The SYNTAX battle in the war between stent and bypass: A landmark surgical win

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The long-standing debate as to which coronary artery revascularization treatment modality (percutaneous coronary intervention [PCI] or coronary artery bypass grafting [CABG]) is superior continues to evolve. The largest comprehensive trial performed to date in this topic has been the Synergy Between PCI With Taxus and Cardiac Surgery [SYNTAX] trial.^{1,2} There have been many published secondary analyses from this trial,^{3,4} with the most recent being a 5-year analysis of causes of death after PCI or CABG.⁵ This study showed a higher incidence of cardiac-related death (mainly due to myocardial infarction) among patients with complex coronary disease who underwent PCI compared with those who underwent CABG. To this end, Mack and colleagues⁶ have provided an Expert Opinion article in this issue of the *Journal* summarizing and highlighting the key findings of the SYNTAX subanalysis.

Mack and colleagues⁶ have nicely summarized the key methods of the SYNTAX trial while raising some important points regarding CABG and PCI. One explanation of possible better outcomes associated with CABG relative to PCI in this study is incomplete revascularization (IR). IR was present in 43.3% of patients who underwent PCI and 36.8% of patients who underwent CABG and was an independent predictor for the overall randomized cohort as a risk factor of cardiac mortality. It has been shown that IR is associated with worse long-term survival among patients undergoing multivessel PCI⁷ and also among those undergoing CABG.⁸ A meta-analysis of randomized, controlled trials including 89,883 patients⁹ who underwent PCI or CABG comparing IR versus complete revascularization concluded that complete revascularization is achieved more commonly with CABG than with PCI and that complete revascularization was associated with lower long-term mortality irrespective of modality (CABG relative risk, 0.70; $P < .001$; PCI relative risk, 0.72; $P < .001$).

It is also worth noting that another study of 2686 patients assessed residual SYNTAX score (rSS), a surrogate

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Central Message

Late cardiac mortality was higher after PCI in SYNTAX, primarily from late MI. One potential mechanism is incomplete revascularization, inherently more common after PCI than after CABG.

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quantitative marker of IR, in patients who underwent PCI.¹⁰ They reported a strong correlation between baseline SYNTAX score and rSS (ie, higher rSS in patients who had higher baseline SYNTAX scores), suggesting that it is difficult to obtain complete revascularization in patients with complex coronary disease undergoing PCI. Furthermore, they reported that rSS was a strong independent predictor of all ischemic outcomes at 1 year, including all-cause mortality.¹⁰

Another interesting point raised by Mack and colleagues⁶ is that cardiologists and internists continue to recommend PCI to patients with complex multivessel coronary artery disease despite the data from SYNTAX and other trials. This raises the importance of having a multidisciplinary heart team,¹¹ emphasized in both the American and European guidelines along with a recent systematic review.¹²⁻¹⁴

A key consideration is whether the benefit of CABG compared with PCI in patients with multivessel disease seen in SYNTAX is due to the inherent differences of these methods of revascularization. One of the putative mechanisms underlying the relative benefit of CABG, along with the documented more complete revascularization, is that bypass can treat existing as well as future blockages. If the high rates of late fatal myocardial infarction with PCI are due to IR or new coronary lesions, then surgical revascularization should continue to be preferred in patients with multivessel disease. Alternatively, if late stent thrombosis is responsible for many of the late infarctions, the gap in results could be reduced with additional

improvements in PCI—specifically fractional flow reserve¹⁵ and later generation stents.¹⁶ Regardless, it behooves cardiac surgeons to adopt measures to reduce further the perioperative complications—in particular stroke¹⁷—and also late graft failure. To this end, there have been advances in off-pump techniques and, more recently, a push toward arterial revascularization.^{14,18-20} As well, it is important to emphasize that the results of both PCI and CABG are enhanced by optimal medical therapy and that continuous research and advances in pharmacotherapy are therefore paramount.

In conclusion, we agree with the excellent editorial by Mack and colleagues⁶ that patients with complex coronary disease should be offered CABG in preference to PCI, because there is a clear advantage with respect to cardiac-related survival.

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