Using bilateral internal thoracic arteries—just do it

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Central Message

Magruder and colleagues evaluated clinical outcomes between different configurations of bilateral internal thoracic arteries in patients undergoing isolated coronary artery bypass grafting surgery. This article highlights the importance of that work, along with its strengths and weaknesses.

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Conventional coronary artery bypass grafting surgery (CABG) is commonly performed using a left internal thoracic artery (LITA) to bypass the left anterior descending (LAD) territory and saphenous vein grafting to bypass other non-LAD territories; however, there has been a surge of enthusiasm for a multiarterial grafting strategy¹⁻³ in general, and bilateral internal thoracic arteries (BITAs) in particular.⁴⁻⁶ The importance of arterial grafting, including BITA, is strongly supported by society guidelines⁷ (eg, Society of Thoracic Surgeons,⁸ American College of Cardiology/American Heart Association,⁹ and European Society of Cardiology and the European Association for Cardio-Thoracic Surgery¹⁰). Despite these recommendations, only 5% of isolated CABG procedures engage a BITA grafting approach.¹¹ Potential reasons for lack of BITA use by cardiac surgeons include increased operative time, greater technical challenge, potential for sternal wound complications, and the lack of perceived survival benefit until the second postoperative decade.^{11,12} Furthermore, optimal graft configuration in patients undergoing multiarterial revascularization is unclear.⁴ Important questions include whether both internal thoracic arteries (ITAs) should be directed to the left coronary system, whether the LITA should always be directed to the LAD, and the appropriateness of in situ versus free conduit (typically for the right ITA [RITA]).

To this end, Magruder and colleagues¹³ undertook a single-center, retrospective study investigating whether BITA graft configuration affects long-term clinical outcomes. More specifically this study included 762 patients who underwent isolated CABG between 1997 and 2014 using a BITA strategy stratified into 4 relevant groups: in situ LITA to LAD and in situ RITA to the left coronary circulation (n = 239), in situ LITA-LAD and in situ RITA to right coronary circulation (n = 239), in situ RITA-LAD and in situ LITA to left coronary circulation (n = 185), and in situ LITA-LAD and free-composite RITA to any part of the coronary circulation (n = 99). Using these 4 basic configurations, the authors then tested 3 grafting hypotheses

using propensity scores to adjust for baseline differences. With a median follow-up of 1128 days, they concluded that graft configuration was not an independent predictor of repeat revascularization or death. Specifically, adjusted hazard ratios for death, repeat revascularization, and composite of death and repeat revascularization were similar between the 2 in situ BITA grafting strategies for the left coronary circulation and comparing an in situ LITA-LAD versus an in situ RITA-LAD. Lastly, in patients with a LITA-LAD configuration, adjusted outcomes were similar in patients with RITA grafting (in situ or Y) to the left coronary versus the right coronary system.

There are a number of key points that are worth discussing. It is known that degree of target vessel stenosis and competitive flow has been shown to influence ITA patency.¹⁴ In this study, although BITA grafting was avoided in patients with diabetes, obesity, and/or pulmonary disease, it was generally left to the surgeon's discretion for choosing the graft configuration and it is not known what target vessel characteristics and anatomic criteria were used. Furthermore, each group had on average 3 distal anastomoses, suggesting there was at least a third conduit (with the exception of the composite group); thus, whether clinical outcomes were influenced by the non-ITA conduits is not known.

In adjusted analyses using propensity scores, none of the comparisons were statistically different. According to Kaplan-Meier curves presented in the article,¹³ the composite outcome of repeat revascularization and death showed

statistical differences. Presumably baseline differences account for this inconsistency and not the grafting strategy per se. It looks like the composite group did worse overall. Although this may have been influenced by follow-up issues, the composite group had more prevalence of diabetes and required more intraoperative transfusions. With regard to composite or free RITA configurations, a randomized trial by Nasso and colleagues¹⁵ showed that event-free survival was similar between patients receiving composite RITA (off the LITA) versus free RITA. In addition, a recent study by Robinson and colleagues¹⁶ comparing BITA Y grafting (using a free RITA) showed that at a mean of 5.5 years post-CABG angiography, degree of native vessel stenosis (odds ratio, 0.66 per 10% increase), and anatomic territory (circumflex odds ratio, 2.64 and right coronary artery odds ratio, 6.73 vs anterior territory) were among the predictors of anastomotic occlusion. In the study by Magruder and colleagues,¹³ majority of the composite RITA grafts went to the obtuse marginal and perhaps this was done based on certain anatomic factors that were not captured in the study.

Magruder and colleagues¹³ showed that there was no difference in adjusted outcomes between RITA targeted to the left versus the right coronary system. It is known that the right coronary artery is larger and therefore native competitive flow is a problem. It has been shown that saphenous vein grafts have better patency compared with ITA grafts at <5 years for moderate right coronary artery stenosis (>70%); however, late after surgery, ITA are more effective.¹⁷ Furthermore, Sabik and colleagues¹⁸ showed that at 9.2 years of follow-up, late survival was similar between patients receiving a second ITA to the circumflex versus the right coronary system. As such it is reassuring that long-term outcomes between ITA to the right versus left were comparable. Given that median follow-up was 1128 days (3.09 years), 5- and especially 10-year estimates should be made with caution. In addition, it is important to emphasize that the RITA was used preferentially for the left coronary system overall.

Finally, Magruder and colleagues¹³ conducted an observational study, with small numbers and few events, limited follow-up, and temporal biases in the treatment strategies. The investigators appropriately computed post hoc power studies that suggested the study was only powered to test for relatively large between-group differences. One could argue that such differences are not biologically plausible considering the magnitude of effect of a second arterial graft compared with a single arterial graft; also, smaller differences that may still be clinically important would not be evident. The patients included in the study were highly selected (ie, young and healthy), which impedes external validity. Furthermore, BITA was avoided in patients with diabetes in this study, at least in the earlier years. Diabetes is a common reason for many surgeons to exclude the use of

BITA grafting in efforts to decrease risk of sternal wound infection.¹⁹ However, Raza and colleagues² performed a large study of 11,922 patients with diabetes and concluded that BITA grafting maximizes long-term survival and recommended use in all patients with diabetes with low risk of deep sternal wound infection. Furthermore, a large portion of ITAs were harvested in a skeletonized fashion and skeletonization has also been shown to be safe in diabetic patients undergoing BITA harvesting.²⁰

Overall, Magruder and colleagues¹³ should be congratulated for undertaking this retrospective study and applying meticulous analytic methods to compare long-term outcomes. Given that the survival advantage typically becomes apparent during the second decade after BITA surgery,¹¹ long-term studies such as this—along with the much anticipated late results of the Arterial Revascularization Trial²¹ that compares BITA to single ITA—will hopefully redefine conventional practices of CABG with respect to conduit selection. What does this particular study add? Point estimates for the adjusted hazard ratio of death or repeat revascularization were close to unity for each of the primary grafting hypothesis comparisons. The take-home message is that using BITAs is more important than the precise configuration of the BITAs used. In other words: BITA—just do it!

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