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Vascular Access Site and Outcomes Among 26,807 Chronic Total Coronary Occlusion Angioplasty Cases From the British Cardiovascular Interventions Society National Database



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ABSTRACT

OBJECTIVES The aim of this study was to assess, using a national percutaneous coronary intervention (PCI) database, access-site choice and outcomes after chronic total occlusion (CTO) PCI.

BACKGROUND Given the influence of access site on outcomes, the use of radial access in CTO PCI warrants further investigation.

METHODS Data were analyzed from the British Cardiovascular Intervention Society dataset of 26,807 elective CTO PCI procedures performed in England and Wales between 2006 and 2013. Multivariate logistic regression was used to identify predictors of access-site choice and its association with outcomes.

RESULTS There was a significant decrease in femoral artery (FA) access from 84.6% in 2006 to 57.9% in 2013. Procedural factors associated with FA access included dual access (odds ratio [OR]: 3.89; 95% confidence interval [CI]: 3.45 to 4.32), CrossBoss/Stingray (OR: 1.87; 95% CI: 1.43 to 2.12), intravascular ultrasound (OR: 1.32; 95% CI: 1.21 to 1.53), and micro-catheter use (OR: 1.18; 95% CI: 1.03 to 1.39). There was an association between FA access and the number of CTO devices used ($p = 0.001$ for trend). Access-site complications (1.5% vs. 0.5%; $p < 0.001$), periprocedural myocardial infarction (0.5% vs. 0.2%; $p = 0.037$), major bleeding (0.8% vs. 0.2%, $p < 0.001$), transfusion (0.4% vs. 0%; $p < 0.001$), and 30-day death (0.6% vs. 0.1%; $p = 0.002$) were more frequent in patients undergoing CTO PCI using FA access. An access-site complication during CTO PCI was associated with significant increases in transfusion (8.0% vs. 0.1%; $p < 0.001$), procedural coronary complication (17.3% vs. 5.8%; $p < 0.0001$), major bleeding (8.4% vs. 0.3%; $p < 0.001$), and mortality at all time points.

CONCLUSIONS FA access remains predominant during CTO PCI, with case complexity and device size associated with its use. Access-site complications were more frequent with FA use and strongly correlated with adverse outcomes. (J Am Coll Cardiol Intv 2017;10:635–44) © 2017 by the American College of Cardiology Foundation.

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**ABBREVIATIONS
AND ACRONYMS****BCIS** = British Cardiovascular
Intervention Society**CABG** = coronary artery bypass
graft**CTO** = chronic total occlusion**MI** = myocardial infarction**NICOR** = National Institute of
Cardiovascular Outcomes
Research**PCI** = percutaneous coronary
intervention

Radial arterial access is increasingly the preferred choice for percutaneous coronary intervention (PCI) among interventional cardiologists worldwide (1,2). Factors influencing this major change in practice over the past decade include an improvement in patients' experience; a reduction in hospital costs through facilitation of day-case PCI; the avoidance of major bleeding, transfusion, and access-site complications; and reductions in short- and long-term mortality (3-10). Although there remains significant variation in radial

rates by country, center, and operator, many default radial centers now perform more than 90% of procedures without the need to puncture the femoral artery. Indeed, the most recent British Cardiovascular Intervention Society (BCIS) National Angioplasty Audit revealed that in 2014, 75.3% of all PCI procedures in the United Kingdom were performed using the radial artery (11).

Access-site choice is defined by a number of factors, including physician practice and preference, anatomic variation (such as radial loops), radial occlusion, and arterial spasm (12,13). However, particularly complex case subgroups such as patients with histories of coronary artery bypass graft (CABG) surgery and those with chronic occlusive disease may still be undertaken using femoral arterial access (14). In particular, chronic total occlusion (CTO) PCI presents several access-site challenges, including the need for dual arterial access and large-caliber guide catheters to facilitate CTO techniques (15,16). Therefore, moving to routine radial arterial access remains a technical challenge for many CTO PCI procedures despite advances in the technology and experience that have facilitated the almost exclusive use of radial artery access in non-CTO PCI procedures at many centers.

CTO outcomes from the BCIS dataset have previously been analyzed but without a specific focus on access site (17). There are many sources of data, both randomized and registry-based, on non-CTO PCI procedures and access site but no clinical trials of access-site practice in CTO PCI and its associated outcomes and only limited observational registry data from small single-center series (18-20). Therefore, the aim of the present study was to examine, using the BCIS National PCI Audit, the baseline demographics, procedural characteristics, and predictors and the outcomes of patients undergoing CTO PCI from the femoral artery compared with the radial artery.

METHODS**STUDY DESIGN, SETTING, AND PARTICIPANTS.**

We analyzed national data from all patients with stable angina who underwent elective PCI for CTO in England and Wales between January 2006 and December 2013.

SETTING, DATA SOURCE, AND STUDY SIZE.

Data on PCI practice in the United Kingdom were obtained from the BCIS dataset, which records this information prospectively and publishes it in the public domain as part of the national transparency agenda (21). The data collection process is overseen by the National Institute of Cardiovascular Outcomes Research (NICOR) (<http://www.ucl.ac.uk/nicor/>) with high levels of case ascertainment. In 2013, 98.6% of all PCI procedures performed in the National Health Service hospitals in England and Wales (<http://www.bcis.org.uk>) were recorded in the database. The BCIS-NICOR database contains 113 clinical, procedural, and outcomes variables, with approximately 80,000 new records added each year. The participants of the database are tracked by the Medical Research Information Services for subsequent mortality using the patients' National Health Service number (a unique identifier for any person registered within the National Health Service in England and Wales). Although the BCIS dataset covers the entire United Kingdom, only patients from England and Wales have mortality tracked by the Office of National Statistics, so the present analysis is restricted to patients from these 2 countries.

STUDY DEFINITIONS.

We analyzed all recorded elective CTO PCI procedures that were undertaken for stable angina in England and Wales between January 1, 2006, and December 31, 2013. Patients were categorized according to access-site choice during CTO PCI. Participants with missing information on access site and CTO status were excluded. In cases in which more than 1 arterial access site was used, any femoral artery puncture was defined as a femoral case. For example, a dual-access case with left radial and right radial access was considered a radial case. However, a dual-access case with right radial and right femoral access was considered a femoral case. Study definitions were used as in the BCIS-NICOR database. Specifically, pre-procedural renal failure was defined as any 1 of the following: creatinine >200 $\mu\text{mol/l}$, renal transplantation history, or dialysis. Penetration catheters most commonly used during the study period were the Tornus and Gopher catheters. Microcatheters most commonly used during the study period were

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