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A Comparison of Transradial and Transfemoral Approaches for Percutaneous Coronary Intervention in Elderly Patients Based on a Propensity Score Analysis

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Abstract

The transradial approach (TRA) has been used as access site for percutaneous coronary intervention (PCI) for years. However, no large sample study has evaluated the effect of TRA in elderly patients. A total of 1098 elderly patients (age $\geq$ 75 years) who underwent PCI by TRA or transfemoral approach were recruited. A 1:1 matched propensity score analysis was performed to minimize bias. The rates of major adverse cardiovascular events that included death, myocardial infarction (MI), and target vessel revascularization during hospitalization (1.3% vs 6.6%, $P = .014$) and at 1-year follow-up (6.0% vs 13.9%, $P = .019$) were significantly lower in the TRA group. Transradial approach was also associated with lower rates of in-hospital MI (1.3% vs 5.3%, $P = .046$), access-site complications (3.3% vs 9.9%, $P = .018$), and major bleeding (1.3% vs 5.3%, $P = .046$). In conclusion, TRA showed better safety in elderly patients; it should be considered as a preferred route for elderly patients.

Keywords

coronary artery disease, percutaneous coronary intervention, access site, elderly, transradial, transfemoral

Introduction

Compared with the transfemoral approach (TFA), the transradial approach (TRA) is increasingly adopted as access site for percutaneous coronary intervention (PCI) because of the superior properties, such as fewer access-site complications, earlier ambulation, and higher postprocedure quality of life.[1-3] Elderly people (age $\geq$ 75 years) with severe coronary artery disease (CAD) are a growing population who will benefit from PCI treatment; however, they are also at high risk of access-site complications and periprocedural bleeding.[4-6] Previously, only small studies have evaluated the effect of TRA in elderly patients.[7-12] Therefore, this study aims to compare the in-hospital and 1-year outcomes between TRA and TFA in this population.

Materials and Methods

Patient Selection and Data Collection

We recruited 1098 elderly patients (age $\geq$ 75 years) who had undergone PCI with stent implantation between June 1, 2006, and April 30, 2011, at our institution, FuWai Hospital in Beijing, China; they were prospectively followed up for around 1 year. The angiographic characteristics of the patients were downloaded from the digital database of our institution. The clinical characteristics and in-hospital outcomes were extracted from the medical charts by a group of trained medical graduate students. Major clinical events were adjudicated by the data quality committee, which was composed of 4 senior clinical fellows. Informed consents were obtained from all patients, and the study protocol was approved by the ethic

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committee of FuWai Hospital. The follow-up checkups were performed by full-time staff of our institution by telephone visits at 6 months and 1 year after the patient's discharge. All the data were properly preserved and maintained confidentially.

Antiplatelet and Anticoagulation Treatments

All patients were pretreated with aspirin and clopidogrel before PCI. Clopidogrel (75 mg/d) consecutively taken for at least 6 days before the procedure was required or a 300-mg bolus was administered. A loading dose of 80 to 100 IU/kg heparin was also administered intravenously at the start of the procedure. Glycoprotein IIb/IIIa inhibitor or subcutaneous low-molecular-weight heparin was administered after the procedure at the doctor's discretion. The sustained dual antiplatelet therapy was prescribed for at least 1 year for patients with implantation of drug-eluting stents and for 1 month for patients with implantation of bare metal stents.

Percutaneous Coronary Intervention Procedure and Hemostasis

All the procedures were performed by doctors with experience of TRA, who also performed >200 PCIs each year. Since 2006, TRA has become increasingly popular in our hospital, but TFA was still preferred in certain conditions, such as failed Allen test, a nonpalpable or weak radial pulse, a history of coronary artery bypass graft (CABG) surgery, and patients who are potentially in need of several catheters or devices. Usually an unsuccessful right-hand artery puncturing or failed catheterization by TRA may lead to a crossover to TFA. Hemostasis for TRA was relatively easier compared with that for TFA. In TRA patients, the sheath was removed immediately, and hemostasis was achieved by clamp compression of the puncture site. However, in TFA patients, the sheath cannot be removed until the activated partial thrombin time dropped to less than 75 seconds, and hemostasis was achieved by finger pressing of the puncture site for at least 20 minutes followed by sandbag compression for 8 hours. Patients were advised to exercise their lower limbs transversely after the removal of the sandbag and start to ambulate 24 hours after the procedure.

