

Comparisons of clinical outcome in coronary artery bypass grafting by RIMA-LIMA or LIMA-SVG in diabetic patients



Anaesthesiology

KEYWORDS:

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ABSTRACT

Introduction: LIMA + RIMA was associated with improved long-term survival and diminished rates of angina recurrence and late MI and that RA grafts were associated with improved short-term and long-term patency rates.

Objective: To evaluate arterial grafts (RIMA & LIMA) in diabetic patients by comparing medium term outcomes to group of patients where SVG were utilized.

Methodology: Patients were randomly assigned to one of 2 graft strategies: Right internal mammary artery was used to graft the circumflex territory or the right coronary territory system and a saphenous vein graft was used for the right coronary system; or Saphenous vein graft were directed to the right coronary territory or for the circumflex territory.

Results: Total 54 patients were included in both groups. Out of which 28 were Group A (IMA-LIMA) & remaining 30(LIMA-SVG) were from other group. Total 8 patients were died after discharge and within one year. Out of these three were from group A and remaining five were from group B.

Conclusion: Favorable results for the use of arterial conduits and results that are at least as good as those seen in conventional CABG, these results should allow surgeons flexibility in their choice of conduits.

Introduction

Coronary artery bypass grafting (CABG) is a well-established therapy for patients with multivessel coronary artery disease, with excellent short- and medium-term results. In addition to providing symptom relief, CABG has been shown to provide significant survival benefits with acceptable post-operative morbidity and mortality.¹ Diabetes is a risk factor for coronary artery disease (CAD) and heart failure. Approximately 20% to 30% of patients undergoing coronary artery bypass surgery (CABG) have DM. The impact of diabetes on short-term mortality and morbidity in patients undergoing CABG is unclear.²

During the early to mid 1980's, reports emerged in the literature describing the considerably diminished long-term patency rates of saphenous vein grafts (SVG), eventually leading to SVG occlusion which would result in the inevitable recurrence of symptoms, the need for readmission to hospitalization and coronary re-intervention and possibly even death. The most commonly used graft was the saphenous vein (particularly the great saphenous vein) and is still in use. However, due to the success story of the left internal mammary artery LIMA, total arterial revascularization has gained much importance for coronary bypass graft surgery. These arterial grafts also have an added benefit of a better long-term patency rate and survival.^{3,4}

The survival benefit provided by a left internal mammary artery (LIMA) graft to the left anterior descending (LAD) artery has been known since several decades. Appropriately, the LIMA to LAD graft forms the backbone of modern day coronary artery surgery practice. With the success of LIMA grafts, it seemed intuitive that using other arterial conduits such as the right internal mammary artery (RIMA), the radial artery (RA) and/or the gastroepiploic artery (GEPA) in conjunction with LIMA grafts would further improve long-term outcomes. In fact, studies showed that LIMA + RIMA was associated with improved long-term survival and diminished rates of angina recurrence and late MI and that RA grafts were associated with improved short-term and long-term patency rates.^{5,6} The association between diabetes and mortality after CABG surgery among patients is less conclusive.⁷

The objective of the present study was to evaluate arterial grafts (RIMA & LIMA) in diabetic patients by comparing medium term outcomes to group of patients where SVG were utilized.

Methodology

All Diabetic patients who underwent CABG at Superspeciality hospital from 2015 until 2016, in were identified studied retrospectively. From these patients only those patients who underwent CABG using either RIMA -LIMA (Group A) or LIMA+SVG (Group B) were included for consideration in the final analysis.

In both groups only patients with a LIMA to the left anterior descending artery were included. Total 54 patients were included in both groups. Out of which 28 were Group A (IMA-LIMA) & remaining 30(LIMA-SVG) were from other group. Known case of diabetes either on insulin or oral hypoglycemic drugs were included in the study. Patients included in study were <80 years of age undergoing primary isolated CABG for graft able triple-vessel disease. Patients were excluded from studies were diabetes mellitus with poor blood glucose control or recurrent infections, history of sustained ventricular tachycardia or fibrillation, previous or concomitant aortic or mitral valve surgery, any cerebrovascular surgery, serum creatinine greater than 3 mg per deciliter.

The left internal mammary artery was used to bypass the anterior circulation. Patients were randomly assigned to one of 2 graft strategies: (1) Right internal mammary artery was used to graft the circumflex territory or the right coronary territory system and a saphenous vein graft was used for the right coronary system; or (2) Saphenous vein graft were directed to the right coronary territory or for the circumflex territory. All patients received intravenous nitroglycerine infusions for the first 24 hours upon return from the operating room unless hypertensive (systolic blood pressure < 90 mm Hg.). Other routine post-operative medications included daily aspirin as well as resumption of cholesterol lowering agents, β -blockers and angiotensin converting enzyme inhibitors as appropriate. Detailed information on a wide range of pre-operative, intra-operative, and in-hospital post-operative variables including post-operative complications and in-hospital mortality for all patients were recorded. Patients were followed for one year for occurrence any untoward event. Descriptive and inferential statistics were done to compare viable in both groups.

