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Multiple arterial grafting: for every patient and every surgeon?

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Observational studies and meta-analyses have suggested that patients who receive multiple arterial grafting (MAG) have better long-term survival than patients who receive single arterial grafting (SAG).¹ Comparative observational studies, however, are open to treatment allocation bias, and it is likely that the benefit observed for MAG may be related to unmeasured confounders due to the tendency of surgeons to use MAG in patients perceived as healthier and with longer life expectancy.² In the Radial Artery Database International Alliance (RADIAL) study, a patient-level pooled analysis of six RCTs comparing the radial artery (RA) and the saphenous vein graft as the second conduit for bypass surgery, a significant reduction in the composite of death, myocardial infarction, or repeat revascularization was shown in the RA group at 10-year follow-up (hazard ratio [HR]: 0.73, 95% confidence interval [95% CI]: 0.61–0.88, $P < 0.001$) and in a post-hoc analysis, the use of the RA was also associated with a significantly lower incidence of death (HR: 0.73, 95% CI: 0.57–0.93], $P = 0.01$).³ In contrast, the 10-year results of the Arterial Revascularization Trial (ART), the largest randomized clinical trial comparing patients undergoing bilateral internal thoracic artery (BITA) versus single internal thoracic artery (SITA) grafting, reported no difference in mortality between the two cohorts (HR: 0.96, 95% CI: 0.82–1.12, $P = 0.62$).⁴ There are, however, important issues with the ART trial including a high degree of crossover from the BITA to SITA arm, as well as a high rate of RA use in the SITA group.⁵

It is becoming increasingly apparent, however, that higher-risk patients (i.e. older age, higher prevalence of comorbidities) may not benefit from the use of MAG. Randomized studies have shown that there is no difference in patency between arterial and venous grafts at early follow-up, but arterial grafts have a superior patency in the mid- and long-term (after four years).^{6,7} This suggests that patients who do not have mid- to long-term life expectancy may not see the benefit associated with MAG. A post-hoc analysis of the ART trial suggests that the use of BITA over SITA grafting is associated with a lower incidence of major adverse event including all-cause mortality, myocardial infarction, or stroke, in younger, but not older, patients.⁸ Similarly, in an analysis of a New Jersey registry of over 26,000 patients, the benefit of MAG on the 10-year survival were not seen in patients older than 70 years and with ejection fraction $\leq 30\%$.⁹ Moreover, in an analysis of 64,402 patients in New York State, MAG was associated with lower incidence of major adverse

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cardiac event (composite of mortality, myocardial infarction, or repeated revascularization) and longer survival at 7-year follow-up among low-risk (<10% 1-year mortality), but not high-risk (≥10% 1-year mortality) patients.¹⁰ Indeed, the 2018 ESC/EACTS guidelines on myocardial revascularization recommend the use of MAG only in patients with a reasonable life expectancy.¹¹

In addition to the selection of the patients who may benefit more from MAG, surgeon and center experience play a major role. In an analysis of the Society of Thoracic Surgeons National Database, operative mortality after BITA grafting was higher, when compared with SITA grafting, at low experience centers (use of BITA <5%), but not in experienced centers (use of BITA from 20% to 40%).¹² Similarly, a meta-analysis of 34 studies including 27,894 patients revealed that long-term mortality was significantly and inversely associated with center volume (P=0.02), with better survival reported by high volume BITA centers.¹³

To conclude, as we wait for the results of the Randomized comparison of the clinical Outcome of single versus Multiple Arterial grafts (ROMA) trial, designed to settle the MAG question in a cohort of more than 4,000 patients (results expected after 2025), the current evidence supports the use of MAG in younger patients, with a low prevalence of comorbidities, and a reasonable life expectancy. Furthermore, surgeon expertise and institutional experience should be taken into consideration in the decision-making process on the best treatment for patients with coronary artery disease.

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