

“Power Carlino”

A Novel Method for Modifying Wire-Impenetrable Proximal Caps During Chronic Total Occlusion Revascularization



Michael Megaly, MD, MS,^a Mir B. Basir, DO,^a Emmanouil Brilakis, MD, PhD,^b Khaldoun Alaswad, MD^a

A 78-year-old woman was referred for percutaneous coronary intervention of a right coronary artery chronic total occlusion (CTO) due to medically refractory angina. The occlusion was long, with a J-CTO (Multicenter CTO Registry in Japan) score of 3 (Figure 1A). An attempt to puncture the proximal cap with highly penetrating guidewires failed. We switched to antegrade dissection and re-entry and attempted “scratch and go” and “knuckle wire” techniques without success. We then performed the Carlino technique by injecting 0.5 mL contrast through a microcatheter advanced as far distally as possible in the proximal cap (Figure 1B). However, we still failed to knuckle with the polymer-jacketed wire, and the dissection extended partly to the proximal vessel. We left the knuckle in place, rewired with a workhorse wire to deliver the microcatheter to the proximal cap, inflated a 3.0-mm balloon over the knuckled wire, and injected an additional 0.5 mL contrast through the microcatheter (power Carlino) (Figure 1C, Video 1). We were then successful in knuckling a Gladius wire (Asahi Intecc) into the marginal branch. We used controlled re-entry with a Stingray balloon (Boston Scientific) into the distal right coronary artery with a good final angiographic result (Figures 1D to 1F, Videos 2 and 3).

Wire-impenetrable proximal caps are challenging to penetrate despite using stiff guidewires. Several techniques are used, such as increasing tip stiffness and tapered tip guidewires and increasing support. The “power microcatheter” technique refers to guidewire advancement through a microcatheter anchored against the vessel wall by balloon inflation.

The Carlino technique has been used effectively in impenetrable proximal caps but risks creating a dissection that extends to the proximal vessel. The “power Carlino” technique is performed by injecting contrast through a microcatheter that is advanced as far as possible against the proximal cap and is anchored against the vessel wall by inflating a 1:1 sized balloon with the target vessel lumen. The inflated balloon may enhance the microdissection effect of the contrast and protect against retrograde extension of the dissection. A potential limitation of this technique is the increased risk for perforation. Hence only a small (<1 mL) amount of contrast should be injected under continuous fluoroscopic guidance. In summary, the “power Carlino” technique (Figure 2) can be a useful tool for crossing “wire-impenetrable” proximal caps during CTO percutaneous coronary intervention.

ACKNOWLEDGMENT The authors acknowledge Dr Mariam Tawadros for her efforts and contribution in medical illustration.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Dr Alaswad has received consulting and speaker honoraria from Boston Scientific, Cardiovascular Systems, Abbott Vascular, and Teleflex. Dr Brilakis has received consulting and speaker honoraria from Abbott Vascular, American Heart Association (associate editor, *Circulation*), Amgen, Asahi Intecc, Biotronik, Boston Scientific, Cardiovascular Innovations Foundation (Board of Directors), ControlRad, Cardiovascular Systems, Elsevier, GE Healthcare, IMDS, InfraRedx, Medicare, Medtronic, Opsens, Siemens, and Teleflex; is an owner of Hippocrates; and is a shareholder in MHI Ventures and Cleerly Health. Dr Basir is a consultant and speaker for Abbott Vascular, Abiomed, Cardiovascular Systems, Chiesi, Procyon, and Zoll. Dr Megaly has reported that he has no relationships relevant to the contents of this paper to disclose.

From the ^aDepartment of Cardiology, Henry Ford Hospital, Detroit, Michigan, USA; and the ^bMinneapolis Heart Institute at Abbott Northwestern Hospital, Minneapolis, Minnesota, USA.