End point Definition

The primary end point was defined as major adverse cardiovascular events (MACEs) during hospitalization and at 1-year follow-up; this included all-cause death, myocardial infarction (MI), and target vessel revascularization (TVR). The secondary end point was defined as each component of the primary end point, as well as major bleeding and access-site complications. Access-site complications included large local hematoma that prolonged hospital stay, arteriovenous fistula, pseudoaneurysm, and mediastinal or retroperitoneal hematoma. Any overt bleeding events were recorded, and the severity of bleeding was adjudicated and classified using the "Bleeding Academic Research Consortium" (BARC)[13] definition. In this study, BARC $\geq$3 grade bleeding was considered as major bleeding, which was further distinguished as access-site related or nonaccess-site related. In-hospital MI was defined as a postprocedure elevation of troponin I >3 times the 99th percentile upper reference limit with either new onset of chest pain or new changes in the electrocardiogram (new Q waves, ST-segment elevation, or deviation in $\geq$2 contiguous leads). Target vessel revascularization referred to any percutaneous or surgical revascularization of a previously treated vessel.

Statistics

Continuous variables are expressed as mean value $\pm$ standard deviation. Normally distributed variables are compared with Student t test, and not normally distributed variables are compared with Wilcoxon rank-sum test. Categorical variables are expressed as proportion and compared using chi-square test or Fisher exact test, as appropriate. Logistic/Cox regression analysis was applied to predict TRA effect on the in-hospital and 1-year outcomes, which was expressed as odds ratio (OR)/hazard ratio and 95% confidence interval (CI).

Since the route was not randomly selected, a 1:1 matched propensity score analysis was introduced to minimize the bias. Logistic regression analysis was performed to calculate the probability of 1 patient's assignment. Propensity scores were calculated using the following baseline variables: gender, age, prior MI, prior PCI, prior CABG, prior stroke, diabetes mellitus, hypertension, hyperlipidemia, hemoglobin < 90 g/L, serum creatinine > 133 μmol/L, PCI indications, left ventricle ejection fraction (LVEF), use of GP IIb/IIIa inhibitor, sheath size, number of diseased vessels, left main branch disease, use of intra-aortic balloon pump device, postprocedure thrombolysis in MI flow, use of drug-eluting stent, and total length of stent. A difference of $\leq$0.01 in the estimated propensity score between the TRA and TFA groups indicated that the 2 patients were matched. Finally, 151 matched pairs appeared, and the C-statistic for the propensity score model was 0.78. Paired t test for continuous variables and paired chi-square or Fisher exact test for categorical variables were performed within the matched pairs. Kaplan-Meier curves were constructed for the outcomes in the matched patients. Each matched pair was considered as a separate stratum to estimate the overall hazard of TRA versus TFA using matched logistic/Cox regression analysis. Patients' data were analyzed on the principle of intention to treat (before the crossover), and a repeat PCI for the same patient was not counted as a separate file in the analysis. All the analyses were performed using SAS software, version 9.13 (SAS Institute, Cary, North Carolina), and a 2-sided $P \leq .05$ was considered significant.

Results

Patient Characteristics

A total of 1098 elderly patients (age $\geq$ 75 years) who had undergone PCI either by TRA or TFA with stent implantation

Table 1. Baseline Characteristics.[a]

