Radial artery and right internal thoracic artery: jousting for the throne of coronary artery bypass grafting

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Even in the presence of multivessel coronary artery disease, a majority of the patients in almost all developed countries receive only a single arterial conduit during coronary artery bypass grafting (CABG) (1). This continues to occur despite a large body of evidence demonstrating improvements in clinical outcomes for patients who receive more than one arterial graft during CABG. Several randomized controlled trials (RCTs) suggest better patency rates for the radial artery (RA) versus the saphenous vein (SV) (2-4). Growing evidence has demonstrated the superiority of the RA and right internal thoracic artery (RITA) in regards to patency when compared to the SV (5).

In a recent multicenter, retrospective cohort study, Tranbaugh *et al.* (6) report their experience in 13,324 consecutive, primary CABG patients and compared the long-term survival of patients receiving RA (n=4,577), RITA (n=1,674) or SV (n=7,073) as a second graft. A significant overall survival benefit was seen only when comparing the RA to the SV [hazard ratio (HR) 0.82, P<0.001], while the overall survival comparison between the RITA and SV was similar (HR 0.97, P=0.49). This goes against the current literature supporting the use of bilateral internal thoracic arteries (BITA) over single internal thoracic artery (SITA) grafting (7,8). However, for patients under 70 years, the authors report a survival benefit for the RA and the RITA versus SV (HR 0.77, P<0.001 and HR 0.86, P=0.03, respectively). For patients above 70 years there was no statistical difference in long-term survival between the RA and the RITA versus SV (HR 0.94, P=0.37 and 1.11, P=0.12, respectively). No difference in overall survival was observed between the RA and the RITA across all ages (HR 0.92, P=0.16). This led the authors to propose the use of either the RA or RITA as optimal choice in patients under 70 years, while suggesting a more selective strategy in patients above 70 years.

Tranbaugh and colleagues should be congratulated for their investigations of one of the largest series comparing long-term follow-up between the RA, RITA and SV. However, there are some points that warrant discussion.

To date, the only RCT comparing the RA and the RITA is the RAPCO trial (9). At 10 years follow-up (10) a non-significant trend toward high patency for the RA to the RITA was found. A network meta-analysis (11) comparing all the conduits used for CABG revealed no significant difference between the RA and the RITA in terms of functional and complete graft occlusion. However, the RITA had a higher probability of being the best conduit (75% at rank probability analysis) and at ≥4 years follow-up, the RITA was associated with a non-significant 27% absolute risk reduction for functional graft occlusion compared to the RA. A meta-analysis of propensity-matched studies (PMS) (12) showed that the operative mortality was not different between the RA and RITA [odds ratio (OR) 1.53, P=0.07], but demonstrated a statistically significant 25% risk reduction of late death and a lower risk of repeat revascularization for the RITA when compared to the RA

(HR 0.75, P=0.028 and 0.37, P=0.03 respectively). In a subsequent PMS study (13) comparing the RITA and RA as second arterial conduits in CABG, Benedetto and colleagues demonstrated a comparable mortality between the two groups during the first 4 years of follow-up (HR 1.00, P=0.98). However, after 4 years the RITA was associated with a significant reduction in late mortality compared to RA (HR 0.67, P=0.02). A subgroup analysis suggested a late survival advantage of RITA compared to RA when the experimental conduit was grafted the left coronary system (HR 0.69, P=0.04), but no advantage when it was grafted on the right coronary system (HR 0.98, P=0.93).

Of note, in Tranbaugh's study the left internal thoracic artery (LITA) and RITA were harvested as pedicled grafts. In the meta-analysis by Benedetto's group (12) the RITA was associated with an increased incidence of sternal wound complications (OR 1.50, P=0.15). However, a subgroup analysis between pedicled and skeletonized harvesting showed a 3-fold risk of sternal wound complication in the pedicled subgroup [OR 3.18, 95% confidence interval (CI): 1.34–7.57], while in the skeletonized approach results were comparable to the RA (OR 1.07, 95% CI: 0.67–1.71). This is a possible explanation of why in Tranbaugh's group study the survival benefit of the RITA did not reach statistical significance compared to the SV, while the RA did.

Another explanation for the discrepancy between the two arterial conduits can be found in the population demographics composing the two groups. Overall, RA patients were healthier, younger, had a higher male-to-female ratio, and better ventricular function relative to the RITA group. Although the authors applied statistical models to correct this group diversity, it is likely that a selection bias persist. Only RCTs can provide an unbiased perspective, but to date only a single trial comparing RA and RITA (10) has been conducted. Therefore, future trials are of paramount importance to provide more significant and less biased results.

Finally, in Tranbaugh's study different institutional protocols have been used, that may have introduced a confounding bias. The RITA group is the least affected, as 89% were performed in only one of the three centers, while the RA and SV were distributed among the various institutions.

When dealing with the surgical strategy to adopt during CABG for the RA and RITA, different indications can be found for the two arterial conduits (14). In particular, in patients at high risk of sternal or pulmonary complications, and when distal or multiple grafts have to be used, the RA is recommended. On the other hand, the RITA should be considered the best option when there is lack of ulnar compensation, when there is poor target vessel runoff, or in cases with moderate target vessel stenosis (15).

In conclusion, the RA and RITA are at least comparable one to the other and both are a more appropriate choice than the SV. As each of the two arterial vessels has different indications, they should be considered complementary and their use should be tailored to the individual patient characteristics.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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