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**REPLY: THE  
INCOMPLETE PUZZLE  
OF COMPLETE  
REVASCULARIZATION**  
Reply to the Editor:



Bianco and colleagues<sup>1</sup> study on complete revascularization (CR) in coronary artery bypass grafting (CABG) has unsurprisingly generated considerable dialogue. Among these commentaries, Zhou and colleagues<sup>2</sup> have provided some thought-provoking questions.

One of their main questions is whether CR *should* be recommended for all patients as a blanket recommendation. While we acknowledge the limitations of the study by Bianco and colleagues,<sup>1</sup> including residual confounding, it also supports a larger body of evidence that suggests that there is significant benefit to CR in CABG.<sup>3,4</sup> It seems appropriate that CR should indeed be one of the core priorities of CABG.

How one achieves CR is debatable, and several definitions have been proposed and studied, with varying clinical benefit. The analyses by Bianco and colleagues<sup>1</sup> suggest that revascularization of non-main-branch vessels is unlikely to provide further benefit over revascularization of only main-branch vessels. As a rule of thumb, keeping the revascularization strategy simple, even in the context of extensive multivessel disease, is a safe bet. Any benefit derived from revascularization of non-main-branch vessels is probably marginal at best.

Zhou and colleagues<sup>2</sup> suggest that populations that may not benefit from CR include patients with diabetes, those with reduced left ventricular ejection fraction, frail patients, and elderly patients. We are not sure these patients really do not benefit from CR. On the contrary, it appears that most patient populations benefit from CR, including those with lower ejection fractions.<sup>5</sup> Furthermore, “benefit” may not necessarily mean improved survival but freedom from angina and freedom from myocardial infarction and revascularization events, which is quite significant from a patient perspective. The aforementioned patient population, instead, is more likely to undergo

incomplete revascularization (IR) and have worse outcomes irrespective of CR or IR, indicative of a worse disease and comorbidity profile.<sup>6</sup> Perhaps we should reframe our question to “how can we better and safely achieve CR in these populations?” That question is more challenging to answer and may be answered one day with a hybrid approach.

Finally, Zhou and colleagues<sup>2</sup> also bring up the role of multiple arterial grafting in the setting of IR. As they noted, previous studies have demonstrated that multiple arterial grafts may offset the poor outcomes associated with IR.<sup>7</sup> More recently, Rosenblum and colleagues<sup>8</sup> found that multiple arterial grafting led to improved midterm survival in both CR and IR cohorts. More evidence with respect to the interaction between IR and multiple arterial grafting will hopefully be obtained with the ROMA trial.<sup>9</sup>

We thank Zhou and colleagues<sup>2</sup> for their insights and encouraging the continued investigation of CR in the setting of CABG. The questions of CR in CABG are more relevant than ever in today’s everchanging landscape of revascularization, and it would be a great service to our profession and patients to gain further understanding of such.

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