	All Patients			Propensity Score-Matched Patients		
Variable	TRA, N = 873	TFA, N = 225	P	TRA, N = 151	TFA, N = 151	P
Age	77.36 ± 2.59	77.75 ± 2.66	.043	77.62 ± 2.84	77.82 ± 2.74	.537
Male	598 (68.5%)	138 (61.3%)	.043	87 (57.6%)	90 (59.6%)	.726
Prior MI	197 (22.6%)	78 (34.7%)	<.001	34 (22.5%)	45 (29.8%)	.149
Prior CABG	17 (1.9%)	41 (18.2%)	<.001	11 (7.3%)	11 (7.3%)	1.000
Prior PCI	160 (18.3%)	53 (23.6%)	.083	35 (23.2%)	32 (21.2%)	.678
Prior stroke	82 (9.4%)	16 (7.1%)	.272	11 (7.3%)	13 (8.6%)	.670
Diabetes	225 (25.8%)	65 (28.9%)	.348	40 (26.5%)	38 (25.2%)	.793
Hypertension	596 (68.3%)	152 (67.6%)	.838	98 (64.9%)	102 (67.5%)	.626
Hyperlipidemia	445 (51.0%)	96 (42.7%)	.026	56 (37.1%)	66 (43.7%)	.241
Clinical diagnosis						
STEMI	143 (16.4%)	39 (17.4%)	.713	30 (19.9%)	23 (15.2%)	.289
NSTEMI	60 (6.9%)	20 (8.9%)	.302	9 (6.0%)	13 (8.6%)	.375
Unstable angina	430 (49.3%)	113 (50.4%)	.751	78 (51.7%)	77 (51.0%)	.908
Stable angina	226 (25.9%)	50 (22.3%)	.268	33 (21.9%)	37 (24.5%)	.585
Other	14 (1.6%)	2 (0.9%)	.548	1 (0.7%)	1 (0.7%)	1.000
LVEF, %	61.12 ± 8.22	58.24 ± 8.47	<.001	59.78 ± 9.35	59.08 ± 7.76	.478
LVEF < 50, %	62 (7.1%)	29 (12.9%)	.008	19 (12.6%)	13 (8.6%)	.261
Hemoglobin, g/L	129.34 ± 15.43	126.49 ± 16.06	.015	125.46 ± 14.79	124.86 ± 16.56	.742
Serum creatinine, μmol/L	88.38 ± 24.41	91.95 ± 24.94	.053	86.81 ± 22.45	90.70 ± 24.18	.149
Periprocedural medication						
GP IIb/IIIa inhibitor	27 (3.1%)	9 (4.0%)	.506	3 (2.0%)	4 (2.6%)	.702
LMWH	649 (74.3%)	171 (76.0%)	.608	109 (72.2%)	112 (74.2%)	.697

Abbreviations: CABG, coronary artery bypass graft; GP IIb/IIIa inhibitor, glycoprotein IIb/IIIa inhibitor; LMWH, low-molecular-weight heparin; LVEF, left ventricle ejection fraction; MI, myocardial infarction; NSTEMI, non-ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction; TFA, transfemoral approach; TRA, transradial approach; PCI, percutaneous coronary intervention; SD, standard deviation.
[a] Data represented as n (%) or mean ± SD.

were included. Of the 1098 patients enrolled, 873 (79.5%) were in the TRA group and 225 (20.5%) were in the TFA group. Compared with TRA, the TFA group comprised older patients and more cases with prior MI or CABG. A higher prevalence of hyperlipidemia as well as a lower level of hemoglobin and LVEF was detected in the TFA group. In the propensity score-matched patients, the baseline characteristics were quite comparable between the TRA and the TFA groups. The baseline features of all the patients and the propensity score-matched patients are shown in Table 1.

The angiographic results are presented in Table 2. The coronary characteristics were more severe in the TFA group than in the TRA group. But in the propensity score-matched patients, only the treated chronic total occluded lesions were more frequent in the TFA group; no other significant differences were detected.

Procedure Outcomes

Nineteen (2.2%) patients were transferred from the TRA group to the TFA group due to failed catheterization; no patients in the TFA group were transferred to the TRA group. A closure device was used in 102 (45.3%) patients in the TFA group. In the propensity score-matched patients, the proportion of drug-eluting stents was similar between TRA and TFA, and no significant differences were detected in procedure-related complications (eg, dissection or acute thrombosis). The total procedure time and contrast volume were also similar between TRA and TFA.

