APPENDIX. CONFERENCE DISCUSSION

Dr D.P. Taggart (Oxford, UK): If what you have shown us is correct, because this is one of the longest propensity-matched follow-ups that exists in the literature, then again, as Professor Buxton showed us, this is potentially very important.

But this is also the first time I have seen a paper on bilateral internal mammary arteries which showed no difference; there was absolutely no difference in deep sternal wound infection. There are two possibilities here, either you are doing something totally different from every other group who has ever achieved this, or, alternatively, in your propensity matching you must have excluded patients who did have deep sternal wound infections. So the obvious question I am going to ask you is, of the bilateral IMA grafts you have shown us here, what percentage is that of the total population who had bilateral IMA grafts?

Dr Grau: Of the total of 6,000 patients, around 1,800 of them had bilateral mammarys. From that total, we selected the group for propensity matching analysis. The overall risk of a sternal wound infection in that population was around 0.5%, so it was very low in the entire group even before our selection by propensity matching. This was shown in one of the first tables when I described the two populations; the risk of a sternal wound infection in the overall series of 6,000 cases was also very low.

But the truth of the matter is that there was no difference between bilateral mammarys and the use of a single mammary, understanding that the other 4,000 patients that were not included in the single mammary SVG were likely to be people who were sick or were older and who we couldn’t match by propensity matching analysis to the BIMA group. There was nobody younger.

Dr Taggart: Do you use some different technique for harvesting your mammary arteries?

Dr Grau: Well, I have listened to some of the questions from the previous presentation, and I have to say that what we do is we do not overuse the Bovie to cauterise anything over the sternal side of the mammary bed. We use clip, clip and cut, so there is no diathermy injury to the arcade feeding the middle of the sternum. We do not skeletonise completely, as Dr. Buxton was showing in his slides. We leave the veins attached to the in-situ mammary. Basically these are the two things that we do. We do meticulous harvesting of the mammary.

Dr D. Pagano (Birmingham, UK): How many surgeons were involved in this study?

Dr Grau: Four surgeons in total from 1994 to 2010.

Dr Pagano: And has the rate of use of double mammary changed over time?

Dr Grau: Yes, it did change. In the 1990s, I would say 1996-1997, one of the surgeons led in the use of bilateral mammarys and everybody kind of followed track after that.

Dr Pagano: So there are two methodological issues that I think you need to address and recognise the potential limitations of your outstanding results. First of all, if you do a propensity score matching within a single unit, you are really tied down by confounding by indication. The second thing is that if you have four surgeons, you will have some variability in the outcomes, and that variability may be significant, and you should consider using surgeons as a random effect to account for that.

Dr Grau: Point well taken.

EDITORIAL COMMENT

Bilateral internal mammary arteries: a very important missing trick for coronary artery bypass grafting

David P. Taggart*

Department of Cardiac Surgery, John Radcliffe Hospital, Oxford University Hospitals NHS Trust, Oxford, UK

* Corresponding author. Department of Cardiac Surgery, John Radcliffe Hospital, Oxford University Hospitals NHS Trust, Oxford OX3 9DU, UK. Tel: +44-1865-221121; fax: +44-1865-220244; e-mail: david.taggart@orh.nhs.uk (D.P. Taggart).

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In the current issue of the journal, Grau et al. [1] described 17-year outcomes of a propensity-matched group of 928 patients with bilateral internal mammary arteries (BIMAs) and 928 with a left internal mammary artery (LIMA) and additional vein grafts as necessary. Their most important conclusion is a clinically important survival benefit with BIMAs at ~10% at 10 years and 18% at 15 years and further enhanced if performed as an off-pump procedure. If correct, this should encourage a change in clinical practice because currently fewer than 10% of patients in Europe and fewer than 5% in the USA receive BIMA grafts. So, two fundamental questions are: (i) are the conclusions supported by the data and (ii) are the conclusions consistent with other existing evidence?

