findings of the ART study. The Randomized Comparison of the Clinical Outcome of Single Versus Multiple Arterial Grafts trial is ongoing, and we look forward to finding answers from this study.⁶

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Commentary: Do you know the way to ... 2 arterial grafts (in patients older than age 70 years)?

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The article by Navia and colleagues¹ details plans to improve long-term survival to 67.0% and 66.0% with bilateral internal thoracic artery (BITA) bypass compared with survival of 56.0% and 53.0% for a single internal thoracic artery (LIMA) graft, and reverse saphenous vein grafts/radial artery strategy in unmatched and propensity matched patients older than age 70 years undergoing coronary artery bypass grafting (CABG). Previous reviews by Lytle and colleagues² and Locker and colleagues³ demonstrated increased longevity in patients undergoing CABG with 2 internal thoracic or 2 arterial grafts.

In patients older than age 70 years, Mohammadi and colleagues⁴ suggest that BITA or all arterial graft strategies do not increase life expectancy in patients older than age

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CENTRAL MESSAGE

An off-pump BITA technique demonstrated increased long-term survival in a select population older than 70 years.

60 years. In contrast, Kurlansky and colleagues⁵ reported increased survival in all ages with a second ITA graft.

CABG increases longevity because the LITA to left anterior descending (LAD) bypass remains patent in more than 98% of patients at 10 years. Improved long-term survival in patients with a second internal thoracic or arterial graft is related to greater arterial graft patency compared with reverse saphenous vein grafts. Studies from Shih and colleagues⁶ and Tinica and colleagues⁷ tout the high patency rate for the free right ITA (RITA) in a Y or T configuration off the LAD.

In a 2008 study, Navia and colleagues⁸ reported off-pump BITA results with the LITA to LAD and free RITA anastomosed to the LITA (T configuration), and distally to obtuse marginal and right coronary artery

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branches. The results with 44% postoperative angiogram follow-up at 37.7 ± 20.1 months were patency of LITA to LAD at 98.3%, the free RITA to the obtuse marginal branch at 93.2%, and the free RITA to the right coronary artery at 91.2%. Besides their outstanding graft patency rate, the Argentinian group with all surgeons committed to the off-pump technique and 2 ITAs, achieved 0.8% 30-day mortality and morbidity of 4.9% for cerebrovascular accident, postoperative bleeding, and low cardiac output. These are impressive outcomes for a technically demanding operation.

It is noteworthy that of the 4083 patients included in the recent 2011-2018 CABG study, 3230 or 79.1% underwent this challenging off-pump BITA procedure. In the cohort older than age 70 years, only 968 out of 1300 or 74% underwent the BITA procedure, suggesting preoperative selection.

Further demonstrating the selection bias in the older than age 70 years group, the single ITA (SITA) was done off-pump in 75%, whereas the BITA group was performed 98.6% off-pump. This emphasizes that the patients older than age 70 years who received BITA could tolerate the favored off-pump technique, although the more compromised SITA patients received on-pump CABG.

The selection process is verified in the 30-day SITA mortality of 4.5% seen in the unmatched group, and 4.1% for the propensity-matched SITA cohort. This contrasts with 30-day mortality of only 2.3% for unmatched BITA and 2.9% for the propensity-matched BITA group. This underscores that the SITA group had underlying risk factors not captured in the analysis.

Therefore, it is not surprising that patients older than age 70 years receiving BITA had better survival than those receiving SITA because they were better surgical candidates. In the nonpropensity matched comparison, the BITA patients were younger, had a greater percentage of men, had better ejection fractions, and had a greater percentage of elective operations and had fewer re-do operations. Also, the ability to extubate 65.1% of the BITA patients in the operating room compared with 54.5% of

the SITA patients underscores the preoperative selection bias.

The use of a second arterial graft with its improved patency affects patient survival. Can part of the greater BITA survival be attributed to the off-pump technique, and/or anastomosis of the free RITA to the LITA rather than off the ascending aorta or as in situ graft? Do the authors have a group of patients older than age 70 years who had the BITA procedure on-pump, and how does their long-term survival compare with the BITA off-pump cohort?

Factors, including pulmonary status, diabetes, measures of fragility, extremes of weight, and chest radiation, all must be weighed when determining operative approach and conduit selection. The authors have shown increased survival with the off-pump BITA technique in a select group of patients older than age 70 years. Surgeons may utilize other techniques (eg, on pump or in situ RITA) and other conduits such as radial artery to reach their destination ... 2 arterial grafts in the population older than 70 years.

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