Score Matching Patients |
|----------------------------|--------------|-----------------------------------|
|                            | ACEI (n = 918) | ARB (n = 709) | \( P \) | ACEI (n = 660) | ARB (n = 660) | \( P \) |
| Age (years)                | 62.5 ± 9.1    | 63.2 ± 9.3    | .120    | 63.1 ± 9.0    | 63.0 ± 9.4    | .940    |
| Men, n (%)                 | 561 (61.1)    | 408 (57.5)    | .146    | 389 (58.9)    | 384 (58.2)    | .780    |
| BMI (kg/m²)                | 25.8 ± 3.2    | 26.3 ± 3.3    | .009    | 26.1 ± 3.2    | 26.1 ± 3.2    | .990    |
| Hypertension, n (%)        | 696 (75.8)    | 585 (82.5)    | .001    | 530 (80.3)    | 537 (81.4)    | .624    |
| Diabetes mellitus, n (%)   | 510 (55.6)    | 408 (57.5)    | .422    | 372 (56.4)    | 379 (57.4)    | .697    |
| Previous angina, n (%)     | 844 (91.9)    | 659 (92.9)    | .477    | 615 (93.2)    | 614 (93.0)    | .913    |
| Previous MI, n (%)         | 162 (17.6)    | 85 (12.0)     | .002    | 84 (12.7)     | 85 (12.9)     | .934    |
| Previous PCI, n (%)        | 271 (29.5)    | 196 (27.6)    | .407    | 178 (27.0)    | 182 (27.6)    | .805    |
| Current smokers, n (%)     | 366 (39.9)    | 278 (39.2)    | .787    | 270 (40.9)    | 259 (39.2)    | .537    |
| LVEF (%)                   | 61.9 ± 5.5    | 62.4 ± 4.8    | .073    | 62.4 ± 4.9    | 62.4 ± 4.9    | .977    |
| SBP (mmHg)                 | 139.1 ± 19.1  | 138.2 ± 19.2  | .332    | 138.9 ± 19.2  | 138.5 ± 19.1  | .707    |
| DBP (mmHg)                 | 80.4 ± 12.0   | 79.2 ± 11.2   | .054    | 79.8 ± 11.8   | 79.6 ± 11.2   | .831    |
| Laboratory indicators      |              |              |         |              |              |         |
| Serum creatinine (μmol/L)  | 68.7 ± 18.4   | 68.4 ± 16.8   | .777    | 68.7 ± 18.3   | 68.3 ± 16.8   | .641    |
| Blood glucose (mmol/L)     | 7.9 ± 2.8     | 7.8 ± 2.9     | .760    | 7.9 ± 2.8     | 7.8 ± 2.9     | .736    |
| Total cholesterol (mmol/L) | 4.5 ± 1.3     | 4.5 ± 1.3     | .813    | 4.5 ± 1.4     | 4.5 ± 1.3     | .793    |
| Triglycerides (mmol/L)     | 1.7 ± 1.3     | 1.8 ± 1.1     | .555    | 1.8 ± 1.4     | 1.8 ± 1.2     | .920    |
| HDL-cholesterol (mmol/L)   | 1.1 ± 0.3     | 1.1 ± 0.3     | .590    | 1.1 ± 0.3     | 1.1 ± 0.3     | .945    |
| LDL-cholesterol (mmol/L)   | 2.7 ± 1.0     | 2.7 ± 0.9     | .952    | 2.7 ± 1.0     | 2.7 ± 0.9     | .890    |
| Hemoglobin (g/L)           | 137.1 ± 15.7  | 136.6 ± 15.5  | .471    | 136.8 ± 15.4  | 136.6 ± 15.5  | .784    |
| Discharge medication       |              |              |         |              |              |         |
| Aspirin, n (%)             | 915 (99.7)    | 706 (99.6)    | 1.000   | 658 (99.7)    | 657 (99.5)    | 1.000   |
| Clopidogrel, n (%)         | 730 (79.5)    | 610 (86.0)    | .001    | 554 (83.9)    | 564 (85.5)    | .445    |
| Ticagrelor, n (%)          | 188 (20.5)    | 99 (14.0)     | .001    | 106 (16.1)    | 96 (14.5)     | .445    |
| Lipid-lowering agents, n (%)| 888 (96.7)    | 685 (96.6)    | .896    | 637 (96.5)    | 640 (97.0)    | .642    |
| Beta-blockers, n (%)       | 698 (76.0)    | 472 (66.6)    | <.001   | 471 (71.4)    | 456 (69.1)    | .367    |
| Coronary angiography features |              |              |         |              |              |         |
| Infarct-related artery     |              |              |         |              |              |         |
| Left main, n (%)           | 23 (2.5)      | 12 (1.7)      | .262    | 12 (1.8)      | 12 (1.8)      | 1.000   |
| Left anterior descending, n (%)| 479 (52.2)    | 367 (51.8)    | .868    | 346 (52.4)    | 344 (52.1)    | .912    |
| Left circumflex, n (%)     | 232 (25.3)    | 199 (28.1)    | .205    | 177 (26.8)    | 182 (27.6)    | .757    |
| Right coronary, n (%)      | 324 (35.3)    | 254 (35.8)    | .824    | 237 (35.9)    | 232 (35.2)    | .774    |
| 2-vessel, n (%)            | 114 (12.4)    | 109 (15.4)    | .086    | 96 (14.5)     | 96 (14.5)     | 1.000   |
| 3-vessel, n (%)            | 1 (1.1)       | 1 (1.1)       | .855    | 1 (2)         | 1 (2)         | 1.000   |
| Number of stents           | 1.4 ± 0.6     | 1.4 ± 0.6     | .912    | 1.4 ± 0.6     | 1.4 ± 0.6     | .828    |