Results

A total of 58 patients underwent CABG with greater than a single bypass during study period. Out of these 30 patients were in group A (LIMA-RIMA) and 28 were in Group B (LIMA-SVG). Patient

preoperative characteristics of these two groups are shown in Table 1 given below. When compared to patients undergoing LIMA+SVG, patients receiving LIMA -RIMA were younger, more likely to be male. Other factors like hypertension; hypercholesterolemia, stroke; smoking pre-op renal failure; ejection fraction were non significantly differ in both group.

Table 1: Preoperative characteristics among patients.

Variables	Group A (LIMA-RIMA) (n: 30) (%)	GROUP B (LIMA-SVG) (n:28) (%)	P value
Age	60.2 ± 8.4	63.2 ± 12.6	> 0.05 NS
Male: Female	20: 10	19:9	> 0.05 NS
Hypertension	27 (90%)	24 (85.7%)	> 0.05 NS
Cholesterol > 200	17 (56.6%)	15 (53.5%)	> 0.05 NS
Smoking	19 (63.3%)	16 (57.1%)	> 0.05 NS
Stroke	5 (16.6%)	3 (10.7%)	> 0.05 NS
Pre-op renal failure	2 (6.6%)	1 (3.55%)	> 0.05 NS
Recent MI < 7 days	6 (20%)	8 (28.5%)	> 0.05 NS
Previous PCI	11 (36.6%)	9 (32.1%)	> 0.05 NS
Ejection fraction			
> 50	17 (56.6%)	13 (46.4 %)	> 0.05 NS
30-50	7 (23.3%)	10 (35.7%)	
<30	6 (20%)	5 (17.8%)	

Preoperative angiographic characteristics were compared in both groups. Details were given in table 2. Similarly numbers of graft required during surgery were also mentioned.

Table 2: Preoperative angiographic and intraoperative characteristics

Variables	Group A (LIMA-RIMA) (n: 30) (%)	GROUP B (LIMA-SVG) (n:28) (%)	P value
Preoperative angiography			
Left main stenosis >50%,	29 (96.6%)	28 (100%)	> 0.05 NS
Right coronary artery territory stenosis			
70-89 %	8 (26.6%)	11 (39.2%)	> 0.05 NS
90-99%	12 (40%)	8 (28.5%)	
100%	10 (33.3%)	9 (32.1%)	
Circumflex coronary artery territory stenosis			
70-89 %	23 (76.6%)	18 (64.2%)	> 0.05 NS
90-99%	5 (16.6%)	7 (25%)	
100%	2 (6.6%)	3 (10.7%)	
Operative characteristics			
No. of grafts, n (%)			
3	10 (33.3%)	9 (32.1%)	> 0.05 NS
4	13 (43.3%)	13 (46.4%)	
≥ 5	7 (23.3%)	6 (21.4%)	

In group A out of 30 patients two patients were died before discharge from hospital while three patients from group were died. Prognoses were poor of all these patients. Stroke and Myocardial infarction were also seen in three and one case respectively in Group A (LIMA-RIMA) whereas it was seen in one and five cases respectively in group B.

Total 8 patients were died after discharge and within one year. Out of these three were from group A and remaining five were from group B.

Table 3: Clinical Outcomes in both groups

Variables	Group A (LIMA-RIMA)	GROUP B (LIMA-SVG)	P value
In hospital			
Mortality	2 (6.6%)	3 (10.7%)	> 0.05 NS
Myocardial infarction	3 (10%)	5 (17.8%)	< 0.05S*
Stroke	1 (3.3%)	1 (3.5%)	> 0.05 NS
Long term outcome (after 6 month)			

Mortality	3 (10%)	5 (17.8%)	> 0.05 NS
Repeat admission for any cardiac cause	4 (13.3%)	6 (21.4%)	< 0.05 S*
Stroke and other related cause	3 (10%)	5 (17.8%)	< 0.05S*

Discussion

In present study mortality were more in SVG group as compared to total arterial graft. Various studies also reported the poor long-term patency rates of SVG coupled with reports citing the excellent long-term patency rates of and improved survival associated with arterial grafts have encouraged many to abandon the use of SVG in favor of revascularization performed exclusively with arterial conduits.^{3,8,9}

Stevens et al.¹⁰ report that patients undergoing BIMA CABG operations had significantly better long-term freedom from myocardial infarction (MI) and from coronary reoperation. After 10 post-operative years, 85% of BIMA patients were free of myocardial infarction compared to 82% of patients receiving LIMA grafts (p = 0.001). 99% of BIMA patients also were free from coronary reoperation compared to 98% of LIMA patients.

Nasso et al.¹¹ found that patients receiving two arterial grafts had significantly better long-term, cardiac-event free survival outcomes than patients who just received a single arterial graft with or without additional saphenous vein grafts.

Damgaard et al.¹² performed a study to assess the health-related quality of life improvements in patients undergoing traditional CABG procedures versus patients undergoing TAR CABG procedures. 331 patients were randomized between the two revascularization techniques and over 90% of patients responded to the questionnaire at the specified time points.