Clinical Outcomes and Follow-Up Results

The follow-up was completed in 100% of all patients. The median follow-up time was 360 days in the TRA (interquartile range, 353-366 days) group and 362 days in the TFA (interquartile range, 354-367 days) group. The incidence rates of MACE during hospitalization (2.4% vs 6.2%, $P = .007$) and at 1-year follow-up (8.2% vs 13.3%, $P = .024$) were lower in the TRA group than in the TFA group.

In the propensity score-matched patients, the incidence rates of in-hospital MACE (1.3% vs 6.6%, $P = .014$) and 1-year MACE (6.0% vs 13.9%, $P = .019$) were lower in the TRA group than in the TFA group. Transradial approach was also associated with lower rates of in-hospital MI (1.3% vs 5.3%, $P = .046$). Although the in-hospital death, TVR, and the components of 1-year MACE tended to be lower in the TRA group, this did not reach statistical significance (Table 3). The Kaplan-Meier curves for 1-year outcomes in matched patients are shown in Figure 1. The incidence rates of both access-site complications (9.9% vs 3.3%, $P = .018$) and major bleeding (5.3% vs 1.3%, $P = .046$) were higher in the TFA group. Regarding major bleeding according to the original site, the access-site-related major bleeding tended to be higher in the TFA group but did not reach statistical significance

Table 2. Angiographic Characteristics.[a]

Variable	All Patients			Propensity Score-Matched Patients		
	TRA	TFA	*P*	TRA	TFA	*P*
LM disease	8% (70/873)	16.9% (38/225)	<.001	13.2% (20/151)	13.2% (20/151)	1.000
Number of diseased vessels						
Single vessel	19.5% (170/873)	10.2% (23/225)	<.001	15.9% (24/151)	11.3% (17/151)	.308
Two vessels	30.1% (263/873)	22.7% (51/225)	.025	29.1% (44/151)	27.2% (41/151)	.701
Three vessels	50.4% (440/873)	67.1% (151/225)	<.001	55.0% (83/151)	61.6% (93/151)	.243
Graft stenosis	1.0% (9/873)	9.8% (22/225)	<.001	4.0% (6/151)	5.3% (8/151)	.584
Type C lesion	48.7% (609/1250)	57.9% (183/316)	.004	48.7% (114/234)	55.0% (120/218)	.294
Treated lesion (per person)	1.44 ± 0.67	1.41 ± 0.66	.646	1.54 ± 0.79	1.44 ± 0.65	.233
Treated CTO lesion	2.9% (36/1250)	7.0% (22/316)	.002	2.6% (6/234)	7.3% (16/218)	.017
Treated ostium lesion	12.8% (160/1250)	19.9% (63/316)	.002	14.1% (33/234)	19.7% (43/218)	.115
Treated bifurcation lesion	32.3% (404/1250)	36.0% (113/316)	.255	34.6% (81/234)	37.6% (82/218)	.505
Initial TIMI flow grade 3	29.9% (373/1250)	34.7% (109/316)	.101	33.3% (78/234)	33.8% (73/218)	.917
Final TIMI flow grade 3	98.6% (1224/1250)	97.8% (307/316)	.346	97.4% (228/234)	98.1% (212/218)	.607
Sheath size ≤ 6F	97.8% (854/873)	80.8% (181/225)	<.001	92.1% (139/151)	92.7% (140/151)	.828
Drug-eluting stent	96.4% (842/873)	90.7% (204/225)	<.001	95.4% (144/151)	93.4% (141/151)	.453
No. of stents (per person)	1.86 ± 1.02	1.94 ± 1.04	.311	1.93 ± 1.02	1.96 ± 0.95	.816
Average stent diameter, mm	3.00 ± 0.66	3.00 ± 0.46	.883	2.99 ± 0.47	2.98 ± 0.46	.833
Total stent length, mm	42.31 ± 26.12	44.59 ± 27.22	.248	43.63 ± 26.09	44.90 ± 24.92	.378
IABP support	2.2% (19/873)	7.6% (17/225)	<.001	5.3% (8/151)	7.3% (11/151)	.476
Total procedure time, min	42.8 ± 16.3	48.7 ± 20.9	.010	45.8 ± 9.4	47.6 ± 10.7	.578
Contrast volume, mL	138.8 ± 76.2	159.6 ± 90.3	.003	149.0 ± 83.1	158.9 ± 91.7	.351
Interventional complications						
Dissection	0.9% (11/1250)	1.9% (6/316)	.146	0.9% (2/234)	1.4% (3/218)	.599
Thrombosis	0.6% (8/1250)	0.6% (2/316)	.991	1.7% (4/234)	0.5% (1/218)	.189