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BMI, body mass index; CABG, coronary artery bypass graft; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; DBP, diastolic blood pressure; HDL, high-density lipoprotein; HF, heart failure; LDL, low-density lipoprotein; LVEF, left ventricular ejection fraction; MI, myocardial infarction; PCI, percutaneous coronary intervention; PVD, peripheral vascular disease; SBP, systolic blood pressure.
patients who had hypertension (82.5 vs 75.8%, \( P = .001 \)) were higher in patients prescribed ARB. In contrast, the ACEI group showed a higher prevalence of a previous history of MI (17.6 vs 12.0%, \( P = .002 \)). In addition, we found that prescription rates for ticagrelor (20.5 vs 14.0%, \( P = .001 \)) and beta-blockers (76.0 vs 66.6%, \( P < .001 \)) were higher in the ACEI group at discharge. In contrast, the use of clopidogrel (86.0 vs 79.5%, \( P = .001 \)) was more frequent in the ARB group. Laboratory indicators and coronary angiography characteristics were comparable in both groups.

After PSM, potential confounding biases derived from differences in baseline levels were considered in excellent balance between the 2 groups.

Clinical Outcomes

Clinical outcomes by the Kaplan–Meier method and the multivariable Cox regression analysis with a follow-up period of 13 months between both groups are demonstrated in Table 2 and Figure 2.

The occurrence of MACCEs (3.6 vs 3.0%, Log-rank \( P = .473, HR = .860, 95\% CI: .494–1.495, P = .593 \)), all-cause death (1.5 vs 6%, Log-rank \( P = .066, HR = .385, 95\% CI: .124–1.191, P = .097 \)), nonfatal MI (3 vs 7%, Log-rank \( P = .285, HR = 2.540, 95\% CI: .592–10.898, P = .210 \)), stroke (3 vs 6%, Log-rank \( P = .473, HR = 1.718, 95\% CI: .384–7.675, P = .479 \)) and TVR (1.7 vs 1.7%, Log-rank \( P = .925, HR = .998, 95\% CI: .471–2.116, P = .997 \)) did not differ significantly between the 2 groups.