Poor long-term patencies of saphenous vein grafts coupled with the greater long term patency results of the LIMA as the gold standard conduit for CABG has prompted surgeons to seek out additional arterial conduits.^{13,14} Several studies have demonstrated significantly increased long-term survival rates for patients receiving RIMA with LIMA grafting.^{15,16} With favorable results for the use of arterial conduits and results that are at least as good as those seen in conventional CABG, these results should allow surgeons flexibility in their choice of conduits.

References

- Alexander JH, Smith PK. Coronary-Artery Bypass Grafting. *N Engl J Med.* 2016;374(20):1954-64.
- Carson JL, Scholz PM, Chen AY, Peterson ED, Gold J, Schneider SH. Diabetes mellitus increases short-term mortality and morbidity in patients undergoing coronary artery bypass graft surgery. *J Am Coll Cardiol.* 2002;40(3):418-23.
- Légaré JF, Buth KJ, Sullivan J a, Hirsch GM. Composite arterial grafts versus conventional grafting for coronary artery bypass grafting. *J Thorac Cardiovasc Surg.* Elsevier; 2004 Jan;127(1):160-6.
- Al-Sabti HA, Al Kindi A, Al-Rasadi K, Banerjee Y, Al-Hashmi K, Al-Hinai A. Saphenous vein graft vs. radial artery graft searching for the best second coronary artery bypass graft. *Vol. 25, Journal of the Saudi Heart Association.* Elsevier; 2013. p. 247-54.
- Weiss AJ, Zhao S, Tian DH, Taggart DP, Yan TD. A meta-analysis comparing bilateral internal mammary artery with left internal mammary artery for coronary artery bypass grafting. *Ann Cardiothorac Surg.* AME Publications; 2013 Jul;2(4):390-400.
- Vallely MP, Edelman JJB, Wilson MK. Bilateral internal mammary arteries: evidence and technical considerations. *Ann Cardiothorac Surg.* AME Publications; 2013 Jul;2(4):570-7.
- Kip KE, Faxon DP, Detre KM, Yeh W, Kelsey SE, Currier JW. Coronary Angioplasty in Diabetic Patients. *Circulation.* 1996;94(8).
- Lytle BW, Loop FD, Cosgrove DM, Ratliff NB, Easley K, Taylor PC. Long-term (5 to 12 years) serial studies of internal mammary artery and saphenous vein coronary bypass grafts. *J Thorac Cardiovasc Surg.* 1985 Feb;89(2):248-58.
- Cohen G, Tamariz MG, Sever JY, Liaghathi N, Guru V, Christakis GT, et al. The radial artery versus the saphenous vein graft in contemporary CABG: A case-matched study. *Ann Thorac Surg.* 2001 Jan;71(1):180-6.
- Stevens LM, Carrier M, Perrault LP, Hébert Y, Cartier R, Bouchard D, et al. Single versus bilateral internal thoracic artery grafts with concomitant saphenous vein grafts for multivessel coronary artery bypass grafting: effects on mortality and event-free survival. *J Thorac Cardiovasc Surg.* 2004 May;127(5):1408-15.
- Nasso G, Coppola R, Bonifazi R, Piancone F, Bozzetti G, Speziale G. Arterial revascularization in primary coronary artery bypass grafting: Direct comparison of 4 strategies-Results of the Stand-in-Y Mammary Study. *J Thorac Cardiovasc Surg.* 2009 May;137(5):1093-100.
- Damgaard S, Lund JT, Lilleor NB, Perko MJ, Madsen JK, Steinbrüchel DA. Comparably improved health-related quality of life after total arterial revascularization versus conventional coronary surgery-Copenhagen arterial revascularization randomized patency and outcome trial. *Eur J Cardio-thoracic Surg.* 2011 Apr;39(4):478-83.

13. Cameron AAC, Green GE, Brogno DA, Thornton J. Internal thoracic artery grafts: 20-year clinical follow-up. *J Am Coll Cardiol.* 1995 Jan;25(1):188-92.
14. Goldman S, Zadina K, Moritz T, Ovitt T, Sethi G, Copeland JG, et al. Long-term patency of saphenous vein and left internal mammary artery grafts after coronary artery bypass surgery: Results from a Department of Veterans Affairs Cooperative Study. *J Am Coll Cardiol.* 2004 Dec 7;44(11):2149-56.
15. Lytle BW, Blackstone EH, Loop FD, Houghtaling PL, Arnold JH, Akhrass R, et al. Two internal thoracic artery grafts are better than one. *J Thorac Cardiovasc Surg.* 1999;117(5):855-72.
16. Kurlansky PA, Traad EA, Dorman MJ, Galbut DL, Zucker M, Ebra G. Thirty-Year Follow-Up Defines Survival Benefit for Second Internal Mammary Artery in Propensity-Matched Groups. *Ann Thorac Surg.* 2010 Jul;90(1):101-8.