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REPLY: SKELETONIZED BILATERAL INTERNAL THORACIC ARTERY GRAFTING IS A QUALITY METRIC IN CORONARY ARTERY BYPASS GRAFTING

Reply to the Editor:

I read with interest the letter to the editor by Navia and colleagues.¹ After commending the published outcomes of their evolving coronary artery bypass grafting (CABG) technique over last 2 decades, based on the routine use of total arterial revascularization by composite T skeletonized bilateral internal thoracic artery (BITA) grafting in 95% of their patients undergoing CABG, including in elderly patients, I have several important points to further discuss.

First, indeed, as the authors mention, the Arterial Revascularization Trial (ART)² suffered from several flaws. The 14% crossover rate (from BITA to single internal thoracic artery [SITA]) and the 22% “unexpected” use of radial artery (RA) in the SITA group, as well as the difference between the “intention-to-treat” neutral outcomes versus the significant survival advantage with multiarterial grafting (MAG) in the “as-treated” analyses, are also well known and discussed. However, an eye-opening editorial by Taggart³ raises several additional crucial flaws in ART that for some reason tend to be ignored by the “nonadvocates” of BITA grafting. Apparently, in ART, the participating surgeon’s experience in using BITA grafting was never validated by the investigators (participating surgeons were supposed to perform >50 BITA cases before being included in ART). Admittedly, not validating it was a serious mistake, since the crossover rate for individual surgeons in ART varied from 0% to an astonishing 100%, which

indicates that there were surgeons participating in ART who were completely incompetent with BITA grafting. In addition, patients crossing from BITA to SITA had proven significant inferior outcomes. However, most importantly, surgeons with more than 50 BITA cases in ART had a significant reduction in mortality and in composite end points at 10 years in the “intention-to-treat” analysis! Hence, if that requirement would have been validated and enforced, the results of ART would most probably well confirm BITA outcome superiority over SITA. This definitely provides another important perspective on ART and an overall additional insight on flaws in some randomized trials. A great example is the recently published randomized RAPCO (Radial Artery Patency and Clinical Outcomes) trial,⁴ comparing RA versus right internal thoracic artery (RITA) outcomes, and concluding that RA outperforms RITA in terms of patency and survival at 10 years. It is beyond the scope of this letter to discuss this study’s flaws in detail, suffice to say that the RITA conduits were all only pedicled, only free, and sewn proximally only to the aorta! This decision was made to maximize comparability between the RA and RITA but unfortunately does not reflect the current practice and use of RITA, as shown in the current study¹ and in many recent others. In addition, the RAPCO results completely contradict a much more comprehensive and inclusive benchmark patency study⁵ published 9 years ago by the same surgical group, which clearly concluded that “Late patencies of RITA are excellent, equivalent to the LITA for identical territories, always better than radial arteries and saphenous vein grafts, and remain free of atheroma. Use of RITA in addition to LITA, is associated with excellent survival in triple vessel coronary disease. More extensive use of RITA in CABG is recommended.” Notably and as previously published, the RITAs in that study⁵ were reported to be all skeletonized! Hence, I would argue that declaring that the RA is “the free conduit of choice,” based on the RAPCO trial, would be a terrible mistake. Those differences in RITA patency may be related to how and where the RITA was used rather than to its real structure and function.

Second, the authors are to be commended for their uniquely uniform adaptation by all surgeons of their total arterial CABG strategy. The question is how could their strategy be generalized, and how to build a MAG program. In a recent publication,⁶ it was proposed that the first step to acquire core skills in a MAG program is proficiency in skeletonized harvest of the ITA. I completely agree. Handling the ITA is different and of a greater technical demand compared with RA and saphenous vein grafts, requiring superb dexterity, and the earlier you begin harvesting and sewing BITA, the more proficient, fast, and secure you will become in all of its versatile configurations. Mastering skeletonization of both ITAs should be step 1 and a prerequisite for a MAG surgeon before start performing ITA