After PSM, we also found no differences in the incidence of MACCEs (3.3 vs 2.9%, Log-rank \( P = .625, HR = .860, 95\% CI: .465–1.590, P = .630 \)), all-cause death (1.5 vs 8%, Log-rank \( P = .051, HR = .334, 95\% CI: .090–1.238, P = .101 \)), nonfatal MI (2 vs 8%, Log-rank \( P = .104, HR = 4.929, 95\% CI: .576–42.195, P = .145 \)), stroke (5 vs 5%, Log-rank \( P = .996, HR = 1.049, 95\% CI: 0.208–5.290, P = .954 \)) and TVR (1.4 vs 1.8%, Log-rank \( P = .522, HR = 1.276, 95\% CI: .537–3.031, P = .581 \)) between the ACEI and ARB groups.

Figure 3 presents subgroup analyses concerning MACCEs in all study populations. There was no obvious difference in prognosis according to the multivariate Cox regression analysis between the 2 groups.

Discussion

The present study was the first to indicate that there were no differences in MACCEs, all-cause death, nonfatal MI, stroke or TVR between the ACEI and ARB groups in UA patients undergoing successful PCI with preserved left ventricular systolic function. Similarly, we also found no differences in subgroup analyses based on age, sex, risk factors for coronary disease (hypertension and diabetes mellitus), discharge medication (beta-blockers) and coronary angiography characteristics (left anterior descending artery occlusion).

ACEI can decrease mortality and the risk of MI in patients who have left ventricular systolic dysfunction.\(^5\)–\(^7\) Therefore, the 2020 European guideline advises that ACEI should be taken into consideration in UA patients with HF with LVEF <40% unless contraindicated, while ARB is an alternative treatment for patients with ACEI intolerance.\(^8\) Nevertheless, presently, the long-term prognosis using ACEI or ARB is still controversial. In the Valsartan in Acute Myocardial Infarction (VALIANT) trial,\(^9\) valsartan and captopril demonstrated similar effectiveness in reducing death from any cause after acute myocardial infarction (AMI). Similar drug effects were in accordance with our findings. However, only AMI patients who had left ventricular systolic dysfunction in the VALIANT trial were enrolled, which made the conclusions less conclusive. In the ONgoing Telmisartan Alone and in combination with Ramipril Global Endpoint Trial

### Table 2. Clinical Outcomes by the Kaplan–Meier Method and Multivariable Cox Regression Analysis.

| Outcomes                  | ACEI        | ARB         | Log-Rank | Hazard Ratio (95% CI) | \( P \) |
|---------------------------|-------------|-------------|----------|-----------------------|--------|
| All patients              |             |             |          |                       |        |
| MACCEs                    | 33 (3.6%)   | 21 (3.0%)   | .473     | .860 (0.494–1.495)    | .593   |
| All-cause death           | 14 (1.5%)   | 4 (6.6%)    | .066     | .385 (1.124–1.191)    | .097   |
| Nonfatal MI               | 3 (3%)      | 5 (7%)      | .285     | 2.540 (0.592–10.898)  | .210   |
| Stroke                    | 3 (3%)      | 4 (6.6%)    | .473     | 1.718 (0.384–7.675)   | .479   |
| TVR                       | 16 (1.7%)   | 12 (1.7%)   | .925     | .998 (0.471–2.116)    | .997   |
| Propensity score matching patients |            |             |          |                       |        |
| MACCEs                    | 22 (3.3%)   | 19 (2.9%)   | .625     | .860 (0.465–1.590)    | .630   |
| All-cause death           | 10 (1.5%)   | 3 (5%)      | .051     | .334 (0.090–1.238)    | .101   |
| Nonfatal MI               | 1 (2%)      | 5 (8%)      | .104     | 4.929 (0.576–42.195)  | .145   |
| Stroke                    | 3 (5%)      | 3 (5%)      | .996     | 1.049 (208–5.290)     | .954   |
| TVR                       | 9 (1.4%)    | 12 (1.8%)   | .522     | 1.276 (0.537–3.031)   | .581   |

