Alternative Wrist Access for Chronic Total Occlusion Percutaneous Coronary Intervention

The use of transradial access (TRA) in percutaneous coronary intervention (PCI) has been steadily increasing and is recommended by both American and European guidelines.[1,2] TRA is associated with fewer vascular access complications and lower mortality than transfemoral access (TFA) in several studies that included mainly (95%) patients with acute coronary syndromes.[3] Regardless of whether radial access has a favorable risk/benefit ratio in complex PCI, such as chronic total occlusion (CTO), its use has been controversial because complex PCIs often require the use of large-bore guiding catheters (≥7 French) and strong guide catheter support.

Two randomized controlled trials recently compared radial with femoral access for complex PCI. The Complex Large-Bore Radial PCI trial[4] randomized 388 patients who underwent complex PCI (58% CTO PCI) requiring large-bore access to TRA versus TFA and showed lower incidence of clinically relevant access-site bleeding and vascular access complications in the TRA group (3.6% vs 19.1%, p <0.001), with similar procedural success. The Femoral or Radial Approach in the Treatment of Coronary Chronic Total Occlusion trial randomized 610 patients who underwent CTO PCI and showed that TRA was noninferior to TFA in procedural success but had significantly fewer access-site complications (2.0% vs 5.6%, p = 0.019).[5] However, use of large sheath sizes has been independently associated with radial artery occlusion, a complication that could hinder utilization of TRA in future procedures.[6] Consequently, operators have been exploring novel transwrist access sites, such as distal TRA (dTRA) and transulnar access (TUA).

In this month's issue of the *American Journal of Cardiology*, Poletti et al[7] compared alternative forearm access sites with standard TRA in 154 patients who underwent CTO PCI between 2019 and 2023 at a single center in Belgium. Of the 154 patients, 104 underwent standard (proximal) TRA access, whereas 50 patients underwent TUA and/or dTRA access. Use of alternative forearm access increased during the last year of the study (30 alternative access cases vs 9 standard access cases in 2022). Patients in the alternative access group were younger and more likely to undergo CTO PCI for symptom improvement. Lesion complexity scores, including the J-CTO (Multicenter CTO Registry of Japan) score, the PROGRESS-CTO (Prospective Global Registry for the Study of Chronic Total Occlusion Intervention) score, and the CASTLE (Coronary artery bypass grafting history, Age (≥70 years), Stump anatomy [blunt or invisible], Tortuosity degree [severe or unseen], Length of occlusion [≥20 mm], and Extent of calcification [severe]) score, were similar between the 2 patient groups, whereas lesions in the alternative access group were longer.

Antegrade crossing was successful in 71.2% of the procedures, whereas large-bore catheters were more commonly used in cases with alternative access (44% vs 26%, p = 0.028). A single arterial access was used in 77% of the study cases. Procedural outcomes in the alternative access group, such as technical success (92% vs 95%, p = 0.50), procedural success (92% vs 94.2%, p = 0.70), and major adverse cardiac and cerebral events (MACCE) and vascular complications (4.8% vs 6.0%, p = 0.70), were similar to those in the standard access group and remained so after propensity score matching.

The findings of the present study are consistent with previous research on the use of dTRA in CTO PCI (Table 1)[8–10] and support use of alternative forearm access in this group of patients. The authors should be commended for their efforts to expand the options for transwrist access beyond proximal TRA, and for highlighting the comparable efficacy of these alternative approaches in cases involving 7 French catheters. This is particularly significant in the context of CTO PCI, given that multiple revascularization attempts may be required for such lesions[11] and previous TRA procedures may preclude using the proximal radial artery in subsequent interventions.

The study findings should be interpreted in the context of some limitations. First, the study was nonrandomized and single center, with all procedures performed by a single expert operator with extensive experience in alternative forearm access sites; hence, they may not apply to less experienced operators. Second, a single arterial access was used in most cases in this series, yet dual arterial access is recommended for most CTO PCIs (unless there are no contralateral collaterals) to optimize the efficacy and safety of the procedure.[12,13] Third, the incidence of radial artery occlusion was not assessed.

In summary, the proximal radial artery is just 1 option for forearm arterial access. Both dTRA and TUA were associated with procedural outcomes equivalent to those of proximal TRA, supporting their use in CTO PCI.

Declaration of Competing Interest

Dr. Brilakis declares consulting/speaker honoraria from Abbott Vascular, American Heart Association (associate editor Circulation), Amgen, Asahi Intecc, Biotronik, Boston Scientific, Cardiovascular Innovations Foundation (Board of Directors), CSI, Elsevier, and GE Healthcare (Little Chalfont, United Kingdom), IMDS, Medicure, Medtronic, Siemens, and Teleflex; research support: Boston Scientific and GE Healthcare; being owner, Hippocrates LLC; and shareholder: MHI Ventures, Cleerly Health, and Stallion Medical. The remaining authors have no conflicts of interest to declare.

