influencing the decision making in graft selection such as angiogram findings (i.e., coronary anatomy, vessel diameter, and functional data such as fractional flow reserve measurement) and patient's life expectancy (i.e., poor morbidity or terminal disease) have not been considered in their analysis. In this regard, we believe that the detailed status of the coronary arteries (i.e., the level of native vessel occlusion, coronary anatomy, and inadequate coronary diameter) and other influencing variables on life expectancy are also relevant for decision making regarding the graft choice.

In fact, in clinical practice, many surgeons are mostly prone to using a second arterial graft after considering the coronary anatomy including dominancy and surgical feasibility, the level of stenosis (i.e., proximal or peripheral), and functional degree of obstruction. In fact, functional characterization of the target vessel lesion is of crucial importance because arterial grafts (in comparison to venous grafts) are more sensitive to native competitive flow (3,4).

Thus, it cannot be excluded that the reported better outcome in patient survival might (also) be related to the coronary status rather than to the type of graft per se. Although the results of the study by Royse et al. (1) are promising and call for a rethink with regard to decreasing numbers in total or partial arterial revascularization in multivessel disease, one must be critical regarding the retrospective design of the study and the lack of detailed anatomic or functional variables regarding coronary status included in the propensity score.

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REPLY: Better Survival With Radial Grafting

Is it Really All About the Conduit?

We thank Dr. Motekallemi and colleagues for their interest in our paper (1). They are correct to point out that even extensive retrospective propensity score matching (PSM) will not account for all potential variables affecting graft selection. In this study time frame of the 1990s, many of the variables relating to coronary anatomy were not collected. However, the authors are incorrect in asserting that the variables listed are of much greater importance than those used for the PSM and imply invalidity of the results.

Currently, clinicians are fixated on the use of more arterial conduits leading to higher late survival from lower progressive failure relative to saphenous vein grafts (SVG), which have a well-documented pattern of failure. We challenge the reader to consider an alternative: that it is reducing the use of SVG that leads to improved outcome—after all, it is the SVG that is likely to fail.

We direct the reader to a recent publication where this concept was tested in a largescale cohort (2). Of 24,632 PSM patients, with 2.7 ± 1.1 grafts in each group, 1 group with a single SVG had 1.1 ± 0.6 internal mammary artery (IMA) and 0.7 ± 0.8 radial artery (RA)—so-called multiarterial grafting. The comparison group, those having total arterial revascularization, had 1.4 ± 0.7 IMA and 1.4 ± 0.9 RA. The mortality hazard was 1.22 (95% confidence interval: 1.14 to 1.30) with 1 SVG. Similar data were evident when ≥1 SVG was included in 1 arm (2). These results were reported *despite* coronary anatomy or other considerations referred to by Dr. Motekallemi and colleagues, indicating that these factors were not predominant in the decision making over many years.

Whereas a prospective randomized trial is preferable to a retrospective PSM, it cannot be applied to a historical cohort; and because mortality outcome after surgery requires many years to elapse, PSM analysis is still useful in that it points toward a logic or rationale. A randomized controlled trial may not be ideal either, if it has high crossover as did the recent ART trial (Arterial Revascularisation Trial) (3), or randomization occurs according to a variable that is later discovered not to be the most important in determining outcome.

In our paper (1), we analyzed all-cause mortality against both a conventional operation of left IMA+SVG or to our regional conventional operation of total arterial revascularization. The study findings are broadly consistent with the recent publication on survival with use of SVG (2); and this is consistent with general logic. In the cause of coronary artery bypass grafting failure, we should concentrate our attention on the conduit that is more likely to fail in the long term, rather than the conduit that is more likely to survive.

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Optimizing Coronary Artery Bypass Grafting Outcomes With State-of-the-Art Surgical Coronary Revascularization

We read with interest the paper by Chikwe et al. (1) reporting increased mortality at 10 years following off-pump coronary artery bypass grafting (CABG) compared with on-pump CABG. We are concerned that the off-pump CABG (OPCAB) cohort had a significantly higher rate of incomplete revascularization (15.7% vs. 8.8%). From the surgical and interventional cardiology published reports, it has been well established that incomplete revascularization leads to poorer outcomes. In CORONARY (Coronary Artery Bypass Surgery [CABG] Off or On Pump Revascularization Study), where surgeries were performed by experienced surgeons, there was an equivalent rate of revascularization and equivalent survival between on-pump and off-pump CABG at 5 years (2). In the study by Chikwe et al. (1), the OPCAB group received fewer left internal thoracic artery (ITA) grafts compared with on-pump CABG (84% vs. 89%). The possible inclusion of surgeons with insufficient OPCAB experience, lack of implementation of advanced OPCAB techniques to provide adequate revascularization, and underutilization of left ITA-left anterior descending coronary artery grafts may be contributory to decreased long-term graft patency and survival.

OPCAB is a heterogenous procedure with many variations in technique. It is also a procedure that has significant geographical variations. In Australia, high-volume OPCAB surgeons use an anaortic technique with bilateral ITAs and a radial artery as conduits. The routine use of intracoronary shunts and on-table graft assessment with transit time flow measurement also mitigates the risk of technical issues with grafts, thus increasing graft patency. Other regions of the world may prefer the use of a single ITA with saphenous vein grafts placed on the ascending aorta using a partial-occlusion clamp without using intracoronary shunts and transit time flow measurement, thus exposing patients to increased risk of stroke and long-term saphenous vein graft disease.

The 2018 European Society of Cardiology Guidelines on Myocardial Revascularization have advocated the avoidance of aortic manipulation, the use of multiple arterial grafts, and on-table graft assessment as the standard of care (3). Anaortic, total-arterial OPCAB is an advanced surgical technique that has been shown to provide superior 30-day mortality and stroke outcomes (4). The use of total-arterial grafting and the avoidance of any vein graft use has also been shown to provide superior long-term outcomes (5).

In a similar fashion to mitral valve surgery, it is time to create a coronary surgery subspecialty so that patients may receive the best possible surgical revascularization.

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