Before answering these questions, some relevant background information is useful. The IMA story began in earnest over a quarter of a century ago when Loop et al. [2] from the Cleveland Clinic published their seminal paper reporting that an IMA graft to the left anterior descending coronary artery, in comparison to a saphenous vein graft, over a 10-year period significantly improved the survival accompanied by a reduction in the incidence of myocardial infarction, recurrent angina and the need for repeat intervention. In 2001, our own group published the first systematic review of BIMA versus SIMA in almost 15,000 patients and reported a hazard ratio of death at 0.81 in favour of BIMA patients [3]. Such observations were entirely consistent with several angiographic studies reporting superior angiographic patency of both IMAs in comparison to saphenous vein grafts when placed to the left-sided coronary vessels both early [4] and late [5] after surgery.

Although such evidence in favour of BIMA has been available for over a decade, their routine use in clinical practice as
mentioned earlier remains very low. This is even more surprising when a majority of polled surgeons reported that they did believe that BIMA offered clinical benefits to most patients (and indeed two-thirds of surgeons said that they would personally want BIMA if they required coronary artery bypass grafting (CABG)) [6]. It has to be assumed therefore that the low rate of BIMA use is explained by the fact that, in the same survey, a majority of surgeons believed that the use of BIMA had a ‘learning curve’, would add to the duration of the operation and could actually increase early mortality and morbidity and especially deep sternal wound infections [6].

To date, there has only been one publication of a randomized trial of BIMA versus SIMA [7]. The arterial revascularization trial (ART) is one of the largest trials ever conducted in cardiac surgery and randomized 3102 patients in 28 centres in seven countries by 67 surgeons to SIMA or BIMA with supplemental veins or radial arteries as necessary. Although the primary outcome of this trial is 10-year survival, the 1-year results have been published [7], reporting similar 30-day and 1-year outcomes in terms of death (1.2 and 2.4% for both groups), stroke, myocardial infarction and repeat revascularization. BIMA increased the length of surgery by 23 min, but its main adverse effect was an increase in the need for sternal wound reconstruction at 1.9 versus 0.6% in the SIMA group.

The current study by Grau et al. [1] described the 17-year survival in relatively contemporary (from 1994) propensity-matched groups of 928 BIMA and 928 SIMA patients (from a database containing 6313 patients). The groups were well matched for 18 preoperative and 5 intraoperative factors although the BIMA group remained on average 2 years younger with a slightly lower body mass index. There was a high proportion of off-pump procedures (around half of the patients in both groups) indicating a high level of surgical expertise. There were no significant differences in 30-day mortality at ≏1% or in any important postoperative complication and especially stroke.

If the survival benefit of BIMA reported in the current study is real, then it is clinically very important and should encourage more routine use of BIMA. It is certainly consistent with several other studies reporting a survival benefit of BIMA [3, 8] and it is noteworthy that no study has reported a long-term detrimental effect of BIMA. What is also particularly striking in the current report is the very low incidence of deep sternal wound infection (0.3%) in both groups. This is much lower than that traditionally reported in the literature and is especially surprising as the authors report using a pedicled technique to harvest the IMA as a skeletonized approach (i.e. only harvesting the IMA and not denuding the surrounding tissues) has been reported to reduce the incidence of sternal wound problems [9]. It is especially noteworthy therefore that the incidence of diabetes in the propensity-matched patients was 11% in contrast to 31% in the whole population, suggesting a strong selection bias against using BIMA in patients with diabetes. Indeed, there is much evidence to suggest that the major predictors of sternal wound infection are diabetes, obesity and chronic lung disease [2] and the ART showed an increase in the need for sternal reconstruction from 0.6 in the SIMA group to 1.9% in the BIMA patients.

Another potential advantage of the bilateral IMA technique is when used in conjunction with off-pump surgery allowing a no-touch aortic technique. Several groups have reported a reduced incidence of stroke by avoiding cardiopulmonary bypass and any aortic manipulation such as attaching saphenous veins or radial artery to the aorta [10].

Despite almost a decade of strong evidence of the clinical superiority of BIMA grafting, there remains a low use of BIMA in patients undergoing CABG. There is now robust evidence from the literature both from large registries and from one randomized trial that the use of BIMA does not increase early mortality or most aspects of morbidity with the possible exception of a slight increase in sternal wound problems. Even this complication can be reduced dramatically by avoiding the use of BIMA in diabetic patients or those with marked obesity. The low use of BIMA grafts is an indication on contemporary CABG and professional societies should actively encourage the performance of BIMA grafts and use this as part of a quality matrix for assessing the standard of CABG.

REFERENCES