Funding: none.

See page 241 for Declaration of Competing Interest.

https://doi.org/10.1016/j.amjcard.2023.06.003

Table 1
Comparison of distal with proximal radial access for CTO PCI

Studies	Technical success (dTRA vs TRA)	Procedural success (dTRA vs TRA)	In-hospital MACCE (dTRA vs TRA)	Vascular complications (dTRA vs TRA)
Poletti et al (Present study)	92% vs 95% (p = 0.50)	92% vs 94% (p = 0.70)	4% vs 1.9% (p = 0.60)	2.0% vs 2.9% (p >0.90)
Lin et al (2021)	94%*	94%*	0.7%*	3.7%*
Nikolakopoulos et al (2021)	91% vs 86% (p = 0.014)	91% vs 84% (p = 0.05)	0.8% vs 2.4% (p = 0.26)	1.3% vs 2.3% (p = 0.09)
Achim et al (2022)	91% vs 83% (p = 0.161)	88% vs 80% (p = 0.664)	3.8% vs 4.3%† (p = 1)	3.8% vs 5.1% (p = 0.820)

dTRA = distal transradial access; MACCE = major adverse cardiac and cerebrovascular events; TRA = standard (proximal) transradial access.
* No data for standard TRA.
† 30-day MACCE.

Athanasios Rempakos, MD
Michaella Alexandrou, MD
Emmanouil S. Brilakis, MD, PhD*
Minneapolis Heart Institute and Minneapolis Heart Institute Foundation, Abbott Northwestern Hospital, Minneapolis, Minnesota.
* Corresponding author: Tel: 612-863-3900; fax: 612-863-6441.
(esbrilakis@gmail.com).

