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Transradial Coronary Interventions for Complex Chronic Total Occlusions

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ABSTRACT

OBJECTIVES The aims of this study were to assess whether the transradial approach can be applied to treat complex chronic total occlusion (CTO) and to determine the predictors of transradial percutaneous coronary intervention (PCI) failure.

BACKGROUND Consistent data on the outcomes of transradial PCI for treating CTO are scarce.

METHODS Consecutive patients who were not receiving hemodialysis and had undergone PCI for CTO were enrolled. The clinical and angiographic characteristics, procedural details, and outcomes of the transradial and transfemoral procedures were examined.

RESULTS In total, 280 and 305 CTO PCI procedures involved transradial and transfemoral access, respectively. The technical success rates did not significantly differ in the entire cohort analysis and the propensity score–matched analysis (74.6% vs. 72.5%; $p = 0.51$ and 70.6% vs. 73.3%; $p = 0.57$). When only cases with J-CTO (Multicenter Chronic Total Occlusion Registry of Japan) scores of ≥3 were examined, the transradial group had a significantly lower success rate than the transfemoral group (35.7% vs. 58.2%; $p = 0.04$). The use of guiding catheter size <7 F (odds ratio [OR]: 5.50; $p = 0.008$), calcification (OR: 3.20; $p = 0.001$), occlusion length >20 mm (OR: 2.97; $p < 0.001$), and age (OR: 1.04; $p = 0.03$) were associated with transradial CTO PCI failure.

CONCLUSIONS Transradial PCI for CTO may be feasible in noncomplex cases, although complex cases still pose a challenge. In cases of transradial PCI for CTO, if possible, guiding catheter size ≥7 F should be selected regardless of lesion morphology. Furthermore, the transfemoral approach should be preferentially considered for complex CTO, particularly in cases with calcification. (J Am Coll Cardiol Intv 2017;10:235–43) © 2017 by the American College of Cardiology Foundation.

Since the first report on transradial percutaneous coronary intervention (PCI) in 1993, its use has become widespread in modern interventional practice because of the associated reduced bleeding risk, early ambulation, and improved patient comfort (1,2). The use of the transradial approach significantly reduces procedure access site-related major bleeding in comparison with the femoral approach (3).

In contrast, transradial PCI has certain disadvantages, such as the learning curve and limitations of guiding catheter size, which may result in inadequate backup support for the guiding catheter (4). Recent enhancements in devices and techniques, along with the accumulation of experience, have improved the procedural outcomes of PCI. However, the application of transradial PCI for complex lesions remains challenging because of these disadvantages.

Some evidence suggests that the transradial approach is clinically equivalent to the femoral approach in the treatment of chronic total occlusion (CTO); however, consistent data on transradial PCI for CTO are scarce (5–7). To investigate whether the transradial technique can be applied to treat

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ABBREVIATIONS AND ACRONYMS

ACS = acute coronary syndrome

CABG = coronary artery bypass grafting

CI = confidence interval

CTO = chronic total occlusion

OR = odds ratio

PCI = percutaneous coronary intervention

complex CTO and to determine the predictors of transradial PCI failure, we examined the clinical and angiographic characteristics, procedural details, and outcomes of transradial and transfemoral PCI for CTO.

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METHODS

STUDY POPULATION. During the 10-year period between January 2005 and December 2014, a total of 10,631 PCI procedures were performed at our institution; in particular, 8,379 PCI procedures (78.8%) involved transradial access, 1,573 PCI procedures (14.8%) involved transfemoral access, and 679 PCI procedures (6.4%) involved transbrachial access. After excluding patients receiving hemodialysis, we enrolled a consecutive series of patients who underwent PCI for CTO during this period. This study protocol was approved by the Institutional Review Board. Most of the patients underwent coronary angiography with a 4-F catheter with transbrachial access in advance. CTO was defined as a coronary obstruction with a TIMI (Thrombolysis In Myocardial Infarction) flow grade of 0 and an estimated occlusion duration of ≥3 months. All the included patients had at least 1 occlusion within a native vessel. The occlusion length was measured from the site of total occlusion to that of collateral flow. Angiographic characteristics, such as occlusion length, stump morphology, presence of calcification, presence of tortuosity, and bridging collateral vessels, were recorded. The J-CTO (Multicenter Chronic Total Occlusion Registry of Japan) score, which represents a grading scale for procedural difficulty, was calculated for each lesion on the basis of the lesion characteristics and the prior attempts to open the CTO, as previously described (8). The patients were divided into 2 groups according to the PCI access site: transradial and transfemoral access. In the cases of hybrid access, the access site and guiding size used for the antegrade approach were used.

PROCEDURE AND IN-HOSPITAL OUTCOMES. The patients were pre-treated with aspirin and ticlopidine or clopidogrel and were administered heparin to maintain an activated clotting time of >250 s. All procedures were performed by operators highly experienced in the treatment of CTO, with the access site and interventional strategy left to the discretion of the operator. If the patient had a narrowed radial artery or radial loop, contralateral radial access was considered. Moreover, retrograde angiography from the contralateral side was performed, if necessary. A retrograde approach was considered when angiography showed unfavorable signs for antegrade wiring or when the antegrade approach failed. In our institution, the Extra Back Up guiding catheter (3.5 to 3.75, Medtronic, Minneapolis, Minnesota) was routinely used for the left coronary artery and the Short tip Amplatz Left guiding catheter (1.0 to 1.5, Medtronic) was used for the right coronary artery. A plastic-jacket hydrophilic guidewire was initially used; if required, a guidewire with a tip stiffness of 3 g was used, and the stiffness was directly increased to 12 g. Technical success was defined as the restoration of an antegrade TIMI flow grade of 3 with <50% final residual stenosis. The hospital course was evaluated by individual chart review. Death, Q-wave myocardial infarction, cardiac tamponade, emergent coronary artery bypass grafting (CABG), cerebral infarction, access site–related major bleeding, and contrast-induced nephropathy were recorded as procedural complications. An access site–related major bleeding complication was defined as bleeding requiring blood transfusion and/or surgical repair. Contrast-induced nephropathy was defined as either an increase in serum creatinine level of >25% or an absolute increase in serum creatinine level of 0.5 mg/dl.

STATISTICAL ANALYSIS. We assigned cases to the transradial access and transfemoral access groups according to the PCI access site in order to assess the effect of the access site. Categorical variables are presented as absolute number (percentage), and continuous variables are presented as mean ± SD. The differences between the groups were evaluated by using the chi-square test or Fisher exact test for categorical variables and the 2-tailed Student *t* test for continuous variables. A p value <0.05 was considered to indicate statistical significance.

Propensity-score matching was used to reduce the effect of selection bias and potential confounding between groups when estimating the effect of the access site on successful recanalization. Possible confounders were chosen for their potential associations with the outcome of interest on the basis of clinical knowledge. The conditional probability of the transradial approach was calculated by fitting a logistic regression model using several variables (age, sex, height, body mass index, current smoking, hypertension, hypercholesterolemia, diabetes mellitus, estimated glomerular filtration rate <60 ml/min/1.73 m^2,