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Letters

TO THE EDITOR

Coronary Occlusion and Ischemia Reduction

I read with great interest the article by Jang et al. (1) and the accompanying editorial by Barbato and Wijns (2) regarding the long-term survival benefit of revascularization compared with medical therapy in patients with coronary chronic total occlusion and well-developed collateral circulation. According to the authors, it seems as though all patients received "modern medical therapy," and because this was a retrospective study, there was no requirement for informed consent.

I congratulate the authors for a very nice piece of work, but I would like to remind them that the term they use (CTO), standing for chronic "total" occlusion, might instead be abbreviated CCO, standing for chronic coronary occlusion. "Total" is redundant because all occlusions are total.

Several years ago, I wrote an article on coronary artery collaterals (3). Before and since writing that article, I have always believed that collaterals do not appear angiographically unless ischemia is present in the distribution of those collaterals. I have also never believed that if the collateral provides excellent blood flow to the ischemic zone, ischemia will disappear and the collaterals will remain. To put it somewhat differently, in my opinion, visible collaterals only exist if ischemia is present, and if ischemia is present, the myocardium supplied by the collateral vessel is viable.

All collateral seen angiographically may be protective against or limit infarction but may not provide adequate flow to prevent myocardial ischemia and regional myocardial dysfunction. Thus, I do not believe that all angiographically visible collaterals eliminate myocardial ischemia, but they may make ischemia more difficult to provoke.

I could not find out whether or not the patients evaluated in this paper (1) had post-percutaneous coronary intervention (PCI) angiography to determine the presence or absence of collaterals after the revascularization was accomplished. This would have been an important observation that would indicate that collaterals are only present when the demand (ischemia) for them is present.

The conclusion that the authors make, that "aggressive revascularization by surgery or PCI may reduce the risk of mortality and MACE [major adverse cardiac events] by eliminating 'ischemia'," seems reasonable to me, but I would also propose that the risk of mortality and MACE may be reduced if "ischemia" is eliminated by aggressive medical therapy. In fact, I cannot think of a single incidence in which the continued presence of ischemia is good for the patient.

*C. Richard Conti, MD
*Medicine
7900 SW 43rd Drive
Gainesville, Florida 32608
E-mail: richard.conti@medicine.ufl.edu

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Please note: Dr. Conti has reported that he has no relationships relevant to the contents of this paper to disclose.

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2. Barbato E, Wijns W. Are we ready for new paradigm shift in percutaneous revascularization of chronically occluded vessels with well-developed collaterals?: from leaving 'em all to stenting 'em all. J Am Coll Cardiol Intv 2015;8:280–2.

3. Conti CR. Coronary artery collaterals. Clin Cardiol 2010;33:188–9.

REPLY: Coronary Occlusion and Ischemia Reduction

My colleagues and I appreciated the comments of Professor Conti regarding the clinical significance of revascularization for the treatment of coronary chronic total occlusion (CTO) with well-developed collateral circulation. We read with interest the editorial comment provided by Barbato and Wijns (1) in addition to the letter to the editor by Conti. It is an undeniable fact that successful revascularization of CTO is associated with a survival benefit, but the greatest challenge of this aggressive CTO treatment is the low predictability of successful revascularization and the relatively high possibility of fatal complications. In this sense, we agree with Barbato and Wijns' opinion that accurate risk stratification and better selection criteria for patients undergoing CTO

revascularization are needed. We also agree with Conti's opinion that, unless ischemia is present, collaterals do not appear angiographically; if the collateral provides excellent blood flow to ischemic myocardium, the collaterals will remain (2). Werner et al. (3) reported that even collaterals that appear well developed on angiography are not able to fully replace anterograde blood flow; therefore, restoring flow reserve does little to prevent myocardial ischemia. Our hypothesis was that well-developed collateral flow in patients with stable CTO lesions may partially protect the myocardium and the revascularization may allow complete maintenance of viable myocardium (4), and we identified long-term survival benefits of aggressive revascularization compared with medical therapy in our study. Unfortunately, because we did not routinely perform contralateral injections after successful revascularization of CTO in our practice, we could not identify the existence or disappearance of collaterals after CTO revascularization, as mentioned in Conti's letter. However, we agree with his hypothesis that the change of collateral flow after CTO revascularization in coronary angiography might correlate with whether ischemia of viable myocardium occurs or not. This hypothesis requires further detailed study.

As stated by Barbato and Wijns (1), our study might have reported a higher rate of successful percutaneous coronary intervention (PCI) or coronary bypass grafting (CABG) compared to previous studies of CTO revascularization. However, remarkable developments in the survival benefits posed by CTO revascularization are rapidly becoming a reality because CTO PCI techniques have improved and the experience of CABG has also increased. We anticipate that the survival benefits of aggressive reduction of remnant ischemia by revascularization or intensive medication in patients with CTO lesions will be verified by future large-scale randomized trials.

Woo Jin Jang, MD
Jeong Hoon Yang, MD, PhD
***Seung-Hyuk Choi, MD, PhD**
Young Bin Song, MD, PhD
Joo-Yong Hahn, MD, PhD
Jin-Ho Choi, MD, PhD
Wook Sung Kim, MD, PhD
Young Tak Lee, MD, PhD
Hyeon-Cheol Gwon, MD, PhD
*Division of Cardiology
Department of Medicine, Cardiac and Vascular Center
Samsung Medical Center
Sungkyunkwan University School of Medicine
#50, Irwon-dong, Gangnam-gu
Seoul 135-710
Republic of Korea
E-mail: sh1214.choi@samsung.com

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Fate of Bioresorbable Vascular Scaffold Metallic Radio-Opaque Markers at the Site of Implantation After Bioresorption

The use of bioresorbable vascular scaffolds (BRS) is increasing in patients with coronary artery disease undergoing percutaneous coronary interventions. Because the devices are radiolucent on fluoroscopy, 2 adjacent cylindrical platinum markers are incorporated in the proximal and distal edges of the polymeric devices for precise scaffold deployment and post-dilation during the procedure. In addition, the metallic radio-opaque markers (MRMs) also provide anatomic landmarks for long-term follow-up when all the polymeric struts have been bioresorbed. There has been concern about the potential risk of MRM beads becoming dislodged from the device and embolized into the coronary bed after complete bioresorption of the polymeric struts. Beyond the biological hazard of MRMs embolization, the additional inconvenience is that the embolization may result in the incapacity to locate the coronary segment where the fully bioresorbed scaffold was implanted. Invasive assessment of BRS such as quantitative coronary angiography (QCA), intravascular ultrasound (IVUS), or optical coherence tomography (OCT) may be unable to detect the precise location of the MRMs either because of the