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anastomoses. This definitely takes more than 50 cases, and skeletonization should be performed, for training purposes, even if the left internal thoracic artery only is harvested.⁷ In contrast, they also recommend starting with the RA as the conduit of choice and once achieving 50% of cases with the RA only, then starting to use BITA. I would argue that there is no difference in technical handling and sewing a RA than a SVG. Furthermore, by using a RA you do not become a MAG surgeon or “MAG program” yet. In addition, their proposed “algorithm for graft selection for the second target vessel in elective CABG cases” is clearly biased in favor of the RA. I assume that the surgeons of the current study¹ and many others would not accept this algorithm. Indeed, and agreeably, as opposed to the current study’s recommendations, they recommend that off-pump coronary artery bypass strategy should be left as the last goal in developing a MAG program (step 5), as current data are not sufficient to show any additional short- or long-term major advantages with this technique, and proficiency in performing the delicate anastomoses with BITA is much more important for the patient’s survival than performing the surgery as off-pump coronary artery bypass grafting.

Third, the authors used the skeletonized ITA harvest technique only. Current 2018 European Association for Cardiothoracic Surgery/European Society of Cardiology guidelines on myocardial revascularization recommendations on procedural aspects of CABG are confusing.⁸ If “BITA grafting should be considered in patients who do not have a high risk of sternal wound infection (IIA, B),” and “skeletonized ITA dissection is recommended in patients with a high risk of sternal wound infection (I, B),” based on current accumulating data, wouldn’t it be prudent to recommend the skeletonized technique in all patients undergoing BITA as class I, B? There is no question that pedicled BITA harvest confers a significant risk factor for sternal wound infection. Skeletonized harvest of BITA should be obligatory and an ultimate “package deal” in BITA grafting.

Fourth, in ART, it was a “surprise” that 22% of patients undergoing SITA received an additional RA. Taggart, in his aforementioned editorial, claims that “at the time of conception and inception of ART, it was not known that radial artery grafts would result in superior angiographic patency compared to vein grafts, that would result in

improved clinical outcomes.” Without digging into facts and dates, this notion puts additional burden on the investigators of the ROMA (Randomization of Single vs Multiple Arterial Grafts) trial.⁹ Data are accumulating that skeletonized harvest of BITA provides improved ITA conduits as opposed to the pedicled ITA harvest in terms of length, versatility and flow of the conduit and, most importantly, significantly lowers the incidence of mediastinitis,¹⁰ which can undoubtedly lead to increased mortality, and when the secondary outcomes measured in ROMA trial include sternal wound infection rates, why isn’t skeletonized BITA harvest a clear recommendation or even a surgical prerequisite in the surgical requirements and guidelines of the ROMA trial, whereas for some reason the only recommendation for skeletonizing a conduit relates to the RGEA? It will be unacceptable to claim in 2030, when the results of ROMA are expected to be published, that those data were unknown at the time of inception and conception of the ROMA trial.

There is no doubt that the excellent surgical outcomes¹ were volume dependent. There is mounting evidence supporting that notion in MAG. However, volume is not a guarantee of quality. It has been previously shown¹¹ that excellent outcomes can consistently be achieved even in relatively low-volume programs, as long as they were correlated with focus on quality, as manifested by compliance with evidence-based quality standards. In addition, it may well be that an organizational culture focused on quality might be more important than specific protocols in care improvement. External and internal peer review and open discussions of all surgical and technical aspects between surgeons as well as “misses” and more importantly “near misses” and complications, may be significantly facilitated when all surgeons in a department adopt one uniform surgical CABG technique.

Finally, it was surprising that at the recent 6th annual International Coronary Congress (ICC) virtual meeting, when the president of the Society of Thoracic Surgeons asked the experts’ panel “if it is already time to declare BITA and MAG as a “quality metric”? There was no unanimously positive answer.

Skeletonized BITA grafting is a quality metric in CABG surgery!

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