1. Writing Committee Members, Lawton JS, Tamis-Holland JE, Bangalore S, Bates ER, Beckie TM, Bischoff JM, Bittl JA, Cohen MG, DiMaio JM, Don CW, Fremes SE, Gaudino MF, Goldberger ZD, Grant MC, Jaswal JB, Kurlansky PA, Mehran R, Metkus TS Jr, Nnacheta LC, Rao SV, Sellke FW, Sharma G, Yong CM, Zwischenberger BA. 2021 ACC/AHA/SCAI guideline for coronary artery revascularization: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *J Am Coll Cardiol* 2022;79:e21–e129.
2. Neumann FJ, Sousa-Uva M, Ahlsson A, Alfonso F, Banning AP, Benedetto U, Byrne RA, Collet JP, Falk V, Head SJ, Juni P, Kastrati A, Koller A, Kristensen SD, Niebauer J, Richter DJ, Seferovic PM, Sibbing D, Stefanini GG, Windecker S, Yadav R, Zembala MO, ESC Scientific Document Group. 2018 ESC/EACTS Guidelines on myocardial revascularization. *Eur Heart J* 2019;40:87–165.
3. Gargiulo G, Giacoppo D, Jolly SS, Cairns J, May ML, Bernat I, Romagnoli E, Rao SV, MAHv Leeuwen, Mehta SR, Bertrand OF, Wells GA, Meijers TA, Siontis GCM, Esposito G, Windecker S, Jüni P, Valgimigli M. Effects on mortality and major bleeding of radial versus femoral artery access for coronary angiography or percutaneous coronary intervention: meta-analysis of individual patient data from 7 multicenter randomized clinical trials. *Circulation* 2022;146:1329–1343.
4. Meijers TA, Aminian A, van Wely M, Teeuwen K, Schmitz T, Dirksen MT, Rathore S, van der Schaaf RJ, Knaapen P, Dens J, Iglesias JF, Agostoni P, Roolvink V, Hermanides RS, van Royen N, van Leeuwen MAH. Randomized comparison between radial and femoral largebore access for complex percutaneous coronary intervention. *JACC Cardiovasc Interv* 2021;14:1293–1303.
5. Gorgulu S, Kalay N, Norgaz T, Kocas C, Goktekin O, Brilakis ES. Femoral or radial approach in treatment of coronary chronic total occlusion: a randomized clinical trial. *JACC Cardiovasc Interv* 2022;15:823–830.
6. Uhlemann M, Möbius-Winkler S, Mende M, Eitel I, Fuernau G, Sandri M, Adams V, Thiele H, Linke A, Schuler G, Gielen S. The Leipzig prospective vascular ultrasound registry in radial artery catheterization: Impact of sheath size on vascular complications. *JACC Cardiovasc Interv* 2012;5:36–43.
7. Poletti E, Castaldi G, Scott B, Benedetti A, Moroni A, Jattari HE, Convens C, Verheye S, Vermeersch P, Zivelonghi C, Agostoni P. Alternative (transulnar or distal radial) arterial access for chronic total occlusion percutaneous coronary intervention (sub-analysis from the minimalistic hybrid approach algorithm registry). *Am J Cardiol* 2023;200:57–65.
8. Lin CJ, Lee WC, Lee CH, Chung WJ, Hsueh SK, Chen CJ, Yang CH, Fang HY, Cheng CI, Wu CJ. Feasibility and safety of chronic total occlusion percutaneous coronary intervention via distal transradial access. *Front Cardiovasc Med* 2021;8:673858.
9. Nikolakopoulos I, Patel T, Jefferson BK, Sheikh AM, Jaber W, Samady H, Khatri JJ, Yeh RW, Tamez H, Koutouzis M, Tsiafoutis I, Jaffer FA, Doing AH, Dattilo P, Uretsky BF, Toma C, Elbarouni B, Alaswad K, Choi JW, Lembo NJ, Parikh M, Kirtane AJ, Ali ZA, Omer M, Vemmou E, Xenogiannis I, Karacsonyi J, Rangan BV, Abdullah S, Banerjee S, Garcia S, Burke MN, Brilakis ES, Karmpaliotis D. Distal radial access in chronic total occlusion percutaneous coronary intervention: insights from the PROGRESS-CTO registry. *J Invasive Cardiol* 2021;33:E717–E722.
10. Achim A, Szigethy T, Olajos D, Molnár L, Papp R, Bárczi G, Kákonyi K, Édes IF, Becker D, Merkely B, Van den Eynde J, Ruzsa Z. Switching from proximal to distal radial artery access for coronary chronic total occlusion recanalization. *Front Cardiovasc Med* 2022;9:895457.
11. Rempakos A, Kostantinis S, Simsek B, Karacsonyi J, Choi JW, Poommipanit P, Khatri JJ, Jaber W, Rinfret S, Nicholson W, Gorgulu S, Jaffer FA, Chandwaney R, Ybarra LF, Bagur R, Alaswad K, Krestyaninov O, Khelimskii D, Karmpaliotis D, Uretsky BF, Soylu K, Yildirim U, Potluri S, Rangan BV, Mastrodemos OC, Allana S, Sandoval Y, Burke NM, Brilakis ES. Outcomes of chronic total occlusion percutaneous coronary intervention after a previous failed attempt. *Am J Cardiol* 2023;193:61–69.
12. Brilakis ES, Grantham JA, Rinfret S, Wyman RM, Burke MN, Karmpaliotis D, Lembo N, Pershad A, Kandzari DE, Buller CE, DeMartini T, Lombardi WL, Thompson CA. A percutaneous treatment algorithm for crossing coronary chronic total occlusions. *JACC Cardiovasc Interv* 2012;5:367–379.
13. Wu EB, Brilakis ES, Mashayekhi K, Tsuchikane E, Alaswad K, Araya M, Avran A, Azzalini L, Babunashvili AM, Bayani B, Behnes M, Bhindi R, Boudou N, Boukhris M, Bozinovic NZ, Bryniarski L, Bufe A, Buller CE, Burke MN, Buttner A, Cardoso P, Carlino M, Chen J-Y, Christiansen EH, Colombo A, Croce K, Santos FD, de Martini T, Dens J, di Mario C, Dou K, Egred M, Elbarouni B, ElGuindy AM, Escaned J, Furkalo S, Gagnor A, Galassi AR, Garbo R, Gasparini G, Ge J, Ge L, Goel PK, Goktekin O, Gonzalo N, Grancini L, Hall A, Hanna Quesada FL, Hanratty C, Harb S, Harding SA, Hatem R, Henriques JPS, Hildick-Smith D, Hill JM, Hoye A, Jaber W, Jaffer FA, Jang Y, Jussila R, Kalnins A, Kalyanasundaram A, Kandzari DE, Kao HL, Karmpaliotis D, Kassem HH, Khatri J, Knaapen P, Kornowski R, Krestyaninov O, Kumar AVG, Lamelas PM, Lee SW, Lefevre T, Leung R, Li Y, Li Y, Lim ST, Lo S, Lombardi W, Maran A, McEntegart M, Moses J, Munawar M, Navarro A, Ngo HM, Nicholson W, Oksnes A, Olivecrona GK, Padilla L, Patel M, Pershad A, Postu M, Qian J, Quadros A, Rafeh NA, Råmunddal T, Prakasa Rao VS, Reifart N, Riley RF, Rinfret S, Saghatelyan M, Sianos G, Smith E, Spaedy A, Spratt J, Stone G, Strange JW, Tammam KO, Thompson CA, Toma A, Tremmel JA, Trinidad RS, Ungi I, Vo M, Vu VH, Walsh S, Werner G, Wojcik J, Wollmuth J, Xu B, Yamane M, Ybarra LF, Yeh RW, Zhang Q. Global Chronic Total Occlusion Crossing Algorithm: JACC State-of-the-Art Review. *J Am Coll Cardiol* 2021;78:840–853.