Abbreviations: CTO, chronic total occlusion; LM, left main; IABP, intra-aortic balloon pump; TFA, transfemoral approach; TIMI, Thrombolysis in myocardial infarction; TRA, transradial approach; SD, standard deviation.
[a] Data represented as proportion or mean ± SD.

Table 3. Major Outcomes.[a]

Variable	All Patients			Propensity Score-Matched Patients		
	TRA, N = 873	TFA, N = 225	*P*	TRA, N = 151	TFA, N = 151	*P*
In-hospital major outcomes						
MACE	21 (2.4%)	14 (6.2%)	.007	2 (1.3%)	10 (6.6%)	.014
All-cause death	4 (0.5%)	6 (2.7%)	.007	0 (0.0%)	3 (2.0%)	.248
Cardiac death	4 (0.5%)	6 (2.7%)	.007	0 (0.0%)	3 (2.0%)	.248
MI	16 (1.8%)	9 (4.0%)	.070	2 (1.3%)	8 (5.3%)	.046
TVR	2 (0.2%)	2 (0.9%)	.188	0 (0.0%)	2 (1.3%)	.498
Stroke	0 (0%)	0 (0%)	1.000	0 (0%)	0 (0%)	1.000
Total hospital stay, d	6 [5,9]	8 [6,14]	<.001	7 [5,10]	8 [6,14]	.022
Postprocedure stay, d	3 [2,5]	4 [3,7]	<.001	3 [2,5]	4 [3,7]	.002
1-Year outcomes						
MACE	72 (8.2%)	30 (13.3%)	.024	9 (6.0%)	21 (13.9%)	.019
All-cause death	29 (3.3%)	15 (6.7%)	.032	5 (3.3%)	9 (6.0%)	.270
Cardiac death	14 (1.6%)	9 (4.0%)	.035	3 (2.0%)	5 (3.3%)	.723
MI	21 (2.4%)	10 (4.4%)	.119	4 (2.6%)	9 (6.0%)	.151
TVR	28 (3.2%)	8 (3.6%)	.796	2 (1.3%)	6 (4.0%)	.283

Abbreviations: MACE, major adverse clinical event; MI, myocardial infarction; TVR, target vessel revascularization; TFA, transfemoral approach; TRA, transradial approach.
[a] Data represented as n (%) or median (interquartile range).

(4.6% vs 1.3%, $P = .173$), and no difference was observed for the nonaccess-site-related major bleeding between TRA and TFA (0% vs 0.7%, $P = 1.000$). The total hospital stay (7 [5,10] vs 8 [6,14] days, $P = .022$) as well as the postprocedure stay (3 [2,5] vs 4 [3,7] days, $P = .002$) was also substantially reduced by TRA.

