Left internal mammary artery usage in coronary artery bypass grafting: a measure of quality control

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ABSTRACT

INTRODUCTION Over the last two decades, many studies have shown better long-term patency rates and survival in patients undergoing coronary artery bypass grafting (CABG) with left internal mammary artery (LIMA) to the left anterior descending artery (LAD). World-wide, LIMA is accepted as the 'gold standard' for surgical revascularisation and its usage has been steadily increasing.

PATIENTS AND METHODS Between April 1997 and September 2001, a total of 4406 consecutive patients underwent coronary artery bypass grafting with revascularisation to the left anterior descending artery.

RESULTS Of the study group, 4047 (91.8%) patients received LIMA to LAD, leaving 359 (8.2%) who did not. Six sub-groups of patients in whom LIMA usage was significantly less were the elderly (> 70 years of age), females, diabetics, patients having emergency CABG, poor left ventricular (LV) function (ejection fraction [EF] < 30%) and patients with respiratory disease.

CONCLUSIONS Although the current focus in the UK is on mortality rates, we believe that it will not be long before this will also include the incidence of major morbidity after CABG such as stroke, myocardial infarction (MI), renal failure and sternal wound problems. We also believe that we should now consider LIMA usage as a marker of quality control after CABG.

KEYWORDS

LIMA – CABG – Quality control

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Over the last two decades, many studies have shown better long-term patency rates and survival in patients undergoing coronary artery bypass grafting (CABG) with left internal mammary artery (LIMA) to the left anterior descending artery (LAD).^{1–3} However, in the early years, the routine use of LIMA to graft the LAD was believed to be associated with a greater early morbidity, including an increased risk of bleeding and respiratory insufficiency in patients undergoing CABG. Some of the more recent papers have shown as good, if not better, early outcomes in patients in whom LIMA has been used.^{4–7} World-wide, LIMA is accepted as the 'gold standard' for surgical revascularisation of the LAD and its usage has been steadily increasing. We believe that a stage has been reached, where we should now consider LIMA usage as a marker of quality control after CABG.

LIMA audit

Recently, Karthik *et al.*^{8,9} completed a retrospective audit of LIMA usage at the Cardiothoracic Centre–Liverpool NHS Trust which was presented at the meeting of North-West Quality

Improvement Programme (NWQIP) for Cardiac Interventions. Between April 1997 and September 2001, a total of 4406 consecutive patients underwent coronary artery bypass grafting with revascularisation to the left anterior descending artery. Of these, 4047 (91.8%) received LIMA to LAD, leaving 359 (8.2%) who did not. This study very clearly demonstrated that:

1. Approximately 4% of all patients undergoing first-time CABG do not need a graft to the LAD.
2. Of the rest, about 92% receive LIMA to LAD.
3. Six sub-groups of patients in whom LIMA usage was significantly less were: (i) the elderly (> 70 years of age); (ii) females; (iii) diabetics; (iv) patients having emergency CABG; (v) poor left ventricular (LV) function (ejection fraction [EF] < 30%); and (vi) respiratory disease. LIMA usage was also reduced in patients undergoing combined CABG and valve procedures.
4. There were no significant differences in risk-adjusted, in-hospital mortality or morbidity whether LIMA was used or not.

5. A case-note review revealed that the commonest reasons for non-usage of LIMA were damage during harvest (1%), poor flow (1%), poor lung function (1%), unstable patients (0.5%) and respiratory and vascular co-morbidities.
6. This study had an impact on data collection at the Cardiothoracic Centre and we have modified our database to record the reason for non-usage of LIMA prospectively in any given case.

Current practice

A study by Leavitt *et al.*¹⁰ from Northern New England has shown that age, female sex, diabetes, emergency cases and patients with a smaller body mass index (BMI) were less likely to have LIMA usage. Karthik *et al.*⁹ also identified significant lower LIMA utilisation in obese patients. While the benefits of LIMA usage for most patients undergoing CABG is well accepted, certain high-risk sub-groups of patients are still denied the routine use of LIMA for LAD revascularisation. In such patients, the short-term risks associated with LIMA use are perceived to be greater than the supposed long-term benefits. Although it continues to be a matter of debate, this issue is important as the proportion of such patient sub-groups has been rising due to improving results of CABG and advances in interventional cardiology.^{11,12}

The results of both individual cardiac surgeons and institutions are currently in the limelight. While there is general consensus amongst the surgical community, government and the lay public regarding the need for this, there is a significant difference of opinion about the best way forward. With the imminent release of crude mortality rates of individual surgeons into the public domain,¹⁵ the relevance and likely impact of such public disclosure on current practice is very uncertain. Surgeons favour publication of some form of risk-stratified mortality. The Parsonnet and the EuroSCORE systems are two widely used tools of risk stratification in cardiac surgery.^{14–16} While there are limitations with both these models,^{17,18} a recent study from the north-west of England has demonstrated a feasible and rational way of using EuroSCORE risk stratification to allow meaningful comparisons.¹⁸

CABG is the commonest major cardiac operation. A recent study of the Society of Thoracic Surgeons database reveals a LIMA usage of 81% across all coronary revascularisation procedures in the US.¹⁹ Furthermore, Mack *et al.*²⁰ have shown that about 15% of the patients undergoing CABG in 69 hospitals across 17 states in the US between 1999–2002 did not receive any arterial grafts. Although the current focus in the UK is on mortality rates, we believe that it will not be long before the focus will also include the incidence of major morbidity after CABG such as stroke, myocardial infarction (MI), renal failure and sternal wound problems and their impact on the quality of life of patients

after CABG. As the public's access to medical knowledge becomes easier with information on almost all aspects of CABG including techniques, conduits and outcomes, easily available on the internet, their awareness of the benefits of LIMA usage will become greater.

The issues

The rate of LIMA usage is also likely to be of significance to healthcare providers. Patients who receive LIMA to LAD as a part of coronary revascularisation are likely to need fewer interventions and have fewer morbid events in the long term.^{1,2} This is likely to have a significant impact on the distribution and utilisation of resources and manpower.

It is widely recognised that LIMA utilisation across the UK has varied between 75% and 80%. Over a 6-year period beginning April 1997, LIMA use has steadily increased across the four cardiac centres in the north-west of England from 83.9% to 89%. In these centres, LIMA use has varied between 77.4% and 89.9% with significant variations between individual surgeons of 61–97%.⁸ Although varying patient case mix could perhaps account for some of this variation, we believe that individual practices remain the main reason for this discrepancy. While undoubtedly the decision to use or not use the LIMA in any individual case is uniquely the surgeon's response to a given situation, the evidence suggests that LIMA to LAD should be the goal. Entirely justified reasons for non-usage should be recorded as part of routine data collection.

We now collect the reasons for non-usage of LIMA prospectively as a part of our routine data collection. We believe that this is a way forward and should probably become a part of the minimum data set. This information would not only be important for patients and healthcare providers, but it may also have a significant impact on the practice of surgeons with regards to LIMA utilisation.

Conclusions

We believe that LIMA usage is a vital quality assessment monitor in patients undergoing CABG. We recommend that LIMA usage and its counterpoint (*i.e.* reasons for non-usage) should be incorporated into the routine data collection strategies for cardiac surgery.

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