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; CI, confidence interval; MACCEs, major adverse cardiovascular and cerebrovascular events; Nonfatal MI, nonfatal myocardial infarction; TVR, target vessel revascularization.
telmisartan also showed no significant difference in cardiac outcomes compared to ramipril in diabetes mellitus or vascular disease patients, who were not associated with HF. However, the small proportion of UA patients (14.9%) and the lack of LVEF data in the ONTARGET trial made the results not meet our targeted population. In addition, the Optimal Trial in Myocardial Infarction with the Angiotensin II Antagonist Losartan (OPTIMAAL) trial also showed no differences in the incidence of deaths (18 vs 16%, HR = 1.13, 95% CI: 0.99–1.28, P = .07), cardiac death (CD) (9 vs 7%, HR = 1.19, 95% CI: 0.98–1.43, P = .07), nonfatal re-infarction (14 vs 14%, HR = 1.03, 95% CI: 0.89–1.18, P = .72) and all-cause hospital admission (66 vs 65%, HR = 1.03, 95% CI: 0.97–1.10, P = .37) between losartan and captopril groups at a median follow-up period of 2.7 (9) years.

Even though there was comparable cardiovascular risk between 2 groups, the OPTIMAAL trial recommended that ACEI should be considered as preferred therapy in patients who had a high risk AMI.

It was recently pointed out that patients with AMI registered in the Osaka Acute Coronary Insufficiency Study prescribed ACEI had more improved survival than those prescribed ARB in a period of 5 years (HR = .53, 95% CI: .38–.74, P < .001).12

ACEI and ARB have their respective mechanisms of action that may contribute to differences in long-term prognosis between the 2 groups. ACEI has been shown to decrease the risk of death and MI in patients with hypertension, diabetes mellitus and HF. Conversely, ARB does not seem to decrease the risk of death or MI. This is because ACEI has cardiovascular benefits independent of antihypertensive effects, which are absent in ARB.13,14 ACEI inhibits angiotensin-converting enzyme (ACE) and consequently reduces the production of angiotensin II. ACEI also suppresses bradykinin breakdown into inactive peptides, whereas bradykinin has many benefits, such as the improvement of endothelial function and ischemic preconditioning, delaying the development of atherosclerosis, vasodilation and stimulation of nitric oxide1.15-17 ARB blocks selectivity for the angiotensin II type 1 (AT1) receptor, which contributes to a compensatory elevation of angiotensin II levels and the activation of the angiotensin II type 2 (AT2) receptor. Moreover, the AT2 receptor causes detrimental effects, including instability and rupture of plaques, thrombosis, inflammation and myocyte apoptosis.18,19

Briefly, current European guidelines do not fully encompass the longer-term use of ACEI/ARB in UA patients with preserved left ventricular systolic function after PCI. However, in-stent restenosis (ISR) is a major drawback of PCI. Groenewegen et al20 found that angiotensin II can promote neointimal proliferation in rats after stenting; neointimal area was increased in the angiotensin II group (.88 ± .21 mm²) vs control group (.66 ± .16 mm²) (P < .05). Recent studies suggest the importance of ACEI/ARB in improving long-term prognosis and reducing ISR. Peters et al21 demonstrated that ARB reduced the rates of ISR and revascularization with complex coronary artery disease after PCI. Guneri et al22 showed that ACEI may reduce the incidence of ISR in type 2 diabetic patients with D allele. Furthermore, the therapeutic mechanism involving ACEI/ARB depends on the blockade of angiotensin II, and angiotensin II contributes directly to the pathogenesis of coronary ischemic events via the development of atherosclerosis, cardiovascular remodeling, and decreased fibrinolysis.23 Based on these studies,20-23 we believe that ACEI/ARB should not be limited to UA with left ventricular systolic dysfunction after PCI, which could be applied to reduce ISR and delay the process of atherosclerosis in UA patients undergoing successful PCI with preserved left ventricular systolic function. In addition, as the percentage of patients with preserved left ventricular systolic function is
significantly more than those with left ventricular systolic dysfunction, there is a great need to investigate the effects of ACEI/ARB on long-term prognosis. Thus, we compared clinical outcomes between ACEI or ARB treatment in UA patients with preserved left ventricular systolic function after PCI.

