Bilateral mammary artery vs. single mammary artery grafting: promising early results: but will the match finish with enough players?

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This editorial refers to ‘Randomized trial to compare bilateral vs. single internal mammary coronary artery bypass grafting: 1-year results of the Arterial Revascularisation Trial (ART)’†, by D.P. Taggart et al., on page 2470

A single internal mammary artery (SIMA) rather than vein graft to the left anterior descending coronary artery is undoubtedly the standard therapy in coronary bypass surgery. Surprisingly, the usage of two mammary arteries has not been accepted as the standard of care and the benefits and disadvantages have been a matter of debate for years. Numerous compelling retrospective studies have documented a clear benefit for bilateral mammary artery (BIMA) grafting over SIMA grafting in reducing the long-term risk of death, cardiac death, and late cardiac events. Nevertheless, there is a wide discrepancy between these findings in the literature and clinical practice. In the USA, BIMA usage is only around 4% and in Europe 12%. The saphenous vein is still a widely used graft because of its accessibility, sufficient length, and ease of manipulation. Bilateral mammary artery grafting has been associated with an increased rate of sternal dehiscence a potential complication, particularly in diabetics. It seems however that using skeletonized BIMA grafts may lower the incidence of sternal complications. Another argument that is often used against BIMA usage is that composite grafting is susceptible to the effect of flow competition and may lead to a higher incidence of graft occlusion or string sign in up to 20% of the patients. Nonetheless, this compares favourably with an astonishing 45% of vein grafts that failed between 12 and 18 months in the PREVENT IV trial. This figure certainly revived the discussion whether two mammary arterial grafts are not better than one. A recent angiographic follow-up study, however, observed just a 14% vein graft failure at 5 years and demonstrated similar early clinical outcomes, including in-hospital mortality and post-operative morbidity, between patients with only arterial grafts and those with a saphenous venous graft as an additional conduit. Given the low incidence of 3.4% of symptomatic graft occlusion in the SYNTAX study, it is clear that not every graft failure leads to a major adverse event. In the SYNTAX study, bilateral mammarys were used in a relatively high percentage of 28% of the CABG patients but one could speculate whether the stroke rate of 2.2% might have been lower with a more liberal use of BIMAs as cross-clamping of the aorta is avoided and the ‘no-touch’ technique is considered effective for reducing stroke risk in patients with the atherosclerotic ascending aorta. However, all these observations originate from studies that are not randomizing between one mammary vs. two mammary grafts and follow-up is too short as the benefits of BIMA grafts increase with the duration of follow-up particularly with reference to the need for redo surgery. The major reasons for not using BIMA grafts is this lack of definitive evidence of benefits and the perceptions that BIMA grafting takes more time and it is technically more challenging.

It is now 24 years after Loop et al. undoubtedly showed that a SIMA to the left anterior descending coronary artery offers a survival benefit over a venous bypass. The Arterial Revascularisation Trial (ART) published in this issue from the European Heart Journal could again potentially change the practice of coronary surgery. This is the 1-year interim report of a randomized study on BIMA vs. SIMA with a primary outcome of survival at 10 years.

The 30-day mortality of only 1.2% and 1-year mortality of 2.3% in the SIMA group and 2.5% in the BIMA group shows that there is no mortality difference between the two surgical modalities but it also shows how safe coronary bypass surgery has become and what excellent results it provides. More than 40% of the patients were operated using the off-pump technique and the stroke rate at 1 year was 1.6%. The revascularization rate at 1 year was as low as 1.3 and 1.8% in the SIMA and BIMA groups, respectively, with no statistical difference between the two groups. Only sternal wound reconstruction, one of the main concerns with the use of two mammary arteries, was significantly higher in the BIMA group: 1.9 vs. 0.6% in the SIMA group (relative risk 3.24; confidence interval 1.54–6.83). Taggart et al. should be congratulated.

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for these excellent results. The low 1 year mortality rate may serve as a benchmark for both coronary artery bypass and percutaneous revascularization studies. The major step forward is that it takes away some of the concerns of a potential higher rate of early complications with BIMA grafting. But undoubtedly, every surgeon will be waiting for the final report that should appear in 9 years from now. Here might be a caveat. In the original report on the design of the trial, it was expected that ‘compliance is likely to be 100%, except in the unusual situation where the planned operation is not possible for technical reasons’ and that the loss of patients is minimal. The percentage of patients who did not receive the allocated treatment in the BIMA group was however as high as 16.4 and 13.9% of them received a SIMA. In the SIMA group, non-compliance was much lower: 3.3%. Obviously, even in the hands of experienced surgeons, BIMA grafting is not always feasible. If one assumes that the lost to follow-up towards the 10-year mortality endpoint is only 1%, then still the power of the study is lowered by almost 45%. Figure 1A displays a simulation of 5000 trials with the original assumptions of the trial and with the enlarged sample size of 3102 patients (Computer Program: IcebergSim). Figure 1B displays a simulation of 5000 trials now with the actual allocation of the patients and a presumed lost to follow-up of 1%. It is clear that the chance that the null hypothesis will not be rejected has increased considerably. Hopefully, the investigators will be able to keep the ‘lost to follow-up’ to a minimum in order not to decrease the power of the study further.

One of the other major achievements of this group of investigators, which should not be underestimated, is the fact that they were able to obtain funding and execute this study without industry involvement. This study addresses an important research question that has been debated for many years but no industry would be willing to fund such a study as no drug or device is involved. Let this be an example that such kinds of studies can be carried out. It will take many years before we have final results of the study, but this preliminary report has taken away some of the concerns of BIMA grafting. In the meantime, it seems that there is enough evidence from retrospective studies to perform BIMA grafting in patients with a reasonable life expectancy.

Conflict of interest: none declared.

References

Cocaine-induced epicardial coronary artery thrombosis resulting in extensive myocardial injury assessed by cardiac magnetic resonance imaging

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Cocaine causes myocardial injury through multiple mechanisms including vasoconstriction, adrenergic hyper-stimulation, and de novo thrombus formation. This report presents two cases of cocaine-induced coronary artery thrombosis with no underlying stenosis, resulting in substantial myocardial injury.

A previously well 32-year-old man presented with chest pain which commenced 24 h after intranasal cocaine use. He denied use of any other elicit substance, but had previously used cocaine. Twelve-lead electrocardiogram revealed inferior ST segment elevation. Urgent angiography demonstrated thrombotic occlusion of the right coronary artery (Panel A). Coronary aspiration restored TIMI III flow, but no underlying stenosis was identified (Panel B). Troponin peaked at 3409 ng/L (N < 14 ng/L). Cardiac magnetic resonance (CMR) imaging showed inferior akinesia, and extensive transmural late enhancement with microvascular obstruction (MVO: Panels C and D). No late enhancement was observed in other coronary territories.

A 43-year-old man presented with 4 h of chest pain 48 h after first time intranasal cocaine use. He denied other substance use. ST segment elevation in the anterior leads resulted in immediate thrombolysis and transfer. Troponin peaked at 6.5 μg/L (N < 0.03 μg/L). Angiography showed normal coronary arteries (Panel E), but ventriculography demonstrated akinesis of the anterior wall. Cardiac magnetic resonance confirmed this (Panel F) and showed increased T2-signal intensity (Panel G) and transmural late gadolinium enhancement with MVO (Panels H and I) supporting occlusion of his left anterior descending coronary artery as the cause of his presentation, not seen at angiography due to thrombolysis.

In these cases, CMR illustrates extensive myocardial injury resulting from cocaine-induced coronary artery thrombosis without underlying coronary artery disease.

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