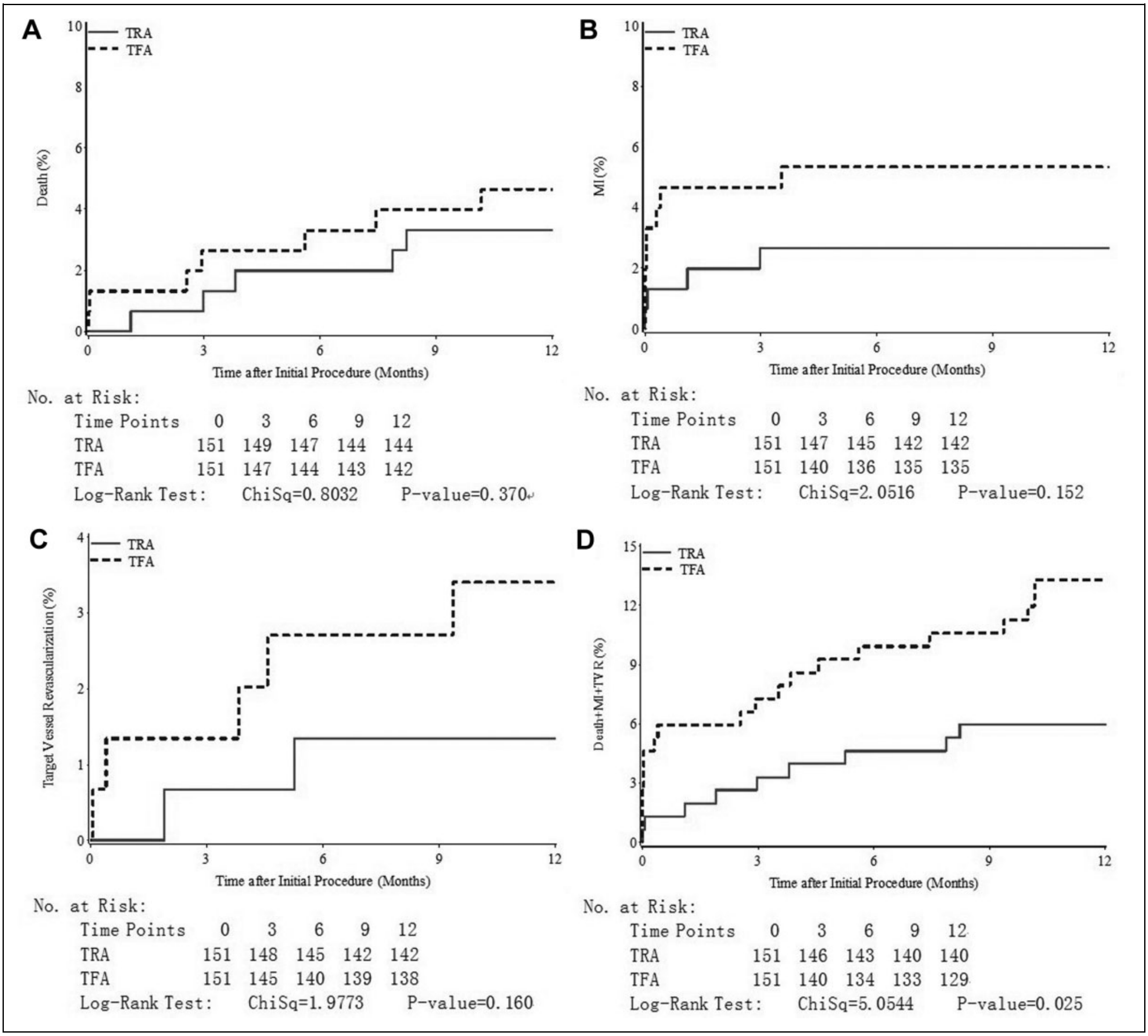

Figure 1. A, Kaplan-Meier curves for occurrence of death between transradial and transfemoral groups of 12-month follow-up in the propensity score-matched patients. B, Kaplan-Meier curves for occurrence of myocardial infarction between transradial and transfemoral groups of 12-month follow-up in the propensity score-matched patients. C, Kaplan-Meier curves for occurrence of target vessel revascularization between transradial and transfemoral groups of 12-month follow-up in the propensity score-matched patients. D, Kaplan-Meier curves for occurrence of major adverse cardiovascular event between transradial and transfemoral groups of 12-month follow-up in the propensity score-matched patients. MI indicates myocardial infarction; TFA, transfemoral approach; TRA, transradial approach; TVR, target vessel revascularization.

Performing logistic/Cox regression analysis in the propensity score-matched patients, TRA acted as an independent predictor of lower rate of in-hospital MACE (OR: 0.20, 95% CI: 0.04-0.91) and access-site complications (OR: 0.33, 95% CI: 0.12-0.92; Tables 4 and 5).

