Section: CTVS

Original Research Article

LONG TERM OUTCOME IN TOTAL ARTERIAL REVASCULARISATION VS ROUTINE REVASCULARISATION IN OFF PUMP CABG

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ABSTRACT

Background: Left internal mammary artery anastomosis to left anterior descending artery has become gold standard over last few decades but long-term patency of saphenous vein is always doubtful. So, we decided to compare our cases of total arterial bypass to non-total arterial bypass. **Materials and Methods:** Patients who underwent either total arterial revascularisation CABG or non-total arterial revascularisation CABG between January 2011 and December 2015 were reviewed. We excluded the patients with an ejection fraction of less than 30%, those who had had previous cardiac surgery and concomitant valve replacement. **Results:** A total of 1279 patients underwent CABG for 3-vessel coronary artery disease during the study period. After applying inclusion and exclusion criteria, of these 320 were added in TAR group and 360 were added in non-TAR group. Major adverse cardiac and cerebrovascular events(MACCE) were significantly (p value less than 0.05) low in total arterial revascularization at the end of 10 years follow up, though few early post-operative outcomes like reexploration for bleeding, longer mechanical ventilation and sternal wound infection were more in total arterial bypass. **Conclusion:** Total myocardial revascularization with composite arterial grafts provided superior clinical results and improved patient outcome, even in short- and long-term period. Arterial conduit related benefits were clearly evident with respect to freedom from MACCE.

INTRODUCTION

Despite angioplasty becoming a more popular for coronary revascularization, coronary artery bypass grafting (CABG) remains the standard of care for patients with multi vessel coronary disease. In that left internal mammary artery (LIMA)anastomosis to stenosed left anterior descending artery has shown superior patency rate, good survival benefits and has become gold standard. Although using multiple arterial grafts along with LIMA exclusively for long-term survival is still debated.

In the past decade, there have been a number of studies showing the safety and feasibility of the right internal mammary artery (RIMA) and radial arteries (RAs) when used to supplement the LIMA. The patency of these conduits is at least equivalent to, if not superior to, that of the saphenous vein (SV).[1-7] Given the biological effects of arterial conduits, there is thought that it will give long term survival benefits. As such, we decided to evaluate our experience with total arterial revascularization (TAR) using internal mammary arteries (IMAs) and RAs and compare it with the traditional approach of internal mammary artery (SIMA) supplemented by saphenous vein (SV)in patients with 3-vessel coronary artery disease.

MATERIALS AND METHODS

Study sample: It is retrospective observational study. Patients were included for study if they had 3-vessel coronary disease, underwent primary isolated nonemergency off pump CABG, and received at least 1 in situ IMA. Patients were excluded if they have single, or double vessel disease, concomitant valve replacement surgery, on pump CABG, ejection fraction less than 30%. Three-vessel disease was defined as 3 coronary systems each with greater than or equal to 70% stenosis in angiographic view (left main stenosis >50% was counted as 2 systems, the left anterior descending [LAD] and circumflex, such that left main and right coronary disease was considered 3-vessel disease). We selected patients undergoing surgery since January 2011 till December

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2015, because this coincided with the introduction of the RIMA and RA conduits in our institute. Patients who received all arterial grafts were included in Total Arterial Revascularisation (TAR) group, and patient who received at least one venous grafts were included in Non Total Arterial Revascularisation (Non-TAR) group. All the selected patients received LIMA-LAD grafting.

A total of 1279 patients underwent operation for 3-vessel coronary artery disease during the study period. After applying inclusion and exclusion criteria, of these 320 were added in TAR group and 360 were added in non-TAR group. All the data collected from medical record department of our hospital and follow up data from OPD, each patient was followed for 10 years.

Outcomes

Outcome for this study were MACCE (Major Adverse Cardiac and Cerebrovascular Events) i.e Death, Myocardial infarction, Stroke and need for reintervention like Angioplasty or redo CABG. Evaluating MACCE helps to track overall safety and long-term success of treatment for coronary diseases. Other short-term outcomes like duration of mechanical ventilation, total stay in hospital, wound infection, need for Intra-aortic balloon pump (IABP), acute renal failure, blood transfusion.