Several retrospective observational studies have recently described comparable cardiovascular risk between ACEI/ARB treatment in UA patients with preserved left ventricular systolic function after PCI. Raposeiras et al reported that patients who had NSTE-ACS with preserved left ventricular systolic function did not appear to benefit from ACEI/ARB in reducing mortality. An increasing degree of prescribed ACEI/ARB in all patients after NSTE-ACS is mainly because of a tendency to therapeutic optimism. Regrettfully, this study did not evaluate the effects of ACEI and ARB separately. Cespon et al focused on a ACS population with preserved left ventricular systolic function to assess whether the selection between ACEI and ARB could contribute to differences in long-term prognosis. They found that there were no differences in combined events (all-cause death, AMI and HF) (HR = 1.03, 95% CI: .85–1.24, P = .796), AMI (HR = 1.03, 95% CI: .75–1.43, P = .839) and HF (HR = 1.04, 95% CI: .81–1.34, P = .768) between the ACEI and ARB groups after the follow-up period (median follow-up: 3.6 ± 2.1 years). Their findings on the lack of differences in prognosis were consistent with ours. Ann et al divided their study population with CHD into AMI (n = 21747) and angina (n = 28708). They allocated those patients into 2 groups, the ACEI and ARB groups, based on discharge medications. After PSM, they found that the occurrence of all-cause death (HR = 1.113, 95% CI: .986–1.257, P = .084) was not significantly different in the angina group, with a median follow-up of 2.2 years. Nevertheless, neither of the above study populations were restricted to patients with UA.

Our study is the first to examine the longer-term use of ACEI or ARB treatment in an East Asian population with UA with preserved left ventricular systolic function after PCI, which manifests a real clinical world outlook. Prognoses were comparable between ACEI or ARB treatment according to our final conclusion. Hence, we think that our study may not only increase indications and prescriptions of ARB but also provide important references for cardiologists about the selection of renin–angiotensin–aldosterone system (RAAS) inhibitors after PCI. However, further prospective, high-quality, large-sample randomized controlled trials are required to evaluate the conclusion.

The present study has limitations even though we performed PSM to adjust for possible confounding baseline factors. First, it was a single-center retrospective study with a small sample size, which might cause data loss and selection bias. Second, our study did not collect specific data concerning the specific ACEI and ARB used or their dose. Third, the study population were divided by post-discharge medication, we do not know how long patients had been taking their medications and changes in drug after hospital discharge. Such confounding factors might significantly influence the reliability of

| Variable | No. of patients | MACCEs | Hazard ratio (95% CI) | P |
|----------|----------------|--------|----------------------|---|
| Age (years) | | | | |
| ≥ 65 | 708 | | 0.798(0.585–1.176) | .580 |
| < 65 | 919 | | 0.831(0.593–1.370) | .629 |
| Gender | | | | |
| Men | 969 | | 0.870(0.445–1.700) | .684 |
| Women | 658 | | 0.750(0.291–1.934) | .551 |
| Hypertension | | | | |
| Yes | 1281 | | 0.985(0.544–1.783) | .960 |
| No | 346 | | 0.197(0.025–1.555) | 1.123 |
| Diabetes mellitus | | | | |
| Yes | 918 | | 0.671(0.342–1.318) | .247 |
| No | 709 | | 1.201(0.464–3.114) | .706 |
| Beta-blockers | | | | |
| Yes | 1170 | | 0.869(0.468–1.613) | .657 |
| No | 457 | | 0.775(0.237–2.540) | .674 |
| LAD occlusion | | | | |
| Yes | 846 | | 1.038(0.486–2.217) | .924 |
| No | 781 | | 0.637(0.286–1.419) | .270 |

Figure 3. Subgroup analyses concerning MACCEs in all study populations. MACCEs, major adverse cardiovascular and cerebrovascular events; CI, confidence interval; LAD, left anterior descending; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker.
the outcomes. Fourth, the selection of RAAS inhibitors after PCI was at the discretion of the cardiologists.

**Conclusion**

No clear differences in MACCEs, all-cause death, nonfatal MI, stroke or TVR were observed between the ACEI and ARB groups during a 13-month follow-up period. Thus, we consider that prognoses are comparable between ACEI or ARB treatment in UA patients who have preserved left ventricular systolic function after PCI. To further confirm our results, prospective and large-sample randomized controlled trials are needed.

**Author Contribution**

All authors contributed to (1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, and (3) final approval of the version to be published.

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