Discussion

This study is so far the largest to perform a comprehensive comparison of TRA and TFA in elderly patients. The principal findings showed that in the propensity score-matched patients, TRA was associated with significantly reduced in-hospital and 1-year MACE compared with TFA. So elderly patients with CAD may represent a potential subgroup who will benefit from the TRA approach.

Elderly patients constitute a large part of patients with CAD who need PCI.[14] Meanwhile, they are at high risk of procedure complications due to common comorbidities, long-term standing hypertension, and atherosclerosis of peripheral arteries. The femoral artery is the traditional route for PCI, but it may lead to

Table 4. Bleeding and Complications.[a]

	All Patients			Propensity Score-Matched Patients		
Variable	TRA, N = 873	TFA, N = 225	*P*	TRA, N = 151	TFA, N = 151	*P*
Access-site complications	23 (2.6%)	19 (8.4%)	<.001	5 (3.3%)	15 (9.9%)	.018
Hematoma	21 (2.4%)	11 (4.9%)	.064	5 (3.3%)	8 (5.3%)	.393
Mediastinum hematoma	1 (0.1%)	0 (0.0%)	1.000	0 (0.0%)	0 (0.0%)	1.000
Aneurysm	1 (0.1%)	6 (2.7%)	<.001	0 (0.0%)	6 (4.0%)	.030
Arteriovenous fistula	0 (0.0%)	0 (0.0%)	1.000	0 (0.0%)	0 (0.0%)	1.000
Retroperitoneal hematoma	0 (0.0%)	2 (0.8%)	.042	0 (0.0%)	1 (0.7%)	1.000
Need surgical repair	0 (0.0%)	3 (1.3%)	.009	0 (0.0%)	2 (1.3%)	.498
BARC ≥3 grade bleeding	11 (1.3%)	13 (5.8%)	<.001	2 (1.3%)	8 (5.3%)	.046
BARC ≥2 grade bleeding	87 (10.0%)	42 (18.7%)	<.001	18 (11.9%)	27 (17.9%)	.145
Access-site-related major bleeding	5 (0.6%)	9 (4.0%)	<.001	2 (1.3%)	7 (4.6%)	.173
Nonaccess-site-related major bleeding	6 (0.7%)	4 (1.8%)	.129	0 (0.0%)	1 (0.7%)	1.000
Transfusion	5 (0.6%)	7 (3.1%)	.004	0 (0.0%)	5 (3.3%)	.060

Abbreviations: BARC, Bleeding Academic Research Consortium; TFA, transfemoral approach; TRA, transradial approach.
[a] Data represented as n (%).

Table 5. Regression Analysis for the Effect of TRA (vs TFA).

	All Patients		Propensity Score-Matched Patients	
Outcomes	OR/HR (95% CI)	*P*	OR/HR (95% CI)	*P*
In-hospital outcomes[a]				
MACE	0.37 (0.19-0.74)	.005	0.20 (0.04-0.91)	.038
Major bleeding	0.21 (0.09-0.47)	<.001	0.25 (0.05-1.18)	.080
Access-site complications	0.29 (0.16-0.55)	<.001	0.33 (0.12-0.92)	.033
1-Year outcomes[b]				
MACE	0.94 (0.81-1.10)	.433	0.92 (0.72-1.16)	.469
All-cause death	0.96 (0.83-1.11)	.609	0.97 (0.78-1.22)	.814

Abbreviations: CI, confidence interval; HR, hazard ratio; MACE, major adverse cardiovascular event; OR, odds ratio; TRA, transradial approach; TFA, transfemoral approach.
[a] In-hospital outcomes are analyzed in logistic model and expressed as OR.
[b] 1-Year outcomes are analyzed in Cox model and expressed as HR.

access-site complication and bleeding. The radial artery is easy to puncture and to achieve hemostasis.[15] So ever since the first TRA PCI successfully performed by Kiemeneij and Laarman in 1993, this technique has been favorably adopted.[16]