Surgical Technique

All cases were done via midline routine sternotomy. Conduits harvested in standard fashion, pedicle mammary arteries, open harvesting of radial artery and saphenous vein. In non-TAR CABG, usual anastomosis was LIMA – LAD, followed by one or two proximal anastomosis then two or more distal anastomosis (sequential if needed). In TAR, Y configuration used like LIMA-RIMA -Y and LIMA-RA-Y followed by three or more distal anastomosis. Some cases proximal anastomosis for radial artery conduit followed by distal anastomosis.

Statistical Analysis

Preoperative demographic and investigative data, operative variables, postoperative mortality, morbidity, and 10 years follow up were compared between the TAR and non-TAR groups. Categoric variables were expressed as frequencies and compared using the Fisher exact and chi-square tests. Continuous variables were expressed as mean standard deviation and compared using the unpaired t test. The Kaplan–Meier method was used to analyse survival.

RESULTS

A total of 1279 patients underwent CABG for 3-vessel coronary artery disease during the January 2011 and December 2015. After applying inclusion and exclusion criteria, of these 320 were added in TAR group and 360 were added in non-TAR group. All patient's data like demographic characteristics, intraoperative details was obtained from medical records. Each patients post-operative follow up data was collected from OPD and each patients last follow up was 10 years from surgery date.

[Table 1] showed demographic features in TAR and non-TAR groups which showed no statistical difference between age, sex, BMI, family history, smoking, diabetes, hypertension, stroke, COPD, SYNTAX score, NYHA class 3 or 4, PVD and previous angioplasty except ejection fraction in which TAR group patients had good EF compare to other group.

[Table 2] demonstrated equal number of distal anastomosis in both groups which proved complete revascularisation achieved in total arterial and non-total arterial grafting. It also showed more duration of surgery and requirement of blood transfusion in total arterial bypass. [Table 3] denotes comparison of early post-operative outcomes in which atrial fibrillation and total duration of stay were equal in both groups while duration of mechanical ventilation, reoperation for bleeding and sternal wound infection were significantly more in total arterial revascularization.

[Table 4 and 5] showed major adverse cardiac and cerebrovascular events comparison in both groups. Freedom from MACCE at interval of 1, 5 and 10 years was significantly low in total arterial revascularisation. Individual incidence of death, myocardial infarction, stroke and reintervention at the follow up of 10 years was low in total arterial revascularisation which was statistically significant.

Table 1: Demographic characteristics of TAR and non-TAR groups

Variables	TAR(n=320)	Non-TAR (n=360)	P value
Age (years)	63.5+/-8.7	61.8+/-9.3	0.98
Sex (Male)	62.5%	58.3%	0.786
BMI(kg/m2)	27.8+/-4.7	28.4+/-3.9	0.721
Family history	55(17.18%)	65(18.05%)	0.56
Smoking	78(24.3%)	85(23.6%)	0.67
Diabetes	120(37.5%)	150(41.61%)	0.23
Stroke	45(14.06%)	30(8.3%)	0.15
COPD	8(2.5%)	10(2.7%)	0.56
Syntax score	28.32+/-8.6	27.56+/-9.56	0.67
NYHA class 3 or 4	21%	19%	0.309
PVD	15%	16%	0.25
Previous angioplasty	3%	2%	0.154
Ejection fraction	50.7	38.4	0.048

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Table 2: Intraoperative differences between TAR and non-TAR groups

Variables	TAR group	Non-TAR group	P value
Number of distal anastomosis	4.2+/-2.3	4.6+/-1.8	0.125
Blood transfusion	42%	15%	0.04
Duration of surgery (mean) minutes	350.7	230	0.047