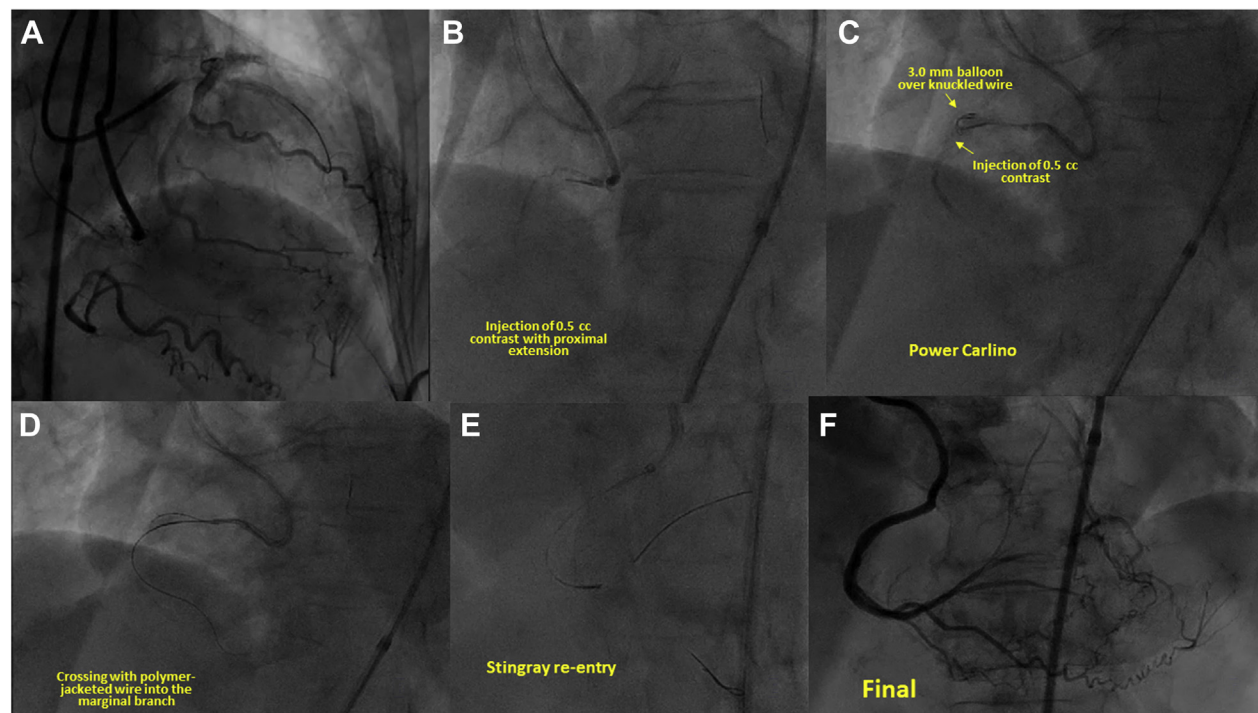
The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

Manuscript received August 18, 2021; accepted August 24, 2021.

ISSN 1936-8798/\$36.00

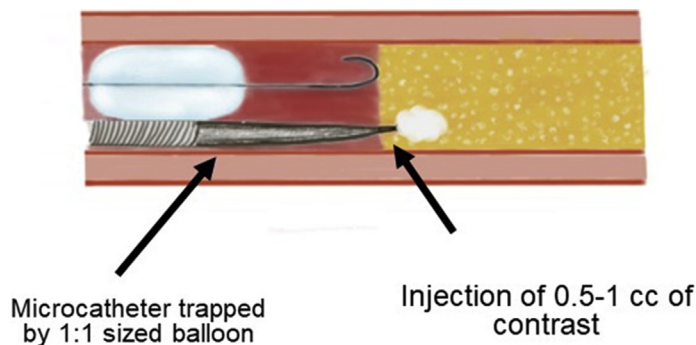
<https://doi.org/10.1016/j.jcin.2021.08.065>

FIGURE 1 Power Carlino Steps



(A) Chronic total occlusion of the right coronary artery. (B) Use of the Carlino technique with the proximal extension of dissection. (C) Use of the "power Carlino" technique. (D) Knuckling a polymer-jacketed wire into the right ventricular marginal branch. (E) Re-entry using a Stingray device. (F) Final angiographic result.

FIGURE 2 Power Carlino Technique



ADDRESS FOR CORRESPONDENCE: Dr Khaldoun Alaswad, Department of Cardiology, Henry Ford Hospital, 2799 W Grand Boulevard, Detroit, Michigan 48202, USA. E-mail: kalaswad@gmail.com.

KEY WORDS chronic total occlusion, CTO, PCI, wire-impenetrable cap, wire-uncrossable cap

APPENDIX For supplemental videos, please see the online version of this paper.