Previous studies indicated that TRA could benefit certain subgroups of patients with CAD having higher survival rate.[17,18] But the effect of TRA in elderly patients was not consistent. Ziakas et al[7] found similar in-hospital death between TRA and TFA among elderly patients with acute MI. Koutouzis et al[8] found no difference for in-hospital and 1-year mortality by TRA and TFA in elderly patients undergoing primary PCI. The only randomized trial that included 377 octogenarians[9] covering all the presentations of patients with CAD showed no difference of in-hospital mortality between TRA and TFA. Our study, based on the propensity score matching method suggested that TRA could reduce the in-hospital and 1-year MACE compared with TFA, and the difference was mainly driven by a lower rate of in-hospital MI (1.3% vs 5.3%, P = .046) in the TRA group, but without any difference in death or TVR during hospitalization or at 1-year follow-up. Patients with ST-segment elevated MI were reported to gain short- or medium-term benefit from TRA,[14] but they only accounted for less than one-fifth of the total patients in our study, which indicated the benefit of TRA affected in this age-specific population but not in patients with specific PCI indication. Our study also found a higher rate of in-hospital MI with TFA compared with TRA; the underlying reason is not clear. One possible reason is that a higher rate of chronic total occlusion (CTO) lesions was treated in the TFA group in the propensity score-matched patients. Treating CTO lesions involves a potential higher risk of perforation or procedure-related complications, and the distal embolization of atherothrombotic debris could result in myocardial injury as well as loss of recruitable collateral flow to other coronary territories.[19,20] However, Suero et al reported similar rates of Q-wave MI with CTO PCI compared with non-CTO PCI (0.5% vs 0.6%, P = .67).[21] So it is still hard to tell whether the difference in periprocedure MI in the elderly patients lies in treating CTO lesions or is related to the PCI route itself. This calls for further studies.

Access-site bleeding accounts for approximately 50% to 80% of all periprocedural major bleeding in patients undergoing PCI.[1] In our study, access-site-related major bleeding accounted for 58% of all major bleeding events in elderly patients. The access-site-related major bleeding in the TRA group was greatly reduced (by 85%) compared with TFA (0.6% vs 4.0%, $P < .001$), which was consistent with a recently published meta-analysis showing that TRA reduced access-site-related major bleeding by 73%.[22] Periprocedural bleeding was associated with adverse prognosis either of access site or nonaccess site.[23-25] Thus, the avoidance of bleeding should be treated as important, and the TRA route for PCI in elderly patients seems to be effective.

Access-site complications occur more often in older people than in younger ones.[6] Previous studies reported the rates of access-site complications varied from 0% to 5.1% with TRA and 3% to 19.8% with TFA in elderly patients, which were both relatively higher than those in unselected patients.[7-12] Our study showed that the TFA group had a higher rate of complications compared with TRA (8.4% vs 2.6%, $P < .001$), and the complications that occurred in the TFA group were also more severe, which led to increased cost and prolonged hospital stay. Transradial approach facilitates earlier ambulation; this is of interest for elderly patients. The delayed ambulation by TFA could raise the potential risk of venous thrombosis. In addition, we found a higher rate of crossover in TRA compared with TFA in elderly patients, which was consistent with results from previous studies.[8,11] The absolute rate of crossover was low in our study and may be partly due to the routine choice and TRA experience in our hospital.

Study Limitations

This study was limited by its nonrandomized nature, although we used propensity score matching to minimize the baseline disparity. Although the adjusted baseline features were quite comparable between TRA and TFA, it is still possible that hidden confounders were not totally eliminated. Second, since the learning curve of TRA for beginners could affect the procedure outcomes, we do not know whether our findings can be extrapolated to hospitals with less TRA experience. Transradial approach has been carried out for years in our hospital and it accounted for around 90% of all PCI routes in 2011. Consequently, the effect of TRA versus TFA in hospitals with large proportion of TRA beginners needs further study.

Conclusions

In the propensity score-matched analysis, TRA PCI showed better safety for elderly patients, with reduced in-hospital and 1-year MACE as well as the access-site complication and major bleeding. Therefore, TRA may be a preferred route for PCI in elderly patients.

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