Table 3: Comparison of post-operative variables

Variables	TAR group	Non-TAR group	P value
Mechanical ventilation (hours)	24.6+/-3.8	20.8+/-1.2	0.04
Hospital stay(days)	6.4+/-4.6	5.8+/-3.8	0.23
Reoperation for bleeding	25(7.8%)	10(2.7%)	0.04
Atrial fibrillation	23(7.18%)	28(7.7%)	0.28
Sternal wound infection	12(3.75%)	3(0.8%)	0.035

Table 4: Logistic Regression Analysis of Sociodemographic Variables Associated with Hypertension

Freedom from MACCE at	TAR group	Non-TAR group	P value
1 year	93.7%	90%	0.02
5 year	88.5%	75%	0.03
10 year	80%	65%	0.017

Table 5: Total incidence of major outcomes in post-operative period

Variable	TAR group	Non-TAR group	P value
Death	8%	15%	0.02
Mycocardial infarction	4.2%	7%	0.03
Stroke	2.8%	5%	0.02
Revascularisation	5%	8%	0.01

DISCUSSION

The Internal mammary artery is used worldwide as the graft of choice for myocardial revascularization because of its favourable properties, and the use of the LITA to bypass the LAD has been able to steadily improve the results of CABG surgery across time.[8-10] Consequently, the use of bilateral mammary arteries has been advocated to extend benefits to the circumflex artery and RCAs, but complications like sternal wound infection, more bleeding , more surgery duration.[11-13] concerns many surgeons. In an attempt to overcome technical problems related to the use of the RIMA and to reduce the rate of bilateral mammary harvesting, alternative arterial conduits have been studied. Among them, the RA was the conduit most extensively studied and used. Today, the RA is more frequently used in composite arterial grafts.[14-21]

In our study both groups i.e. total arterial and non-total arterial revascularisation were similar in demographic features except ejection fraction which is attributable to selection bias in selecting patients for total arterial surgery. Low ejection fraction patients were not selected for total arterial because poor LV contractility and dilated heart, failure at the time of surgery.

The number of distal anastomosis were comparable in both groups which indicates there is no incomplete revascularisation in total arterial CABG. With Y configuration (RIMA or Radial artery) or directly from aorta by proximal anastomosis (only in radial artery), all target vessels were revascularized without leaving any territory compromised. This is significant factor achieving total revascularisation which helps patient asymptomatic in post-operative period.

Factors like requirement of blood transfusion, total duration of surgery, duration of mechanical ventilation, reexploration for bleeding were more in total arterial revascularisation sternal wound infection. Bleeding or blood loss in total arterial bypass is attributable to more area of mammary bed which bleeds a lot, keep high ACT, giving heparin in post-operative period and also steep learning curve for both mammary harvesting and total arterial revascularisation. Same reason for longer duration of surgery and longer mechanical ventilation. High sternal wound infection is due to harvesting both mammary artery, in our series only 2 patients required re wiring and 2 patients required vacuum assisted dressing, other patients were managed by routine dressing.

Main advantage of total arterial revascularisation was seen in less incidence of MACCE i.e. less percentage of death, myocardial infarction, stroke and reintervention. The characteristics of patients undergoing CABG surgery have been steadily worsening during the last few years. Today, patients undergoing CABG are younger, deranged lipid profile with a higher number of preoperative risk factors, but they have undergone multiple angioplasty procedures before surgical intervention. Coronary artery disease also worsened, and today, the higher degree of atheromatous degeneration results in an important reduction of both coronary artery diameter and run-off. In these circumstances the use of saphenous vein might be associated with a significantly higher risk of graft occlusion, even in the short term to midterm. This means that the effect of full arterial revascularization on the outcome of patients undergoing CABG might be more evident than previously reported.

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CONCLUSION

In this study, the long-term outcomes of TAR vs non-TAR, were excellent in TAR group, at late follow-up, TAR was associated with improved long term freedom from MACCE, survival, and cumulative incidence of MI. Large randomized clinical trials are needed to confirm the superiority of TAR in the long-term outcomes of CABG population.

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